UDK 378.4(497.5 Rijeka)(05)

ISSN 1848-1299 (tisak)
ISSN 1849-1723 (online)

ZBORNIK VELEUČILIŠTA U RIJECI

Journal of the Polytechnic of Rijeka

Vol. 9, No. 1

VELEUČILIŠTE U RIJECI
COLLEGIUM FLUMINENSE

Rijeka, 2021.

ZBORNIK VELEUČILIŠTA U RIJECI – JOURNAL OF THE POLYTECHNIC OF RIJEKA

Izdavač – Published by
VELEUČILIŠTE U RIJECI - POLYTECHNIC OF RIJEKA
Trpimirova 2/V, 51000 Rijeka
Hrvatska - Croatia

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The authors are responsible for language editing. Editorial Board disclaims responsibility for language and printing errors.

Časopis izlazi jedanput godišnje – Journal is issued once a year
Pretplata - The annual subscription: 120,00 kn (16 €)

Radovi objavljeni u časopisu dostupni su na Portalu hrvatskih znanstvenih i stručnih časopisa – HRČAK
Papers published in the Journal are available through Portal of scientific journals of Croatia - HRČAK
http://hrcak.srce.hr/zbornik-veleri

Časopis je indeksiran u bibliografskoj bazi Emerging Sources Citation Index (ESCI) - Web of Science Core Collection i bazi ERIH PLUS (European Reference Index for the Humanities and Social Sciences) te je uključen u Norwegian Register for Scientific Journals, Series and Publishers (the Nordic List)
The Journal is indexed by the Emerging Sources Citation Index (ESCI) - Web of Science Core Collection and ERIH PLUS (European Reference Index for the Humanities and Social Sciences) and it is included in the Norwegian Register for Scientific Journals, Series and Publishers (the Nordic List)

Oblikovanje naslovnice – Cover Design: SLAVIŠA SRDIĆ
Tisak – Printed by: Chamango, obrt za dizajn
Naklada – Edition: 150 primjeraka – *copies*

Adresa Uredništva – Editorial Board Address
Veleučilište u Rijeci – Zbornik Veleučilišta u Rijeci,Vukovarska 58, 51000 Rijeka, Hrvatska, tel.: ++385 51 321 300;
faks.: ++385 51 211 270; e-mail: zbornik@veleri.hr; https://student.veleri.hr/zbornik/
ISSN 1848-1299 **eISSN 1849-1723**

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UDK 378.4(497.5 Rijeka)(05)

ISSN 1848-1299 (tisak)
ISSN 1849-1723 (*online*)

ZBORNIK

VELEUČILIŠTA U RIJECI

Vol. 9 (2021), No. 1

RIJEKA, 2021.

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Original scientific paper
https://doi.org/10.31784/zvr.9.1.1
Received: 23. 11. 2020.
Accepted: 3. 2. 2021.

ASSESSMENT OF THE INTENTION TO CONSUME FARMED FISH USING THE THEORY OF PLANNED BEHAVIOUR – SCALE VALIDATION

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SUMMARY

One-quarter of fish consumed in Europe comes from aquaculture and research has shown that consumers have a greater preference for wild fish in comparison with farmed ones. As with other food choices, consumer decisions regarding farmed fish are a complex process involving multiple factors. The main objective of this study is to develop and validate a questionnaire that will measure consumer intentions in the consumption of farmed fish using the theory of planned behaviour (TPB) as a theoretical framework. Based on the TPB model, the study also investigates the relationships between attitudes, subjective norms, perceived behavioural control and intention to consume farmed fish. Data collection was performed through an online survey and a total of 118 valid questionnaires were analysed. Based on tests performed, results indicate that the tested scale for measuring TPB constructs is valid and reliable. Alpha coefficients for intention, attitudes, subjective norms and perceived behavioural control were 0.898, 0.857, 0.748 and 0.953, respectively. Variables in the model explain 40% of the variation in farmed fish consumption intentions. Regression analysis confirmed that attitudes and subjective norms significantly influence intention to consume farmed fish, with the subjective norms being the strongest predictor, while perceived behavioural control does not have a significant impact on behavioural intention.

***Key words**: Aquaculture, consumer, farmed fish, theory of planned behaviour*

1. INTRODUCTION

Fish is widely recognised as an essential part of a healthy and balanced diet because of its highly valuable protein content and provision of essential nutrients such as iodine, selenium, calcium, and vitamins A and D (EFSA, 2014). Due to its nutritional value and anti-inflammatory effect, fish is associated with positive health benefits in many pathological conditions such as cardiovascular diseases, obesity, metabolic syndrome, mental health, and cancer (Bork et al., 2020; Jayedi, Shab-Bidar, 2020; Natto et al., 2019).

Global food fish consumption has more than doubled in the last sixty years, from 9.0 kg per capita (in 1961) to 20.5 kg per capita in 2018 and it is expected to continue to grow (FAO, 2020). The underlying factors behind the growing demand for fish are rapid population growth, rising incomes, urbanisation, and increased awareness of the health benefits of fish, facilitated by advancements in the processing and packaging industry and distribution channels (Béné et al., 2015; OECD/FAO, 2018). Since capture fisheries reached a plateau in the late 1980s, with negligible opportunity to expand, aquaculture has become the future of the seafood industry, filling in the demand-supply gap and will continue to play an important role in global food security and nutrition (Anderson et al., 2017; Kobayashi et al., 2015; Martin, 2017). From its beginnings, it is the fastest-growing food production system in the world and currently contributes to more than half of the fish available for human consumption. This share will continue to increase further (FAO, 2020).

However, in Europe, only one-quarter of fish consumed comes from aquaculture (EUMOFA, 2019) which may be due to consumers' greater preference for wild fishery products than farmed ones (reviewed by Cantillo et al., 2020, Carlucci et al., 2015). Farmed fish is often perceived as inferior in terms of the overall quality or taste, health, nutritional value, and safety (Claret et al., 2014; López-Mas et al., 2021; Verbeke, Brunsø, 2005; Verbeke et al., 2007; Rickertsen et al., 2017). Hall and Amberg (2013) concluded in their research that such beliefs are negatively associated with the consumption of farmed fish. On the contrary, a recent study by López-Mas et al. (2021) suggests that positive perception of product does not necessarily lead to higher consumption, i.e. most of the participants preferred wild fish but consumed farmed fish more often. Thus, it becomes clear that along with other food choices, consumer decisions regarding farmed fish are a complex process involving multiple factors.

To the best of authors' knowledge, there is an insufficient number of papers investigating the intention of consumers to consume farmed fish. Therefore, the main objective of this study is to develop and validate a questionnaire that will measure consumers' intention to consume farmed fish, using the theory of planned behaviour as a theoretical framework. Based on the TPB model, the study also investigates the relationships between attitudes, subjective norms, perceived behavioural control and intention to consume farmed fish. In the following sections, the theoretical framework, research hypotheses, methodology and findings are described and discussed. Finally, the results of the research are discussed, and conclusions are drawn.

2. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

The theory of planned behaviour (TPB) is one of the socio-cognitive models most commonly employed to understand different human behaviours, proving suitable in explaining and predicting different food consumption decisions (Ajzen, 2015; McDermott et al., 2015). In the literature, much research can be found that uses the original, extended, or modified TPB model to explain the variance in fish consumption intention and behaviour. Some of these studies have even applied it in the context of a new (Olsen et al., 2008) or preferred type of fishery product (Siddique, 2012; Tomić et al., 2016). For others, it was a tool for observing differences in fish consumption behaviour before and after nutrition education intervention (Mahumudiono et al., 2020) or for measuring the success of an advertising campaign for fresh fish (Scholderer, Grunert, 2001). To the best of the authors' knowledge, there are not many studies (Yi, 2019) that have applied this theory to farmed fish. Therefore, this research should make a valuable contribution to the scarce scientific data.

2. 1 Theory of planned behaviour

According to Ajzen (1991), behavioural intention is the immediate antecedent of any behaviour. The stronger a person's intention, i.e. the more motivated a person is, the more likely the behaviour will be performed. Intention is influenced by three independent constructs, namely attitudes, subjective norms, and perceived behavioural control. Attitudes are defined as a person's overall evaluation of certain behaviour as favourable or unfavourable and they are based on one's beliefs regarding the subject and the possible outcomes of the behaviour. The second antecedent of intention, subjective or social norms, refers to the perceived social pressure to perform or not perform the behaviour (Ajzen, 1991). Given the fact that people are social beings, they value the opinions of others who are important to them. More recently, it has been suggested that subjective norms should also consist of descriptive normative beliefs that are based on the observed actions of those social referents (Ajzen, 2015). An added construct to the previously established theory of reasoned action (TRA) (Fishbein, Ajzen, 1975) is perceived behavioural control, which can account for a major part of the variance in behaviour in combination with intentions. It refers to an individual's perception of the ease or difficulty to perform a certain behaviour and it is assumed to reflect past experiences as well as anticipated difficulties and obstacles. The TPB predicts that the more positive attitudes, greater subjective norms, and perceived behavioural control an individual has towards behaviour, the intention to perform such behaviour will be stronger (Ajzen, 1991).

Table 1 summarises the results of the studies in the domain of fish consumption. For a more precise overview, only those studies with original constructs or that have been expanded with additional ones are included. The table illustrates how good a predictor a particular construct is and to what extent the model explains the variance in intention.

Table 1. Sample TPB studies on fish consumption intention

Study (Country)	Theory	Regression coefficients			
		ATT	SN	PBC	R^2
Verbeke, Vackier, 2005 (Belgium)	TPB	0.21	0.18	0.27	0.31
	extended TPB*	0.06^{ns}	0.12	−0.01^{ns}	0.52
Olsen et al., 2008 (Norway, Spain)	TPB	0.21	0.12	0.43	0.46
Tuu et al., 2008 (Vietnam)	extended TPB*	0.33	0.12	0.16	0.31
Aghamolaei et al., 2012 (Iran)	TPB	0.42	0.12	0.28	0.54
Siddique, 2012 (Bangladesh)	extended TPB*	0.19	0.36	−0.03^{ns}	0.54
Thong, Olsen, 2012 (Vietnam)	TPB	0.43	0.35	0.13^{ns}	0.35
Mitterer-Daltoe et al., 2013a (Brazil)	TPB	0.25	0.42	0.21	0.33
	extended TPB*	0.15	0.10^{ns}	0^{ns}	0.57
Tomić et al., 2016 (Croatia)	extended TPB*	0.40	0.22	0.13	0.40
Fiandari et al., 2019 (Indonesia)	extended TPB*	0.66	0.10^{ns}	0.37	N/A
Yi, 2019 (South Korea)	TPB	0.32	0.41	0.32	N/A
Huang et al., 2020 (China)	TPB	0.27	0.25	0.14^{ns}	0.28
	extended TPB*	0.07^{ns}	0.06^{ns}	0.19	0.58

ATT= attitude towards the behaviour, SN= subjective norm, PBC= perceived behavioural control, INT= intention; *= other constructs also contribute to intention; ns= not significant; N/A= not available

Source: Authors

Studies conducted among Belgian, Iranian and Brazilian consumers suggest that attitudes, subjective norms and perceived behavioural control significantly predicted intention to eat fish (Aghamolaei et al., 2012; Mitterer-Daltoe et al., 2013a; Verbeke, Vackier, 2005). In line with these are the results obtained by Olsen et al. (2008) when examining the intention to consume a new fish product (i.e. fish burger) in a multi-group context. Furthermore, all constructs proved to be significant factors in investigating consumers' purchase of sustainably produced aquaculture products certified by the Aquaculture Stewardship Council (ASC) (Yi, 2019). However, perceived behavioural control was not a significant predictor of intention in the case of Vietnamese and Chinese fish consumers (Huang et al., 2020; Thong, Olsen, 2012). In the extended TPB model, introducing perceived need and/or habit as additional regressors weakened the impact of at least two constructs but at the same time increased the explained variance of behavioural intention (Mitterer-Daltoe et al., 2013a; Huang et al., 2020; Verbeke, Vackier, 2005). Tuu et al. (2008) distinguished social and descriptive norms as direct antecedents of intention, with both having a significantly positive effect on the intention to consume fish (note: in Table 1, the regression coefficient of social norms has been

presented). Additional constructs in repetitive (perceived value) and fresh (health involvement, moral obligation) fish consumption have insignificant and low correlation, respectively, with behavioural intention (Fiandari et al., 2019; Tomić et al., 2016). The findings of the extended TPB model proposed by Siddique (2012) suggest that attitudes, norms and procedural knowledge are the key determinants of intention, whereas perceived behavioural control, price and cost had no significant effect on the intention to consume dry fish. On top of all that, a few studies with the extended TPB model measured perceived behavioural control only through past experience, which provided the best explanation of the intention to eat fish (Higuchi et al., 2017; Mitterer-Daltoe et al., 2013b). Variables related to facilitating conditions were not used in the structural model as they were rejected by the confirmatory analysis (Mitterer-Daltoe et al., 2013b). Lastly, Honkanen and Young (2015) replaced perceived behavioural control with the perception of consumer effectiveness as a possible predictor of intention towards buying sustainable seafood, but it proved to be insignificant while attitude, subjective and personal norms were positively related.

2. 2 Research hypotheses

Attitudes are generally the strongest predictor of food consumption intentions (Ajzen, 2015). In line with this, several studies confirm that positive attitudes towards fish consumption have the most significant effect on the intention to consume fish (Aghamolaei et al., 2012; Fiandari et al., 2019; Thong, Olsen, 2012; Tomić et al., 2015; Tuu et al., 2008). However, introducing habit as a separate regressor in the extended TPB model weakens the impact of attitudes on behavioural intention (Huang et al., 2020; Verbeke, Vackier, 2005). Further, Thong and Olsen (2012) found in their study that fish taste, texture, and appearance, used as indicators of quality, have the highest impact on attitude and together with price and negative effect (smell and bones) explain 60% of the variation in attitude. The taste and healthy image of fish proved to be the strongest influence on the intention to consume fresh fish among Croatian consumers (Tomić et al., 2016). Hence, the following hypothesis is:

H1: Positive attitudes towards the consumption of farmed fish have a positive impact on the intention to consume farmed fish.

Subjective norms have often been argued as the poorest predictor of intention within most studies of TPB (Ajzen, 1991), as well as having the weakest association within discrete food choice (McDermott et al., 2015). However, along with attitudes they have been important determinants in the intention to eat fish (Mitterer-Daltoe et al., 2013a; Thong, Olsen, 2012). Verbeke and Vackier (2005) concluded that, in the subjective norms, the importance of persons in the direct social environment is much greater than that of institutions. The social pressure factor proved to be the strongest in the case of purchasing ASC-certified aquaculture products in Korea (Yi, 2019), highlighting sustainable consumption as a desired behaviour in that country. The proposed hypothesis follows:

H2: Subjective norms towards the consumption of farmed fish have a positive impact on the intention to consume farmed fish.

Even though the inclusion of the perceived behavioural control construct improved the earlier theory of reasoned action (Fishbein, Ajzen, 1975) by improving the ability to predict intention and behaviour, it has received mixed results in the domain of fish consumption. Several studies suggest it has a positive but weak or completely insignificant relationship with intention (Huang et al., 2020; Thong, Olsen, 2012; Tomić et al., 2016; Tuu et al., 2008). Verbeke and Vackier (2005) found perceived behavioural control as the most important predictor in the intention to consume fish. However, when habit is added as a separate regressor, perceived behavioural control becomes insignificant (Mitterer-Daltoe et al., 2013a). When it comes to the intention of consuming a new fish product, perceived behavioural control has the most influence (Olsen et al., 2008). Therefore, the following hypothesis is proposed:

H3: Perceived behavioural control towards the consumption of farmed fish has a positive impact on the intention to consume farmed fish.

3. RESEARCH METHODOLOGY

The objectives of the research are: 1) to design and verify the validity and reliability of the questionnaire for measuring attitudes, subjective norms, perceived behavioural control and intentions towards farmed fish consumption and 2) to determine the impact of attitudes, subjective norms and perceived behavioural control on farmed fish consumption intentions. In order to achieve these goals, a survey questionnaire was designed and tested on data collected by empirical research.

3. 1 Questionnaire and measurement scales

Empirical data were collected by the survey method. Scales from the literature (Tomić et al., 2016) were used to measure attitudes, subjective norms and perceived behavioural control. Additionally, data on the socio-demographic profile of the respondents were collected. Altogether, the research tool consisted of 16 statements, all adapted to the research objectives, namely to behavioural intention towards farmed fish. Attitudes towards farmed fish were measured with five statements, while four statements were used to measure subjective norms. To measure perceived behavioural control, we used three statements, which were reverse coded. To measure the intention to consume farmed fish, we formulated four new statements related to the purchase of farmed fish in the future and the consumption of farmed fish in a catering facility. All items were measured on 5-point Likert-like scales, ranging from 1 ("strongly disagree") to 5 ("strongly agree").

Since the scales for measuring TPB constructs were translated and adapted to the subject of the research, and new statements were added, it was necessary to check the validity and reliability of the questionnaire.

3. 2 Data collection and sample

The survey was answered by persons in charge of purchasing food in the household. The research collected data from the residents of coastal and continental Croatia according to the National

Classification of Territorial Units for Statistics (DZS, 2012). The questionnaire was posted online (Google form), and respondents were contacted by e-mail. The snowball method was used to collect data in July 2019. A total of 123 valid questionnaires were collected.

At the beginning of the survey, a filter question was asked: Do you consume fishery products? Only five respondents (4%) stated that they do not consume fishery products, while 96% of respondents stated that they do. As the most common reasons for not consuming fish, the respondents stated that they do not have the habit (3 respondents), that they do not like fish or do not like the smell/taste, and that the offering is not satisfactory (2 respondents). One respondent stated that he is allergic to fish. These five subjects were excluded from further analysis, so the analysis is based on the responses of 118 subjects. The socio-demographic description of the study sample is shown in Table 2.

Table 2. Socio-demographic structure of the sample (N = 118)

SOCIO-DEMOGRAPHIC VARIABLES		%
Sex	Female	79.7
	Male	20.3
Age	19 – 25	5.1
	26 – 35	29.6
	36 – 50	44.1
	51 – 65	19.5
	> 65	1.7
Education level	Secondary school	5.1
	Bachelor	4.2
	Master or higher	90.7
Number of household members	1	4.2
	2	23.7
	3	30.5
	4	33.9
	5	5.1
	6	2.6
Number of household members under the age of 18	0	51.7
	1	27.1
	2	18.7
	3	2.5
Employment status	Employed full time	89.0
	Part-time employee	0.8
	Unemployed	0.9
	Retiree	4.2
	Student	5.1
Residence	Continental Croatia	61.9
	Coastal Croatia	38.1

Size of the settlement (number of inhabitants)	Less than 2 000	5.9
	2 000 - 4 999	5.9
	5 000 - 9 999	4.3
	10 000 - 99 999	18.7
	100 000 - 199 999	39.8
	200 000 and more	25.4
Average household income per month (HRK)*	Less than 5 000	1.7
	5 001 – 10 000	17.0
	10 001 - 15 000	33.9
	15 001 - 20 000	20.3
	20 001 and more	25.4
	N/A	1.7

1 HRK ≈ 0.13 euros

Source: Authors

The final study sample consisted of 118 participants (79.7% female and 20.3% male). Almost half of the study participants (44.1%) belong to the age range group of 36-50 years, followed by the age range group of 26-35 years (29.7%). Only two participants are older than 65 years. About 90% of the participants hold a university degree. One-third of participants live in households with four members, while a slightly smaller percentage live in a 3-member household (30.5%). Half of the participants have no children, while one and two children were reported by 27.1% and 18.5% of the participants, respectively. Almost 90% of the study participants are fully employed, 4.2% are still students, and 5.1% are retired. Monthly income by household of 33.9% of participants is in the range of 10 001-15 000 HRK, while 45.7% reported income higher than 15 001 HRK. Of the total number of respondents, 61.9% come from coastal, and 38.1% from continental Croatia. Only 19% of participants live in settlements with less than 10 000 inhabitants, while the rest (83.8%) live in settlements with more than 10 001 inhabitants.

3. 3 Data analysis

Data analysis was performed using quantitative methods. Descriptive statistics were used to describe the sample and the mean values and standard deviations of items included in the measurement scale, while validation of measurement scales was performed using multivariate statistics. Exploratory factor analysis was applied to determine the dimensionality of the constructs, while the internal consistency coefficient Cronbach's alpha was used to assess the reliability of the scales for measuring the constructs. The data gathered were analysed using the IBM SPSS Statistics 26 program (www.ibm.com).

4. FINDINGS

4. 1 Descriptive analysis

Initially, descriptive analysis of the items included in the scale was conducted. The TPB constructs with their mean values and standard deviations are presented in Table 3.

Table 3. Descriptive statistics (N = 118)

Code	Item	Min	Max	Mean	Std. Deviation
ATT_1	I like to eat farmed fish.	1	5	3.19	0.81
ATT_2	Eating farmed fish is healthy.	1	5	3.41	0.71
ATT_3	I feel good after eating farmed fish.	1	5	3.41	0.67
ATT_4	Farmed fish has a good taste.	1	5	3.60	0.64
ATT_5	I am very satisfied when farmed fish is on the menu.	1	5	2.94	0.74
SN_1	My family thinks that I should eat farmed fish.	1	5	2.66	0.85
SN_2	My friends think that I should eat farmed fish.	1	5	2.58	0.80
SN_3	My family eats farmed fish.	1	5	3.33	0.93
SN_4	My friends eat farmed fish.	1	5	3.26	0.67
PBC_1	I do not find it difficult to judge the quality of farmed fish.	1	5	3.13	0.89
PBC_2	When I buy farmed fish, the chance to make a bad choice is small.	1	4	2.53	0.70
PBC_3	When I buy farmed fish, I am sure that I make a good choice.	1	4	2.63	0.82
INT_1	In the future, I plan to buy farmed fish.	1	5	3.49	0.95
INT_2	In the future, I plan to consume farmed fish in a catering facility.	1	5	3.18	0.92
INT_3	I will certainly buy farmed fish.	1	5	3.43	0.91
INT_4	I will certainly consume farmed fish in a catering facility.	1	5	3.23	0.93

ATT= attitude towards the behaviour, SN= subjective norm, PBC= perceived behavioural control, INT= intention

Source: Authors

Respondents had moderately positive attitudes towards farmed fish consumption (mean values were between 3.19 and 3.60) and the intention to consume farmed fish (mean values were in the 3.18–3.49 range). The only exception is satisfaction when farmed fish is on the menu, with slightly negative results (2.94±0.74), while most of the respondents agreed with the fact that farmed fish has a good taste (3.60±0.64). Subjective norms were moderately positive and negative. Respondents disagreed that their family and friends think they should consume farmed fish, while at the same time they believe that they do consume it. Furthermore, none of the respondents firmly believe that the purchase of farmed fish is a good choice, and most of them disagreed on that.

4. 2 Validation of the measurement scales

After generating items which reflect the domain of the desired constructs and forming the measurement scales, the validation of the scales should be performed. The first step in the validation of the formed measuring scale for measuring TPB constructs is to determine the content validity of the scale. Experts with experience in scientific research in the field of nutrition and marketing determined the content validity of all constructs. They used a qualitative assessment to judge whether the content of the statements corresponds to the subject of the research. They

also assessed the clarity and unambiguity of the statements, and understanding and readability of the questionnaire. All constructs were found to be well covered by the questions included in the measurement scales.

In the second step, the psychometric characteristics of the scale were assessed using the data collected. In order to determine the dimensionality of the TPB constructs measurement scale and reduce a large number of manifest variables to a smaller number of factors while maintaining the greatest possible variance of the initial results, explorative factor analysis was performed on the scale items. The Kaiser-Meyer-Olkin coefficient (0.842) and Bartlett's sphericity test ($\chi^2_{(120)}$ = 1281,68; $p<0.001$) showed that the correlation matrix was suitable for factor analysis according to the recommendations of Tabachnik and Fidell (2007). This analysis was performed using principal component analysis with varimax rotation. The criteria for the number of factors extracted and variables retained were based on eigenvalues and percentage of variance explained. Factors with eigenvalues greater than one and a solution with at least 60% of the total variance explained were considered acceptable (Hair, 2014). To ensure convergent validity, variables with a factor loading greater than 0.50 were retained considering the sample size (Hair, 2014). To guarantee discriminant validity, we accepted the rule that variables should load significantly only on one factor.

The reliability of the measurement scales was determined by applying the internal consistency coefficient Cronbach alpha. Acceptable values of Cronbach's alpha coefficients are higher than the threshold value of 0.70 (Nunnaly, Bernstein, 1994).

The factor analysis carried out with regard to the above criteria resulted in a solution that extracted four factors explaining 78.11% of the variance (Table 4). A total of three variables were excluded due to the high loading on more than one factor. One statement referred to attitudes ("I am very satisfied when farmed fish is on the menu.") and two items, to subjective norms ("My family eats farmed fish." and "My friends eat farmed fish.").

Table 4. Factor loadings and alpha coefficients for the TPB constructs

	Component				Total variance explained (%)	Alpha coefficient
	1	2	3	4		
INT_1	0.724				43.85	0.898
INT_2	0.852					
INT_3	0.750					
INT_4	0.888					
ATT_1		0.763			14.01	0.857
ATT_2		0.819				
ATT_3		0.843				
ATT_4		0.683				

PBC_1			0.765		10.94	0.748
PBC_2			0.801			
PBC_3			0.830			
SN_1				0.922	9.31	0.953
SN_2				0.931		

ATT= attitude towards the behaviour, SN= subjective norm, PBC= perceived behavioural control, INT= intention

Source: Authors

The reliability of the measurement scales was determined by applying the internal consistency coefficient Cronbach alpha. Alpha values for extracted factors range from 0.748 to 0.953, which is above the acceptability limit of 0.70.

Based on the tests performed and the results obtained, we can conclude that the scale for measuring attitudes, subjective norms, perceived behavioural control and the intention to consume farmed fish is valid and reliable.

After validation of the measurement scales, hypothesis testing was performed using the multiple linear regression method (Table 5).

Table 5. Multiple regression analysis for variables predicting intention to consume farmed fish

Independent variables	**b**	**SE**	**Beta**	**T**	**Sig.**
Constant	0.337	1,558		0.216	0.829
Attitudes	0.461	0.156	0.229	2.959	0.004
Subjective norms	0.664	0.110	0.485	6.042	0.000
Perceived behavioural control	0.159	0.124	0.097	1.281	0.203
R^2	0.419				
Adjusted R^2	0.404				
Standard error	2.506				
F ratio	27.454				
Significance	0.000				

Dependent variable: Intention to consume farmed fish

Source: Authors

Regression analysis was applied to test whether the intention to consume farmed fish can be explained by attitudes towards farmed fish, subjective norms and perceived behavioural control. Prior to regression analysis, four new variables were formed as linear composites of manifest variables, derived from the results of exploratory factor analysis.

The results of regression analysis are statistically significant (F=27.454, p=0.000) and show that the variables in the model explain 40.4% of the variation in farmed fish consumption intention. The analysis confirmed that attitudes (β=0.229, p=0.004) and subjective norms (β=0.485, p=0.000) significantly influence intention to consume farmed fish. Contrary to this, perceived behavioural control does not have a significant impact on behavioural intention (β=0.097, p=0.203). Based on this evidence, it can be concluded that hypotheses H1 and H2 have been confirmed, while hypothesis H3 is rejected.

To better understand the relationship of attitudes and subjective norms with behavioural intention, a correlation analysis of manifest variables was performed applying the Pearson correlation coefficient. The results show that, among attitudes, the variables "I like to eat farmed fish" and "Farmed fish has a good taste" have the highest correlation with behavioural intention, with r=0.568, p=0.000 and r=0.531, p=0.000, respectively. The lowest correlation observed is between the statement "Eating farmed fish is healthy" and the intention to consume farmed fish (r=0.399, p=0.000). When it comes to subjective norms, the associations between behavioural intention and the statements "My family thinks that I should eat farmed fish" (r=0.413, p=0.000) and "My friends think that I should eat farmed fish" (r=0.429, p=0.000) are similar.

5. DISCUSSION

The present study uses TPB to explain the intention to consume farmed fish in a random sample of Croatian consumers. Results indicate that the model explains 40% of the variance in behavioural intentions, which corroborates with the reviewed studies in Table 1.

As hypothesised, subjective norms (i.e. social norms), being the strongest predictor of intention, have a positive impact on the intention to consume farmed fish, which is consistent with the findings in a similar study focused on the intention to purchase sustainably produced aquaculture products (Yi, 2019). Mitterer-Daltoe et al. (2013a) also identified subjective norms as the most influential construct within the original TPB model on fish consumption in Brazil, while Thong and Olsen (2012) reported social pressure being a significant and strong predictor in Vietnam, although it followed after attitude. The results are in contradiction with a number of studies that have identified subjective norms as the least influential construct in overall behaviour as well as in nutrition- and health-related behaviours (Ajzen, 1991; Armitage, Conner, 2001; McDermott et al., 2015, McEachan et al., 2011 Riebl et al., 2015). Armitage and Conner (2001) suggested that a possible explanation of the weak predictive power of subjective norms lies in the fact that they are typically measured by a single item. Multiple-item measures had significantly stronger correlations with intention. In the present study, only social norms related to family and friends were included, both having a similar association with intention. Verbeke and Vackier (2005) explained that social pressure to consume fish mainly comes from direct social environments rather than external ones (government, food industry, advertising). Furthermore, in line with the latest suggestions, descriptive norms were also included as part of the subjective norms but were discarded in the confirmatory factor analysis.

Despite not being the most important antecedent of intention in this study, attitudes as an overall evaluation have a strong and significant impact on intention, with a result similar to those in previous studies (Mitterer-Daltoe et al., 2013a; Olsen et al., 2008; Verbeke, Vackier, 2005), suggesting that an increase in favourable attitudes will be accompanied by an increase in the intention to consume farmed fish. Consumers who like to eat farmed fish and enjoy its taste had a stronger intention to consume farmed fish. Sensory liking of fish as the strongest determinant for the intention to consume fish was also identified in other studies (Mitterer-Daltoe et al., 2013a; Tomić et al., 2016; Verbeke, Vackier, 2005). However, contrary to the findings of Tomić et al. (2016), healthy image was the least appreciated characteristic in farmed fish consumption. Mitterer-Daltoe et al. (2013a) came to an interesting finding when they examined the effects of attitudes on behaviour. Despite having a positive attitude, people did not eat fish, although they did have the intention.

The intention to eat farmed fish is determined by attitudes and subjective norms but is not significantly affected by perceived behavioural control. Although not in line with the TPB postulate, it is no exception among studies on fish consumption (Huang et al., 2020; Siddique, 2012; Thong, Olsen, 2012). Furthermore, in the extended TPB models, including habit as a separate construct renders insignificant the impact of perceived behavioural control (Mitterer-Daltoe et al., 2013a; Verbeke, Vackier, 2005). Possible explanations were provided by Thong and Olsen (2012). First, it could be that the intention to consume farmed fish is under volitional control as TRA assumed, meaning that intention to eat farmed fish is driven significantly by the attitude towards farmed fish and social pressure of family and friends. Secondly, if perceived control is a significant predictor of behaviour, but does not affect intention, it suggests that farmed fish consumption is not likely under volitional control and that there is probably a difference between perceived control and actual control. Since the present study does not investigate behavioural constructs, the explanation remains unknown. It is yet to be examined to what extent perceived behavioural control influences the consumption of farmed fish. The existing evidence of fish consumption behaviour indicates that perceived behavioural control is a significant predictor in most studies, but not more important than intention (Aghamolaei et al., 2012; Fiandari et al., 2019; Thong, Olsen, 2012; Tomić et al., Tuu et al., 2008; Verbeke, Vackier, 2005).

6. CONCLUSION

In conclusion, it can be pointed out that the scale for measuring attitudes, subjective norms, perceived behavioural control and the intention to consume farmed fish is valid and reliable. The strength of this study lies in the fact that a reliable and valid tool for measuring intention to consume farmed fish has been established and tested among Croatian consumers. Additionally, the intention to consume farmed fish is determined by attitudes and subjective norms but not by perceived behaviour control.

At the end, it is necessary to point out the limitations of this study. One of the shortcomings is the small and purposive sample on which the research was conducted, so future research should be conducted on a more extensive and representative sample. Furthermore, consumer intention, rather than actual behaviour, was investigated. It is possible that the respondents gave socially desirable answers when they were asked about the intention to consume farmed fish. Therefore,

future research should examine whether there is a relationship between intention and actual behaviour - consumption of farmed fish. In future research, the theory of planned behaviour can be extended using new constructs, as for example, consumer knowledge of farmed fish or others.

This work was performed within the project AdriaAquaNet – Enhancing Innovation and Sustainability in Adriatic Aquaculture, financed under the INTERREG V-A Italy – Croatia 2014 – 2020 programme. The financing of the work by the European Union is gratefully acknowledged.

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Izvorni znanstveni rad
https://doi.org/10.31784/zvr.9.1.1
Datum primitka rada: 23. 11. 2020.
Datum prihvaćanja rada: 3. 2. 2021.

PROCJENA NAMJERE KONZUMACIJE RIBE IZ UZGOJA PRIMJENOM TEORIJE PLANIRANOG PONAŠANJA – VALIDACIJA SKALE

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SAŽETAK

Jedna četvrtina ribe konzumirane u Europi potječe iz uzgoja (akvakulture). Istraživanja su međutim pokazala da potrošači ipak preferiraju ribu iz ulova u usporedbi sa ribom iz uzgoja. Kao i kod odabira ostalih vrsta hrane, potrošačke odluke vezane uz ribu iz uzgoja složen su proces koji uključuje više čimbenika. Glavni cilj ovog rada je razviti i validirati upitnik koji će mjeriti namjere potrošača da konzumiraju ribu iz uzgoja u okviru teorije planiranog ponašanja (TPP). Također, na temelju TPP modela istražen je odnos između stavova, subjektivnih normi, percipirane kontrole ponašanja i namjere konzumacije ribe iz uzgoja. Podaci su prikupljeni putem online ankete te je ukupno analizirano 118 valjanih upitnika. Dobiveni rezultati potvrđuju valjanost i pouzdanost testiranih ljestvica za mjerenje konstrukata u okviru TPP. Alfa koeficijenti za namjere, stavove, subjektivne norme i percipiranu kontrolu ponašanja iznosili su 0,898, 0,857, 0,748 te 0,953. Varijable u modelu objašnjavaju 40% varijacija u namjerama konzumacije ribe iz uzgoja. Regresijska analiza potvrdila je da stavovi i subjektivne norme statistički značajno utječu na namjeru konzumacije ribe iz uzgoja, pri čemu su subjektivne norme najsnažniji prediktor, dok percipirana kontrola ponašanja nema statistički značajan utjecaj na namjeru ponašanja.

Ključne riječi: *akvakultura, potrošač, uzgojena riba, teorija planiranog ponašanja*

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Original scientific paper
https://doi.org/10.31784/zvr.9.1.2
Received: 16. 7. 2020.
Accepted: 8. 10. 2020.

ATYPICAL FORMS OF WORK AND BUSINESS IN THE CREATIVE INDUSTRY OF THE EUROPEAN UNION

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ABSTRACT

Starting from the insight into atypical forms of work as well as new / alternative business models specific to the creative industry (CI) sectors of the European Union, the paper researches self-employment in the creative industry and volunteering as a prerequisite for self-employment. The creative industry is considered as industry of economically developed countries as well as the prototype industry, whose "recipes" are multiplied in underdeveloped countries and thus materialized for mass distribution. The methodology of the work applied three different groups of methods adapted to hypotheses. The first hypothesis states that EU research indicates business constraints / characteristics in the creative industry. In order to test this hypothesis by meta-analysis of the collected sources, key business constraints in the creative industry were separated, and then atypical forms of work emerged from them. The second hypothesis was tested by descriptive and bivariate statistical analysis of secondary data. It is about analyzing secondary data in a newly formed file constructed for the purposes of this research. The file combines secondary sources of data on cultural statistics (European Union) and GII - Global Innovation Indices (WIPO), which were used to test the hypothesis that self-employment as an atypical form of work in culture is related to the level of the Global Innovation Index (GII).

Key words: *creative industry, business models, meta analysis, atypical forms of work, secondary data*

JEL classification: *O1, Z1*

1. INTRODUCTION

Since the beginning of this millennium, the creative industry (CI) has been systematically encountered in highly developed countries or communities (such as the European Union) and has become synonymous with business activities based on knowledge, innovation and creative projects, and protected by copyright.

Creative industry companies in most EU countries recorded overall growth (+ 4.3%) between 2008 and 2016 and reached at least a 10% share in the total number of companies in the business services sector (2.45 million companies in 2016), whereby the total employment in the EU creative industry amounted to more than 6.7 million employees in the same year of 2016. (KEA & PPMI, 2019).

The EU Commission has defined industry in general in this millennium as „the backbone of the European economy. Europe's global competitive advantage in high value-added products and services translates to more than 20% of the EU's total value-added, with industry directly providing 35 million jobs. Competitiveness is therefore at the heart of the Commission's agenda and, as we stand on the brink of a new industrial revolution, we are committed to supporting the digital and green transformation of EU industry."[1]

Thus, the EU defines industry and the related industrial strategy is based on achieving "global competitiveness, reach climate-neutrality by 2050, and make Europe fit for the digital age"[2], that is, on the development of its own ideas and innovation.

Given that the basic product of the creative industry is knowledge, idea and a copyrighted prototype - a "recipe" suitable for future reproductions relocated to less developed communities, the creative industry occupies an important place in the projection of the future of the EU. This thesis is confirmed by numerous documents of the EU Commission and publicly available information on the conducted research of the creative industry advertised on the website of the EU Commission.[3]

Searle (2017: 6) explain „Copyright is a key intellectual asset for these industries[4], and they account for the majority of copyright policy." Horvat et al. (2018: 14) define the creative industry as an industry that "implies copyright-protected production [which is] and is covered by projects for the production of intangible products and services intended for market exchange." The same authors propose for the Republic of Croatia a creative industry based on twelve sectors (Figure 1).

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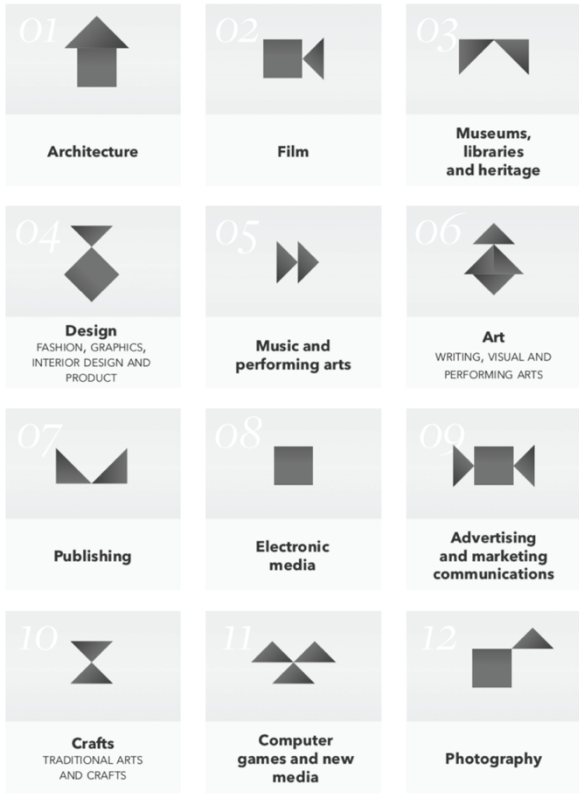
1 https://ec.europa.eu/growth/industry_en, accessed April 5, 2020

2 The European Commission "supports the transformation of the EU's energy-intensive industries to enable a climate-neutral circular economy by 2050; strengthening the skills of citizens to participate in industry; promotion of advanced technologies; support for innovation through policies and programs; taking measures to protect intellectual property in order for companies to better manage and benefit from their intangible assets;..." (https://ec.europa.eu/growth/industry_en, accessed April 5, 2020)

3 https://ec.europa.eu/culture/policy/cultural-creative-industries_en, accessed April 5, 2020

4 The author uses the term "creative industries" in the original, which will be translated in the singular (creative industry) in this paper in order to avoid terminological confusion.

Figure 1. Creative industry sectors in the Republic of Croatia



Source: Horvat et al., (2018:15)

Precisely because of all the above, the development of the creative industry is an indicator of the level of development of the local or national community, and the ordinances and regulations governing the creative industry contribute to its further growth. Searle (2017: 5) warns to „the terminology used to describe the CI has varied over time. In the last thirty years it has moved from the copyright industries, to variations on creative economy, cultural economy, cultural industries, creative industry and culture, and creative and cultural industry."

That it is still an industry that is just being institutionalized is also shown by the fact that only a certain number of authors (Harwiki et al., 2020; Ihani et al., 2020; Majdúchová & Barteková[5], 2020; Waldfogel, 2020; Horvat et al., 2018) call the creative industry[6] singular instead of plural (cultural and creative industries). Horvat et al. (2018) propose that the creative industry to be institutionalized in accordance with Scheme 1 and that 12 sectors of which the heritage sector (museums, libraries

[5] In Slovakia, the creative industry has been officially called in the singular since 2012 (https://en.unesco.org/creativity/policy-monitoring-platform/creative-industry, accessed: 5 April 2020).

[6] The Cambridge Dictionary contains the following description of the creative industry: "an industry that is based on work in which original ideas are important, such as work in the arts or the media, in designing computer software, etc. It is recognized that the creative industries possess significant economic potential. (accessed: April 5, 2020).

and archives) is predominantly cultural sector be structurally harmonized similar to sector harmonization in all other industries. They emphasize that, for example, the processing industry in the Republic of Croatia contains 14 components (sectors), but it is a single industry, not 14 different industries. Furthermore, as stated by Innerhofer et al. (2018: 3) "creative industries is also a result of their interdependent relationship with non-creative, traditional businesses and… the landscape of increased connectivity, complexity, and growth, based on continued digitization, influences and changes creative industries. This could be interpreted as both a challenge and an opportunity for new business models within the creative sectors."

That the EU creative industry is facing institutional and organizational challenges is also confirmed by the research that the EU undertakes and the regulations that harmonize the activities of the cultural and creative sectors of the EU creative industry. Given that this information is publicly available, their publication shows the desire to create an open society "society open to innovation[7], or change that occurs as a result of achieving and introducing innovative theories and practices." (Horvat et al., 2018: 113).

The creative industry is characterized by a high degree of innovation, technological development within the project activity protected by copyright and processes in which the finding (invention) becomes an innovation only after it is transformed into a product or service.

„In the contemporary world, innovative activity is a vital factor of competitiveness and long-term economic growth of a country… In the age of globalisation, implementation and commercialisation of new technologies are perceived as key elements determining competitiveness of particular countries." (Roszko Wójtowicz & Białek, 2019: 268).

All of the above requires the adaptation of traditional business models, and then the introduction of atypical forms of work and business that develop from established business models in the creative industry.

2. PREVIOUS RESEARCH

Business model change is essential for success.
Achtenhagen et al. (2013)

Previous research relevant to this paper has been considered with the aim of determining the business characteristics of CI, the prevailing business models of this industry and the employment models. In addition, innovation is considered because innovation is identified as a key determinant of CI (Petrova, 2018) and it is studied within the WIPO[8] research (Strazdas et al., 2013) taking into account the GII (Global Innovation Index - English Innovative Index) which measures the innovation of 127 countries based on 81 indicators. GII indicators are divided into two sub-indices (innovation input sub-index and innovation output sub-index) and include

[7] Horvat, Mijoč & Ljevak Lebeda (2018: 113) state that "Innovation is often associated with the concepts of inventions (lat. Inventio - invention) and creation (lat. Creatio - birth, creation) which are only components of the concept of innovation lat. inovatio - novelty, invention). Creativity is the starting point of every invention (invention), but invention is only a transitional step towards innovation. "

[8] WIPO – World Intellectual Propery Organization

input sub-indices: institutions, human capital and research, infrastructure, market sophistication, business sophistication, and output sub-indices: scientific outputs, creative outputs.[9]

CI business models are being developed within the framework of legislation that regulates the operations of the CI sector and raises issues of influence to which they are exposed.

„Cultural and creative industries[10] have been recently affected by the broader economic, social and structural changes that are influencing not only the academic debate around cultural and creative industries but also their governance and management models" (Innerhofer et al., 2018: 1). Strengthening the CI shows that its organizational systems are also changing. Thus Strazdas and co-workers describe the innovation of the system as „one type of innovation when the creative process results in the development of a new system, the individual elements of which are not new but the novelty appears in the novel composition, integration and new relations between these elements" (Strazdas et al., 2013: 2). The same authors state that determining the innovative procedure is specially important in CI where the process of confirming innovation achieved in business is often very complex.

Searle (2017) examines business models in the Creative Industry (CI) applies the Baden-Fuller (2016) business model taxonomy to the CI. The adapted Searles taxonomy of KI business models contains four elements: product and service model, solutions model, matchmaking model and multi-sided model (Table 1).

Table 1. Searles' taxonomy of business models of CI

Models	**The goal of the company**	**Type of connection (businesses and consumers)**	**Example of a company**
Product and service	the sale or licensing of standardized goods and services	dyadic[11]	most common in CI
Solutions	tailor the solution to each customer	dyadic	a consulting firm
Matchmaking	facilitate exchange	dyadic	auction houses
Multi-sided	multilateral exchange of values, consumers get added value from each other	triadic[12]	newspapers (readers are both advertisers and consumers)

Source: Searle (2017: 18-19)

[9] WIPO, https://www.globalinnovationindex.org/home, accessed: April 17, 2020

[10] The original author uses the term cultural and creative industries.

[11] The relationship between the two parties (company-customer) dominates.

[12] The company establishes a relationship with consumers, but also customers establish mutual relations.

In interpreting CI's business models, Searle (2017: 19) refers to Baden-Fuller, who notes that „the external relationships between business models, via competition, can be observed within business models, between models, and can manifest competition and cooperation in a variety of models."

From all the above, it can be seen that the unavoidable specificity in the business of CI is related to copyright protection (copyright e. g. Intellectual property, IP)[13], which is also a limitation in business, especially if we take into account numerous copyright infringements.

However, while different authors argue if IP and copyrights matters lead to changes in business models the digital era has indisputably transformed production and distribution technologies and affected their transaction costs. (Kaye, 2013; Doyle, 2017; Searle 2017).

It is important to emphasize the role of digital technology in all sectors of CI. Searle (2017) notes that digital technology is present even in the "non-digital sectors" of CI (performing arts, fashion, and design) because despite the fact that these sectors have not undergone a complete digital transformation in these sectors, advertising and sales in these sectors are achieved using digital technology and online. According to the same author, the digital exchange of information and content in the consumer-producer relationship further complicates the protection of producers' copyright and is particularly complex in multilateral exchange models (Table 1).

Landoni et al. (2019) shows that the application of business innovation must be adapted to the development phase of the enterprise. The same authors state that in the ascending phase of the company innovative solutions are focused on overcoming limited resources (with the aim of building a recognizable reputation of the company), that in the development phase they focus on innovative forms of distribution, and in the maturity phase on creating development platforms. In doing so, the authors warn of the ambivalence of digital technologies, but also tangible assets in their impact on innovative transformations of business models. Namely, although the lack of tangible assets can be a driver for innovative reorganization of companies as well as the use of advanced, digital technology can produce new, unexpected bottlenecks for which it is necessary to ensure rapid change.

As the creative industry relies entirely on knowledge, innovation and creation, its key components are employees (creative workers, creative class) who often come from the field of culture, and the forms of work include self-employment and volunteering, which will be the subject of meta-analysis below, in the next part of this paper.

3. METHODOLOGY

The methodology applied in the paper relies on a meta-analysis of research studies (European Union and WIPO) and on a statistical analysis (descriptive and bivariate) of secondary data collected for European Union countries.

[13] Copyright (intellectual property, IP) is not discussed in detail in this paper because it is primarily related to legal science.

Table 2. Research studies used in meta-analysis

Publication	Year	Publisher	Access
Cultural and creative industries	Permanent	European Commission	https://bit.ly/2XjEfil
Internal Market, Industry, Entrepreneurship and SMSs 2018	2019	European Commission	https://bit.ly/2XyOxeP
The Creative Skills Europe (series) - a Step ahead – Training for innovation - a Safe Bet – Training and workforce development - it is a new world – Training in and for the digital era - Joining forces – funding our Training needs - fruitful co-operations – access to training through Social dialogue	2019	European Commission	https://bit.ly/3cWmQCV
Cultural statistics	2019	Eurostat	https://bit.ly/2WXsuzn
Culture statistics	Permanent	Eurostat	https://bit.ly/2TtTnZz
Research for CULT Committee – Culture and creative sectors in the European Union - key future developments, challenges and opportunities	2019	KEA & PPMI	https://bit.ly/2XqSqCu

Source: Authors

As Table 2 shows, the meta-analysis includes three research studies from 2019, a series of educational manuals from 2019 and two European Union websites where new knowledge about doing business in CI is systematically published.

The methodology based on descriptive and bivariate analysis of secondary data (European Union and WIPO) was implemented by building a new file that consolidated the secondary data taken from former studies. These are the following data sources:

a) Employment in culture: self-employed persons in 2018 (total, men and women, data in %)[14]
b) GII (Global Innovation Index) points and rank for 2018[15]
c) GII (Global Innovation Index) points and ranking for 2019[16]

[14] Eurostat, Cultural statistics 2019. Accessed: https://ec.europa.eu/eurostat/documents/3217494/10177894/KS-01-19-712-EN-N.pdf/915f828b-daae-1cca-ba54-a87e90d6b68b
[15] WIPO, Accessed: https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2018.pdf
[16] WIPO, Accessed: https://www.globalinnovationindex.org/userfiles/file/reportpdf/gii-full-report-2019.pdf

Secondary data were pooled in a new file to test the research hypothesis that atypical forms of work in culture as part of the creative industry are related to the height of the Global Innovation Index (GII). In doing so, it is important to state the way in which the GII index is constructed.

„The innovation efficiency at the macro level GII is calculated as the ratio of the country's contribution to the development of innovations - Innovation Input Sub-Index and the output of the innovation development – Innovation Output Sub-Index. The results show that the innovation efficiency is very different. This means that some countries are using the resources for the innovation development more efficiently than others. A similar situation is observed at the firm level." (Strazdas, Cerneviciute & Jancoras 2013: 2).

The methodological construction of the GII index is shown in Table 3.

Table 3. Methodological construction of the GII (Global Innovative Index)

<table>
<tr><th>Sub-index</th><th>Sub-pilar</th><th colspan="2">Elements</th></tr>
<tr><td rowspan="15">Innovation Input Sub-Index

(the simple average of the first five sub-pillar scores)</td><td>Political environment</td><td rowspan="3">Institutions</td><td rowspan="15">Elements of the national economy

that enable innovative activities</td></tr>
<tr><td>Regulatory environment</td></tr>
<tr><td>Business environment</td></tr>
<tr><td>Education</td><td rowspan="3">Human capital and research</td></tr>
<tr><td>Tertiary education</td></tr>
<tr><td>Research and development</td></tr>
<tr><td>ICT</td><td rowspan="3">Infrastructure</td></tr>
<tr><td>Energy</td></tr>
<tr><td>General infrastructure</td></tr>
<tr><td>Credit</td><td rowspan="3">Market sophistication</td></tr>
<tr><td>Investment</td></tr>
<tr><td>Trade and competition</td></tr>
<tr><td>Knowledge workers</td><td rowspan="3">Business sophistication</td></tr>
<tr><td>Innovation linkages</td></tr>
<tr><td>Knowledge absorption</td></tr>
<tr><td rowspan="6">Innovation Output Sub-Index

(the simple average of the last two pillar scores)</td><td>Knowledge creation</td><td rowspan="3">Scientific outputs</td><td rowspan="6">Evidence of innovation outputs</td></tr>
<tr><td>Knowledge impact</td></tr>
<tr><td>Knowledge diffusion</td></tr>
<tr><td>Creative intangibles</td><td rowspan="3">Creative outputs</td></tr>
<tr><td>Creative goods</td></tr>
<tr><td>Services outputs</td></tr>
</table>

Source: Global innovation index (WIPO)

Given that the GII consists of two sub-indices (innovation input and innovation output), it is important to emphasize that in the analysis of this paper, points for 2018 and points for 2019 were used, which in both cases were calculated as the unweighted arithmetic mean of the input and output. In addition to the above indicators, the analysis also used the ranking of countries that countries have achieved in the observed years in the global ranking of countries in terms of innovation. Bivariate statistical analysis of aggregated secondary data for EU countries was applied to the constructed data, ie Pearson's correlation test was calculated, with the aim of determining the relationship between the level of self-employment in cultural activities of EU member states in 2018 and the level of GII.

4. RESULTS

A meta-analysis of research studies (Table 2) examined the assumption that European Union research studies draw conclusions about atypical forms of work and business in CI (Table 1).

Employees (creative workers, creative class) are a key element of the creative industry. On the European Union's website dedicated to the analysis of the cultural and creative sectors (CCS - culture and creative sectors) of the creative industry, a special chapter has been singled out - *Changing skills* - which describes the skills and abilities of employees in CI. It is stated there that „As the culture sector evolves and changes, so do the skills required of individuals active in the sector. The educational and training needs created by these changes can only be met by an education sector that recognises the change in demand."[17]

The optimistic prediction that the education sector recognizes the challenges of the new age has been somewhat denied by a European Commission study that states that „CCS' professionals increasingly require a blend of creative, digital, managerial and entrepreneurial competences, coupled with soft skills to stimulate innovation. The contribution of CCS to developing trans-sectorial soft and creative skills becomes even more critical in the age of Artificial Intelligence (AI) and the automation of work" (KEA & PPMI, 2019: 7). The latter quote does not indicate that educational processes have adapted to the needs of the creative industry, but points to the need for lifelong learning to adapt the work of heterogeneous creatives to extremely rapid technological and market changes. The same research warns of the need to measure in order to determine how well the existing labor market rules correspond to a highly fragmented work environment and how often social security is applied to atypical forms of work (self-employed) in the creative industry. With regard to skills and education, there is a need to encourage skills development and lifelong learning programs that will „include a clear component for culture and creativity" and „programmes integrating the arts into STEM curricula", „the development of a CCS literacy policy", as well as development of „programmes for entrepreneurship, investEU programme, monitoring the level of public support for culture and „Incentivise the CCS to take up an active role in terms of environmental sustainability" (KEA & PPMI, 2019: 9).

[17] https://ec.europa.eu/culture/policy/cultural-creative-industries/skills_en, accessed April 5, 2020

The European Commission has issued five publications united under the title *The Creative Skills Europe series* (2019) with the aim of "inspiring businesses and professionals from the European creative sectors to engage in training and develop customized solutions for skills development and career management." The publications address the key issues of the creative workforce in the EU, namely innovation, workforce development, work "in" and "for" the digital era, and ways to join forces to find tools to improve workers' skills. The second volume of these publications (Joining forces – Funding our Training needs) states the problem of atypical employment in the field of CI. "Many of the professionals making up the sector are short-term employees or independent workers (self-employed, freelancers, etc.) and a large proportion of the businesses have ten or less employees on the payroll. This means that structured HR policies and training strategies can often be inaccessible, and that professional training opportunities therefore should be offered across the sector in order to develop schemes and tools for all types of creative businesses and workers."[18]

In other words, the creative enterprise market is shaped by a limited (smaller) number of large stakeholders and a multitude of small enterprises forced to innovate the production and content they produce in a digital environment for market competition. Creative workers in certain phases of their work produce innovative solutions, but with the assumption of constantly monitoring the development of technologies, learning about the digital environment and creating original, own solutions. The European Commission also emphasizes the importance of cultural and creative work in its publication *Internal Market, Industry, Entrepreneurship and SMSs 2018* (2019: 35), which states that the role of „cultural and creative sectors in the context of the renewed Industrial Policy Strategy… at EU level… with the aim to investigate how creative sectors generate innovations that make a positive impact in other sectors and help boosting the competitiveness of the economy." Given that creative enterprises are largely organized as medium and small (SMEs), it is important to point out that the same publication identified 89% of SMEs "are expected to improve this market situation through network support. Nearly one in two SMEs is likely to achieve their competitiveness by increasing the greater innovation achieved in the Enterprise Europe Network (EEN). Nearly 6 out of 10 SMEs will estimate that network services will help them preserve and create jobs. Based on the positive results of its first two years within COSME[19] and on 10 years of experience we have supported SMEs, EEN has prepared new strategies for strategic visions to adapt their services to changing business opportunities and to increase the positive impact on small and medium enterprises. Based on the positive results of its first two years under COSME and on its 10 years of experience with providing support to SMEs, the EEN[20] is preparing the implementation of its new strategic vision to adapt its services to changing business needs and to further increase the positive impact on SMEs" (European Commission, 2018: 17).

Considered from the perspective of the Labor market area, two scenarios are identified: aspirational and disruptive scenarios. An aspirational scenario foresees the following possibilities (listed from

[18] http://www.creativeskillseurope.eu/wp-content/uploads/2018/11/CSE-series_Training-and-workforce-development-1.pdf, 2019: 10

[19] COSME – Competitiveness of enterprises and small and medium-sized enterprises programme. COSME also supported the Intellectual Property Rights (IPR) Helpdesk.

[20] The Enterprise Europe Network (EEN) is present in 69 countries, assisting about 250.000 Small and Medium Enterprises (SMEs) yearly to internationalise.

the most-likely ones to the least-likely ones): „The CCS will ensure an advanced position in the society by remaining up to date with the latest trends. In the next ten years, transnational mobility of the European CCS professionals will further increase. CCS freelancers and in other atypical types of work will obtain more access to social security benefits and will increase their work security. CCS professionals will obtain easier access to non- national markets. Creativity and arts will increase their" (KEA & PPMI, 2019: 98).

A disruptive scenario, on the other hand, opens the possibility to the following negative expectations (listed from the most-likely ones to the least-likely ones): „Employees of the CCS will continue being pushed into unfavourable economic and social conditions. Culture and arts will be governed by and performing for elites. In the next ten years, transnational mobility of the European CCS professionals will still be restricted by national and EU regulation (such as lack of progress on visa liberalisation issues, etc.)" (KEA & PPMI, 2019: 98).

The European Commission's CI website (https://ec.europa.eu/culture/policy/cultural-creative-industries/market-finance_en, accessed: April 17 2020) points out that CI is a highly variable business, in terms of both the size of the company and the resources, connections and market reach, and especially the non-harmonized regulations across the EU (related to taxes, business and intellectual property). In the same network place, the complicated one stands out in particular for „access to finance and, thus, markets remain problematic for several reasons:

- Lack of expertise in financial institutions to analyse CCI business models;
- Poor valuation among financial institutions of the intangible assets of CCIs;
- Lack of data and statistics;
- Complexity of culture sector business plans and models."

Unlike CI, for which there are no unambiguous indicators and measurements in the EU, the cultural sector (which according to most nomenclatures is also part of CI) has longer sets of secondary statistics based on which the conclusions are drawn. „In 2018, there were 8.7 million people across the EU-28 working in a cultural activity or a cultural occupation (the definition employed by Eurostat to delineate cultural employment is presented below in the section on Methodological notes). These 8.7 million persons employed were equivalent to 3.8% of the total number of persons employed within the whole of the EU-28 economy" (Culture statistics, 2019: 63).

Volunteer work is perceived as an inevitable and often unwanted form of work in CCS, as well as an atypical form of employment as a self-employed person (freelancer). „It is likely that the trend of practicing atypical forms of work (see section 2.3) by the CCS organisations will continue in the next 10 years. Atypical forms of work demonstrate the flexibility, openness and creativity of the sector. At the same time, when not chosen voluntarily, they can be a result of unhealthy work climate and unjust labor conditions. Without the necessary policy actions/ changes, there is a risk that employees of CCS will continue being pushed into unfavourable economic and social conditions, facing low pay levels and lack of funding to support their artistic research" (KEA & PPMI, 2019: 64).

Based on the conducted meta-analysis of EU research studies, the first hypothesis was partially confirmed. As the meta-analysis shows, European Union research studies partly draw conclusions about atypical forms of work and business in CI. The reason why the first hypothesis was partially rejected is the result of inconsistent statistics in the countries of the European Union on the coverage of the activity and labor force of CI. Uneven statistics in EU countries are the reason why the EU fails to create long, stable sets of secondary CI data.

To test the second hypothesis on the existence of a correlation between the number of self-employed in cultural activities of the constituent countries of the European Union in 2018 and the amount of GII (2018 and 2019), a file was constructed based on secondary data sources (Table 4).

Table 4. Comparison of self-employed persons in culture in 2018 and the Global Innovation Index in 2018 and 2019

Countries	Cultural employment –self-employed persons in 2018			Global Innovation Index			
	Total %	Males %	Females %	2018		2019	
				score (0 - 100)	rank[21]	score (0 - 100)	Rank
Belgium	30	35	23	50,50	25	50,18	23
Bulgaria	18	25	13	46,25	37	40,35	40
Czechia	37	40	33	48,75	27	49,43	26
Denmark	18	22	15	58,39	8	58,44	7
Germany	33	35	30	58,03	9	58,19	9
Estonia	21	27	16	50,51	24	49,97	24
Ireland	33	35	30	57,19	10	56,10	12
Greece	35	36	34	38,93	42	38,90	41
Spain	33	36	28	48,68	28	47,85	29
France	29	33	25	54,36	16	54,25	16
Croatia	12	14	10	40,73	41	37,82	44
Italy	46	51	39	46,32	31	46,30	30
Latvia	20	28	17	43,18	34	43,23	34
Lithuania	18	22	15	41,19	40	41,46	38
Luxembourg	18	17	18	54,53	15	54,37	18
Hungary	24	26	21	44,94	33	44,51	33
Malta	26	26	26	50,29	26	49,01	27

[21] This is the global rank of all analyzed countries, and not the rank related to the order of countries shown in Table 4

Netherlands	48	49	47	63,32	2	61,44	4
Austria	30	34	26	51,32	21	50,94	21
Poland	23	29	18	41,67	39	41,31	39
Portugal	27	29	23	45,71	32	44,65	32
Romania	13	18	-	37,59	49	36,76	50
Slovenia	26	26	26	46,87	30	45,25	31
Slovakia	29	31	28	42,88	36	42,05	37
Finland	28	30	27	59,63	7	59,83	6
Sweden	24	27	20	63,08	3	63,65	2
U. Kingdom	37	38	36	60,13	4	61,30	5
Iceland	31	35	28	51,24	23	51,53	20
Norway	24	26	23	52,63	19	51,87	19
Switzerland	31	37	25	68,40	1	67,24	1

Source: Authors (adapted from Eurostat and WIPO sources)

Insight into Table 4 shows that the largest number of self-employed persons in culture in 2018 was achieved by the Netherlands (the total number of self-employed persons in culture was 48%, men 49%, women 47%). In 2018, the Netherlands was in second place in the global ranking of countries according to the achieved innovation index (GII 63.32). In the same year, the highest innovation index was set for Switzerland (GII 68.40), followed by the Netherlands (GII 63.32), Sweden (GII 63.08) and the United Kingdom fourth (GII 60.13).

Further analysis of Pearson's correlation coefficient confirmed that there is a statistically significant correlation between the total number of self-employed in culture in 2018 and the level of GII in 2018 ($r = 0.377$; $p = 0.04$), but no correlation with the number of male self-employed in culture in 2018 year ($r = 0.342$; $p > 0.05$), ie without connection with the number of women employed in culture in 2018 ($r = 0.309$; $p > 0.05$).

On the other hand, Pearson's correlation coefficient showed that there is a statistically significant correlation between the total number of self-employed in culture in 2018 and the level of GII for 2019 ($r = 0.403$; $p = 0.027$) and the correlation between GII for 2019 and by the number of self-employed men in in the culture (sector) 2018 ($r = 0.365$; $p = 0.047$), but not the correlation to the number of self-employed women in the culture (sector) in 2018 ($r = 0.342$; $p > 0.05$). This data is taken with a grain of salt because the values from two consecutive periods are compared.

The second hypothesis was not rejected because it confirmed the statistically significant correlation of GII in 2018 with the total number of self-employed persons in cultural activities of EU member states in 2018 and the number of employed men in cultural activities of EU member states in 2018. The recommendation for future related research is to determine the number of self-employed in the creative sectors of the European Union (and not only in the cultural sector) and to investigate the relationship between all self-employed employees and the level of GII for the analyzed year or period.

5. DISCUSSION AND CONCLUDING REMARKS

The creative industry confirms its innovative leverage in its own functioning. This is an industry of knowledge and conceptual solutions that is still not harmonized in the European Union with uniform regulations and nomenclatures, thus preventing the coverage of CI statistics, ie the collection and analysis of harmonized secondary sub-acts on CI of the European Union. On the other hand, the scientific and professional attractiveness of CI is confirmed by numerous research papers which explore key elements of business in the creative industry (business constraints / characteristics) and atypical forms of work and business derived from CI business models (Table 1).

The paper presents two hypotheses that were tested by two types of analyzes. The first hypothesis (European Union research studies draw conclusions about atypical forms of work and business in CI) was partially rejected. The reason for its partial rejection lies in the lack of comprehensive, uniform CI statistics in the European Union. On the other hand, the meta-analysis of EU research studies provided insight into the existence of atypical forms of employment in CI (from self-employment to volunteering) which are on the one hand the result of flexibility, openness and creativity of the CI sector, and on the other hand of unfavorable economic and social circumstances in CI.

The second hypothesis (there is a correlation between the number of self-employed persons in the cultural activities of the EU member states and the GII - Global Innovation Index) was not rejected. Based on the analysis of secondary data sources, a statistically significant association of GII in 2018 with the total number of persons who were self-employed in the cultural activities of the European Union member states in 2018 was confirmed. At the same time, no statistically significant correlation was found between the level of GII and the number of self-employed men and women.

The problem of coverage of all self-employed persons in CI was noticed and it is recommended that future researchers repeat the analysis, but with the coverage of all self-employed persons employed in all sectors of CI, and not only in the cultural sector. In order to investigate in more detail the connection between GII and the number of self-employed persons in the cultural or creative sectors of CI, it is necessary to conduct a longitudinal examination of the connection.

Given that the work was created during the COVID-19 pandemic, the sensitivity of CI (especially atypical forms of employment in CI) to the global business context was also observed. In addition to numerous initiatives that sought to ensure the subsistence minimum of volunteers and the self-employed in CI, the cultural and creative sectors of CI often offered free sharing of their own copyrighted content, as a form of volunteering both on a personal and institutional level, by giving the product for free consumption for a certain period.

Entrepreneurial, including voluntary initiatives that originated at the time of the COVID-19 virus are a thematic recommendation for future researchers. The need to overcome spatial constraints has opened new questions related to the operations of companies in CI and the skill of using information technology, rapid response to adverse business circumstances and contribution to the process of strengthening an open society locally and globally.

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Izvorni znanstveni rad
https://doi.org/10.31784/zvr.9.1.2
Datum primitka rada: 16. 7. 2020.
Datum prihvaćanja rada: 8. 10. 2020.

ATIPIČNI OBLICI RADA I POSLOVANJA U KREATIVNOJ INDUSTRIJI EUROPSKE UNIJE

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SAŽETAK

Polazeći od uvida u atipične oblike rada kao i nove/alternativne poslovne modele svojstvene sektorima kreativne industrije (KI) Europske unije, u radu se istražuje samozapošljavanje u kreativnoj industriji i volontiranje kao pretpostavka budućeg samozapošljavanja. Cilj ovoga rada utvrditi je atipične oblike rada u kreativnoj industriji Europske unije te poslovne modele s kojima su povezani. Kreativna industrija pri tome se drži industrijom ekonomski razvijenih zemalja te industrijom prototipa čije se „recepture" umnažaju u nerazvijenim zemljama i tako opredmećuju za masovnu distribuciju. Metodologija rada primijenila je tri različite skupine metoda prilagođenih postavljenim hipotezama. Prva hipoteza navodi kako istraživanja Europske unije ukazuju na poslovna ograničenja/karakteristike u kreativnoj industriji. S ciljem provjeravanja ove hipoteze meta analizom prikupljenih izvora izdvojena su ključna poslovna ograničenja u kreativnoj industriji, a zatim iz njih proistekli atipični oblici rada. Druga hipoteza provjerena je deskriptivnom i bivarijatnom statističkom analizom sekundarnih podataka. Riječ je o analiziranju sekundarnih podataka u novooformljenoj datoteci konstruiranoj za potrebe ovog istraživanja. U datoteci su objedinjeni sekundarni izvori podataka o kulturnoj statistici (Europske Unije) i GII – globalni indeksi inovativnosti (WIPO) te su uporabljeni za provjeru hipoteze kako je samozapošljavanje kao atipičan oblik rada u kulturi povezano s razinom globalnog indeksa inovativnosti (GII).

Ključne riječi: *kreativna industrija, poslovni modeli, meta analiza, atipični oblici rada, sekundarni podatci*

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Original scientific paper
https://doi.org/10.31784/zvr.9.1.3
Received: 30. 11. 2020.
Accepted: 12. 3. 2021.

SENTIMENT ANALYSIS OF SOCIAL MEDIA CONTENT IN CROATIAN HOTEL INDUSTRY

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ABSTRACT

While social media have become a daily routine in modern society, brand communication and engagement with customers have become essential elements of marketing strategy and success in the tourism and hotel industry. This revolution of social media, in tourism and hospitality marketing, contributed to the rise of a novel sentiment analysis from a machine learning and natural language processing point of view. The purpose of the study is: to provide a general descriptive overview of comments posted by Facebook page followers; to identify specific textual attributes of hotel brand posts on social media and to apply the sentiment analysis to Facebook comments from four- and five-star hotel brands in Croatia to identify and compare customers' feelings and attitudes towards the staff, services and products that hotel brands promote by posting messages on Facebook pages. To analyse hotel brand sentiments, the authors collected a total of 4,248 comments and 2,373 postings in English, German and Italian. The results showed that the comments on four- and five-star hotel brands expressed predominantly positive sentiments. Despite the positively oriented sentiments in the comments, Facebook page followers are predominantly passive users and do not tend to comment actively. The results can be used by marketers in the tourism and hospitality industry to plan their future social media communication strategies.

***Key words**: brand communication, social media marketing, sentiment analysis, Facebook comments, hotel industry*

1. INTRODUCTION

The growth of Web 2.0 and social media has enabled the development of user-generated content (UGC) and created a new marketing era that refers to the "extended field of relationship marketing", which has shifted strongly towards the online environment and has reinforced the dynamic and interactive business environment in the hospitality and tourism sector (Kim, Yoo and Yang, 2019; So and Li, 2020). Tourism and hospitality service providers look for unique ways to involve customers in the value-added process and enable personalized experiences (So and Li, 2020). The authors López Barbosa, Sánchez-Alonso and Sicilia-Urban (2015) emphasized the enormous value of customers' feelings or attitudes towards services or products based on customer-generated content researchers, companies and customers themselves. In the age of experience economy, the perceived value of a product or service depends largely on the consumption experience and not on ready-made value propositions aimed at making customer experiences more inimitable and memorable (Lei et al., 2020). Brands in the tourism and hotel industry invest in digital marketing strategies (e.g. Facebook's brand pages) to enhance customer engagement on social media (Su, Reynolds and Sun, 2015). The authors Kumar and Mirchandani (2012) stated that "these investments often see a substantial return on investment, as positive customer interactions in social media experience a ripple effect when they extend from a single user to the broader social network." Therefore, customer engagement in social media can be seen as a crucial source of information, as previous studies show that customer engagement affects positively consumers' brand awareness (Hutter et al., 2013; So et al., 2016), word-of-mouth activities (Hutter et al., 2013), improves customers' brand valuations and future purchase intentions (Hollebeek, Glynn and Brodie, 2014).

With the spread of UGC on various platforms, different opportunities have arisen for marketers and researchers. Through online sentiment analysis, the "big data" produced offered marketers the opportunity to gather marketing intelligence (Erevelles, Fukawa and Swayne, 2016) and researchers the ability to systematically extract and classify consumer sentiment about products and services expressed in comments and postings on social media sites in order to obtain brand attitudes and new market trends (Rambocas and Pacheco, 2018). User-generated content with a focus on comments/reviews in social media can significantly influence the buying decision of potential customers (Ma, Cheng and Hsiao, 2018). The authors Levy, Duan, and Boo (2013) pointed out that more than half of all hotel bookings are influenced by online reviews. Therefore, it is essential for business managers to stay current on technology, customers and social media to align marketing and business efforts with customer needs and issues (Moro and Rita, 2018).

The importance of continuous research on social presence can be seen in the previously highlighted survey on respondents' attitudes to Croatia's online reputation as a tourist destination (Mušanović, 2020). The results indicated that 72.8 percent of the respondents use other tourists' comments as a source of information when searching for information online. A total of 49.8 percent of respondents read consumer reviews on travel review portals, 46.2 percent use social media as a source of information, 41.6 percent use social sharing sites. The most reliable sources are those that offer up-to-date information (52.5 per cent) and those that have the most votes and likes (42.6 percent).

Recently, in a literature review on the role of social media and advertising in hospitality, tourism and travel sectors, Chu, Deng and Cheng (2020) called for qualitative studies, as most studies relied on quantitative methods such as structural equation modelling, content analysis, descriptive analysis and regression analysis. Among others, only two studies with text analysis (Wattanacharoensil and Schuckert, 2015; Chang, Ku, & Chen, 2019) and six studies with thematic analysis were identified (Chan and Guillet, 2011; Lim, Chung and Weaver, 2012; Line and Runyan, 2012; (Blichfeldt and Smed, 2015; Blichfeldt and Smed, 2015; Moro & Rita, 2018). In order to contribute to the applied methods in social media and hospitality research, sentiment analysis is used.

Despite the above facts, the importance and significance of customer engagement and their feelings and/or attitudes towards services or products based on UGC cannot be ignored, given the fact that brand communication, advertising and customer engagement are the main business models for many social media platforms and should be researched continuously (Moro and Rita, 2018). The social networking platform Facebook is a good choice to maintain analysis as the largest social media platform that creates a dynamic environment for brand communication and consumer engagement (Su et al., 2015).

The purpose of the study is: a) to provide a general descriptive overview of comments posted by Facebook page followers; b) to identify specific textual attributes of hotel brand posts on social media that may lead to customer engagement (embodied here as reactions, comments, and shares); c) to apply the sentiment analysis to Facebook comments of four- and five-star hotel brands in Croatia; d) to identify and compare the feelings and attitudes of customers towards the staff, services and products that hotel brands promote by posting messages on Facebook pages; e) to offer meaningful implications for interactive marketing practitioners, online advisers, and social media website operators in the hospitality sector.

The aim of this study is therefore to answer the following research questions:

1. How active are the page followers (users) on the hotel brand's Facebook pages in terms of hotel categorisation?
2. Is there a difference between the sentiment scales of four- and five-star hotel brands in comments posted by page followers on Facebook?
3. What kind of sentiment do Croatian five-star hotel brands spread among Facebook users through comments posted on Facebook?

Following, the literature review, the research methodology is explained and the applied sentiment analysis data flowchart are described. Finally, the obtained results are presented and discussed and the most significant conclusions are reported.

2. LITERATURE REVIEW

2. 1 Social media and advertising in tourism and hospitality

Only a decade ago, social media were considered to be platforms or applications that allow users to socialize, network and share digital content, information and/or sentiments (Kaplan and Haenlein, 2010). With the development of social media, such definitions no longer reflect the full potential and purpose of social media and it is agreed that social media have become one of the most important advertising venues for marketers Chu et al. (2020). Social media may serve today as a channel for a number of marketing activities, such as customer relationship management, customer service, buyer research etc. (Ashley and Tuten, 2014). In other words, as a "dynamic, interconnected, egalitarian and interactive organism", social media has enabled brands and customers to connect through various platforms that allow social networks to build on common interests and values (Peters et al., 2013). This connectedness can be determined as strong or weak "social ties", which play an important role in determining the recommendation behaviour of customers (Verlegh et al., 2013; Li, Larimo and Leonidou, 2020).

Social interactions between brands and customers not only influence consumer decisions, but also the connection patterns of users and the strength of social ties indicate the intensity of social interactions (Aral and Walker, 2014; Li et al., 2020). The brand communication and generation of social media data has increasingly enabled brands to better manage customer relationships and improve business decisions (Libai et al., 2010). A large amount of social media data from different social media types and formats can be easily extracted and meaningfully used with modern information technologies, which helps tourism marketers to understand the actual sentiments and experiences of tourists.

The collection and value creation through social media data has been identified as a new strategic resource that can improve marketing results, it can also serve as an important source for customer analysis, market research and crowdsourcing of new ideas (Gnizy, 2019). It should be emphasized that social media platforms (primarily Facebook) are considered by advertisers as the most beneficial platforms for sharing brand-related content and promoting brand associations (Pütter, 2017).

The phenomenon of social media in hospitality and tourism has received a lot of attention from different perspectives. A content analysis study by Leung, Law, van Hoof, and Buhalis (2013) based on social media studies published between 2007 and 2011, showed that consumer-centred research focuses on the influence of social media on the travel planning process. Another content analysis by Nusair (2020) included 439 social media articles published in 51 hospitality and tourism journals between 2002 and 2016 and showed that social media research in hospitality and tourism is mainly based on quantitative methods. The author found that large datasets, netnography, Travel 2.0 and Web 2.0 were topics that marked a new trend in social media research that emerged between 2011 and 2016. The authors Chu et al. (2020) identified three main perspectives in literature, namely: use of social media from the consumer's perspective, organization's perspective and the effects of social media, while Knoll (2016) identified seven main research topics on advertising in social media:

use of advertising in social media, attitudes towards and exposure to advertising, targeting, user-generated content in advertising, electronic word-of-mouth in advertising, consumer-generated advertising and other advertising effects. The authors Leung, Bai and Erdem (2017) explored the message strategy and its effectiveness in a study of 1,837 messages from 12 hotel brand Facebook pages based on a quantitative methodology. The authors found that the picture message was the best message format. Leung (2019) proved that destinations' Facebook pages are effective in terms of improving fans' visit intentions. Leung (2019) conducted an extensive literature review of Facebook marketing research in the tourism and hospitality industry with three objectives. The first was to investigate how Facebook influences fan behaviour through survey methods and modelling (Choi, Fowler, Goh, and Yuan, 2016; Kang, Tang and Fiore, 2014; Lee, Xiong and Hu, 2012; Leung and Tanford, 2016). Second, to develop a typology of Facebook messages based on content analysis and examine the attractiveness of messages based on the number of likes, comments and shares (Kwok and Yu, 2013; Wang and Kubickova, 2017; Su et al., 2013; Leung, Bai and Erdem, 2017). The third purpose of Facebook marketing research is to investigate the marketing effectiveness of messages through experimental design (Atwood and Morosan, 2015; Cervellon and Galipienzo, 2015; Ladhari and Michaud, 2015; Leung, Tanford and Jiang, 2017). The monetary value of a single Facebook "like" to a business in general is found to be considerable (Gruss, Kim and Abrahams, 2020).

More recently, researchers have shown a growing interest in exploring what encourages likes, comments and shares (Mochon, Johnson, Schwartz and Ariely, 2017), while marketers are replacing advertising-based content with brand-based content in an effort to increase social media activity and customer engagement (Facebook for Business, 2013).

2. 2 Branding with social media

Branding has been identified as a topic of great relevance to attract consumer attention and to respond with messages to promote brand building and stimulate purchasing behaviour in the hotel industry worldwide (Forgacs, 2003; Moro and Rita, 2018). Brand communication on social media refers to any brand-related communication "distributed via social media that enables internet users to access, share, engage with, add to, and co-create" (Alhabash, Mundel and Hussain, 2017). Brand presence on social media occurs as paid display advertising, brand participating in social networks as a brand persona, published branded content, and branded engagement opportunities for consumer participation (Ashley and Tuten, 2014). Therefore, the social media business model perspective plays an important role as companies generate revenue while offering free services and users make their final purchasing decisions. As a result of brand activities in social media, brand awareness and brand liking can be increased, customer loyalty and engagement can be promoted, the mouth-to-mouth communication of consumers about the brand can be stimulated, and traffic can be directed to brand locations online and offline (Ashley and Tuten, 2014).

Alalwan, Rana, Dwivedi and Algharabat (2017) conducted a literature review on social media in marketing and examined 35 articles with related topics on branding through social media platforms,

arguing the crucial influence of marketing activities on brand awareness and identity. Muk and Chung (2014) proved that customers can be motivated to follow a brand site in social media by hedonic and utilitarian factors. Christo (2015) empirically investigated that the characteristics of social media brands play a strong role in predicting customer trust, with a consequence of a positive impact on brand loyalty. Furthermore, Smith and Gallicano (2015) confirmed that Twitter and Facebook are more effective social media platforms for communicating with customers and creating and presenting brand stories than YouTube. Nusair, Bilgihan, Okumus and Cobanoglu (2013) assured that brand innovation is influenced by the importance of social media as a strategic mechanism.

Brand presence and advertising messages in social media must be carefully designed to serve their purposes. Since travel experiences are intangible, advertising focuses essentially on images and can evoke and influence the message recipient's mental imagery of the hotel or trip (Wang and Lehto, 2020).

2. 3 Sentiment analysis in the hospitality context

The development of sentiment analysis was driven by the need to know what others think (Ma et al., 2018). Thanks to the advances in machine learning and data mining, sentiment analysis techniques provide an opportunity to transform qualitative data into quantitative emotional values in a series of words or texts, to compare their online presence with that of their competitors and to create possibilities for more innovative research design (Ma, Cheng and Hsiao, 2018). Therefore, the goal of automatic sentiment recognition is to provide information and extract sentiments from behavioural data. Opinions and attitudes are essential components of interactions between parties, as they provide information that helps to interpret the meaning behind a person's behaviour (intentions) (Zhang and Provost, 2018).

Although the sentimental analysis has been examined in different areas, this paper focuses on the field of social media in hospitality, which is a relatively new phenomenon that started approximately ten years ago with the authors Pekar and Ou (2008). The authors performed sentiment analysis (Termextractor22 tool was used) on 268 customers' hotel reviews based on the natural language processing algorithm with expressions describing different hotel features. The main outcome of this study was the developement of the sentiment relationship between the topic of the sentence and the sentiment itself. Shi and Li (2011) performed the sentiment analysis on a sample of 4000 positive and negative hotel reviews using the support vector machine (SVM) based supervised machine learning model. To improve the understanding of visualizations, Chen, Chen and Takama (2016) applied latent Dirichlet allocation (LDA) to cluster reviews. An interactive visualization system was proposed by the authors, it presented sentiment words with aspects based on natural language processing and sentiment lexicons. Geetha, Singha and Sinha (2017) explored the relationship between customer sentiment and online customer ratings of 496 hotels. The authors used the supervised learning algorithm and performed the analysis using Wordnet 3.0 abs Sentiwordnet 3.0 tools. The customer ratings and actual customer feelings were shown to be consistent across hotels belonging to the two categories of premium and budget. The

findings of Park, Kang, Choi and Han (2020) show that the feedback reviews of re-visitors tend to contain more words in a sentence and reveal more positive/negative sentiments than those of one-time visitors. The authors used linguistic inquiry and word count to conduct a sentiment analysis on the user feedback reviews. Luo, Hunag and Wang (2020) applied a sentiment analysis on 363,723 Chinese-text online reviews using the Jieba tool for Python and the Word2Vec tool to calculate similarity and term frequency. The most positive sentiments are associated, by location followed by facilities, service, price, image and reservation experience, while negative sentiments include sound insulation, air conditioning, bedding, windows, toilets, TV sets, WiFi signals, towels, elevators, hair dryers, slippers, toilet bowls, cash return, bills. The authors Ma et al. (2018) gave a critical overview of the origin, development and process of sentiment analysis in the context of hospitality research and emphasized the beginning of the use of sentiment analysis to analyse customer comments, although hospitality organizations rely heavily on word-of-mouth on the Internet.

The text analysis has provided a set of tools for the direct analysis of text content in social media, especially in the area of novel feature sets, sentiment analysis and semantic understanding (Gruss, Kim and Abrahams, 2020).

3. METHODOLOGY

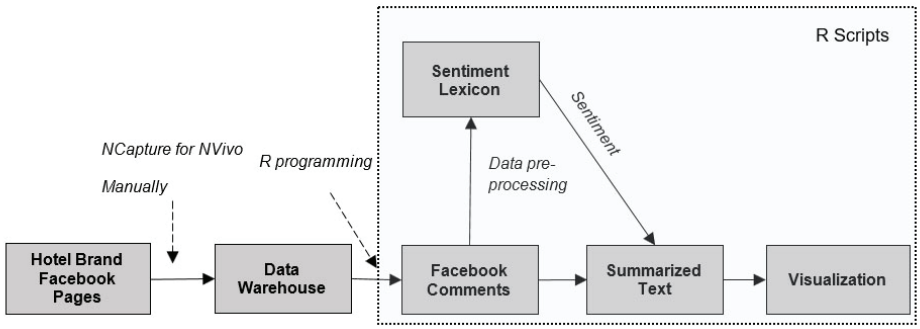
Before the coronavirus COVID-19 triggered an unprecedented global crisis with enormous impact on the political, social and economic system, Croatian tourism was in its "full bloom", breaking tourist records year after year. In 2019, Croatia recorded 21 million tourist arrivals and 108.6 million overnight stays, as published by the Ministry of Tourism and Sport of the Republic of Croatia (2020a). For the first time in Croatian tourism history, more than 20 million tourists visited the destination (90% was accounted by foreign tourists). In total, 39 million overnight stays were recorded in private accommodation, 25 million overnight stays in hotels and 19 million overnight stays at campsites (Ministry of Tourism and Sport of the Republic of Croatia, 2020a). Therefore, it is considered appropriate to conduct the analysis on Croatian hotel brands on social media.

According to the official data published by the Ministry of Tourism of the Republic of Croatia in January 2020, a total of 44 five-star hotels and 329 four-star hotels are categorized (Ministry of Tourism and Sport of the Republic of Croatia, 2020b). The data was collected in February 2020 using NCapture for NVivo and manually from Facebook, as the most popular social networking site. Given the large number of hotel brands in Croatia, several selection criteria had to be defined. First of all, in order to narrow down and specify the sample, hotel brands listed on the first ten pages of the website www.booking.com sorted by hotel rating and category were included in the sample. Secondly, all selected hotel brands had to be searched and checked for an official Facebook website. Hotel brands that did not have an official hotel brand Facebook page, hotel brands that did not post in English and hotel brands that did not post at least three postings per month were excluded from the research. Finally, the sample comprised a total of 31 hotel brands, namely 10 five-star hotel brands and 15 four-star hotel brands. Thirteen

4-star hotels are located at the searside, of which four belog to hotel chains. Two 4-star hotels are located in the continental part of Croatia. Eight 5-star hotels are located at the seaside, of which six belong to hotel chains. Two 5-star hotels are located in the contentnal part of Croatia of which one belongs to the hotel chain. One, two and three-star hotel brands were not observably active on their Facebook pages and were therefore excluded from the sample. The analysis included postings and comments from hotel brands published from January to December 2019. A total of 1,743 comments and 1,026 postings from 5-star hotel brands, and 2,505 comments and 1,347 postings from 4-star hotel brands were collected.

Before data analysis, common text pre-processing functions from R's *tm* package in R Studio were applied. These functions are: *tolower* (makes all text lower case), *removePunctuation* (removes functions such as dots and exclamation marks), *stripWhitespace* (removes tables, extra spaces), *removeNumbers* (removes numbers), *removeWords* (removes certain words (e.g. he and she) or data scientist defined step words), *stemDocument* (reduces prefixes and suffixes on words, making term aggregation easier). To obtain meaningful results, additional functions were applied to remove hypertext transfer protocols ("http"), World Wide Web ("WWW") and symbols such as hashtags ("#") and at signs ("@"), as some comments only contained tags from relatives or links to web pages. The flow chart of the proposed system for mining Facebook comments towards hotel brands is illustrated in Figure 1. Furthermore, the analysis only contained comments in English, German and Italian. Finally, a sample of 725 postings from 5-star hotel brands and 705 postings from 4-star hotels was included in the final analysis.

Figure 1. Flowchart of Sentiment Analysis of Facebook hotel brand comments



Source: Authors

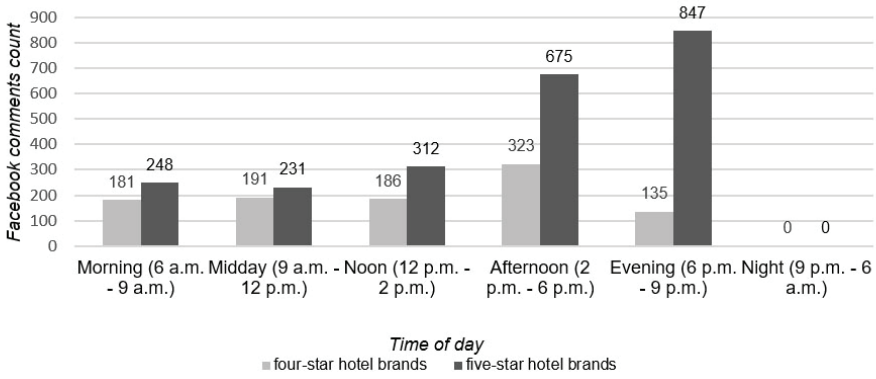
To answer the research questions, sentiment analysis with the AFINN and Bing lexicons was applied. The non-binary AFINN lexicon manually rates words from –5 to 5, with negative values indicating negative sentiment and positive values indicating positive sentiments. The higher the score, the higher the degree of positivity or negativity. There is no fixed range within which AFINN ratings are limited. The Bing lexicon categorizes words in a binary fashion into positive and negative categories.

The sentiment analysis aimed to obtain a calculation of emotional polarity (positive and negative) and an understanding of the attitudes, opinions and emotions expressed. A major advantage of sentiment analysis is that online comments can be collected and analysed in real time. Despite the challenges of automatically detecting sentiment in text (e.g. complexity and subtlety of language use, use of creative and non-standard language, lack of para-linguistic information, lack of large amounts of labelled data, subjective and cross-cultural differences) (Kwartler, 2017), the authors proved the accuracy of given sentiments and results.

4. RESULTS

To gain insight into the characteristics of comments published in hotel brand posts, a descriptive outline is provided. According to the analysis, in 2019 a total of 1,026 postings and 1,743 comments from Croatian five-star hotel brands and a total of 1,347 postings and 2,505 comments from C roatian four-star hotel brands were recorded on Facebook pages. Of the 88,126 page followers of four-star hotel brands on Facebook, most are active during the day and in the afternoon. In total, 881 comments are posted during the day, 135 in the evening and none at night. Of the 244,790 page followers of five-star hotel brands on Facebook, most comments are posted in the afternoon (675) and evening (847).

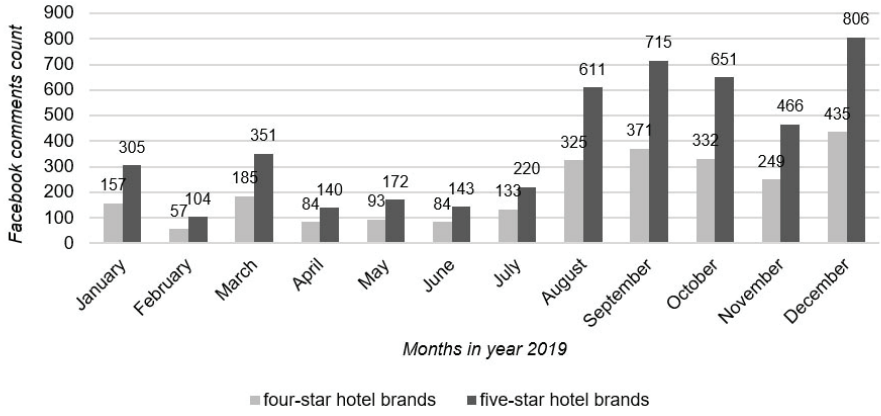
Graph 1. Distribution of Facebook comments by parts of the day



Source: Authors

The descriptive analysis of both hotel brand categorizations shows that the activity of Facebook followers is highest from August to December, reflecting the end of the peak season and the low season. The lowest activity is seen from January to July (Graph 2).

Graph 2. Distribution of Facebook comments by months in 2019



Source: Authors

To identify specific text attributes of hotel brand posts in social media that lead to customer engagement, customer reactions (emojis), comments, shares and number of page followers are collected to calculate the index of interaction rate. The interaction rate index indicates the number of interactions (reactions, comments, shares) in relation to the size of the page (Lies and Fuß, 2019). According to the four-star hotel brands, a total of 204,814 customer reactions (emojis), 2,505 customer comments, 6,039 customer shares and 244,790 page followers were observed. The interaction rate is 87.16 and indicates the average number of interactions per 100 followers of the site, which is very low and is not considered successful.

According to the five-star hotel brands, a total of 144,947 customer reactions (emojis), 1,743 customer comments, 3,321 customer shares and 88,126 page followers were observed. According to this, the interaction rate is 170.22 and indicates the average number of interactions per 100 followers of the site, which is slightly higher but still relatively low.

In previous research, researchers found that social media turned users from passive to active consumers who create content about products and consumption experiences (Bigne et al., 2020). In this case, the page followers of four- and five-star hotel brands in Croatia behave like passive users (*lurkers*) and tend to read posts and comments, view posted photos or videos and have little engagement with the hotel brand and other page followers.

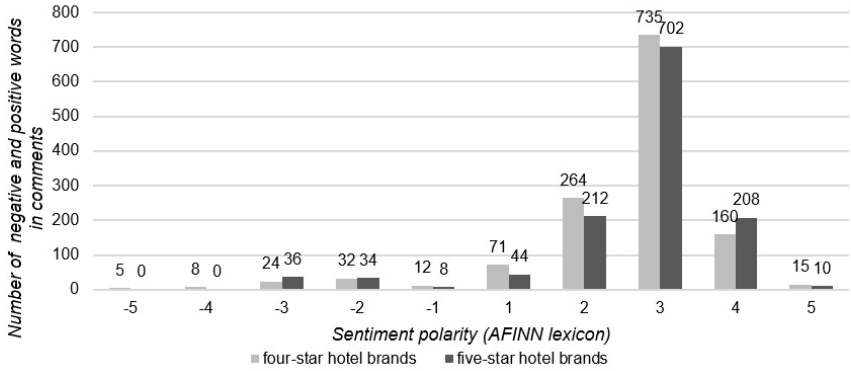
When looking at the frequency analysis of extended positive words, the word beautiful is most frequently mentioned in Facebook comments from four- and five-star hotel brands (35 and 49, respectively). The analysis also showed that Facebook page followers in both hotel categories use almost the same positive words in their comments. Facebook comments of four-star hotel brands contained the word *great* 35 times, *nice* 30, *best* 19, *love* 26, *well* 10, *happy* 16 times. Facebook comments of five-star hotel brand contained the word *great* 20 times, *nice* 10, *best* 41, *love* 31, *well* 15 and *happy* 21 times. Other words most often used in comments are *glad, top, awesome, good,*

amazing, perfect, enjoyed, right, wonderful, fabulous, kindly, stunning, super, top, luxury, thankful, warm, work, recommendation, incredible, joyful, lucky, helped and few more.

The frequency analysis also showed that the comments of four-star hotel brands contained more negative words than the comments of five-star hotel brands. The most common negative words in comments on four-star hotel brands are *bloody* (2), *cold* (2), *hell* (2), *limited* (1), *bad* (1), *bug* (1), *jealous* (1), *sad* (1), *problem* (1), *worry* (1), while the most negative word in the comments on the five-star hotel brands was *hard* (2), *bad* (1), *blur* (1), *cheating* (1), *complaining* (1), *jealous* (1), *incomparable* (1), *nervous* (1), *sad* (1), *shame* (1), *ugh* (1).

In order to fulfil the aim of this study, the sentiment analysis was carried out (Graph 3).

Graph 3. Automatic classification of sentiment polarity of four- and five-star hotel brands



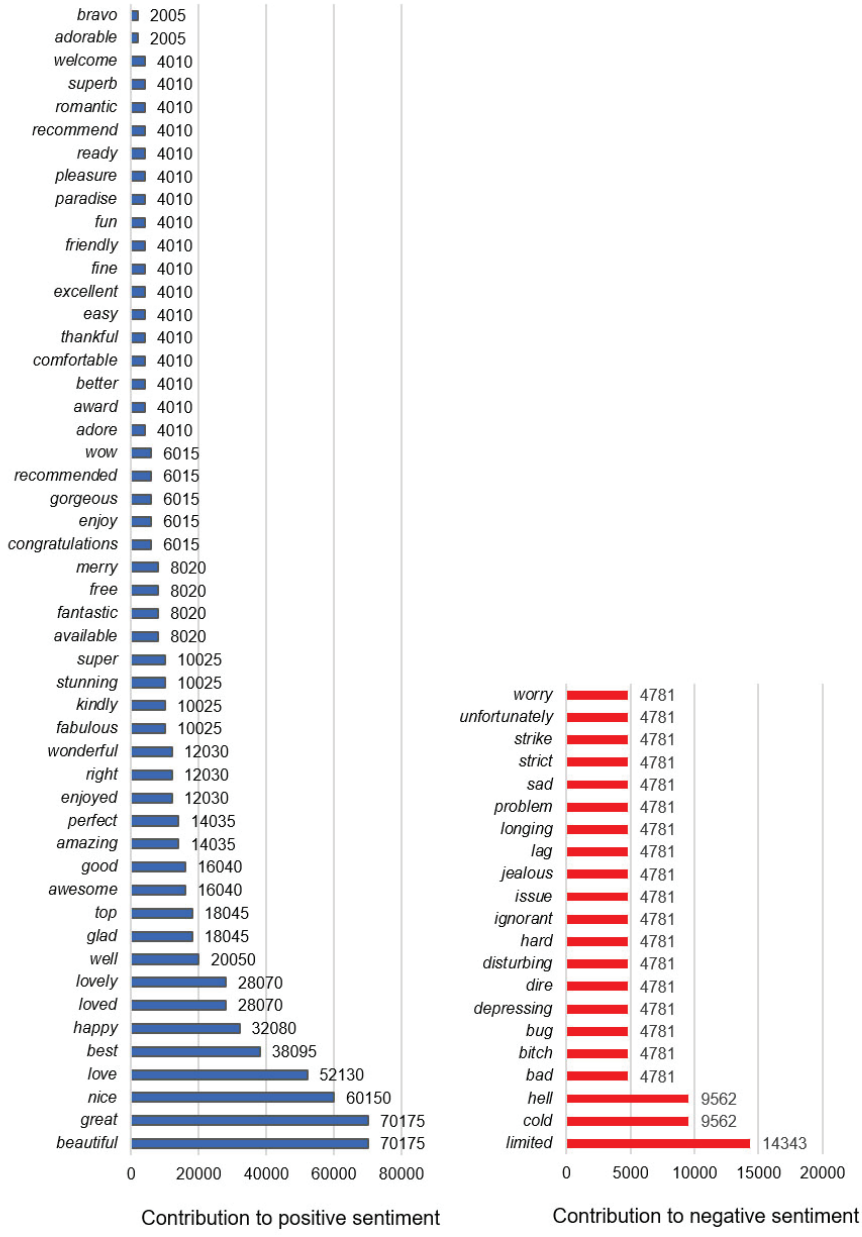
Source: Authors

The analysis showed that the observed Facebook comments contain predominantly positive sentiments. Specifically, four-star hotel brand comments contained a total of 81 negative words and 1,245 positive words. Only 5 words had a sentiment value of –5, 8 words had a sentiment value of –4, while the most negative sentiment values receiving a value of –2. In contrast, 735 words received a sentiment value of 3, followed by sentiment value 2 with 264 words, sentiment value 4 with 160 words and the lowest sentiment value 5 with 15 words.

The analysis of the automatic classification of the sentiment polarity of five-star hotel brands shows that the comments with the values –5 and –4 did not contain negative sentiments. Almost the same number of words contained the sentiment values –3 and –2 (36 and 34 respectively). The distribution of the words with positive values is amounts as for the 4-star hotel brands. The sentiment values contained the most positive words (702), followed by sentiment value 2 (212 words), sentiment value 4 (208 words), sentiment value 1 with 44 words and sentiment value 5 with 10 words.

In addition, the authors draw word contributions on the sentiments of the comments in four-star hotel brands using the Bing lexicon in Graph 4. The Bing lexicon has created data on the contribution to sentiment and clustered them into "positive" and "negative" sentiments.

Graph 4. Words contribution to positive and negative sentiment using Bing lexicon (four-star hotel brands)

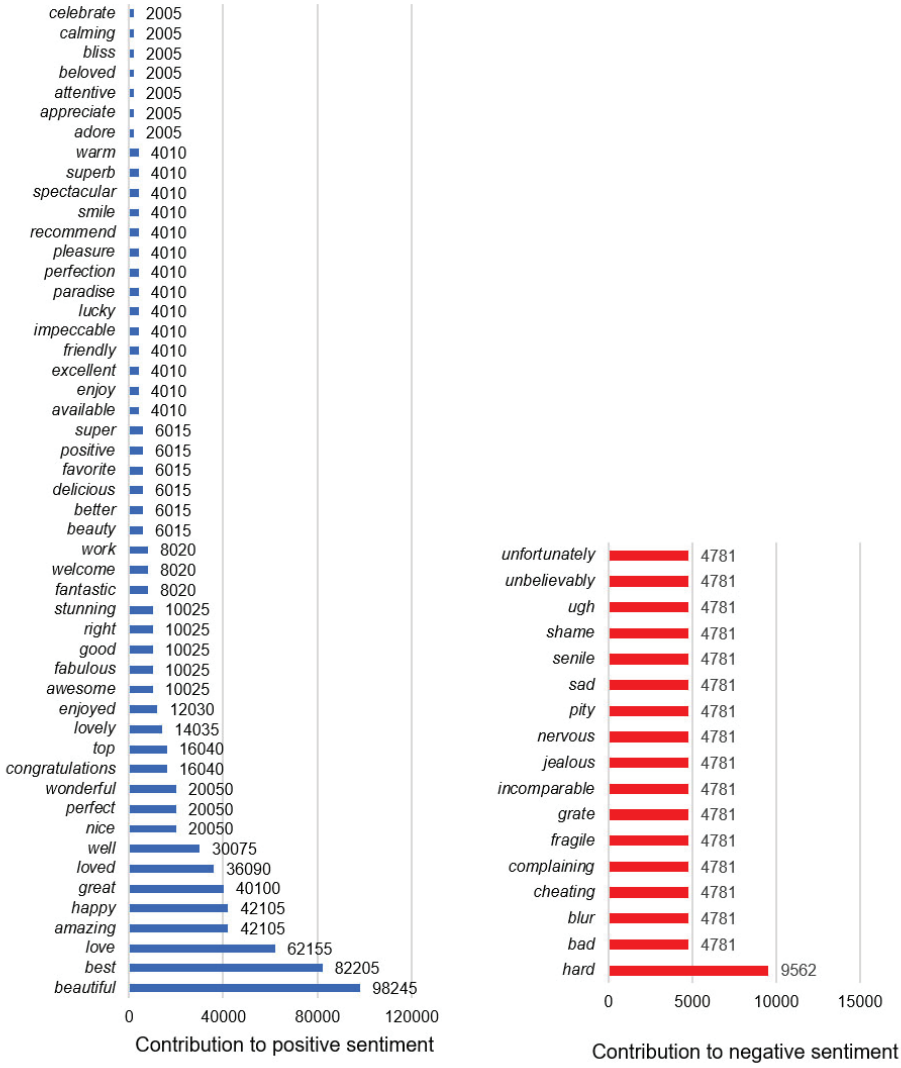


Source: Authors

As shown in the analysis of 4-star hotels, the words *beautiful* and *great* are the most commonly used words, which contributed to the positive sentiment with frequencies of more than 70,000. The smallest contribution to positive sentiment refers to the words *bravo and adorable* with

frequencies of 2,005, and the words *welcome, superb, romantic, recommend* etc. with frequescies of 4,010. The words *limited, cold* and *hell* are words that mostly contributed to the negative sentiment with frequencies of 14,343 and 9,562 respectively.

Graph 5. Words contribution to positive and negative sentiment using Bing lexicon (five-star hotel brands)



Source: Autors

When analysing the contribution to sentiments of five-star hotel brands, the highest contribution to positive sentiment was identified by the words *beautiful* with a frequency of 98,245, *best* with a frequency of 82,205 and *love* with a frequency of 62,155. The lowest frequency of contribution to

positive sentiment is identified by the words *celebrate, calming, bliss, beloved, attentive, appreciate and adore* with frequencies of 2,005.

The highest contribution to negative sentiment refers to the words *hard* (9,562), while the contribution of 4,781 refers to the other negative words such as *bad, blur, cheating, complaining, nervous, pity* and *sad* (see Graph 5).

To ensure that the words accurately reflect the sentiments, the validation was achieved by analysing the Facebook comments of the hotel brands by sentiment polarity:

- Positive sentiments

  [1] *Our most favourite hotel by far... adore Dubrovnik hotel, adore Zagreb... what's not to love about beautiful Croatia...*

  [2] *A beautiful hotel with super friendly staff who gave us a great welcome and looked after us very well on our stay. This hotel has got it so right! Hope to return soon!*

  [3] *Great hotel great staff great everything* ♡

  [4] *Stayed there in June 2019... loved my stay #needtocomeback*

  [5] *Love staying here, best hotel in Zagreb and close to everything you need* ♡

  [6] *Simply the best!!!*

  [7] *It's a gorgeous pool with lovely views across the bay to the old Venetian town of Trogir.*

  [8] *Absolutely beautiful place enjoyed it so much*

  [9] *Ah, a great location for a perfect summer vacation. See you. :) And merry Christmas to you too!*

  [10] Yes, now it is the second time and its fantastic.

- Negative sentiments

  [1] *Is the contest limited to only 1 photo/participant? I can´t find this in terms&conditions*

  [2] *Bloody hell time goes fast*

  [3] *And to dam cold to actually get in the water*

  [4] *Ashleigh M. depressing!!!!!*

  [5] *Sexistic adv made by ignorant marketers. NOT your style. Think deeper*

  [6] *I stayed at the hotel a few years ago. There's a parking problem*

  [7] *It's always hard to leave*

[8] *Such a beautiful place. But a real shame you don't allow non-residents to experience the beauty or sit outside your lovely bar area with a coffee of a morning or a drink of an evening*

[9] *What a pity there's no floating class this week! We would have loved to try it!*

[10] *Oh, you SO deserve this treat! So happy for you. I'm in recovery... trying to get doc to sign-off paperwork so I can leave the hospital! Ugh...*

5. CONCLUSION

Brand communication on social networks has a significant impact on customers' emotional reactions. Nowadays, it is common for customers to publicly express their thoughts and feelings on social media platforms. Therefore, it is essential for companies, especially hotels, to efficiently analyse customers' opinions and use them to design their future communication strategies. The purpose of the study was to provide a general descriptive overview of comments posted by Facebook page followers to identify specific textual attributes of hotel brand posts on social network site and to apply the sentiment analysis to identify and compare the feelings and attitudes of customers towards the staff, services and products that hotel brands promote by posting messages on Facebook pages. New insights were gained by reviewing the activity of hotel brand followers and the sentiment of hotel brand comments on Facebook. The advantage of applied sentiment analysis can be reflected in the fact that it enables researchers and practitioners to exponentially update user-generated content on social media platforms.

This research included an integrated framework to collect, preprocess data, extract sentiment teatures from Facebook posts, classify information and visualize the sentiment results. The results of the sentiment analysis indicated that the sentiment was more positive than negative, which is not surprising, as hotel brands strive to present themselves as positively as possible to draw customers' attention to booking and returning to their hotels. Comparing the contents of both hotel categories in terms of Facebook comments, it can be concluded that there was no significant difference in content and sentiments. The extracted positive words refer to location, service, facilities, image, reservation, circumstances, staff, etc. The negative words mostly refer to individual cases related to the experience of the service and the tourist offer. Apart from the fact that every hotel brand tries to achieve guest satisfaction with its services and offers, in this case only a small number of comments are identified with negative sentiments. Furthermore, the analysis reveald that the four- and five-star hotel brand Facebook pages differ slightly from the activity perspective in terms of the number of likes, comments, and shares. It is interesting to note that the majority of analysed followers of Croatian hotel brand pages are lurkers (passive users) who view posted content and read comments on posts, but rarely or never actively interact (respond, comment or share). This raises the question of whether hotel Facebook content managers are using appropriate brand communication strategies. Research by Kusumasondjaja (2018) found that social media users are more likely to respond positively when the message is created in a conversational or interactive approach, while they avoid interacting with brand content created in a self-oriented style.

The results offer meaningful implications for interactive marketing practitioners and hotel management in general, online consultants, social media site operators and academics. The literature review in this study established the relevance of the given topic and contributed to the state-of-the-art of qualitative research in the field of tourism and hospitality in social media. From a practical point of view, the analysis of large amounts of data and involvement in social media are becoming increasingly relevant to consumer behaviour, customer engagement, changes in brand awareness and the growth of electronic word of mouth (eWOM), but also have a significant impact on the attitudes of newcomers to the business. It appears that practitioners in online media and in the tourism and hotel industry play a crucial role in encouraging and facilitating customer engagement. This study can help managers look beyond hotel ratings to the sentiments customers have about hotels on social media sites. Human language can express emotions that qualitative ratings cannot capture. Hotel brands and marketers should focus on increasing the number of their Facebook followers, paying attention to the social influence of Facebook pages, converting passive users into active users to increase interaction rates and brand awareness, and responding to both positive and negative online comments to improve and maintain their image and respond to customer needs. In addition, hotel managers and marketers should hire staff trained in the use of open source software and programming languages such as R so that they can develop algorithms that best suit their needs and allow them to make the most of valuable, freely available and up-to-date data. The application of sentiment analysis can suitably provide operational and strategic improvements. The real guest experience data provides a more general and truthful interpretation than perceived data from a survey. In addition, the daily application of visual and multimedia analytics could provide an essential tool for risk control and promotion. This indicated that the crucial role of the service provider in creating an environment in which interaction and exchange can take place successfully (Grönroos, 2008). It should be emphasized that no similar studies have been identified that directly contribute to Croatian hotel industry and serve as a basis for further analysis in this area.

This study has several limitations. The results cannot be generalised, as only a total of 25 four- and five-star hotel brands were included in the study. The current study takes into account only one social media platform and comments written in English, German and Italian. The comments of several platforms should be analysed and compared with different algorithms and lexicons supporting several critical languages such as Croatian. Therefore, further studies should address these limitations in order to expand the results. The application of sentiment analysis faces several challenges mentioned in this study. Sometimes users express their opinions in a sarcastic way that is difficult to detect. Despite these limitations, this study provided meaningful results by applying a powerful tool for understanding consumer sentiments.

This paper is the result of the scientific project „Analysis of human and corporate voice of tone on social media in hotel industry“ which is supported by the University of Rijeka (Project No. ZIP-UNIRI-116-5-19)

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Izvorni znanstveni rad
https://doi.org/10.31784/zvr.9.1.3
Datum primitka rada: 30. 11. 2020.
Datum prihvaćanja rada: 12. 3. 2021.

SENTIMENTALNA ANALIZA SADRŽAJA DRUŠTVENIH MEDIJA HRVATSKE HOTELSKE INDUSTRIJE

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SAŽETAK

Iako su društveni mediji postali svakodnevica u modernom društvu, brend komuniciranje i uključenost potrošača postali su ključni elementi marketinške strategije i uspjeha u sektoru turizma i ugostiteljstva. Revolucija društvenih medija, u marketingu, turizmu i ugostiteljstvu, pridonijela je razvoju sentimentalne analize sa stajališta strojnog učenja i obrade prirodnog jezika. Svrha ovog rada je: pružiti opći deskriptivni pregled komentara objavljenih od strane pratitelja Facebook stranice; identificirati specifične tekstualne karatkeristike objava hotelskih brendova na Facebook društvenoj mreži i primijeniti sentimentalnu analizu nad Facebook komentarima hotelskih brendova s četiri i pet zvjezdica u Hrvatskoj kako bi se identificirali i usporedili osjećaji, mišljenja i stavovi kupaca prema osoblju, uslugama i proizvodima koje hotelski brendovi promoviraju objavljivanjem poruka na Facebook stranicama. Da bi se analizirali sentimenti komentara pratitelja hotelskih brendova na Facebook društvenoj mreži, autori su prikupili ukupno 4.248 komentara i 2.373 objave na engleskom, njemačkom i talijanskom jeziku. Rezultati su pokazali da su komentari na stranicama hotelskih brendova imali pretežno pozitivan sentiment. Unatoč pozitivno orijentiranim osjećajima u komentarima, pratitelji Facebook stranica su uglavnom pasivni korisnici i ne sudjeluju aktivno u komentiraju objava. Rezultati mogu koristiti marketinškim stručnjacima u turizmu i ugostiteljstvu za planiranje budućih strategija komunikacije putem društvenih media.

***Ključne riječi**: brand komuniciranje, marketing društvenih medija, sentimentalna analiza, Facebook komentari, hotelijerstvo*

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Original scientific paper
https://doi.org/10.31784/zvr.9.1.4
Received: 12. 11. 2020.
Accepted: 2. 2. 2021.

THE EFFECT OF THE COVID-19 PANDEMIC ON THE CROATIAN ECONOMY

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ABSTRACT

This article titled "The effect of the COVID-19 pandemic on the Croatian economy" deals with exceedingly current events triggered by the pandemic, which have reflected on the national and global economy. Based on the currently available data and the survey of 358 respondents (from both the private entrepreneurship sector and public administration), the effect of COVID-19 on the Croatian economy is observed through declining employment, the required recovery years, and declining GDP. The differences and similarities between this and the great global economic crisis of 2008/2009 as well as the opinion of entrepreneurs on which crisis has had more significant consequences for the economy were examined. A linear regression model predicts the declining employment in the recovery years. The entrepreneurs agree that the crisis caused by the COVID-19 pandemic is far more destructive and devastating to the economy, primarily because there is no end in sight even though the vaccine has been found. The unanimous agreement of the entrepreneurs is that, without further measures aimed at preserving the economy put in place by the Government, it will not be possible to suppress a further decline in employment and GDP, which will lead to a prolongation of the necessary recovery time for the Croatian economy. This research is the basis for further research on the effect of the COVID-19 pandemic on the Croatian economy.

***Key words**: COVID-19 crisis, employment, Financial Crises, GDP*

1. INTRODUCTION

The global health crisis caused by COVID-19 is a unique example in the economic history, to date, of a rapid and profound impact on the world economy. Therefore, the states have had to undertake a number of measures to mitigate the health and economic consequences of the pandemic. The governments of many countries worldwide have reacted to the sudden halt in economic activity by increasing health care expenditures, transferring the funds to the entrepreneurs to preserve liquidity and save jobs, and by postponing tax and credit obligations. State interventions are particularly substantial in supporting business sectors, amounting to more than 10 percent of the GDP in most of the developed countries.

The fact that the world has experienced the COVID-19 crisis while facing an over-indebtedness after a multi-year trend of increasing indebtedness and insufficient recovery from the 2007 global financial crisis should not be overlooked. This is supported by the data on the historically largest share of the public debt (globally) in the GDP of 83 percent. According to the IMF estimates (Jurlin, 2020) for 2020, the share of the government GDP debt in the world will increase by 13.1 percent, and in the event of a new wave of the pandemic in 2021, they predict an additional increase of as much as 20 percent. According to Baker et al. (2020) the crisis caused by COVID-19 has led to an increase of uncertainty because there are no close parallels from the economic history with which a comparison could be made.

The chief economist of the World Bank, Justin Lin, estimated in early 2009 that the financial crisis would result in the most severe recession since the 1930s (Letica, 2010: 3). However, the COVID-19 pandemic, that emerged in the late 2019 in China and spilled over to the entire world in 2020, refuted all of the economists and analysts who thought the 2007 crisis was something that would have the most serious consequences for the economy. According to the El-Erian (Jeffery, 2020) the disorder caused by COVID-19 is not only destructive but has also created "shocks" of supply and demand in all areas of human activity. Some countries have imposed a total travel inside and outside of the country. Precisely because of this, the crisis caused by COVID-19 is a precedent in the history of economic crises.

The situation in the Republic of Croatia is even more alarming because the economy has not yet recovered from the great crisis of 2008 and has faced this situation very unprepared. Due to the partial or complete closure of factories and enterprises in March 2020, there was a decline in industrial production in almost all areas. According to the Central Bureau of Statistics (2020a), the quarterly GDP in the second quarter of 2020 was 15.1 percent lower than in the same quarter of 2019. This is the largest real decline in the quarterly GDP since 1995, when a quarterly estimate of GDP was instituted. Due to closures of world economies and the drop in demand, imports of goods have experienced a significant reduction, especially from the most important foreign trade partners from the European Union. The Republic of Croatia is among the three most severely affected countries. The European Commission (Eurostat, 2020) predicts the biggest drop in GDP to be in Italy, 11.2 percent, Spain 10.9 percent and Croatia 10.8 percent. Although, at first glance, the impact on the EU economy seems symmetrical as the pandemic has hit all Member States, a significant asymmetry of the economic downturn in 2020 and the recovery strength in 2021 is

expected. According to the current forecasts of the European Commission, the differences in the extent of the consequences of the pandemic and the recovery strength among the Member States will be even more pronounced than expected in the spring forecast.

On average, the euro area economy will shrink by 8.7 percent in 2020 and grow by 6.1 percent in 2021. As for the EU-wide economy, it is projected to decline by 8.3 percent in 2020 and grow by about 5.8 percent in 2021. According to the current forecasts (ECB, 2020a), the decline in 2020 will be significantly higher than the 7.7 percent previously projected for the euro area and 7.4 percent projected for the EU as a whole in the spring forecast, as of May 6, 2020. In the wake of the presented forecasts for the Croatian and European economy, this research sought to examine whether the expectations of the entrepreneurs are consistent with the relevant projections of the Government, macroeconomists and the institutions in charge of calculating and monitoring GDP and other economic parameters in Croatia. The survey was conducted in the sixth month of this year on 358 respondents from various economic activities.

The following hypotheses have been set for testing the selected goal:

H1: According to the opinion of Croatian entrepreneurs COVID-19 crisis has and will have more significant consequences than the financial crisis of 2007/2008 (in Croatia 2008/2009)

H2: Entrepreneurs' opinions on the consequences of the crisis caused by the COVID-19 pandemic differ from the Government's assumptions

H3: Entrepreneurs' opinions on the consequences of the crisis caused by the COVID-19 pandemic differ from the assumptions of economic analysts

H4: There is no statistically significant difference between the opinions of entrepreneurs at various stages of post-lockdown mitigation on the economic consequences of the crisis caused by the COVID-19 pandemic in terms of GDP decline, declining of employment and the required recovery years.

The paper consists of six parts including the introduction and the conclusion. The remainder of the paper is organized as follows. Section 2 recalls the literature of theoretical and empirical studies that have examined various economic factors of COVID-19. Section 3 describes the data and the methodology. Section 4 reports the empirical data of the obtained by the research, and Section 5 reports the results of the empirical data and discusses the obtained results on the economic consequences of the COVID-19 crisis.

2. LITERATURE REVIEW

Considering that the research opus of the relevant empirical research papers related to the impact of COVID-19 on GDP is extremely modest, which is understandable given the very short time period and the large number of unknowns, the intention in this chapter is to combine the most important foreign and domestic research papers which are related, in both a broader and a narrower sense, to the topic of the impact of COVID-19 on GDP.

The author Čvarak (2020), in his work, explores the macroeconomics of the crisis and how to approach its resolution. The article explains the health shock impact mechanisms on the economy and the macroeconomic framework of mitigation and the exit from the crisis. In the analysis, he uses the AS-AD model with inflation on the vertical axis for the Croatian data.

Ćutić (2020) analysed the impact of the pandemic on the stability of the PESCO programme and the financing of the security and defence sector in the face of an almost complete cessation of economic activities. He concludes that the Government of the Republic of Croatia made timely decisions regarding the adjustment of the state budget to the new situation and has helped the businessmen.

In her work Maliszevska et.al. (2020) elaborate on an illustrative scenario in which they indicate that the potential loss of income and GDP in the affected countries could be significant. They announce that they will develop the analysis over time as more indicators emerge. Early indicators of economic costs and the magnitude of the estimated impacts indicate the need for a coordinated international crisis response.

Canuto (2020) analyses how quickly and to what extent the national economies will recover after a pandemic. It analyses the available world associations data such as the IMF, the World Bank and concludes that the global economy is expected to be marked after the pandemic by an even greater public debt, an acceleration of the digitalization process and a lesser globalization.

Brodeur et al. (2020) use the Real Business Cycle (RBC) model and conclude that the COVID-19 shock led to a year-on-year decline in GDP of 11 percent in the 4th quarter of 2020. According to the authors, more than half of the reduction was caused by the uncertainty caused by COVID-19.

Baker et al. (2020) conclude that COVID-19 has led to a large increase in uncertainty and state that there are no close historical parallels and that a major limitation in research is the very rapid data change.

In their study, Bonadio et al. (2020) use a quantitative framework to simulate a global blockade in terms of labour supply reductions for 64 countries. The authors find that the average decline in real GDP represents the main decline in the economic activity, which is largely attributed to the disruptions in global supply chains.

Caspedes et al. (2020) formulate a minimalist economic model in which COVID-19 leads to a loss of productivity. The authors predict a vicious circle triggered by a drop in productivity causing lower collateral values, which limits the amount of borrowing activity, leading to a reduction in employment and then back to lower productivity. The COVID-19 shock was also intensified through the loop of the 'unemployment' collapse and the deflation of property prices.

In a study by Coibion et al. (2020), surveys are to assess the macroeconomic expectations of U.S. households (by examining the expenditure decline).

Eleney et al. (2020) model the impact of COVID-19 as a decline in worker productivity and in labour supply, which, ultimately, adversely affects the revenues of various enterprises. Falling

revenues and consequent non-payment of liabilities create a wave of corporate tasks that could bring down financial intermediaries.

3. METHODOLOGY

The aim of this study is to examine whether entrepreneurs' expectations about the economic consequences of the COVID-19 crisis coincide with the relevant projections of the macroeconomists and the institutions as well as of the Government of the Republic of Croatia in terms of GDP, unemployment and recovery years.

In order to test the set hypotheses after the usual descriptive statistics, a linear regression model and the Pearson Chi-Square Test are used. Pearson's chi-squared test is used to determine whether there is a statistically significant difference between the expected frequencies and the observed frequencies in one or more categories. The statistical study used the software IBM SPSS.

In the conducted research, a survey was used as an instrument for obtaining the opinion of various entrepreneurs. The research was conducted online in the period from 26.05. to 16.6.2020 in the conditions in which the business began to return to the new "normal". The survey questionnaire was conducted online to include a sample of respondents in different positions and in different economic activities, determine their attitude and forecasts with regard to the developing situation and compare their forecasts with the forecasts of the Government and the economic analysts and institutions.

In the survey questionnaire has answered 358 people. In the survey participated 77.9 percent of women and 22.1 percent of men. Among respondents, 51.4 percent were Manager / Owner, 7.3 percent were Managers, 15.6 percent Chiefs, 23.2 percent Employees in private companies and 2.5 percent were employees in a public administration. The survey questionnaire consists of two parts and a total of 44 questions. The first part contains 6 questions covering general information about the gender of the respondents, their job, the size of the company, the main activity of the company, the affiliation of the company to a particular county and the stages of relaxation after the lockdown. The second part refers to the state measures put in place to save the economy and the opinion of respondents on the future consequences of this COVID-19 pandemic caused crisis. The research presented in this paper refers to four questions in the second part, namely the insight of entrepreneurs on which crisis will have more significant consequences for the economy: COVID-19 crisis or the financial crisis 2007/2008 (or in the Republic of Croatia 2008/2009); and on the economic consequences of the COVID-19 crisis in terms of the falling GDP, falling employment, as well as the years of economic recovery needed to achieve business results as they were in 2019. Respondents' opinions on these elements were observed in terms of concessions after the lockdown that began on the 16th of March 2020, when all educational institutions and non-food stores were closed, and all services where the advised physical distance could not be maintained were suspended.

The easing of measures after the lockdown was accomplished in three phases. The first phase of easing the lockdown measures began on the 27th of April 2020 with the opening of shops, public transport, and outdoor training. The second phase began on the 4th of May 2020. It enabled the

full operation of the health system, activities that provide personal services such as hairdressers, beauticians, barbers. The third phase began on the 11th of May 2020 in which the gathering of up to 10 people was allowed as well as the work of shopping centres, kindergartens, classroom teaching, catering facilities and hotels, all under certain hygienic conditions. For the purposes of this research, five groups were created: the first three are made up of the official phases of concessions, the fourth consists of entrepreneurs from various industries who could not be placed in the above groups, while the fifth group consists of entrepreneurs who did not have any restrictions (the ones who did not have to suspend operations during lockdown). In the first phase (27.04.2020) was 8.9 percent of the respondents. In the second phase (4.05.2020) was placed 5.0 percent of the respondents. In the third phase (11.05.2020) was placed 12.9 percent of the respondents. The biggest part, 59.2 percent of the respondents did not have restrictions on activities. The 14.0 percent of the respondents were not sure about restrictions, because they are involved in a lot of different activities. First day of lockdown was16.3.2020. The first phase was in lockdown for 42 days, the second phase for 49 days, and the third phase for 56 days. The other groups of respondents (groups 4 and 5) were not in the lockdown.

Table 1 shows the surveyed entrepreneurs according to the size of the company, classified according to the phases of measure relaxation. Most respondents belong to micro-entrepreneurs (65.6 percent), of which 41.6 percent did not stop working; 9.5 percent of micro-entrepreneurs could not be placed in any of the phases as they have more activities or some measures for their activities were not disclosed. In the first phase of the concession were 6.7 percent of micro-entrepreneurs and 5.6 percent in the third phase of the concession.

Table 1. The size of the companies according to the phase of COVID-19 measures relief

SIZE OF COMPANIES	PHASE COVID-19					Total
	1. P. (27.4.)	2. P. (4.5.)	3. P. (11.4.)	NOTHING MENTION	DID NOT STOP THE WORK	
MICRO	6.7%	2.2%	5.6%	9.5%	41.6%	65.6%
SMALL	.6%	.6%	3.1%	1.4%	6.1%	11.7%
MEDIUM	.8%	.3%	1.4%	.3%	3.1%	5.9%
LARGE	.8%	.8%	2.5%	1.7%	2.2%	8.1%
CRAFTMEN, I. PROFESSION	.0%	1.1%	.3%	1.1%	6.1%	8.7%
TOTAL	8.9%	5.0%	12.8%	14.0%	59.2%	100.0%

Source: Authors

Table 2 shows the entrepreneurs who participated in the survey sorted by activities through certain phases of easing measures. Most entrepreneurs (59.2 percent) from the fifth phase, which had no restrictions in doing business, relate to accounting, auditing and tax consulting (36.6 percent).

Table 2. Activities in the phases of COVID-19 measures relief

ACTIVITIES	PHASE COVID-19					Total
	1. P. (27.4.)	2. P. (4.5.)	3. P. (11.4.)	NOTHING MENTION	DID NOT STOP THE WORK	
CONSTRUCTION	.6%	.0%	.0%	.8%	2.2%	3.6%
PUBLIC ADMIN.	.6%	.0%	.3%	.3%	1.4%	2.5%
EDUCATION	.3%	.3%	.8%	.3%	.3%	2.0%
AGRICULTURE	.6%	.0%	.3%	.0%	.8%	1.7%
MANUFACT. IND.	.6%	.3%	.6%	.3%	2.0%	3.6%
FOOD INDUS.	.3%	.0%	.6%	.6%	.6%	2.0%
HOSPITALITY I.	.6%	.0%	3.9%	1.1%	.8%	6.4%
FOOD TRADE	.8%	.0%	.6%	.8%	2.5%	4.7%
TEHNICAL TR.	2.0%	.0%	.6%	.6%	1.4%	4.5%
FINAN. AND INS.	.3%	.0%	.8%	.8%	2.2%	4.2%
PERSONAL S.	.6%	1.1%	.6%	.3%	.8%	3.4%
ACC., AUD. TAX	1.4%	1.4%	1.4%	5.3%	36.6%	46.1%
REST ACT.	.6%	2.0%	2.5%	2.8%	7.5%	15.4%
TOTAL	*8.9%*	*5.0%*	*12.8%*	*14.0%*	*59.2%*	*100.0%*

Source: Authors

Most of the respondents were from the City of Zagreb (30.2 percent); 17.0 percent did not stop the work; 4.7 percent was in the third phase. From the Split-Dalmatia County, (10.1 percent) 5.9 percent did not stop the work and 1.4 percent was in the first phase. From 21 Counties, only Lika-Senj County is not present in this research.

In order to further compare the effects of the 2008/09 crisis with the crisis caused by the COVID-19 pandemic, we determined a regression linear model (one could also say a trend-model because time is an independent variable) for the movement of the number of employed and unemployed.

A linear regression model was determined for the number of employed and unemployed based on empirical data for the period from 2008 to 2014. The obtained model equations were translated so that their starting point was in the 1st quarter of 2020. Based on the thus translated model, a projection for 2020, 2021 and 2022 by quarters was made.

4. EMPIRICAL DATA AND THE ANALYSIS

As the main goal of this paper is to determine the opinion of the respondents - entrepreneurs of different size, activities and from different counties, they were asked basic questions divided into

four variables: 1) which crisis had the more significant consequences for the Croatian economy: the crisis of 2008/2009 or COVID -19 crisis according to the opinions of the entrepreneurs; 2) how many years will it take for the economy to recover in order to achieve the results of 2019; 3) how big a decline in employment due to the COVID-19 crisis is expected by the end of 2020; 4) how big a decline in GDP is expected as a result of the COVID-19 crisis in 2020. The obtained results from the entrepreneurs, based on the survey questionnaire, are shown in Table 3 and were used to achieve the main goal of this paper and by either confirming or rejecting the aforementioned hypotheses.

When asked which crisis had the more significant consequences for the economy, 69.6 percent of the respondents answered that it was the COVID-19 crisis, which is statistically significantly more ($\chi 2 = 54.75$, $p < 0.01$) than the respondents who believe that the crisis of 2008/09 had greater consequences (30.4 percent). There is no statistically significant difference ($\chi 2 (4) = 3.423$, $p = .490$) between the respondents in different phases of the COVID-19 relief measures giving greater significance to the COVID-19 crisis; although, 39.7 percent of the respondents who gave greater significance to the COVID-19 crisis did not have business downtime.

When asked how long the recovery will be to once again reach the results of 2019, 48.6 percent predict a period of at least 3 years, and 21.2 percent up to 5 years. However, there is no statistically significant differences ($\chi 2 (16) = 22.605$, $p = .125$) between the respondents in different phases of COVID-19 mitigation measures and predicted years of recovery for the economy.

When asked what decline in employment is expected by the end of the year, 63.1 percent answered between 11 and 30 percent. There is no statistically significant difference ($\chi 2 (12) = 18.918$, $p = .091$) between the respondents in different phases of the COVID-19 relief measures in reference to the question of the employment decline. 38.3 percent from the group of entrepreneurs who did not have a business interruption and 5.3 percent of entrepreneurs from the first phase.

When asked how big a decline in GDP is expected as a result of the COVID-19 crisis in the Republic of Croatia, as many as 67.9 percent of entrepreneurs agreed with the predictions of the economic analysts. There is no statistically significant difference ($\chi 2 (16) = 17.786$, $p = .337$) between the respondents in different phases of the COVID-19 relief measures and the predicted drop in GDP. 39.9 percent of entrepreneurs who did not have a business interruption.

Table 3. Pearson Chi-Square Test

Description	PHASE OF COVID-19					Total	Pearson Chi-Square	df	Asymp. Sig. (2-sid.)
	1. P. (27.4.)	2. P. (4.5.)	3. P. (11.5.)	NOTHING MENTION	DID NOT HAVE STOP THE WORK				
CRISES	*8.9%*	*5.0%*	*12.8%*	*14.0%*	*59.2%*	*100.0%*	*3.423*	*4*	*.490*
CRISIS 2008/2009	2.8%	1.7%	3.6%	2.8%	19.6%	30.4%			
COVID-19 CRISIS	6.1%	3.4%	9.2%	11.2%	39.7%	69.6%			
RECOVERY YEAR	*8.9%*	*5.0%*	*12.8%*	*14.0%*	*59.2%*	*100.0%*	*22.605*	*16*	*.125*
1 Y	1.4%	1.7%	1.4%	1.7%	13.7%	19.8%			
3Y	3.9%	2.2%	8.7%	6.1%	27.7%	48.6%			
5Y	2.2%	1.1%	2.2%	3.4%	12.3%	21.2%			
10 Y	1.4%	.0%	.6%	2.2%	4.2%	8.4%			
> 10 Y	.0%	.0%	.0%	.6%	1.4%	2.0%			
DECLINE IN EMPLOYM.	*8.9%*	*5.0%*	*12.8%*	*14.0%*	*59.2%*	*100.0%*	*18.918*	*12*	*.091*
TO 10%	1.4%	.8%	2.2%	.6%	9.8%	14.8%			
11% TO 30%	5.3%	3.4%	7.5%	8.7%	38.3%	63.1%			
31% TO 50%	2.0%	.8%	1.4%	3.9%	9.2%	17.3%			
>51%	.3%	.0%	1.7%	.8%	2.0%	4.7%			
DECLINE IN GDP	8.9%	5.0%	12.8%	14.0%	59.2%	100.0%	17.786	16	.337
9.4% GOVERN.	2.5%	1.7%	3.4%	2.8%	16.2%	26.5%			
15% TO 24% EC. ANALY.	6.1%	2.8%	9.2%	9.8%	39.9%	67.9%			
11% TO 15%	.3%	.6%	.3%	.3%	1.1%	2.5%			
30% <	.0%	.0%	.0%	.6%	.3%	.8%			
I DO NOT KNOW	.0%	.0%	.0%	.6%	1.7%	2.2%			

Source: Authors

In table 4 is presented the projection of the number of employed and unemployed for the period 2020–2022. In projection of the number of employed for the period 2020-2022 by quarters we used equation of the linear regression model (empirical data for the period from 2008 to 2014 according to the date of Državni zavod za statistiku (2020b), starting point in 2008):

$$Y = -33.724X + 1.529.579 \qquad R2 = 0,94 \qquad p<0,01$$

X – year (2008 = 0)

Y – number of employed

Translated equation of a linear regression model starting at the end of the 1st quarter of 2020:

Y=-33.724X+1.64 Y=-33.724X+1.649.000

In projection of the number of unemployed for the period 2020-2022 by quarters, equation of the linear regression model (empirical data for the period from 2008 to 2014 according to the date of Državni zavod za statistiku (2020b), starting point in 2008):

$$Y = 16.433X + 251.459 \qquad R2 = 0,86 \qquad p<0,01$$

X – year (2008 = 0)

Y – number of unemployed

Translated equation of a linear regression model starting at the end of the 1st quarter of 2020:

$$Y=16.433X + 129.000$$

Table 4. Projection of the number of employed for the period 2020-2022

QUARTER	NUMBER OF EMPLOYED	NUMBER OF UNEMPLOYED
1Q2020	1,649,000	129,000
2Q2020	1,640,569	133,108
3Q2020	1,632,138	137,217
4Q2020	1,623,707	141,325
1Q2021	1,615,276	145,433
2Q2021	1,606,845	149,541
3Q2021	1,598,414	153,650
4Q2021	1,589,983	157,758
1Q2022	1,581,552	161,866
2Q2022	1,573,121	165,974
3Q2022	1,564,690	170,083
4Q2022	1,556,259	174,191

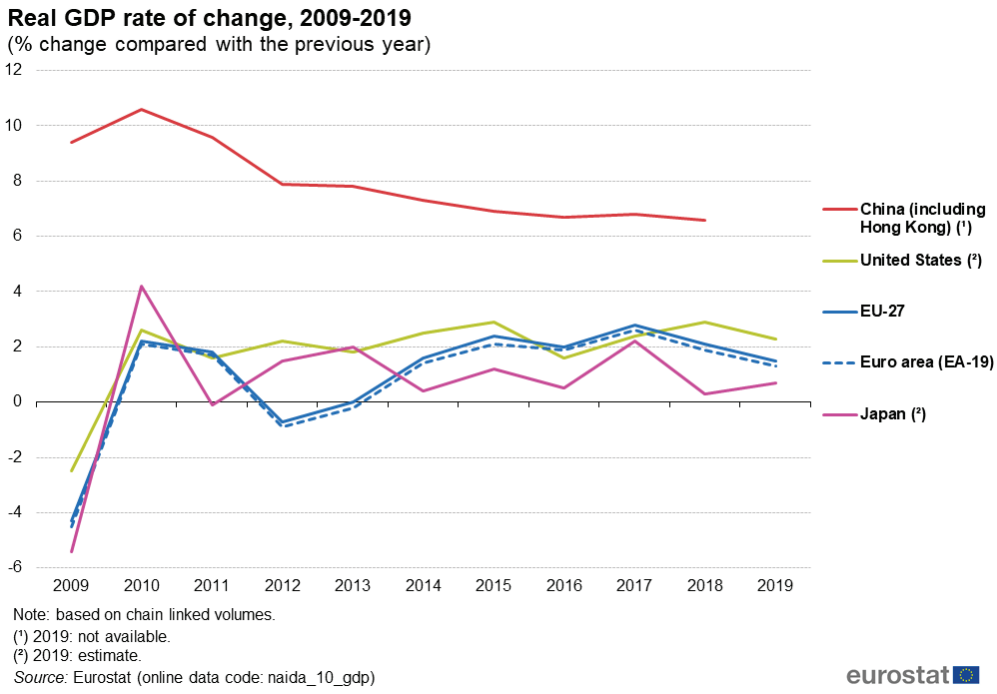
Source: Authors

5. RESULTS AND DISCUSSION

The economic consequences caused by the COVID-19 pandemic have, since the beginning of 2020, dramatically affected the entire business management, both in the euro area and worldwide. According to ECB data released in September (2020b), the real decline in GDP in the EU was 11.8 percent in the second quarter, which is less than the expected projections of the Eurosystem experts from June 2020. This points to a strong, though not a complete, GDP recovery with a growth trend in the third quarter at a rate of 8.4 percent. Real GDP in the EU is projected to decline by 8.0 percent in 2020 and increase by 5.0 percent in 2021 and by 3.2 percent in 2022. This means that, by the end of the projection period, the level of real GDP would be 3.5 percent lower than predicted before the pandemic in the Eurosystem experts' projections from December 2019.

The crisis began in Japan and the United States, where negative (real) annual GDP change rates were recorded in 2009. Unlike the rest of the world, the Chinese economy grew (including Hong Kong) by almost 10 percent each year during the crisis, while it slowed down in the years after the crisis (Chart 1).

Chart 1. Real GDP rate of change 2009-2019



Source: Eurostar, 2020, https://ec.europa.eu/eurostat/statistics-explained/index.php?title= File:Real_GDP_rate_of_change,2009-2019_(%25_change compared with_the_previous _year).png (Accessed: 21.01.2021)

Looking at the global GDP, before the outbreak of the pandemic, growth rate was projected at around 3 percent, then adjusted to 1 percent, and today perhaps even lower. As the World Bank states (2020: 1): "The June 2020 global economic outlook describes the immediate and short-term

prospects of the pandemic impact and the long-term damage it has caused to the economic growth".

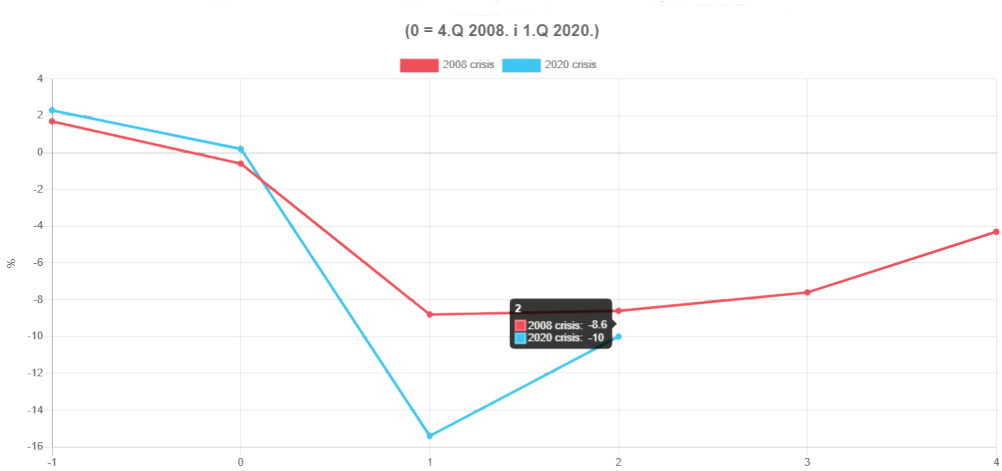
According to Čavrak (2020: 5), the positive circumstance of Croatian society is that, even after the weakened economy after the crisis of 2008 to 2009, Croatia was caught in this epidemiological and economic crisis with a currency sovereignty, which Čavrak quotes as an advantage that was also noticed in the other European Union countries that still have their own currency. In contrast, the Croatian government highlighted the currency sovereignty as a shortcoming in the belief that a common European currency would provide Croatia with a simpler strategy to combat the effects of the COVID-19 virus on the economy.

5. 1 The consequences of the crises on the Croatian economy

The crisis arrived to the Republic of Croatia a little bit later and the global economic crisis is not the only cause (only a partial one) because structural economic problems have existed from before. According Kobešćak (2014: 44) "Along with the transition, the devastation of war and the inadequate privatisation model, a misconceived economic policy that focused on price and exchange rate stability rather than the development which has not significantly changed since the country's independence, has proven itself to be the root cause of the situation". The economic growth that the Republic of Croatia had before the crisis was abruptly stopped.

As many as 69.6 percent of the entrepreneurs who have participated in the survey in early June, faced with the initial economic and life consequences of the COVID-19 crisis, have said that the consequences of this crisis will be far more severe, in Croatia, than the ones of the 2008/2009 crisis. The opinion of the respondents is confirmed by the statistics shown in Graph 2, which shows that the COVID-19 crisis had far more significant consequences than the financial crisis of 2008/09. In the second quarter of 2020, the decrease in GDP was 15.1 percent, in contrast to the financial crisis of 2008, when the GDP decrease in the second quarter was 8.8 percent. In the third quarter of 2020, the decrease in GDP was 10 percent, in contrast to the financial crisis of 2008, when the GDP decrease in the second quarter was 8.6 percent, as shown in Graph 2.

Graph 2. The real Growth of Quarterly GDP in Croatia



X-axis	2008 crisis	2020 crisis
-1	Q3 2008	Q4 2019
0	Q4 2008	Q1 2020
1	Q1 2009	Q2 2020
2	Q2 2009	Q3 2020
3	Q3 2009	Q4 2020
4	Q4 2009	1Q 2021

Source: Državni zavod za statistiku, 2020a, https://www.dzs.hr/Eng/Covid-19/gdp_2_q.html (Accessed: 16.01.2021)

Given the decline in the second quarter by 15 percent, Šaravanja (Privredni.hr, 2020) expects the economy to decline at double-digit rates for the whole year. He points out that this would be a bigger drop than in 2009, when the economy sank by a record 7.4 percent at the beginning of the financial crisis.

5. 2 Years of recovery from the consequences of the COVID-19 crisis in Croatia

The global financial crisis of 2007/2008 resulted in a major recession, especially in the EU-28, and the recovery followed only in 2010 and not evenly for all countries. The Republic of Croatia recorded a six-year decline in GDP for the period of 2009 to 2014. It was only in 2015 that there was a slight growth, but once again insufficient for the overall economic recovery.

The entrepreneurs, 48.6 percent of those surveyed, informed by the experience gained during the previous financial crisis, believe the recovery from the COVID-19 crisis will take at least 3 years,

and as many as 21.2 percent think it will take 5 years. There is no statistically significant difference between the opinion of the respondents in different phases of the COVID-19 relief measures (if they were in first, second or third phase of lockdown or they did not stop with their activities) and the years of recovery.

5. 3 Decline in employment as a consequence of the COVID-19 crisis in Croatia

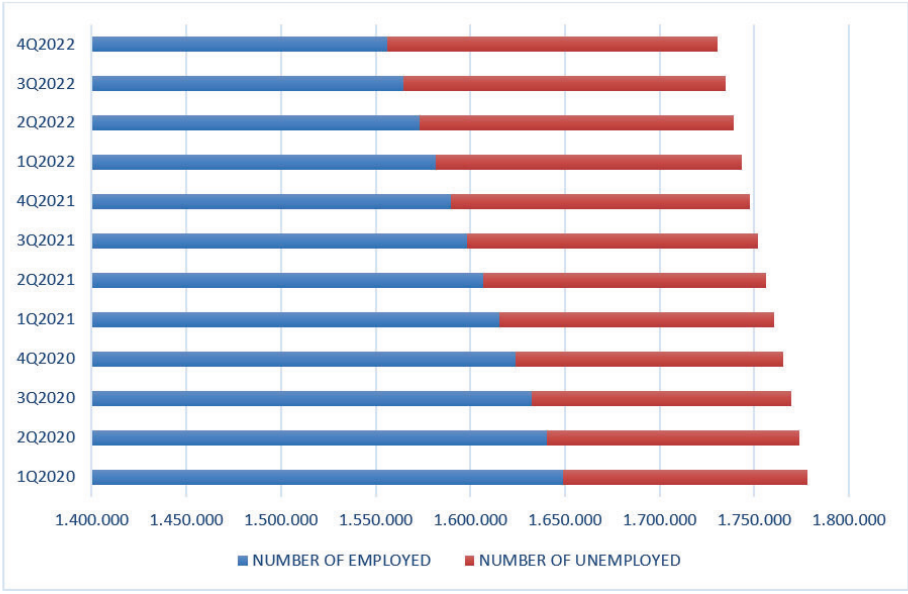
The RBA analysts (Privredni.hr, 2020) state that the largest contribution to the decline in the whole of 2020 will come from personal expenditures, due to the rising unemployment, the fall in employment and the decline of disposable income, while there will be a significant reduction or a delay in investments due to extremely high uncertainty. According to the Croatian Bureau of Statistics (Državni zavod za statistiku, 2020b), in the second quarter of 2020 the number of unemployed persons amounted to 115 thousand, which is an increase of 5.9 percent compared to the same quarter of the previous year.

Litvan (2020) states that, from mid-March to the beginning of the second week of April, the number of the unemployed rose by almost 13,000, to which tens of thousands of jobs that usually open in March due to seasonality should be added, leading to 23,000 jobs which have already been lost.

In order to prevent a larger decline in employment, the Government implement support measures to preserve the jobs, support for part-time work, self-employment, as well as assistance to micro-entrepreneurs.

According to the projection of the linear regression model number of unemployment will increased in the year of recovery from, like is shown in Graph 3. This projection confirms by opinion of examiners in the questionary. Although the majority of surveyed entrepreneurs (63.1 percent) predict a drop in employment 11 to 30 percent larger compared to the previous year due to the pandemic, and as many as 17.3 percent of entrepreneurs predict a drop in employment of 31 to 50 percent, it is difficult to predict what the end of the year will bring. There is no statistically significant difference between the opinion of the respondents in different phases of the COVID-19 relief measures (if they were in first, second or third phase of lockdown or they did not stop with their activities) and the declining in employment.

Graph 3. Projection of the number of unemployed for the period 2020-2022



Source: Authors

5. 4 The decline of GDP in Croatia

The government predicted of decline in GDP of 9.4 percent at the beginning of COVID-19 crisis (Jurlin, 2020). Economic analyst Šonje (Poslovni.hr/Hina, 2020) stated that according to his optimistic estimate, Croatia's GDP could fall by about 11 percent in 2020, and by 15 percent according to the more pessimistic one. In the Hina survey (Glas Slavonije, 2020), economic analysts, on average, expected a decline of 20.5 percent in the second quarter compared to the same period last year, and their estimates ranged from 15 percent to 25 percent.

Of the entrepreneurs who participated in the survey conducted in the first half of June 2020, 67.9 percent agreed with the forecasts of the economic analysts that the annual decline in GDP will be from 15 percent to 24 percent, and, it is especially significant, that 39.9 percent of the entrepreneurs who did not suspend business also chose that option. 26.5 percent of the surveyed entrepreneurs predicted a decline in GDP in the amount of the initial Government projection of 9.4 percent. There is no statistically significant difference between the opinion of the respondents in different phases of the COVID-19 relief measures (if they were in first, second or third phase of lockdown or they did not stop with their activities) and the declining of GDP.

According to the Central Bureau of Statistics data for the second quarter of 2020, GDP fell by 15.1 percent and in third quarter of 2020, GDP fell by 10 percent.

Erste Bank analysts (Wiesner, 2020) stuck to the forecast of GDP decline of 9 percent for 2020 due to the tourist season, which was better than expected.

In September 2020, the Government (Vlada RH, 2020) adopted guidelines for drafting the state budget which project a GDP decline for 2020 of 8 percent, which is less than the initial 9.4 percent. The guidelines forecast a 5 percent growth in 2021, as well as a 3.4 percent GDP growth in 2022 and 3.1 percent growth in 2023.

6. CONCLUSION

The pandemic caused by COVID-19 has led to life and economic consequences worldwide. This research, conducted on 358 entrepreneurs, aimed to establish the first picture of the economic consequences of the COVID-19 crisis, after three months of health and economic life in its clutches.

For the purposes of this research, four hypotheses were created. The first hypothesis that the according to the opinion of Croatian entrepreneurs COVID-19 crisis has and will have more significant consequences than the financial crisis of 2007/2008 (in Croatia 2008/2009) was confirmed, because 69.6 percent of the surveyed entrepreneurs voted for it.

The second hypothesis that the opinions of the entrepreneurs on the consequences of the crisis caused by the COVID-19 pandemic differ from the assumptions of the Government has been confirmed because the respondents predict a larger decline in the GDP compared to the Government.

Unlike the first two hypotheses, the third hypothesis has not been confirmed because 67.9 percent of the entrepreneurs agree with the assumptions of the economic analysts about the fall in GDP as a consequence of the crisis caused by the COVID-19 pandemic. A 15.1 percent drop in GDP in second quarter confirmed the predictions of analysts, and with that the ones of the respondents at the time of the survey.

The fourth hypothesis that there is no statistically significant difference between the opinions of entrepreneurs at various stages of post-lockdown mitigation on the economic consequences of the crisis caused by the COVID-19 pandemic in terms of GDP decline, declining of employment and the required recovery years has been confirmed. All entrepreneurs in the survey, it does not matter in which phase of easing of measures after the lockdown were, in first, second, third or they did not have any interruption of business, agreed about the declining of GDP, declining of employment and year of recovery. Opinion of entrepreneurs about the declining of employment are confirmed by linear regression model also.

The slowdown in recovery in Q4 and the unfavourable epidemiological situation will alleviate and slow something down recovery of the Croatian economy. In 2020, real GDP could decrease by 8.9%, while in 2021 expects GDP growth of approximately 4.9% (Croatian National Bank, 2020).

One of the main limitations of this research is that a large number of respondents in this research came from the activities of accounting, auditing and tax consulting. We can consider such a limitation in both a positive and a negative sense. The downside is that the large number of entrepreneurs, aside from being in the same industry (46.1 percent), did not have a classic lockdown but operated without interruption (36.6 percent). On the other hand, even though the

previously mentioned activities did not have a lockdown, they all organized their activity online in compliance with the health measures in place. In the first days of lockdown, there was a lot of pressure on the accounting, auditing and tax consulting business because the deadlines for submitting the annual financial reports were rapidly approaching; many entrepreneurs had to close their businesses, so there were also problems with submitting the relevant documentation. The pressure to complete and then submit the annual financial reports to the Tax Administration and for public disclosure lasted until the adoption of the amendments to the legislation where the deadlines for submission of the annual financial statements for 2019 were extended until the end of June. However, in addition to this, bookkeeping services and tax advisors deal with filling in all the documentation of Government support, so that it is an activity that is well acquainted with the depth of the COVID-19 crisis and its consequences, not only in their business but also in the activities of their clients.

This research on the entrepreneurs' predictions of the economic consequences of the COVID-19 crisis in the first weeks of June can be used in further research and comparisons with the results achieved either later in 2020 or in subsequent years until the end of the ongoing pandemic, because any empirical research provides a certain contribution to the subsequent understanding of the aforementioned topic.

It can be concluded that the estimates of future economic trends are changing daily. There are similarities to the different possibilities of economic recession, depending on the length and the severity of the pandemic, and especially its impact on the world's leading economies.

According to the latest data, at the time of writing, many countries due to unfavourable development of the epidemiological situation tighten measures, introduced partial lockdowns – in terms of the social life and the economy. All these health and economic measures indicate a significant slowdown in recovery in the last quarter 2020 and continue in the first months 2021. The start of vaccination worldwide at the end of 2020 provides opportunities to begin recovery in 2021. Many entrepreneurs, not only in Croatia, but also in the world cannot survive without a greater support from their governments. All governments, as well as the EU, need to act faster in providing financial support to the economy in order to endure and survive this COVID-19 pandemic.

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Izvorni znanstveni rad
https://doi.org/10.31784/zvr.9.1.4
Datum primitka rada: 12. 11. 2020.
Datum prihvaćanja rada: 2. 2. 2021.

UTJECAJ COVID-19 PANDEMIJE NA HRVATSKO GOSPODARSTVO

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SAŽETAK

Članak pod naslovom „Utjecaj COVID-19 pandemije na hrvatsko gospodarstvo" bavi se vrlo aktualnim događajima izazvanim pandemijom, a koje se odrazilo na nacionalno i globalno gospodarstvo. Na temelju trenutno raspoloživih podataka i provedene ankete na 358 ispitanika (iz realnog sektora i javne uprave) u radu se analiziraju posljedice COVID-19 na hrvatsko gospodarstvo promatrano kroz pad zaposlenosti, potrebne godine oporavka te pad BDP. Također su analizirane sličnosti i razlike sa velikom svjetskom ekonomskom krizom 2008/2009 godine te je ispitano mišljenje poduzetnika o tome koja kriza ima značajnije posljedice za gospodarstvo. Modelom linearne regresije je predviđen pad zaposlenosti u godinama oporavka. Poduzetnici su složni u procjeni da je kriza uzrokovana COVID-19 pandemijom daleko razornija i pogubnija za gospodarstvo, prvenstveno stoga jer joj se ne nazire kraj usprkos pronalasku cjepiva. Jednoglasna je poruka poduzetnika da bez daljnjih mjera za očuvanje gospodarstva od strane Vlade neće se moći zadržati daljnji pad zaposlenosti, kao i BDP-a, što će dovesti do produljenja potrebnog vremena oporavka hrvatskog gospodarstva. Ovo istraživanje je osnova za buduća istraživanja utjecaja COVID-19 pandemije na hrvatsko gospodarstvo.

Ključne riječi: *COVID-19 kriza, zaposlenost, financijske krize, BDP*

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Original scientific paper
https://doi.org/10.31784/zvr.9.1.5
Received: 20. 11. 2020.
Accepted: 5. 2. 2021.

SELF-ASSESSMENT OF ENTREPRENEURIAL COMPETENCIES OF STUDENTS OF HIGHER EDUCATION

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ABSTRACT

Entrepreneurship has become an important academic field leading to a growing interest of scientists in the study, development and evaluation of entrepreneurial competencies of young people. Business based aspects of entrepreneurial competencies relate to the development of personality traits, student skills that influence one's personal development for successful entrepreneurs. The main purpose of this paper is to examine the entrepreneurial competencies of students during their studies and how they relate to their socio-demographic characteristics. The research was conducted in November 2019 on a sample of 172 respondents and included first-year undergraduate students of business economics and undergraduate studies of digital marketing at institution of higher education. The results of the research show a positive statistically significant correlation between all entrepreneurial competencies of students. Statistically significant differences in entrepreneurial competencies according to the gender of students were found. And finally, statistically significant differences in entrepreneurial competencies between undergraduate students of business economics and undergraduate studies in digital marketing were shown. It is expected of students with a higher degree of management competencies attending entrepreneurial education more capable of becoming future entrepreneurs. The primary contribution of this paper is to point out the need to increase students' awareness of the positive impact of entrepreneurial education programs that contribute to the development of such competencies.

Key words: *entrepreneurial competencies, students, gender, study, entrepreneurship*

1. INTRODUCTION

In the last two decades, technological changes and globalization have significantly affected the business of enterprises. Such business environments put a high demand on staffers with developed entrepreneurial competencies, such as problem solving and decision making. Employees are notably required to be creative and innovative, to have the digital competencies necessary to operate in a changing business environment. Entrepreneurial competence influences the development of an entrepreneurial mindset and a more efficient use of students' existing knowledge and their skills. One of the strategic tasks of higher education institutions should include taking responsibility for the development of students' entrepreneurial competencies in all their years of study with the aim of a better preparation for the labor market. Through study programs, professors should help students become aware of the importance and the need to develop competencies that are crucial for their employment or the start of their own businesses. The paper analyzes the relationship between students' competencies in relation to gender and the study program in which the respondents study. Students' entrepreneurial competencies depend on their personal perception, new challenges, focus on innovative and creative ways of solving problems and the desire to succeed. These characteristics can be considered as components of traits that ultimately motivate an individual to take entrepreneurial action. The underlying assumption of the research is that knowledge and experiential learning about entrepreneurial competencies during one's studies can affect the level of self-assessment of one's competence.

The aim of this research was to examine the existence and the intensity of the relationship between the respondent's entrepreneurial competencies and their differences according to the gender and type of studies in which they study. The tasks arising from the main goal of the research are the following: to determine the connection of all entrepreneurial competencies of students, to determine the differences in entrepreneurial competencies of students, to determine the differences in entrepreneurial competencies by gender and the study program at higher education institutions. A self-assessment scale was applied that included the following components: decision making, initiative, achievement of results, leadership, empathy, team work, and integrity. Decision making can depend on a number of factors, requires taking responsibility and is considered a key entrepreneurial competence. Initiative means personal quality that shows a willingness to get things done and to take responsibility, connects to a person who notices what needs to be done in time, acts proactively and independently, but also in cooperation with others. Achieving results indicates that a person is focused on the implementation of set goals by properly organizing all available resources. Leadership encompasses knowledge in a personal, professional, business aspect that makes a difference between the gender. Empathy is important because someone empathetic is prone to teamwork and collaboration. Teamwork comprises procedures undertaken by a group of people who work together to achieve set goals. Integrity means having strong moral principles, taking responsibility for one's business decisions.

The contribution of this paper relates to the results and insights we have gained through empirical research that can help develop entrepreneurial competencies of students as part of their studies at higher education institutions. The findings obtained in this paper should find their practical application also in human resource management. Firstly, the article provides a theoretical overview

of the relevant literature related to research on entrepreneurial competencies. It is followed by a description of the research methodology and a presentation of the obtained results. Finally, a discussion and conclusion follows, outlining the theoretical and practical implications.

2. LITERATURE REVIEW

A review of the literature shows that entrepreneurial competence is a multidimensional construct within different theoretical conceptualizations and the components and structures of the concept should be distinguished. Entrepreneurial competencies imply determining the relationship of individual constituent elements that may include entrepreneurial competence and form a different structure depending on the selected group. Perić, Oberman Peterka and Getoš, (2020) state that entrepreneurship is defined as one of the key lifelong competencies and represents the ability to turn ideas into real projects. As such, it includes creativity, initiative, taking responsibility, taking risks, planning and project management. Terms such as competencies, abilities, resources, skills are used in the literature and are often used interchangeably (Boyatzis, Saatcioglu, 2008; Sánchez 2011; Rasmussen et al. 2011; Lans, Baggen, Ploum, 2018). The personal characteristics of an enterprising person are initiative, creativity, ability to take risks, strong persuasive power, flexibility, imagination, independence, problem-solving ability, need for achievement, leadership ability, perseverance and a high degree of faith and ability to manage one's own destiny (Gibbu, 1987 , 6). According to Kurtz and Bartram (2002:229), "competencies are sets of behaviors that are instrumental for achieving desired outcomes and results." Competence can be seen as the ability to functionally use knowledge and skills in different contexts and consists of technical knowledge, methodological knowledge, participatory knowledge and self-knowledge. In an educational context, competence is the developing general capability of persons (or organizations) to perform (such as an activity, a task, solve a problem), and when a program is successfully completed, the candidate receives a license (Mulder, 2007: 11). According to Ploum (2019) competence is an integrated ability to achieve lasting effective performance in a particular professional domain, job, role, organizational context. The term refers to coherent groups of knowledge, skills, attitudes, expertise, abilities that can be used in a business environment.

Today, no consensus has yet been reached on the very definition of entrepreneurial competence. This problem is visible in most contemporary theoretical and empirical papers through the constant need of researchers for re-conceptualizations. Research, today, has a limited possibility of generalization due to the fragmentary approach and theoretically different foundations of the researched construct. Prominent authors who have defined entrepreneurial competencies are Chandler Jansen, 1992); Man, Lau, & Chan, (2002), and a broader discussion of entrepreneurial competencies emerges from the Mitchelmore and Rowley studies (2010, 2013). Entrepreneurial competencies are defined as underlying characteristics such as generic and specific knowledge, motive, traits, self-images, social roles and skills which result in venture birth, survival and/or growth (Bird, 1995: 51). Entrepreneurial competencies are considered a higher-level characteristic encompassing personality traits, skills and knowledge, and therefore can be seen as the total ability of the entrepreneur to perform a job role successfully (Man et al. (2002:124). Gibb (2002) states that there are a number of specific entrepreneurial competencies required for entrepreneurial activity,

which need to be developed at the same time as core business competencies. Entrepreneurial competencies have been identified as a specific set of competencies relevant to the exercise of successful entrepreneurship (Mitchelmore and Rowley, 2010: 93).

In the European Competence Framework, entrepreneurial competences include taking responsibility for one's own behavior and actions, initiatives and reasonable risk-taking, introducing and supporting innovation, proactive action, reacting positively to change, setting and achieving goals, teamwork, motivation for success. Furthermore, entrepreneurial competence is considered to be one of the basic competences necessary for living and working in a knowledge-based society and should be provided to every individual through education (formal and non-formal) (European Commission, 2006). It is therefore crucial that universities develop entrepreneurial skills and knowledge within study programs (Sánchez 2011). Accordingly, by the end of formal education, students should have developed key competencies that enable them to behave and work as an adult, with the aim of their further development through lifelong learning and adult education programs (EC: Key Competences for Lifelong Learning: European Framework of Reference, 2006). Encouraging an entrepreneurial mindset will contribute to an increased employment of young people in the labor market.

Many authors emphasize that the main cause of non-competitiveness of the labor force in Croatia is the lack of entrepreneurial competencies in a non-entrepreneurial environment (Bejaković 2004; Sedlan Kőnig, 2013; Singer, Šarlija, Pfeifer and Oberman-Peterka, 2018). Accordingly, higher education institutions should develop student entrepreneurship competencies. Tittle, Terzidis, (2020) state that many authors define entrepreneurial competencies as a combination of competencies, traits, and other categories important to entrepreneurial activity. Sadler, (2013) points out that in the last decade the competency model has dominated the education system with an emphasis on learning outcomes. It starts from the assumption that each study program and each course provides the most appropriate place to acquire cognitive and other higher-order skills (Sadler, 2013). In this way, students develop and acquire competencies through knowledge and skills acquired in study programs. Reflection on the development of competencies provides an opportunity to analyze the factors that influence the formation of positive attitudes of students towards entrepreneurship. Rasmussen et al. (2011) state that previous research on entrepreneurial competencies has focused on the individual entrepreneur and it is unlikely that one entrepreneur possesses all the necessary competencies and credibility to start a new business. Wiek, Withycombe, Redman (2011) state that interpersonal competence encompasses the ability to motivate and facilitate collaborative research and problem solving. This capacity includes communication, negotiation, collaboration, empathy, leadership, and pluralistic and transcultural thinking skills (Kevany 2007). Researchers have found in a number of studies that personal background and characteristics such as values, attitudes, motivation, traits, and skills predispose some individuals to entrepreneurial behavior (Collins, Hanges, Locke, 2004; Stewart, Roth 2007). On the other hand, several studies suggest that emotional processes can influence decision-making behavior and judgment in a wide range of business situations which can help to understand the entrepreneurial point of view, making decisions in conditions of insecurity from individual to interpersonal

relationships (Isen, Labroo, 2003; Cohen, 2005). Similarly, Cardon, Foo, Shepherd, Wiklund (2012) confirm that entrepreneurship implicitly contains an emotional component as well.

In the study, Kumpikaite, Ramirez, Ribeiro (2012) explored students 'skills as future employees in international companies, with the aim of showing the diversity of these skills within several cultures, specifically in students from Spain, Portugal, Lithuania, Turkey and Iran. The researched skills were divided into four groups - personal, technical, interpersonal and conceptual skills. The highest average grade is below 3.00, which is quite a low grade and indicates the underdevelopment of all researched skills of students in different countries. Maelah, Aman, Mohamed, Ramli (2012) analyzed the impact of the 6-month accounting study program on students' soft skills development, and the skills developed included time management, oral communication and teamwork, which was expected because it is also a skill that is most often developed during formal education. According to Oberman Peterka and Alpeza, (2013) the most important role of entrepreneurship education is to develop entrepreneurial skills, behaviors and traits that will provide individuals with coping in conditions of great insecurity conditioned by globalization. In the study Sedlan Kőnig, (2013) the results confirm that a higher level of development of entrepreneurial competence increases the propensity for entrepreneurial behavior and the likelihood of starting one's own business. The research also confirms that teaching at colleges does not significantly contribute to the development of entrepreneurial competence and that extracurricular activities have a much more important role here.

The Pollard, Wilson (2014) study states that students at all levels of education, young entrepreneurs and business start-ups must practice an entrepreneurial mindset, defined with five components: the ability to think creatively, strategically, analytically and reflectively; have confidence in their abilities; ability to cooperate; have well-developed communication skills and understanding of the current business context. Mulder (2014) argues that although various attempts to implement competency-based professional learning programs have been fiercely criticized, the later development of the competency theory and research has provided new insights that have emphasized the integrative significance of competencies in professional practice. This helped to map professional fields from the domain of a specific and generic behavioral perspective. Jin and Huang, (2014) state that professional competences or soft skills have become the most essential attributes of computer science and computer engineering undergraduates. We explored ways to expose computing students to entrepreneurial ideas, to spark their entrepreneurial spirit and to enhance their professional competences during their studies. In terms of teamwork skills, according to Kaushal (2016), those individuals who love teamwork and feel comfortable working in such an environment are considered highly desirable employees. On the other hand, Mesquita, Lopes, Bredis (2016) state that actually specific traits, such as leadership, optimism, perseverance, passion, resilience, creativity, empathy, and others, are more easily found in the person of the entrepreneur. Such personality traits can be strengthened, and skills can be acquired directly through the training process in study programs (Mesquite et al., 2016).

According to Hamburg, Bucksch (2017), entrepreneurship education programs should offer students tools for creativity and adoption of digital skills for objective analysis of business ideas and communication through digital technologies, solving technical and environmental problems using

information and communication technologies, conducting marketing strategy, using free digital tools for developing and evaluating. He also emphasizes that Europe needs eco-innovative entrepreneurs with digital skills, and thus the development of entrepreneurial attitudes should become one of the goals of education, and this requires the cooperation of all involved stakeholders in the business environment (Hamburg, Bucksch 2017). Furthermore, the results of a survey conducted in 2017 on a sample of 153 students of business economics studies showed that there are no statistically significant differences in the level of creativity among students depending on their gender and age (Šlogar, Jerin, Pendeš, 2017). Hamburg, Bucksch, (2017) state that the document "Perception and Reality: Measuring Digital Skills in Europe", which summarized the results of digital skills studies in five European countries, contains the results of one study showing that in Austria 94% of respondents described their digital skills as "average" to "very good," but only 39% managed to pass it well on testing. In a study by Fernández Pérez, Montes Merino, Rodríguez Ariza, Alonso Galicia, (2017) suggest that students with a higher degree of emotional competence attending entrepreneurial education will have a more positive attitude towards entrepreneurship and will be considered more capable of becoming entrepreneurs. Furhermore, Widuri, (2017) maintains that through entrepreneurship education they will be educated to become individuals who have their ability and also develop entrepreneurship spirit to became a tough person and can create their own business. RezaeiZadeh, Hogan, O'Reilly, Cunningham, Murphy (2017) showed that productive thinking, motivation, interpersonal skills, and leadership are key entrepreneurial competencies to be developed in an educational context. Mars and Torres, (2018) maintain that entrepreneurial leadership education generates reveal opportunities for strengthening collegiate entrepreneurial leadership curriculum and instruction and enhancing the capacities of students to become effective leaders of change.

González-López, Pérez-López, Rodríguez-Ariza, (2020) reveal that competencies related to commitment, planning, organization, and entrepreneurial intent have a significant and direct impact on emerging entrepreneurial behavior. Likewise, entrepreneurial competencies improve the relationship between entrepreneurial intent and entrepreneurial activities. Relying on the knowledge of competencies in the analyzed studies, it can be determined that they are related to the basic framework of this research. Chahar, Hatwal, and Arya (2020) focus on the role of professional education in promoting entrepreneurial skills among female students doing professional courses in the various engineering and management institutes of Rajasthan state. Results show a positive association between professional education and entrepreneurial skill. Perić, Oberman Peterka, Getoš, (2020) did research to what extent professional education will contribute towards the development of entrepreneurial skills of students on a sample of 1272 students from 15 vocational secondary schools in the County of Osijek-Baranja. Results show no correlation between a formal program of education and the level of entrepreneurial competencies. We may well argue that students are the future enablers of entrepreneurial ventures and it is therefore essential to develop their entrepreneurial competencies during their education.

The following hypotheses are set:

H1 - There is a positive statistically significant correlation between all entrepreneurial competencies of students.

H2 - There are statistically significant differences in students' entrepreneurial competencies.

H3 - There are statistically significant differences in entrepreneurial competencies between female and male students.

H4 - There are statistically significant differences in entrepreneurial competencies between students studying in the undergraduate study of business economics and in the undergraduate study of digital marketing.

3. RESEARCH METHODS

The survey of students' attitudes is aimed at collecting data on their entrepreneurial competencies, students' self-assessment. As part of the research, questionnaires were applied to a sample of undergraduate students of business economics and undergraduate studies of digital marketing at higher education institutions. The data was collected in November 2019 at the Libertas International University and at the Algebra University Colleges where students filled out a questionnaire using paper and pencil. Before the start of the study, the respondents were given instructions and the anonymity and purpose of the research were emphasized. The response of the participants was very satisfactory and the sample included 172 students. Considering the fact that the higher education institutions that participated in the research are located in the city of Zagreb, it is considered that this is a convenience sample. The questionnaire consisted of 49 questions. Socio-demographic data referred to the gender of the participants, age, their current major. The second part deals with custom Competencies Measurement Questionnaire constructed to assess specific, pre-defined competencies. Defined competencies are: decision making, initiative, achieving results, leadership ability, empathy, teamwork and integrity. In all self-assessment questions, instruments with an associated Likert scale of five degrees were used. The paper analyzes the correlation and relationship of these components using correlation analysis, regression analysis, F-test and T-test. The analysis was performed in MS Office Excel 2016.

4. RESEARCH RESULTS

The results show that out of a total of 172 respondents, 42 percent of women and 58 percent of men participated in the study, which represents an approximately normal distribution of gender and data. The majority of respondents (77 percent) are from Libertas International University while 23 percent of them are from Algebra College. Furthermore, according to the type of study, 77 percent of students study in the first year of undergraduate study of business economics, while 23 percent of students study in the first year of undergraduate study of digital marketing. The division of respondents by age includes 81 percent of respondents between 19 and 21 years, while 19 percent of respondents are between 22 years or over to a maximum of 32 years. These characteristics are common for first-year students, and as respondents were randomly selected, the sample is considered representative.

Correlation and regression analysis were applied to examine the relationship between students' entrepreneurial competencies. The results are shown in Table 1 below.

Table 1. Pearson's coefficient of linear correlation of students' entrepreneurial competencies

Entrepreneurial competencies of students	Decision making	Initiative	Achievement of results	Ability to lead	Empathy	Team work	Integrity
Decision making	1.00						
Initiative	**0.58**	1.00					
Achievement of results	**0.67**	**0.60**	1.00				
Ability to lead	**0.58**	**0.57**	**0.77**	1.00			
Empathy	0.30	**0.38**	**0.47**	**0.51**	1.00		
Team work	**0.49**	**0.44**	**0.61**	**0.64**	**0.54**	1.00	
Integrity	**0.51**	**0.48**	**0.63**	**0.67**	**0.44**	**0.51**	1.00

** blue indicates significance p <0.05*

Source: Authors

Table 1 shows that the interrelationship between all dimensions of students' entrepreneurial competencies is positive and statistically significant. The strongest correlation was recorded between the components of leadership ability and achievement of results (r = 0.77), while the weakest correlation was recorded between empathy and decision making (r = 0.30). This confirmed hypothesis H1 *There is a positive statistically significant correlation between all entrepreneurial competencies of students (p <0.05).*

To determine the differences in the evaluation of individual components in the amounts of their arithmetic means, the F-test was used to determine the differences in variances and apply the appropriate T-test. Table 2 shows the results of the F-test and the T-test between the entrepreneurial competencies of the students.

Table 2. F-test and T-test results between students' entrepreneurial competencies

Entrepreneurial competencies of students	Decision making	Initiative	Achievement of results	Ability to lead	Empathy	Team work	Integrity
F-test							
Decision making	1.00						
Initiative	0.46	1.00					
Achievement of results	0.36	0.10	1.00				
Ability to lead	0.14	**0.03**	0.58	1.00			
Empathy	0.34	0.83	0.06	**0.02**	1.00		

Team work	0.71	0.71	0.20	0.07	0.56	1.00	
Integrity	0.37	0.10	0.98	0.56	0.06	0.21	1.00
T-test							
Decision making	1.00						
Initiative	**0.00**	1.00					
Achievement of results	0.64	**0.00**	1.00				
Ability to lead	0.79	**0.00**	0.44	1.00			
Empathy	0.38	**0.04**	0.65	0.10	1.00		
Team work	0.64	**0.01**	0.98	0.45	0.68	1.00	
Integrity	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	1.00

** blue indicates significance p <0.05*

Source: Authors

In Table 2, unequal variances between leadership and initiative abilities and between leadership and empathy abilities were recorded only twice between the observed components, and a T-test with the assumption of different variances was used to examine the differences between their arithmetic means, while other pairs of components were used. T-test with assumption of equal variances. In the second part of Table 2, the components among which a deviation is observed, are marked. In particular, between the initiative and all other components and between integrity and all other components there is a statistically significant difference in arithmetic means, which confirmed the hypothesis H2 *There are statistically significant differences in entrepreneurial competencies of students (p <0.05).*

Table 3. Arithmetic means of students' entrepreneurial competencies

Entrepreneurial competencies of students	Average
Decision making	3.76
Initiative	**3.56**
Achievement of results	3.73
Ability to lead	3.78
Empathy	3.70
Team work	3.73
Integrity	**4.04**

** blue indicates significance p <0.05*

Source: Authors

Table 3 presents an overview of the arithmetic means of students' entrepreneurial competencies and the results of self-assessment show that students rated statistically significantly lower in the

initiative component with an average of 3.56, while in the integrity component they rated 4.04. The analysis of differences in entrepreneurial competencies according to the gender of the respondents was performed using the F-test and the T-test.

Table 4. Results of F-test and T-test between entrepreneurial competencies according to gender of respondents and amounts of corresponding arithmetic means of student responses

	Decision making	Initiative	Achievement of results	Ability to lead	Empathy	Team work	Integrity
F-test	0.37	0.44	0.34	0.64	0.61	0.84	0.33
T-test	**0.02**	**0.01**	0.37	0.73	0.69	0.89	0.74
Gender	**Average**						
Male	**3.86**	**3.67**	3.77	3.77	3.68	3.73	4.06
Female	**3.63**	**3.39**	3.69	3.80	3.73	3.74	4.03

** blue indicates significance p <0.05*

Source: Authors

In Table 4, the results show that the F-test did not find differences between variances of entrepreneurial competencies by gender, so a T-test with the assumption of equal variances was used to examine the differences. The T-test identified two statistically significant differences between the sexes of the respondents in the decision-making and initiative components. In both cases, male respondents were rated higher. In the decision-making component, the average score of male respondents is 3.86, and of female respondents 3.63, and in the initiative component, the average score of male respondents is 3.67, and of female respondents 3.39. This confirmed H3 *There are statistically significant differences in entrepreneurial competencies between female and male students (p <0.05).*

Similar to the previous analysis by gender, the F-test and the corresponding T-test were used to analyze the deviation of entrepreneurial competencies between undergraduate students in the first year of business economics and the first year of undergraduate digital marketing.

Table 5. Results of F-test and T-test between entrepreneurial components by type of study and amounts of corresponding arithmetic means of student responses

	Decision making	**Initiative**	**Achievement of results**	**Ability to lead**	**Empathy**	**Team work**	**Integrity**
F-test	0.85	0.22	0.98	0.44	0.20	0.82	**0.01**
T-test	**0.01**	**0.12**	0.08	0.01	0.66	0.94	**0.00**
Average							
Business economics	**3.70**	**3.51**	3.69	3.72	3.69	3.73	**3.98**
Digital marketing	**3.99**	**3.70**	3.88	3.97	3.74	3.73	**4.27**

** blue indicates significance p <0.05*

Source: Authors

In Table 5, all differences in components according to the undergraduate study of business economics and the undergraduate study of digital marketing were examined using the T-test with the assumption of equal variances except for integrity where the T-test with the assumption of different variances was used (F-test <0.05) . Significant discrepancies were found in the arithmetic means between students of business economics and of digital marketing in three components: decision making, initiative and integrity. In all three components, students of digital marketing have a higher arithmetic mean compared to students of business economics. In the decision-making component, the arithmetic mean of students of digital marketing is 3.99, while for students of business economics it is 3.70. For the initiative component, it is 3.70 for digital marketing students and 3.51 for business economics students. Furthermore, for the integrity component, it is 4.27 for digital marketing students and 3.98 for business economics students. This confirmed the fourth hypothesis H4 - There are statistically significant differences in managerial competencies between undergraduate students of business economics and undergraduate students of digital marketing ($p < 0.05$).

5. DISCUSSION

The aim of this study was to examine students' self-assessment of entrepreneurial competences defined by components: decision making, initiative, achievement, leadership, empathy, teamwork and integrity and to check for differences in gender and type of study. Entrepreneurial competencies depend on the development of personality traits, knowledge, skills, attitudes and abilities that are necessary for individuals to act as successful entrepreneurs. The results confirm a statistically significant correlation between all dimensions of students' entrepreneurial competencies, thus confirming the first hypothesis. The strongest correlation was recorded between the components of leadership skills and achievement of results ($r = 0.77$). Also, the second hypothesis was confirmed that there are statistically significant differences in entrepreneurial competencies of students ($p < 0.05$). A discrepancy was found between the initiative and other components as well as the integrity of the other components with a statistically significant difference in the arithmetic means. Furthermore, respondents were rated in the initiative component with an average of 3.56, while in the integrity component they were rated at 4.04. The results showed statistically significant differences between the sexes of respondents and for the decision-making component the average score of male respondents was 3.86, and of female respondents 3.63, and in the initiative component the average score of male respondents was 3.67 and female respondents 3.39. This confirmed the third hypothesis of statistically significant differences in entrepreneurial competencies between female and male students ($p < 0.05$). Significant discrepancies were also found in the arithmetic means between students of business economics and of digital marketing in three components: decision making, initiative and integrity. When making decisions, the arithmetic mean of students of digital marketing is 3.99, while for students of business economics it is 3.70. For the initiative component, it is 3.70 for digital marketing students and 3.51 for business economics students. Furthermore, for the integrity component, it is 4.27 for digital marketing students and 3.98 for business economics students. This confirmed the fourth hypothesis of statistically significant differences in managerial competencies between undergraduate students of business economics and in the undergraduate study of digital marketing ($p < 0.05$). Reflection on the obtained research

results provides an opportunity to analyze students according to the factors that influence the formation of positive attitudes about entrepreneurship.

6. CONCLUSION

This study is based on the literature on key competencies and reflects the growing interest in developing the existing set of entrepreneurial competencies that creates the preconditions for designing of new study programs at higher education institutions. The obtained results are in line with previous research and indicate the need to introduce teaching courses with the aim of developing and strengthening the entrepreneurial competencies of students in all years of study programs. Therefore, it can be assumed that students who have developed entrepreneurial competencies, as a rule, will start initiatives and innovative activities, and achieve the set goals by taking responsibility. Such an approach requires an understanding of the business environment and the use of business opportunities based on the abilities, skills and knowledge that entrepreneurs will need to achieve business success.

Furthermore, the results of this research indicate the necessary development of entrepreneurial competencies within study programs at higher education institutions. Entrepreneurship education at higher education institutions plays an important role in preparing students for the labor market and in developing their careers. Entrepreneurial education should encourage a balance between theory and practice and project-based activities by involving students in the development of digital content and working in virtual networks, thus creating the necessary experience to facilitate inclusion in the labor market. This approach can be the basis for assessing the existing competencies of an individual or a team, thus highlighting areas in which additional education and training is needed.

There are also some limitations in this research. Students often give socially desirable answers through self-assessment of personal limitations. Second, the limitation relates to the type of sample because despite the relatively large number of respondents who participated in the survey, the sample is not representative of the student populace. Third, the research was conducted in a geographically limited area that includes the city of Zagreb. These arguments favor the fact that most higher education institutions are located in Zagreb in which a large number of students from all over Croatia complete their studies. The compared groups of students differ in a number of other characteristics, and these results can only be used as an indication of the possible impact on competencies, which should be further verified by the experimental method.

Given the results of the research, the study programs should ensure the acquisition of entrepreneurial competencies and expand the content to at least two compulsory courses and distribute them evenly during the five-year studies. Courses on the development of entrepreneurial competencies should necessarily include more internships and team projects in order for students to come into direct contact with business activities and in this way to develop the necessary competencies. The conducted analysis draws attention to the lack of empirical evidence on the discourse on the development of entrepreneurial competencies of young people. Not all methodological components of key competencies are elaborated in detail in the literature. The review literature

does not provide enough empirical evidence that the researched competencies enable success in the business world. The literature has not elaborated in detail the conceptually embedded sets of interrelated competencies nor all the critical components, including the methodological components of key competencies.

The research is limited to the student populace, so future research should be conducted on a larger sample at other higher education institutions and more broadly in the industrial sectors in order to establish settings for a further comparison of research results. In order to develop entrepreneurial competencies, continuous monitoring of performance within and outside study programs is required; experimenting with learning and teaching settings; reflecting on achievements and shortcomings and adapting competencies to the needs of the labor market.

The findings gained in this research should find their practical application in human resource management. Equally, this study contributes to a better understanding of entrepreneurial competencies aiming to improve the processes arising from stakeholder interactions in the business environment. Furthermore, the results of this research indicate the importance of acquiring entrepreneurial knowledge and skills during studies, which ones students need to develop in their studies, and which are necessary for success in entrepreneurship. This study has formulated and presented the research results on this topic, achieving a conceptual scientific contribution related to the originality of setting the research goal in an insufficiently researched area; development of scientific thought on youth entrepreneurial competencies. In the applicative sense, the contribution will be accomplished by directly achieving the purpose and objectives of the research, which is the possibility of a better understanding of the entrepreneurial competencies of students for the labor market. The knowledge gained from the research will be useful to both scientists and the business, i.e. people who are direct stakeholders in the business environment. It is considered that the empirical part of the paper could be stimulating for other relevant research, which could, ultimately, contribute to the development of this area as a whole. It is also suggested to design a longitudinal research by comparing entrepreneurial competencies at the beginning of studies with those acquired at the end of studies. In future research, a sample of students in another geographical area is expected to give similar results in terms of self-assessment of entrepreneurial competencies.

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Izvorni znanstveni rad
https://doi.org/10.31784/zvr.9.1.5
Datum primitka rada: 20. 11. 2020.
Datum prihvaćanja rada: 5. 2. 2021.

SAMOPROCJENA PODUZETNIČKIH KOMPETENCIJA STUDENATA NA VISOKIM UČILIŠTIMA

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SAŽETAK

Poduzetništvo je postalo važno akademsko područje koje dovodi do sve većeg interesa znanstvenika za proučavanje, razvoj i ocjenu poduzetničkih kompetencija mladih. Poslovni aspekti poduzetničkih kompetencija odnose se na razvoj osobina ličnosti, studentskih vještina koje utječu na nečiji osobni razvoj za uspješne poduzetnike. Glavna svrha ovog rada je ispitati poduzetničke kompetencije studenata za vrijeme studiranja i kako su povezane sa njihovim socio-demografskim obilježjima. Istraživanje je provedeno na uzorku od 172 ispitanika u studenom 2019. godine, a obuhvaćeni su studenti prve godine preddiplomskog studija poslovne ekonomije i preddiplomskog studija digitalnog marketinga na visokim učilištima. Rezultati istraživanja pokazuju da postoji pozitivna statistički značajna povezanost između svih poduzetničkih kompetencija studenata. Utvrđeno je da postoje statistički značajne razlike u poduzetničkim kompetencijama prema spolu studenata. I na kraju, prikazane su statistički značajne razlike u poduzetničkim kompetencijama između studenata preddiplomskog studija poslovne ekonomije i preddiplomskog studija digitalnog marketinga. Očekuje se da će studenti s višim stupnjem upravljačkih kompetencija koji pohađaju poduzetničko obrazovanje smatrati se sposobnijima da postanu poduzetnici u budućnosti. Primarni doprinos ovog rada jest ukazati na potrebu povećanja svijesti studenata o pozitivnom utjecaju poduzetničkog obrazovanja koji doprinose razvoju takvih kompetencija.

Ključne riječi: *poduzetničke kompetencije, studenti, spol, studij, poduzetništvo*

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Izvorni znanstveni rad
https://doi.org/10.31784/zvr.9.1.6
Datum primitka rada: 7. 12. 2020.
Datum prihvaćanja rada: 2. 2. 2021.

ISTRAŽIVANJE ZADOVOLJSTVA KORISNIKA VISOKOŠKOLSKE KNJIŽNICE

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SAŽETAK

Ocjenjivanje knjižničnih usluga najobjektivniji je način uvida u organizaciju i rad knjižnice. Svrha ovog istraživanja bila je istražiti zadovoljstvo korisnika knjižničnih usluga. U tu je svrhu provedeno prikupljanje primarnih podataka na primjeru Knjižnice Veleučilišta u Rijeci. Podaci su prikupljani tehnikom anketiranja. Upitnik za prikupljanje podataka sastojao se od šest dijelova: važnost knjižničnih usluga, zadovoljstvo pojedinom knjižničnom uslugom, uvjeti rada u knjižnici, ukupno zadovoljstvo korisnika knjižnice, lojalnost korisnika knjižnice i profil ispitanika. Uzorak čine studenti preddiplomskih i specijalističkih diplomskih stručnih studija, a podaci su prikupljeni u razdoblju od siječnja do studenoga 2020. godine. U analizi prikupljenih podataka korištene su metode deskriptivne statistike, t-test i regresijska analiza. Rezultati deskriptivne analize pokazali su orijentiranost korisnika knjižničnom osoblju, preko kojeg se najčešće informiraju o radu Knjižnice. Pronalazak literature najvažnija je knjižnična usluga. Ukupno zadovoljstvo korisnika knjižnice ocijenjeno je prosječnom ocjenom 4,55, što pokazuje visok stupanj zadovoljstva uslugama u promatranoj knjižnici. Na temelju provedenog t-testa moguće je zaključiti da korisnici knjižnice koji studiraju na različitim razinama studija imaju značajno različite stupnjeve zadovoljstva pojedinom knjižničnom uslugom, dok obje grupe slično ocjenjuju ukupno zadovoljstvo knjižnicom. Nadalje, postoji statistički značajna povezanost između zadovoljstva pojedinom knjižničnom uslugom i ukupnog zadovoljstva korisnika knjižnice. Također su značajno povezani ukupno zadovoljstvo i lojalnost korisnika knjižnice. Provedeno istraživanje pridonijelo je boljem razumijevanju stavova o knjižničnim uslugama, te je slijedom toga pokazalo niz prijedloga temeljem kojih Knjižnica može redefinirati poslovanje, uvjete rada i usluga i uskladiti ih s prijedlozima korisnika, a s ciljem poboljšanja razine zadovoljstva i postizanja pozitivnih namjera u ponašanju.

Ključne riječi: *zadovoljstvo korisnika, kvaliteta knjižnične usluge, ocjenjivanje knjižničnih usluga, visokoškolska knjižnica, kvantitativna analiza*

1. UVOD

Visokoškolska knjižnica korisniku nudi raznolike usluge (uz najvažniju uslugu vezanu uz posudbu, spomenimo informacije o građi, pomoć u pretraživanju knjižničnih kataloga i upućivanje na samostalno pronalaženje građe i informacija, njihovo selektiranje i vrednovanje, pretraživanje raznih baza podataka, izravni dodir s građom itd.). Povratna informacija od korisnika knjižnice ističe se kao jedna od važnih i vrijednih smjernica u valorizaciji postojećih te uvođenju pojedinih novih usluga i načinu njihove organizacije, uopće poslovanju i prioritetima u organizaciji visokoškolske knjižnice. Vrednovanje knjižničnih usluga jedan je od objektivnih načina na koji se može sagledati poslovanje i organizacija knjižnice, koji se kasnije mogu posebno usmjeriti na uspješnije upravljanje knjižnicom i ispreplesti s daljnjim planiranjem u izradi strateškog plana knjižnice za neko sljedeće određeno vremensko razdoblje. Visokoškolske knjižnice, stoga, vrlo često ispituju zadovoljstvo svojih korisnika pruženim uslugama, služeći se rezultatima takvih istraživanja kao pokazateljima uspješnosti svoga rada.

Vrednovanja knjižnice, s obzirom na različito definiranje kvalitete visokoškolskih knjižnica, Pikić definira kroz tri pristupa (Pikić, 2016:112-113); 1) vrednovanja koja su povezana s ispitivanjem ekonomičnosti i adekvatnosti poslovanja knjižnica (kvalitetu definiraju kao uspješnost knjižnice da svojim karakteristikama poslovanja/aktivnostima dokaže ekonomičnost i adekvatnost svojih resursa za informacijske potrebe svojih korisnika (Petr Balog, 2010), ukratko, knjižnica bi bila kvalitetna ako posluje poštujući optimalan odnos troškova i rezultata poslovanja[1]; 2) drugi pristup u vrednovanju knjižnica kvalitetu definira kao stupanj utjecaja knjižnica u okruženju u kojem djeluju, na svoje korisnike i užu i širu zajednicu, obrazujući i informirajući, ostvarujući akademski uspjeh, šireći informacijsku pismenost i sl.[2]; 3) treći način pristupa vrednovanju knjižnice na temelju povratnih informacija vezanih uz zadovoljstvo korisnika knjižničnom uslugom, odnosno njihova stava o razini kvalitete knjižnične usluge definirana iz perspektive različitih knjižničnih dionika, koji ocjenjuju koliko je knjižnica svojim uslugama zadovoljila njihove potrebe, od informacijskih do pružanja građe, procjenjuju omjer ili u kojoj je mjeri dobivena knjižnična usluga/aktivnost u skladu s korisničkim očekivanjima, od posudbe građe do informacijskih usluga, prostora, opreme, kompetentnosti osoblja[3]. Istraživanja koja ispituju zadovoljstvo korisnika česta su (McKnight, 2006; Oakleaf, 2010; Atkinson, 2017) i u Hrvatskoj vrlo popularna (Petr, 2000; Barada, Zdravković, 2009; Dukić *et al.*, 2009; Badurina, Dragija-Ivanović, 2010; Novak, 2010; Petr Balog, 2010; Petr Balog *et al.*, 2010; Petr Balog, Plašćak, 2012; Radičević, 2013; Aleksić, Seiter-Šverko, 2014; Petr Balog, Gašo, 2016; Pikić, 2016; Moslavac, 2017; Pikić, 2017; Franculić, 2018).

[1] Ova se vrednovanja knjižnične djelatnosti temelje na pokazateljima uspješnosti međunarodnih i hrvatskih standarda, a to su za vrednovanje knjižnične djelatnosti norma HRN ISO 11620 (1998, 2003, 2008, 2014) „Informacije i dokumentacija – pokazatelji učinka knjižnica" i HRN ISO 2789 (1991, 2003, 2006, 2013) „Informacije i dokumentacija – međunarodna knjižnična statistika" (Martek, 2009).

[2] Vrednovanja knjižnica u tom smislu podrazumijevaju istraživanja kao što su citatna analiza objavljenih radova nastavničkog osoblja ili studentskih završnih radova, testiranja informacijske pismenosti, analiza znanstvene produkcije ustanove u čijem je sastavu knjižnica i sl.

[3] Neki od popularnih anketnih alata za ovakav pristup su, primjerice, SCONUL Satisfaction Survey, LibQUAL+, SERVQUAL, WebQUAL.

2. TEORIJSKA OSNOVA ISTRAŽIVANJA

Zadovoljstvo klijenta može se promatrati s različitih stajališta, zbog čega postoji i niz definicija ovog koncepta. Fornell (1992) definira zadovoljstvo klijenta kao ukupnu ocjenu kupovine. Oliver (1997) navodi da se radi o klijentovu sudu o tome jesu li proizvod ili usluga pružili ugodnu razinu ispunjenja, dok Zeithaml i Bitner (2003) smatraju da je zadovoljstvo klijenta njegova subjektivna ocjena proizvoda ili usluge o tome, ispunjavaju li ti proizvodi ili usluge njegova očekivanja i potrebe. Iako pregled literature ukazuje na razlike u pojedinim definicijama zadovoljstva klijenta, Giese i Cote (2000) zaključuju da sve definicije imaju sljedeće zajedničke elemente: 1) zadovoljstvo klijenta je reakcija (emocionalna ili spoznajna); 2) reakcija se odnosi na određeni element klijentova zadovoljstva (očekivanja, proizvod/usluga, iskustvo kupovine i sl.); 3) reakcija nastaje u određenom trenutku (nakon korištenja, na temelju prijašnjih iskustava i sl.).

U konceptualizaciji zadovoljstva klijenta potrebno je ukazati i na povezanost s kvalitetom usluge, kao njegovom prethodnicom, te s lojalnošću klijenta kao njegovom važnom posljedicom. Percipirana kvaliteta je klijentov stav o superiornosti usluge ili proizvoda (Zeithaml, 1988). Ona, dakle, odražava doživljenu, stvarno pruženu uslugu. To je spoznajna mjera koja dovodi do zadovoljstva klijenta. Pozitivna veza između kvalitete usluga i zadovoljstva klijenta dokazana je i na primjeru usluga i korisnika knjižnica (primjerice, Choshaly i Mirabolghasemi, 2018; Gómez-Cruz, 2019). S druge strane, Kandampully i Suhartanto (2000) navode da lojalan klijent kupuje od istog proizvođača proizvoda ili pružatelja usluga kada god je to moguće, taj proizvod ili uslugu preporučuje drugima i ima pozitivan stav prema poduzeću. Istraživanja su pokazala (primjerice Fornell, 1992; Kandampully i Suhartanto, 2000; Coker, 2013; Xu i Du, 2018) da se zadovoljni klijenti vraćaju, ponovno kupuju i koriste već poznate proizvode i usluge te pozitivno govore o svom iskustvu.

Pristup vrednovanju knjižnice na temelju povratnih informacija vezanih uz zadovoljstvo korisnika knjižničnom uslugom primijenjen je i u našem istraživanju vrednovanja zadovoljstva korisnika, a time i kvalitete. Kvalitetnom drži knjižnicu „čiji su korisnici zadovoljni opsegom i izvedbom knjižničnih usluga ili koji procjenjuju da je dobivena usluga u knjižnici ispunila ili čak nadmašila njihova očekivanja" (Pikić, 2016:113).

Kvaliteta usluge i zadovoljstvo korisnika knjižnice, dakle, mogu se poimati povezano, no zadovoljstvo podrazumijeva širu predodžbu od kvalitete usluge, koju najčešće povezujemo uz određene specifične i različite komponente ili dimenzije određene usluge (Kiran, Diljit, 2011). U kontekstu usluga visokoškolskih knjižnica zadovoljstvo korisnika može biti više ili manje povezano uz poslovanje knjižnice, poput zadovoljstva opremljenošću knjižnice, opsegom zbirke ili dostupnošću naslova obvezne ispitne literature, brojem primjeraka, zadovoljstvo dostupnošću stranih časopisa i sl. ili zadovoljstvo samom uslugom, brzinom komunikacije osoblja knjižnice u rješavanju upita, načinima slanja obavijesti o dostupnosti građe, komunikacijom knjižničara s korisnicima, pomoći u pretraživanju, kompetentnost i stručnost osoblja. Posljedično, visok stupanj zadovoljstva uslugama odrazit će se na posjećenost knjižnice i lojalnost korisnika, ali i dokazati da je zadovoljstvo korisnika knjižnice kategorija fluidnih karakteristika, temeljenih na sveukupnom trudu njenih zaposlenika, stoga ne mora uvijek biti posljedica financijskih mogućnosti knjižnice i

njezina ulaganja u opseg građe. Naime, možemo razlikovati korisnika koji ispunjen nezadovoljstvom izlazi iz knjižnice jer knjiga koju treba nije dio knjižničnog fonda ili je već na posudbi, od korisnika koji također nije posudio željeni naslov, ali mu je knjižničar posvetio svoju pažnju i ponudio svoje znanje, pretražujući kataloge i baze podataka, ne bi li pokušao pronaći zamjensku relevantnu literaturu, zabilježio kontakte kako bi ga obavijestio kada posuđena građa bude opet dostupna na vrijeme i bez odgađanja ili uputio studenta na knjižnicu u kojoj je građa dostupna i sl. i koji, u konačnici, osjeća pomoć i trud knjižničara kao pozitivni odjek.

Intencija istraživanja prikazanog u ovom radu jest da njegovi rezultati u budućnosti pridonesu poboljšanju rada visokoškolske knjižnice čije zadovoljstvo korisnika istražujemo, Knjižnice Veleučilišta u Rijeci. Naime, specifični su razlozi dolaska korisnika u svaku visokoškolsku knjižnicu, a s obzirom na to, različita su i njihova očekivanja, a nejednaka poimanja o kvaliteti i neujednačena očekivanja rezultiraju različitim stupnjevima zadovoljstva. Jedan od razloga različitih očekivanja korisnika povezujemo uz činjenicu da, iako su svi ispitani aktivni korisnici Knjižnice Veleučilišta u Rijeci studenti, imaju, s obzirom na njihova prethodna iskustva vezana uz usluge knjižnice, nejednaka očekivanja. Dakle, ne smijemo zaboraviti da je grupa studenata koju anketiramo posve heterogena s obzirom na stavove o kvaliteti, pa posljedično, imaju i različit osjećaj zadovoljstva primljenim uslugom. Valja, stoga, naglasiti razliku u očekivanjima o uslugama knjižnice među studentima koji su prije studija bili korisnici srednjoškolske knjižnice koju su odlikovali skromniji knjižnični fond, odsustvo kataloga i radno vrijeme od nekoliko sati dnevno, od stavova onih koji su bili korisnicima vrlo opremljene srednjoškolske knjižnice, bogatog, katalogiziranog knjižničnog fonda i dvosmjenskog radnog vremena.

Vezano uz studij i znanstveni i stručni rad studenata, očekivanja obuhvaćaju njihovu potrebu za literaturom i uvidom u knjižnični fond, za knjižničnim uslugama, tematskim pretraživanjima, pretraživanjima kataloga, baza podataka, zatim potrebe vezane uz uvjete u kojima radi knjižnica, uz mogućnosti samostalnog ili grupnog rada u knjižnici, potrebe za edukacijom korisnika, informacijama o dostupnosti literature, pronalasku odgovarajuće literature potrebne za pisanje radova i istraživanje i sl.

3. KNJIŽNICA VELEUČILIŠTA U RIJECI

Knjižnica, kao i samo Veleučilište u Rijeci, osnovana je prije više od dva desetljeća, a danas djeluje na prostoru sveukupne površine 114 m^2 (uključuje prostor knjižničnog zatvorenog i otvorenog fonda, referentne zbirke, čitaonice (20 radnih mjesta namijenjenih korisnicima za pretraživanje kataloga, izradu seminara, rad na instaliranim programima koji prate potrebe nastave), prostor za grupno učenje i individualni rad, prostor zatvorenog spremišta, skriptarnicu i prostor za osoblje Knjižnice)[4]. Čitaonica je opremljena s petnaestak radnih mjesta s računalima za samostalni rad, koja imaju pristup *online* katalozima, bazama podataka koje su u pretplati Ministarstva znanosti i obrazovanja i ostalim elektroničkim izvorima dostupnima na Veleučilištu u Rijeci. Fond Knjižnice je interdisciplinaran, a proširuje se u skladu sa sadržajima koji se proučavaju na Veleučilištu (tehničke, biotehničke, prirodne, društvene i interdisciplinarne znanosti te mala zbirka

[4] Područni odjeli Knjižnice smješteni su na pojedinim odjelima u Poreču i Pazinu i djeluju u knjižnicama ustanova u kojima se održavaju predavanja za studente.

humanističko-umjetničke tematike). Od 2015. godine Knjižnica je uključena u Digitalni akademski arhiv i repozitorij Dabar. U Knjižnici je zaposlena voditeljica Knjižnice, uz studenta koji u svojstvu pomoćnog knjižničara pomaže u posudbi i razduživanju građe.

Prema podacima iz *online* kataloga Crolist i arhive Knjižnice Veleučilišta u Rijeci knjižnični fond se krajem 2020. sastoji od 7000 svezaka monografskih publikacija, a knjižnica je pretplaćena na 30-ak stranih i domaćih časopisa (ukupno 380 svezaka periodike). Više od 1900 završnih i specijalističkih završnih radova obranjenih na Veleučilištu od 2015. javno je dostupno u Digitalnom repozitoriju Veleučilišta DabarVeleRi, koji se od dana uspostave redovito popunjava novim ocjenskim radovima, a odnedavno i radovima nastavnika, ako su dostupni u smislu autorskih prava. Literatura koju Knjižnica ne posjeduje nabavlja se međuknjižničnom posudbom, a pridruženo članstvo Knjižnice Veleučilišta u integrirani Knjižnični sustav Crolist omogućuje brz kontakt i međuknjižničnu posudbu s knjižnicama u Rijeci i RH, kao i europskima. Posljednja reakreditacija Veleučilišta u Rijeci, provedena od 10. do 12. ožujka 2020., neovisnim vrednovanjem Stručnog povjerenstva ocijenila je usluge Knjižnice visokom razinom kvalitete[5].

Sukladno stavovima Europske komisije prema kojima se kvaliteta u visokom obrazovanju definira kroz jasan cilj u kontinuiranom pružanju znanja, vještina i kompetencija potrebnih nakon završetka studija, po zapošljavanju[6], Knjižnica u planiranju svojih budućih aktivnosti teži osuvremenjivanju i jasnom usmjerenju svojih usluga ključnim kompetencijama koje se očekuju od studenata, poput personaliziranog učenja, razvijanja kritičkog razmišljanja i kompetencija koje teže rješavanju problema, te fleksibilnim, inovativnim tehnikama poučavanja i učenja osmišljenima kako bi se povećala djelotvornost obrazovanja i kapaciteti studenata visokih učilišta. U tom smislu posebno se u novom obrazovnom okruženju, koje se odlikuje razvojem informacijsko-komunikacijskih tehnologija, čini važnim podvući obrazovnu uloga knjižnice u smislu tendencija razvijanja potrebnih vještina studenata, povezanih uz informacijsku pismenost (usp. Dewey, 1997; Lau 2011; Golenko, Arh, 2020), poput uspješnog pronalaženja informacije, njena učinkovitog vrednovanja te potom i korištenja, uz razvoj i kontinuirano širenje i usavršavanje kritičkog mišljenja kao potke u visokoškolskom i, daljnjem, cjeloživotnom obrazovanju (Špiranec, Banek Zorica 2008). Korištenje IKT-a i poznavanje informacijskih izvora povezano je s korisničkim potrebama, stoga programi informacijskog opismenjavanja postaju preduvjet za uspješno učenje studenata, a time i sve više neizostavni dio rada visokoškolske knjižnice (Candy *et al*., 1994). Zadovoljstvo korisnika kvalitetom usluga knjižnice povezano uz kompetencije koje uključuju informacijsku pismenost izuzetno su važno polazište.

4. METODOLOGIJA

Svrha ovog istraživanja bila je istražiti zadovoljstvo korisnika usluga Knjižnice. Iz toga proizlaze sljedeći ciljevi istraživanja: a) ocijeniti stupanj važnosti pojedinih knjižničnih usluga, b) ocijeniti stupanj zadovoljstva korisnika pojedinim knjižničnim uslugama, c) ocijeniti stupanj ukupnog

[5] https://www.azvo.hr/hr/vrednovanja/postupci-vrednovanja-u-visokom-obrazovanju/reakreditacija-visokih-ucilista/rezultati-vrednovanja-rvu (pristupljeno 5. studenoga 2020).

[6] Europska komisija. Obrazovanje i izobrazba. Relevantno i visokokvalitetno visoko obrazovanje. Usp. http://ec.europa.eu/education/policy/higher-education/quality-relevance_hr (pristupljeno 5. studenoga 2020).

zadovoljstva korisnika knjižničnih usluga, d) utvrditi postoji li statistički značajna razlika u stupnju važnosti knjižničnih usluga i stupnju zadovoljstva korisnika s obzirom na razinu studija ispitanika, e) utvrditi prirodu povezanosti zadovoljstva korisnika pojedinim knjižničnim uslugama s ukupnim zadovoljstvom korisnika, f) utvrditi prirodu povezanosti ukupnog zadovoljstva korisnika i njihove lojalnosti prema knjižničnim uslugama.

Kako bi se postigli ciljevi istraživanja, kreiran je anketni upitnik, te su podaci prikupljeni metodom ispitivanja pisanim putem. Temeljem pregleda literature i upitnika koji se inače koriste u knjižnicama kada se provode slična istraživanja (Petr, 2000; Barada, Zdravković, 2009; Dukić *et al.*, 2009; Badurina, Dragija-Ivanović, 2010; Novak, 2010; Petr Balog, 2010; Petr Balog, Plašćak, 2012; Radičević, 2013; Aleksić, Seiter-Šverko, 2014; Petr Balog, Gašo, 2016; Pikić, 2016; Moslavac, 2017; Franculić, 2018), pitanja u upitniku podijeljena su u cjeline koje su dizajnirane za mjerenje važnosti knjižničnih usluga (6 pitanja), zadovoljstva korisnika pojedinom knjižničnom uslugom (8 pitanja), uvjeta rada u knjižnici (6 pitanja), ukupnog zadovoljstva korisnika (1 pitanje) te lojalnosti korisnika (2 pitanja). Sve su varijable mjerene na Likertovoj ljestvici s 5 stupnjeva. Osim toga, upitnik sadrži i tri općenita pitanja o korisnicima usluga (studij ispitanika, učestalost korištenja knjižničnih usluga te način upoznavanja s knjižničnim uslugama).

Istraživanje je provedeno na uzorku studenata kao korisnika Knjižnice Veleučilišta u Rijeci od siječnja do studenoga 2020. godine. Tiskana anketa u knjižnici nudila se korisnicima zainteresiranim za sudjelovanje u istraživanju. Anketa nije bila dostupna u elektroničnom obliku s obzirom na to da se željelo ispitati mišljenje onih korisnika koji aktivno borave u radnom prostoru knjižnice i čitaonici, stoga je dio pitanja bio povezan upravo sa zadovoljstvom vezanim uz sam prostor čitaonice, računala i građu, pa time i usluge koje su samo tamo dostupne. Zaposlenici knjižnice dijelili su upitnik studentima koji su bili spremni sudjelovati u istraživanju, a ispitanici su ispunjene upitnike predavali na za to predviđeno mjesto u knjižnici. Razdoblje prikupljanja podataka obilježeno je epidemiološkim mjerama koje su utjecale i na rad knjižnica, pa je posjet knjižnicama tijekom proljeća i ljeta 2020. bio u većoj mjeri onemogućen, a zahtjevi korisnika su se uglavnom rješavali *online* (čime usmjerenost „*online* korisnika" mijenja fokus na samo dio usluga knjižnice, dakle i stavove o zadovoljstvu i kvaliteti). Navedeno, svakako, otvara prostor za nadopunu i proširenje ankete na cjelokupnu populaciju studenata, bez obzira je li njihov posjet fizički ili virtualni, zatim na nastavno osoblje i vanjske korisnike. Prikupljen je 91 ispravno ispunjen anketni upitnik, te taj uzorak čini osnovu za analizu prikupljenih podataka[7].

Prikupljeni podaci analizirani su primjenom odabranih metoda deskriptivne, bivarijatne (t-test za nezavisne uzorke, jednostavna regresijska analiza) i multivarijatne statističke analize (multipla regresijska analiza). Metodama deskriptivne statističke analize opisan je uzorak, te su ocijenjene varijable za mjerenje zadovoljstva korisnika knjižničnih usluga. T-test za nezavisne uzorke korišten

[7] Zbog neobičnih okolnosti povezanih uz pandemiju, Knjižnica u 2020. nije kontinuirano radila punim kapacitetom, što je za potrebe ovog rada važno istaći, u smislu reduciranog dolaska korisnika u sam prostor Knjižnice. Broj ukupnih fizičkih posjeta Knjižnici za navedeno razdoblje iznosi 889 posudbi (statistika prema katalogu Crolist za 2020.), dakle ispitano je 10 % korisnika. Broj posjetitelja u siječnju i veljači 2020. bio je podjednak onome u 2019., no u razdoblju od sredine ožujka do početka rujna knjižnica je bila otvorena samo za virtualne usluge, da bi se od rujna nadalje otvorila djelomično, samo za korisnike koji građu naručuju unaprijed i dolaze uz najavu e-mailom u točno određenim vremenskim intervalima, kako bi se zadovoljile protuepidemiološke mjere.

je za utvrđivanje statistički značajne razlike u stupnju važnosti knjižničnih usluga i stupnju zadovoljstva korisnika s obzirom na razinu studija ispitanika. Jednostavnom regresijskom analizom provedeno je ispitivanje povezanosti između ukupnog zadovoljstva korisnika i njihove lojalnosti prema knjižničnim uslugama. Primjenom multiple regresijske analize testirana je povezanost između zadovoljstva korisnika pojedinim knjižničnim uslugama i ukupnog zadovoljstva korisnika knjižnice.

5. REZULTATI

U ovom dijelu rada prikazani su rezultati provedene statističke analize. Prvo je opisan uzorak. Zatim su prezentirani rezultati ocjenjivanja zadovoljstva korisnika knjižničnih usluga. Slijedi usporedba stupnja zadovoljstva korisnika s obzirom na razinu studija ispitanika. Na kraju je ispitana povezanost između zadovoljstva korisnika pojedinim knjižničnim uslugama i ukupnog zadovoljstva korisnika, te povezanost ukupnog zadovoljstva korisnika i njihovih namjera u ponašanju prema knjižničnim uslugama.

5. 1 Korisnici Knjižnice

Opis uzorka prikazuje tablica 1.

Tablica 1. Opis uzorka

Varijabla		Postotak
Studij	Preddiplomski stručni studij Informatika	12,1
	Specijalistički diplomski stručni studij Informacijske tehnologije u poslovnim sustavima	12,1
	Preddiplomski stručni studij Poduzetništvo	12,1
	Specijalistički diplomski stručni studij Poduzetništvo	15,4
	Preddiplomski stručni studij Promet	14,3
	Specijalistički diplomski stručni studij Promet	11,0
	Preddiplomski stručni studij Sigurnost na radu	9,9
	Specijalistički diplomski stručni studij Sigurnost na radu	4,4
	Preddiplomski stručni studij Telematika	8,8

Varijabla		Postotak
Učestalost posjeta knjižnici	Više puta tjedno	17,6
	Jednom tjedno	17,6
	Jednom mjesečno	11,0
	Više puta mjesečno	27,5
	Svakih nekoliko mjeseci	13,2
	Jednom u semestru	13,2
Način upoznavanja s knjižničnim uslugama	Informacija od nastavnog osoblja	17,6
	Putem mrežne stranice knjižnice	39,6
	Informacija od knjižničnog osoblja	49,5
	Prethodno iskustvo (savjeti studenata)	31,9

Izvor: autorice (2020)

Iz tablice 1 vidljivo je da uzorak obuhvaća studente stručnih i specijalističkih studija koji najčešće u knjižnicu dolaze na tjednoj bazi ili nekoliko puta mjesečno. Studenti se najčešće s knjižničnim uslugama upoznaju na temelju informacija koje dobiju od knjižničnog osoblja. Oko 40 % ispitanika o uslugama se informira na mrežnim stranicama Knjižnice. Također, bitan izvor informacija je i prethodno iskustvo drugih studenata, tj. razmjena informacija studenata među sobom.

Ovakav odgovor ne iznenađuje, s obzirom na to da Knjižnica, s početkom nove akademske godine otvara svoja vrata novim korisnicima, informirajući svaku novu studijsku grupu studenata na prvoj godini, na uvodnim predavanjima, o mogućnostima i načinima korištenja Knjižnice Veleučilišta, specijalizirano vezano uz određeni studij.

Anketa također pokazuje da studenti najmanje informacija o Knjižnici dobivaju od nastavnog osoblja i posredstvom mrežnih stranica knjižnice, na što se zanimljivo osvrnuti s obzirom na dvije činjenice. Naime, iako se unazad tri desetljeća većina marketinške komunikacije knjižnica s korisnicima općenito odvijala posredstvom masovnih medija, istraživanja marketinga u kulturi ukazuju na neučinkovitost takva pristupa, upravo zbog njegove neselektivnosti i pristupu koji podrazumijeva nedovoljnu definiranost ciljanih skupina (Mi, Nesta, 2006; Pavičić *et al*., 2006:204). Treba, stoga, komunicirati individualno, obraćajući se korisniku usluge, u našem slučaju studentu, kao pojedincu s posebnim, profiliranim upitima[8]. Iako je za općenitije informacije, poput onih o radnim vremenu, uslugama i načinima kontaktiranja s knjižnicom mrežna stranica izvrstan medij, ona nikako ne može biti i jedini i najvažniji način komunikacije s osobljem knjižnice (Vrana, Pavić, 2017), što je i potvrđeno u našem istraživanju. Rezultat, također, potvrđuje da su korisnici, unatoč uvriježenom mišljenju da je u današnje vrijeme informatizacije dostupnost informacija puno šira i sadržajnija, svjesni da je izravni kontakt s knjižničarom najbrža i najtočnija informacija. Ovakav pristup dokazuje da je brzina informiranja u akademskom

[8] Iako se, u smislu individualizacije komunikacije, naglašava važnost da, zbog brze i lake komunikacije koju omogućuju, knjižnice promoviraju svoje usluga na društvenim mrežama (Vrana, Pavić, 2017), recentno istraživanje ukazuje da one nisu dovoljno zastupljene među visokoškolskim knjižnicama u Hrvatskoj. Profil na Facebooku, tako, posjeduju sve sveučilišne knjižnice, dok ih među visokoškolskim profil ima samo 18 % (Pažur 2019).

svijetu vrlo bitna činjenica, a to je osobito važno naglasiti u kontekstu tako često ponavljanih iskustava nastavnika, knjižničara, ali i studenata, s kojima se susrećemo svaki dan, a koja započinju upitom korisnika knjižničaru o literaturi za seminar, jer „na Googleu nema ništa"... Stoga, unatoč uvriježenim činjenicama, spoznaju studenata o tome da će u pronalaženju literature i informacija imati bolje rezultate nakon posjeta knjižnici ili kontaktiranja s knjižničarima, no što će rezultirati „googlanjem" naslova, svakako valja naglasiti kao vrijednu.

5. 2 Ocjenjivanje zadovoljstva korisnika knjižničnih usluga

Ekonomska literatura slaže se u činjenici da se otprilike 96 % svih primatelja neke usluge koji nisu zadovoljni neće nikada naglas požaliti isporučitelju te usluge, no 90 % od njih nikada se više neće ni vratiti na mjesto nezadovoljstva. Štoviše, svaki korisnik od ovih 90 % koji se nikada više neće vratiti svoje će loše iskustvo podijeliti s najmanje 9 drugih osoba, od kojih će 13 % to isto iskustvo podijeliti s čak 20 i/ili više drugih osoba. Dakle, ako u mjesec dana u knjižnici imamo 10 nezadovoljnih korisnika, među njima ćemo čuti pritužbu samo od jednog; pritom nećemo biti ni svjesni da naši korisnici nisu zadovoljni našom knjižnicom i njezinim uslugama. Nakon mjesec dana najmanje će 101 osoba znati da naša knjižnica ne pruža dobru uslugu (Carr 1990, prema Petr Balog, Gašo, 2016:63).

U nastavku su prikazani rezultati ocjenjivanja zadovoljstva korisnika knjižničnih usluga. Rezultati se odnose na ocjenu stupnja važnosti knjižničnih usluga, ocjenu stupnja zadovoljstva korisnika knjižničnih usluga, ocjenu uvjeta rada i ocjenu namjera ponašanja.

Tablica 2. Ocjena stupnja važnosti knjižničnih usluga

Varijabla	Aritmetička sredina	Standardna devijacija
Pronalazak odgovarajuće literature	4,54	0,750
Online katalog	3,44	1,128
Pretraživanje baza podataka	3,51	1,303
Rezervacija i obavijesti o dostupnosti knjiga (*e-mailom*, telefonom, SMS-om)	4,02	1,145
Edukacija korisnika o pretraživanju knjižničnih kataloga i baza podataka	3,99	1,049
Utjecaj knjižničnih usluga na osobni, stručni i akademski razvoj	4,23	0,776

Napomena: ljestvica ocjenjivanja obuhvaća 5 ocjena, gdje ocjena 1 znači „posve nevažno", a ocjena 5 „vrlo važno".

Izvor: autorice (2020)

Prema rezultatima u tablici 2 zaključuje se da studenti najvažnijim cijene pronalazak odgovarajuće literature (aritmetička sredina = 4,54), dok je druga po važnosti usluga povezana uz dostupnost i rezervaciju literature koja im je potrebna (aritmetička sredina = 4,02). Važna usluga je i ona vezana

uz edukaciju korisnika u pretraživanju knjižničnih kataloga i baza podataka (aritmetička sredina = 3,99). Pretraživanje baza podataka i *online* katalog rangirani su kao osrednje važne knjižnične usluge.

Ujedno, ispitanici smatraju da knjižnične usluge imaju važan utjecaj na njihov osobni, stručni i akademski razvoj.

Tablica 3. Ocjena zadovoljstva korisnika knjižničnih usluga

Varijabla	Aritmetička sredina	Standardna devijacija
Čitaonica	4,03	1,197
Računalna oprema	3,80	1,204
Radno vrijeme	3,56	1,352
Edukacija u pronalaženju informacija	4,13	0,933
Knjižnična građa	4,20	0,934
Dostupnost časopisa	4,05	1,047
Susretljivost i ljubaznost osoblja	4,74	0,554
Brzina pružanja zatražene informacije	4,64	0,792
Ukupno zadovoljstvo	4,55	0,946

Napomena: ljestvica ocjenjivanja obuhvaća 5 ocjena, gdje ocjena 1 znači „vrlo nezadovoljan", a ocjena 5 „vrlo zadovoljan".

Izvor: autorice (2020)

Prosječne ocjene zadovoljstva korisnika knjižničnih usluga kreću se od 3,56 do 4,74 te pokazuju visok stupanj zadovoljstva pojedinim elementom usluge. Prema dobivenim rezultatima, korisnici su najzadovoljniji susretljivošću i ljubaznošću osoblja (aritmetička sredina = 4,74) te brzinom kojom mogu dobiti zatraženu informaciju (aritmetička sredina = 4,64). Korisnici knjižnice najmanje su zadovoljni radnim vremenom, iako taj element usluge nije ocijenjen negativno (aritmetička sredina = 3,56), te prosječna ocjena pokazuje osrednje zadovoljstvo radnim vremenom.

Ukupno zadovoljstvo korisnika knjižničnih usluga ocijenjeno je prosječnom ocjenom 4,55, što pokazuje da su ispitanici, sveukupno gledajući, vrlo zadovoljni uslugama u promatranoj knjižnici.

Tablica 4 ujedno pokazuje da je oko 90 % ispitanika zadovoljno ili vrlo zadovoljno knjižničnim uslugama, dok ih 5,5 % ima neutralan stav.

Tablica 4. Distribucija odgovora za varijablu „ukupno zadovoljstvo"

Stupanj zadovoljstva	Struktura (%)
Vrlo nezadovoljan	4,4
Nezadovoljan	0,0
Niti zadovoljan niti nezadovoljan	5,5
Zadovoljan	16,5
Vrlo zadovoljan	73,6

Izvor: autorice (2020)

Tablica 5 sadrži prosječne ocjene uvjeta rada u knjižnici.

Tablica 5. Ocjena uvjeta rada u knjižnici

Varijabla	Aritmetička sredina	Standardna devijacija
Prostor za individualni rad	2,51	1,345
Dulje radno vrijeme	3,16	1,401
Više računala	2,68	1,124
Bolje opskrbljena građom	2,71	1,508
Edukacije o korištenju građe	2,71	1,401
Pomoć pri pisanju rada	3,55	1,455

Napomena: ljestvica ocjenjivanja obuhvaća 5 ocjena, gdje ocjena 1 znači „u potpunosti se ne slažem", a ocjena 5 „u potpunosti se slažem".

Izvor: autorice (2020)

Rezultati iz tablice 5 pokazuju da se ispitanici uglavnom slažu da bi knjižnica trebala pružati pomoć pri pisanju stručnog ili znanstvenog rada (aritmetička sredina = 3,55), dok o ostalim uvjetima rada imaju neutralan stav (aritmetičke sredine kreću se od 2,51 do 3,16).

Tablica 6. Ocjena lojalnosti korisnika knjižnice

Varijabla	Aritmetička sredina	Standardna devijacija
Preporuka kolegama	4,43	0,701
Usklađenost s očekivanjima	3,84	0,873

Napomena: ljestvica ocjenjivanja obuhvaća 5 ocjena, gdje ocjena 1 znači „u potpunosti se ne slažem", a ocjena 5 „u potpunosti se slažem".

Izvor: autorice (2020)

Tablica 6 sadrži prosječne ocjene lojalnosti korisnika knjižnice. Rezultati pokazuju visoku lojalnost korisnika prema korištenju usluga u promatranoj knjižnici, što podrazumijeva pozitivnu usmenu predaju (preporuka) i usklađenost s očekivanjima.

5. 3 Razlike u ocjenama važnosti knjižničnih usluga i zadovoljstva korisnika s obzirom na razinu studija ispitanika

Slijedi analiza razlika u prosječnim ocjenama važnosti knjižnični usluga s obzirom na razinu studija ispitanika. U tablici 7 prikazani su rezultati t-testa.[9]

[9] Prema Morgan et al. (2004.), t-test je robusna metoda, te ga se može upotrebljavati i u slučajevima da podaci nisu normalno distribuirani, a da se pri tome ne našteti valjanosti samog testa. Slijedom toga, opravdano je primijeniti ovu metodu i na podacima u ovom istraživanju.

Tablica 7. Usporedba prosječnih ocjena važnosti knjižničnih usluga s obzirom na razinu studija ispitanika

Varijabla	Preddiplomski studij (A. S.)	Diplomski studij (A. S.)	T-test	Sig.
Pronalazak odgovarajuće literature	4,65	4,38	1,713	0,090
Online katalog	3,44	3,44	0,027	0,979
Pretraživanje baza podataka	3,65	3,31	1,258	0,212
Rezervacija i obavijesti o dostupnosti knjiga (*e-mailom*, telefonom, SMS-om)	4,17	3,82	1,398	0,167
Edukacija korisnika o pretraživanju knjižničnih kataloga i baza podataka	4,21	3,69	2,398	0,019*
Utjecaj knjižničnih usluga na osobni, stručni i akademski razvoj	4,33	4,10	1,372	0,173

Napomena: A. S. – aritmetička sredina, tj. prosječna vrijednost; * - značajnost razlike na razini $p = 0,05$.

Izvor: autorice (2020)

Ocjene važnosti pojedinih knjižničnih usluga pokazuju da ispitanici s obje razine studija najveću važnost pridaju pronalasku odgovarajuće literature. S druge strane, korisnicima koji studiraju na preddiplomskom studiju najmanje je važna usluga *online* kataloga, dok je korisnicima na diplomskoj razini studija najmanje važno pretraživanje baza podataka. Ispitanici koji studiraju na preddiplomskom studiju su svim promatranim elementima knjižničnih usluga pridali veću važnost u usporedbi s korisnicima na diplomskom studiju.

Rezultati t-testa pokazuju da su uočene razlike slučajne, tj. nisu statistički značajne za većinu promatranim knjižničnih usluga. Statistički značajna razlika postoji samo za ocjenu važnosti edukacije korisnika o pretraživanju knjižničnih kataloga i baza podataka. Prema tome, ispitanici na različitim razinama studija razložito ocjenjuju važnost edukacija. Korisnici knjižničnih usluga koji studiraju na preddiplomskom studiju pridaju edukaciji o pretraživanju knjižničnog kataloga i baza podataka značajno veću važnost u usporedbi s onima koji studiraju na diplomskoj razini studija. Pretpostavka je da su studenti na diplomskim studijima vještiji i obrazovaniji u smislu informacijske pismenosti i da su edukaciju koju Knjižnica nudi pohodili u ranijim godinama studiranja, pa im dodatna edukacija na tom polju više znači u smislu individualnog osposobljavanja povezanog uz konkretan problem.

Sljedeća tablica sadrži rezultate analize razlika prosječnih ocjena zadovoljstva korisnika knjižničnih usluga s obzirom na razinu studija ispitanika.

Tablica 8. Usporedba prosječnih ocjena zadovoljstva korisnika knjižničnih usluga s obzirom na razinu studija ispitanika

Varijabla	Preddiplomski studij (A. S.)	Diplomski studij (A. S.)	T-test	Sig.
Čitaonica	4,29	3,69	2,343	0,022*
Računalna oprema	4,13	3,36	3,193	0,002**
Radno vrijeme	3,77	3,28	1,720	0,089
Edukacija u pronalaženju informacija	4,33	3,87	2,359	0,020*
Knjižnična građa	4,37	3,97	2,010	0,047*
Dostupnost časopisa	4,29	3,74	2,528	0,013*
Susretljivost i ljubaznost osoblja	4,81	4,64	1,405	0,164
Brzina pružanja zatražene informacije	4,84	4,39	2,480	0,016*
Ukupno zadovoljstvo	4,52	4,59	-0,350	0,727

Napomena: A. S. – aritmetička sredina, tj. prosječna vrijednost; * - značajnost razlike na razini $p = 0,05$; ** - značajnost razlike na razini $p = 0,01$.

Izvor: autorice (2020)

Prema rezultatima iz tablice 8 razvidno je kako su korisnici koji studiraju na preddiplomskim studijima najzadovoljniji brzinom pružanja zatražene informacije, dok su oni koji studiraju na diplomskim studijima najzadovoljniji susretljivošću i ljubaznošću osoblja. S druge strane, obje grupe ispitanika najmanje su zadovoljne radnim vremenom knjižnice. Ispitanici koji studiraju na preddiplomskom studiju su za sve promatrane knjižnične usluge izrazili viši stupanj zadovoljstva u usporedbi s onima koji studiraju na diplomskom studiju.

Rezultati t-testa pokazuju da su uočene razlike statistički značajne za šest promatranih varijabli. Prema tome, ispitanici na različitim razinama studija izražavaju različit stupanj zadovoljstva za usluge čitaonice, računalnu opremu, edukaciju o pronalaženju informacija, knjižnične građe, dostupnost časopisa i brzinu pružanja zatražene informacije. Korisnici knjižničnih usluga koji studiraju na preddiplomskom studiju značajno su zadovoljniji tim elementima knjižnične usluge u usporedbi s onima koji studiraju na diplomskoj razini studija.

Za ostale elemente knjižnične usluge (radno vrijeme te susretljivost i ljubaznost osoblja) uočene razlike su slučajne, tj. nisu statistički značajne. Može se zaključiti da se prosječne ocjene ispitanika s preddiplomskog studija ne razlikuju značajno od prosječnih ocjena ispitanika s diplomskog studija, tj. da korisnici s obje razine studija izražavaju sličnu razinu zadovoljstva radnim vremenom i susretljivosti i ljubaznosti osoblja.

Nadalje, korisnici koji studiraju na diplomskom studiju izrazili su viši stupanj ukupnog zadovoljstva knjižnicom od korisnika s preddiplomskog studija. Ipak, prema rezultatima t-testa, ta je razlika

slučajna, tj. nije statistički značajna. Na temelju toga može se zaključiti da se prosječne ocjene ukupnog zadovoljstva ispitanika s preddiplomskog studija ne razlikuju značajno od prosječnih ocjena ispitanika s diplomskog studija. Prema tome, korisnici s obje razine studija izražavaju sličnu razinu ukupnog zadovoljstva knjižničnim uslugama.

5. 4 Povezanost zadovoljstva korisnika pojedinom knjižničnom uslugom i ukupnog zadovoljstva korisnika knjižnice

Cilj primjene multiple regresijske analize je utvrditi prirodu povezanosti između zadovoljstva korisnika pojedinom knjižničnom uslugom i ukupnog zadovoljstva korisnika knjižnice. Pri tome pojedine knjižnične usluge predstavljaju nezavisne varijable, dok je ukupno zadovoljstvo korisnika knjižnice zavisna varijabla u regresijskom modelu.

Tablica 9. Rezultati multiple regresijske analize

Pokazatelji	**Vrijednost**			
Koeficijent multiple korelacije R	0,785			
Koeficijent determinacije R^2	0,616			
Prilagođeni R^2	0,577			
Standardna pogreška procjene	0,370			
F-vrijednost	15,637			
Pouzdanost	0,000			
Nezavisna varijabla	**b**	**Beta**	**t**	**Sig.**
Konstanta	1,363		3,849	0,000*
Čitaonica	−0,216	−0,458	−3,338	0,001*
Računalna oprema	0,121	0,256	1,995	0,050**
Radno vrijeme	0,133	0,321	3,329	0,001*
Edukacija u pronalaženju informacija	0,033	0,054	0,296	0,768
Knjižnična građa	0,156	0,258	1,843	0,069
Dostupnost časopisa	−0,153	−0,283	−2,397	0,019**
Susretljivost i ljubaznost osoblja	0,884	0,877	8,209	0,000*
Brzina pružanja zatražene informacije	−0,229	−0,319	−2,414	0,018**

Napomena: zavisna varijabla: ukupno zadovoljstvo; * - značajno na razini $p = 0,01$; ** - značajno na razini $p = 0,05$.

Izvor: autorice (2020)

Rezultati multiple regresijske analize pokazuju jaku, pozitivnu i statistički značajnu povezanost između zadovoljstva korisnika pojedinom knjižničnom uslugom i ukupnog zadovoljstva korisnika knjižnice ($R = 0,785$, $p < 0,01$). Vrijednost koeficijenta determinacije (R^2) pokazuje da se 61,6 % varijance ukupnog zadovoljstva korisnika knjižnice može predvidjeti (objasniti) kombinacijom promatranih pojedinačnih knjižničnih usluga.

Nadalje, prema rezultatima u tablici 9, šest od osam nezavisnih varijabli značajno utječe na zavisnu varijablu. Najvišu značajnu vrijednost ima varijabla „susretljivost i ljubaznost osoblja" ($\beta = 0{,}877$, $p < 0{,}01$), što znači da je ona najvažnija nezavisna varijabla u promatranom modelu, te najviše utječe na ukupno zadovoljstvo korisnika knjižnice. Slijede varijable „čitaonica" ($\beta = -0{,}458$, $p < 0{,}01$), „radno vrijeme" ($\beta = 0{,}321$, $p < 0{,}01$), „brzina pružanja zatražene informacije" ($\beta = -0{,}319$, $p < 0{,}05$). Najmanje važne nezavisne varijable u ovom regresijskom modelu su „dostupnost časopisa" ($\beta = -0{,}283$, $p < 0{,}05$) i „računalna oprema" ($\beta = 0{,}256$, $p < 0{,}05$), zbog čega ovi elementi knjižnične usluge imaju najmanji utjecaj na ukupno zadovoljstvo korisnika knjižnice.

S obzirom na to da je cjelokupni regresijski model statistički značajan ($F = 15{,}637$, $p < 0{,}01$), može se zaključiti da su pojedine knjižnične usluge značajno i pozitivno povezane s ukupnim zadovoljstvom, tj. da zadovoljstvo čitaonicom, računalnom opremom, radnim vremenom, edukacijom u pronalaženju informacija, knjižničnom građom, dostupnošću časopisa, susretljivošću i ljubaznošću osoblja te brzinom pružanja zatražene informacije mogu značajno predvidjeti ukupno zadovoljstvo korisnika knjižnice.

5. 5 Povezanost ukupnog zadovoljstva korisnika knjižnice i njihove lojalnosti

Priroda povezanosti ukupnog zadovoljstva korisnika knjižnice i njihove lojalnosti prema knjižničnim uslugama ispitana je jednostavnom regresijskom analizom. Rezultati su prezentirani u tablici 10.

Tablica 10. Rezultati jednostavne regresijske analize

Pokazatelji	**Vrijednost**			
Koeficijent korelacije R	0,344			
Koeficijent determinacije R^2	0,119			
Prilagođeni R^2	0,109			
Standardna pogreška procjene	0,662			
F-vrijednost	11,983			
Pouzdanost	0,001			
Nezavisna varijabla	**b**	**Beta**	**t**	**Sig.**
Konstanta	3,266		9,528	0,000*
Ukupno zadovoljstvo	0,255	0,344	3,462	0,001*

Napomena: zavisna varijabla: lojalnost; * - značajno na razini $p = 0{,}01$.

Izvor: autorice (2020)

Rezultati u tablici 10 pokazuju statistički značajnu povezanost između ukupnog zadovoljstva korisnika knjižnice i njihove lojalnosti ($F = 11{,}983$, $p < 0{,}01$).

Prema koeficijentu korelacije ($R = 0{,}344$), postoji slaba i pozitivna veza između zadovoljstva i lojalnosti korisnika knjižnice. Vrijednost koeficijenta determinacije (R^2) pokazuje da se 11,9 % varijance u varijabli „lojalnost" može predvidjeti varijablom „ukupno zadovoljstvo korisnika".

5. 6 Rasprava i preporuke za buduća istraživanja

U raspravi o rezultatima i eventualnim ograničenjima ukazujemo na nekoliko zanimljivosti.

Ograničenja istraživanja koja su, kako je već obrazloženo, djelomično intencionalna u usmjerenju na samo one ispitanike koji koriste prostor Knjižnice, mogu ukazati na mali broj anketiranih korisnika, čime se otvara prostor novim pitanjima, jer se zanimljivim predmnijeva proširiti krug ispitanika i uključiti u anketu sve kategorije korisnika. U tom smislu bismo, u daljnjem, inauguriranom istraživanju, uključili e-anketom i mišljenja o zadovoljstvu pruženim uslugama, nazovimo ih tako, e-korisnika, tj. korisnika koji rjeđe borave u knjižnici i najčešće s njenim osobljem komuniciraju e-poštom. Također bi bilo dobro obuhvatiti stavove nastavnog osoblja, s obzirom na to da njihova poimanja kvalitetne usluge i očekivanja, tj. zadovoljstvo dobivenim uslugama polazi od djelomično različitih premisa. Naime, ovo istraživanje naglasilo je važnost koju studenti korisnici knjižnice pridaju pronalasku odgovarajuće literature. Budući da je strategija nabave knjižnične građe tako osmišljena da se nabavljaju gotovo svi dobavljivi naslovi čiju nabavu nastavnici iniciraju, pretpostavka je da će njihova očekivanja biti posljedično povezana s navedenim. Naime, zahtjev nastavnika za nabavom literature gotovo uvijek rezultira kupovinom knjiga, ili barem međuknjižničnom posudbom, ako je građu nemoguće drugačije nabaviti. Upravo stoga nastavnici kao korisnici mogu drugačije odgovoriti na pitanje jesu li zadovoljni knjižničnim fondom, tj. ima li knjižnica svu potrebnu građu. S druge strane, studenti rijetko iniciraju nabavu građe, kada iznimno ukažu na nedostatak naslova koji je istaknut na popisu literature određenog kolegija, nakon čega se, suradnjom nastavnika i knjižničarke, knjige nastoji nabaviti. Jedan od rezultata ispitivanja analize zadovoljstva svakako će biti i jasnije poticanje studenata, nastavnika i knjižničara na zajedničku suradnju i bržu komunikaciju prilikom nabave nove ispitne literature.

Zaključak ankete koji podvlači zadovoljstvo korisnika brzinom kojom mogu dobiti zatraženu informaciju također treba naglasiti, osobito povezanu uz visok stupanj zadovoljstva koje iskazuju prema susretljivosti i ljubaznosti osoblja. Naime, ovaj odgovor potvrđuje da su korisnici prepoznali važnost brzine komunikacije u savjetovanju o građi. Dobrodošlo je u tom smislu savjetovanje sa stručnom osobom i pritom brža komunikacija u vezi s posudbom (potvrđivanje rezervacije *e-mailom* i telefonom, obavijesti o dolasku rezervirane građe u Knjižnicu *e-mailom* i SMS-om, te stoga i brzo posuđivanje građe dok su studenti još u zgradi na predavanju i sl.).

Istraživanje zadovoljstva studenata također je naglasilo i istaklo važnost usluge knjižnice kao centra edukacije korisnika u pretraživanju knjižničnih kataloga i baza podataka. Iako je dosadašnja praksa Knjižnice na tom području pružala studentima četiri vrste edukacije, različite forme, sadržajnog

opsega i trajanja[10], jasno je da studenti edukaciju povezanu uz informacijsku pismenost i uopće edukaciju o knjižničnim uslugama[11] poimaju kao vrlo bitnu u svom školovanju.

Osrednje zadovoljstvo koje studenti iskazuju uvjetima rada Knjižnice ističe moguće nedostatke prostora čitaonice u kojoj, zbog česte gužve, ponekad nedostaje prostora za individualni rad. Ovaj podatak nije nov, pojavio se i u opsežnijim prethodnim istraživanjima, u kojima se također dokazala važnost potrebe za izdvojenim prostorom za miran rad i koncentraciju pri učenju, bez obzira kakav prostor ima čitaonica (Allen *et al.*, 2010; Yoo-Lee *et al.*, 2013). Osrednje zadovoljstvo računalnom opremljenošću Knjižnice odražava se zapravo kao manji nedostatak, budući da Veleučilište ima dvije računalne učionice, no korisnici su naučeni posjećivati Knjižnicu, dijelom i zbog usluga i dostupne građe. Što se tiče niže razine zadovoljstva radnim vremenom, može se pretpostaviti da je ona povezana s različitim smjenama u kojima se održavaju predavanja ili s različitim očekivanjima studenata s obzirom na pretpostavljenu veličinu i radno vrijeme knjižnica iz kojih dolaze.

Nadalje, rezultati upućuju da je zadovoljstvo korisnika pojedinom knjižničnom uslugom značajno i pozitivno povezano s ukupnim zadovoljstvom korisnika knjižnice. Zaključuje se kako veće zadovoljstvo čitaonicom, računalnom opremom, radnim vremenom, edukacijom u pronalaženju informacija, knjižničnom građom, dostupnošću časopisa, susretljivošću i ljubaznošću osoblja te brzinom pružanja zatražene informacije dovodi do većeg ukupnog zadovoljstva korisnika knjižnice. Pri tome najvažniju ulogu u postizanju ukupnog zadovoljstva ima susretljivost i ljubaznost osoblja.

Osim toga, rezultati ovog istraživanja također pokazuju pozitivnu i značajnu vezu između zadovoljstva i lojalnosti korisnika knjižnice, ukazujući da veće zadovoljstvo korisnika knjižnice rezultira njihovom lojalnošću, tj. to će radije preporučiti usluge knjižnice drugim kolegama.

6. ZAKLJUČAK

Istraživanje je nastalo kao produkt strategije Knjižnice Veleučilišta u Rijeci da stalno pokušava unaprijediti kvalitetu svojih usluga i svoga poslovanja, čiji je važan dio i analiza istraživanja zadovoljstva korisnika. Nakon više desetaka parcijalnih anketa na manjem uzorku koje su istraživale zadovoljstvo korisnika manjim inovacijama u poslovanju Knjižnice, ovo je prvi opširniji istraživački ciklus pri čijem su planiranju, početkom 2020., autorice predmnijevale otvoriti prostor za dodatnim, proširenim, nastavkom. Ta je godina otvorila vrata za još jedno područje istraživanja, osobito za

[10] Najkraće, polusatno upoznavanje studenata s Knjižnicom održava se u listopadu; knjižničarka posjećuje svaku studijsku grupu na prvom semestru stručnog studija i ukratko upoznaje studente s mrežnim stranicama Knjižnice, načinima pretraživanja kataloga i najznačajnijim bazama podataka za sadržaje koji se uče na specifičnom studiju, a čije se poveznice nalaze na mrežnim stranicama Knjižnice. Sadržajnije, tjedne radionice Kako do željene literature studentima se nude tijekom semestra, no primijećeno je da, unatoč brojnim prijavama na radionice, studenti u konačnici teško usklađuju rasporede. Stoga se u Knjižnici održava i treći tip radionica, za manje grupice studenata, koje obuhvaćaju pretraživanja vezana uz određene uže tematske interese. Konačno, tu su i radionice prilagođene individualnim tematskim pretraživanjima, poput konzultacija, na koje studenti dolaze na neku vrst korekcije popisa literature koju su pronašli sami, a koju će knjižničarka nadopuniti savjetovanim dodatnim naslovima, jer se studente potiče i uči samostalnom pretraživanju kako bi se, po diplomi, znati snaći u moru stručne i manje stručne literature.

[11] Osim spomenutih ciklusa radionica, kao dio edukacije navodimo uslugu e-mailom Pitajte knjižničare, radionice vezane uz informacijsku pismenost, informacijske letke o osnovnim informacijama o knjižničnim uslugama, ankete o zadovoljstvu korisnika novouvedenim inovacijama i sl.

knjižničare, jer su zbog pandemije i naglog prelaska na online nastavu knjižnice velikim naporima nastojale korisnicima otvoriti svoja vrata. Čini se, naime, korisnim, u daljnjem istraživanju, u smislu uočavanja suvremenih trendova i promjena u radu visokoškolskih knjižnica, ovo istraživanje nadopuniti iskazivanjem stavova korisnika o poslovanju online u posebnim uvjetima i dodatnom poboljšanju i prilagodbi.

Zaključno ističemo da ovo istraživanje ostavlja prostora za nadopunu i proširenje, dok će njegovi rezultati poslužiti u promišljanju o mogućim poboljšanjima usluga u praktičnom smislu, budući da će poslužiti kao opravdana motivacija u donošenju odluka vezanih uz prerazmještaj prostora Knjižnice i redefiniranje postojećeg. Promjene će sada biti temeljene na pouzdanim informacijama, ne pretpostavljenim željama korisnika i zaposlenika Knjižnice, pa bi, primjerice, dio studentskih prijedloga mogao biti prihvaćen i moglo bi se stvoriti manje odvojenih i mirnijih radnih mjesta za individualni rad ili rad u parovima, no, ovisno o financijskim i prostornim ograničenjima, manje je vjerojatno da će se uspjeti proširiti prostor same čitaonice.

Procjena postojećeg stanja mogla bi nadopuniti procedure i strategije nabave i širenja knjižničnog fonda i time usluge koje Knjižnica nudi studentima. Naime, stavovi studenata iskazani stupnjem zadovoljstva u anketi, povezani s knjižničnom građom (dostupnost odgovarajuće literature i fond knjižnice), uvjetima rada u Knjižnici (prostorom, računalnom opremom, radnim vremenom), mišljenja o radu knjižničnog osoblja (stručnost, susretljivost), kvalitetom i brzinom informacija (pretraživanja, rezervacije, obavijesti i brzina usluge) te mogućnosti edukacije koje Knjižnica nudi (pretraživanje kataloga, pomoć pri pronalaženju građe, radionice koje promiču informacijsku pismenost, radionice povezane s izradom seminarskih radova, osnova pismenosti i sl.) pomoći će u formiranju zaključaka o utemeljenju pretpostavke da korisnici Knjižnicu Veleučilišta u Rijeci doživljavaju kao važno informacijsko središte u procesu studiranja i svog znanstvenog i stručnog rada, te da su, sukladno tome, zadovoljni uslugama koje ona pruža.

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Original scientific paper
https://doi.org/10.31784/zvr.9.1.6
Received: 7. 12. 2020.
Accepted: 2. 2. 2021.

CUSTOMER SATISFACTION RESEARCH WITH LIBRARY IN HIGHER EDUCATION

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ABSTRACT

Evaluation of library services is the most objective way to determine library's organisation and performance. The purpose of this research was to examine customer satisfaction with library services. Primary data was gathered in Library of Polytechnic of Rijeka. Data was gathered using questionnaire that consisted of six parts: library services importance, customer satisfaction with particular library service, working conditions in library, overall customer satisfaction with library, behavioural intentions of library customers, and respondents' profile. Sample consists of graduate and postgraduate students. Data was gathered from January to November 2020. Data was analysed using descriptive statistics, t-test, and regression analysis. Descriptive analysis results showed importance of library staff, that has important role as the main source of information regarding the library services. The most important library service is finding the literature. Overall customer satisfaction's average score was 4,55, implying high level of customer satisfaction with the library. T-test results indicated that library customers who study at different study levels have significantly different customer satisfaction levels with particular library services. On the other hand, both groups of respondents have similar perceptions regarding overall customer satisfaction. In addition, customer satisfaction with particular services have significant effect on overall customer satisfaction with library services. Similarly, overall customer satisfaction significantly impacted behavioural intentions of library customers. Present research contributed to better understanding of library services perceptions, thus showing variety of suggestions for increasing library performance and working conditions. These should meet customers' needs, aiming to enhance customer satisfaction level and to achieve positive behavioural intentions of library customers.

Key words: *customer satisfaction, library service quality, evaluation of library services, academic library, quantitative analysis*

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Izvorni znanstveni rad
https://doi.org/10.31784/zvr.9.1.7
Datum primitka rada: 1. 12. 2020.
Datum prihvaćanja rada: 2. 3. 2021.

NAČINI INFORMIRANJA I PREPOZNAVANJE LAŽNIH VIJESTI KOD STUDENATA U HRVATSKOJ TIJEKOM COVID-19 PANDEMIJE

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SAŽETAK

Problemsko područje rada je informiranje i manipulacije informacijama. Fokus se stavlja na informacijske poremećaje i prepoznavanje lažnih vijesti jer to postaje sve veći problem, posebno u digitalnim medijima koji omogućuju njihovo viralno širenje. U radu su opisane vrste informacijskih poremećaja, s naglaskom na dezinformacije i lažne vijesti koje se najčešće objavljuju s ciljem manipulacije javnošću. Osim njih, terminološki se determiniraju pojmovi misinformacija, malinformacija i infodemija. Analiziraju se načini širenja lažnih vijesti, od onih koje šire ljudi – najčešće putem društvenih mreža, pa do upotrebe „botova". Da bi se što bolje prepoznali informacijski poremećaji, te na pravilan način reagiralo na njih, iznose se smjernice i alati koji omogućuju provjeru istinitosti informacijskih sadržaja. Dostupna istraživanja ukazuju da je prisutnost lažnih vijesti u medijskom prostoru globalan problem, pogotovo u vrijeme pandemije koronavirusa, ali nije zastupljen u svim zemljama istim intenzitetom. Hrvatska se navodi kao zemlja čiji stanovnici znaju izbjegavati lažne vijesti. Vlastitim istraživanjem dobio se uvid u učestalost i najčešće oblike informiranja kod studenata, te njihovu sposobnost prepoznavanja lažnih vijesti. Studenti preferiraju informiranje putem digitalnih medija (web, društvene mreže), dok je upotreba tradicionalnih medija značajno manja. Smatraju da su najpouzdaniji izvor informacija televizija i radio, a internet (izuzimajući društvene mreže) je na drugom mjestu. Iako smatraju da su uspješni u prepoznavanju lažnih vijesti, iskazali su značajno manju stvarnu sposobnost njihovog prepoznavanja.

Ključne riječi: *informiranje, lažna vijest, dezinformacija, infodemija, digitalni mediji, COVID-19*

1. UVOD

Vrijeme u kojem živimo opisuje se kao informacijsko doba, a ključnu ulogu u njemu imaju upravo informacije. Informacija ima veliki značaj za gospodarstvo, politiku, obrazovanje i sve druge aspekte života. Informacija se oplemenjuje u procesu komunikacije, s brojem konzumenata raste joj vrijednost, a mediji u tome igraju važnu ulogu. Danas postoje raznovrsni izvori informacija, a količina informacija raste eksponencijalno. Međutim, to ne znači da su ljudi u informacijskom društvu dobro i kvalitetno informirani. Zbog velikog i brzog protoka informacija sve je teže pronaći kvalitetnu informaciju, a česta je pojava lažnih, štetnih i zlonamjernih informacija. Pojavom dezinformacija manipulira se javnim mišljenjem, utječe na demokratske procese i narušava povjerenje u institucije, digitalne i tradicionalne medije (Europska komisija, 2018). Informacijski poremećaji su vrlo složen problem, a najkraće se mogu opisati kao onečišćenje informacija.

Sadržaj istinitih informacija vjerno i bez odstupanja opisuje stvarno stanje predmeta, događaja, pojave ili procesa i takve se informacije mogu provjeriti, dok netočne informacije daju pogrešnu, lažnu sliku događaja, procesa, predmeta ili pojave, pa se one nazivaju i dezinformacije (Krelja Kurelović, 2014: 29). „Povećanje broja dezinformacija i ozbiljnost prijetnje utječu na sve veću osviještenost i zabrinutost civilnog društva u državama članicama EU-a i na međunarodnoj razini" (Europska komisija, 2018). Lažne vijesti brzo se šire zbog njihova učestalog dijeljenja putem društvenih mreža, što čine i svjetski poznate osobe koje imaju veliki broj pratitelja. Veliko longitudinalno istraživanje sveučilišta MIT pokazalo je da se lažne vijesti na Twitteru šire brže od istinitih, te je 70% veća mogućnost da će korisnik proslijediti lažne vijesti nego istinite (Vosoughi i sur., 2017). Isti izvor ističe da lažne vijesti u većoj mjeri šire ljudi, a ne botovi. Stoga je cilj ovog rada ukazati na problem prisutnosti lažnih vijesti na internetu, načine njihova širenja i metode prepoznavanja. Zadatak rada je istražiti navike studenata vezane za informiranje, te njihovu sposobnost prepoznavanja lažnih vijesti. U skladu s navedenim, postavljene su dvije hipoteze. Prvom hipotezom želi se utvrditi postoji li statistički značajna razlika u korištenju tradicionalnih i digitalnih medija za informiranje, očekujući da studenti više koriste digitalne medije. Drugom hipotezom želi se utvrditi postoji li statistički značajna razlika između percipirane i stvarne sposobnosti studenata u prepoznavanju lažnih vijesti.

2. INFORMACIJSKI POREMEĆAJI U DIGITALNOM OKRUŽENJU

Čovjek je svakodnevno izložen velikoj količini informacija koje pristižu iz različitih izvora. Međutim, sve više informacija koje primamo nisu provjerene i istinite činjenice. Karakteristika digitalne informacije je da se ona jednostavno kreira, objavljuje, dijeli i širi, a odgovornost za vjerodostojnost informacija i njihovu kvalitetu najčešće je u rukama osobe koja ju objavljuje. Digitalnu informaciju je lako izmijeniti i manipulirati njome, a neki od primjera su fotomontaža ili rezanje i spajanje različitih video zapisa u novu cjelinu. Stoga ne čudi sve učestalija pojava lažnih vijesti (eng. *fake news*) i različitih informacijskih poremećaja. Lažne vijesti postaju ozbiljan problem digitalnog društva jer se internetom, posebno putem društvenih mreža, šire trenutno i globalno.

U prošlosti se dugo vjerovalo da je Zemlja ravna ploča, međutim to nije bila lažna vijest jer tada čovječanstvo nije imalo dovoljno resursa za provjeru navedene teorije. Tijekom 20. stoljeća može

se pronaći dosta primjera lažnih vijesti u klasičnim medijima (tisak, radio, televizija), a primjeri manipulacije informacijama uočeni su ne samo u tekstovima, već i kod fotografija (Dejanović, 2020). Iako su lažne vijesti postojale i prije pojave Interneta, one su se širile sporije, imale su manji doseg, a time i manju štetnost. Danas je internet glavni komunikacijski kanal, izvor informiranja, te način zabave i provođenja slobodnog vremena. Društvene mreže koristi sve veći broj ljudi zbog održavanja kontakata i komuniciranja, dijeljenja sadržaja, te poslovnih prilika. Digitalni mediji omogućuju jednostavno i brzo kreiranje, dijeljenje i komentiranje različitih sadržaja što doprinosi njihovoj popularnosti, ali istovremeno rezultira nizom problema kao što je pojava informacijskih poremećaja. Osim ljudi, značajnu ulogu u viralnom širenju lažnih vijesti imaju „botovi", računalni programi kojima se automatizira pisanje novinskih vijesti ili objava na društvenim mrežama tako da izgledaju kao da ih je napisao čovjek. Mnoge web stranice s lažnim vijestima zarađuju putem oglašavanja, što Facebook i Google pokušavaju spriječiti, te zapošljavaju ljude koji provjeravaju i skidaju lažni sadržaj sa svojih platformi.

Ne lažiraju se samo vijesti. Internetski prostor pun je lažnih profila na društvenim mrežama, lažnih recenzija proizvoda i usluga na stranicama poznatih online trgovina (npr. Amazon) i online rezervacijskih sustava. Tripadvisor je u svom izvještaju o transparentnosti naveo da je 2,1 posto svih objavljenih recenzija tijekom 2018. godine lažno, te je uklonio preko 1.5 milijuna lažnih recenzija, a najviše lažnih recenzija dolazi iz Rusije (Justament, 2019).

2. 1 Vrste informacijskih poremećaja

Dezinformacije su informacije koje su namjerno lažne i stvorene da bi naštetile pojedincu, društvenoj skupini, organizaciji ili zemlji, a najčešće se plasiraju zbog zarade, političkih interesa i utjecaja (Wardle, 2019: 9). Dezinformacije su zavaravajuće, izmišljene, netočne informacije koje govore o događajima koji se nikada nisu dogodili ili izjavama koje nikada nisu bile izrečene, a mogu nastati nenamjerno ili slučajno (Ciboci i sur., 2018).

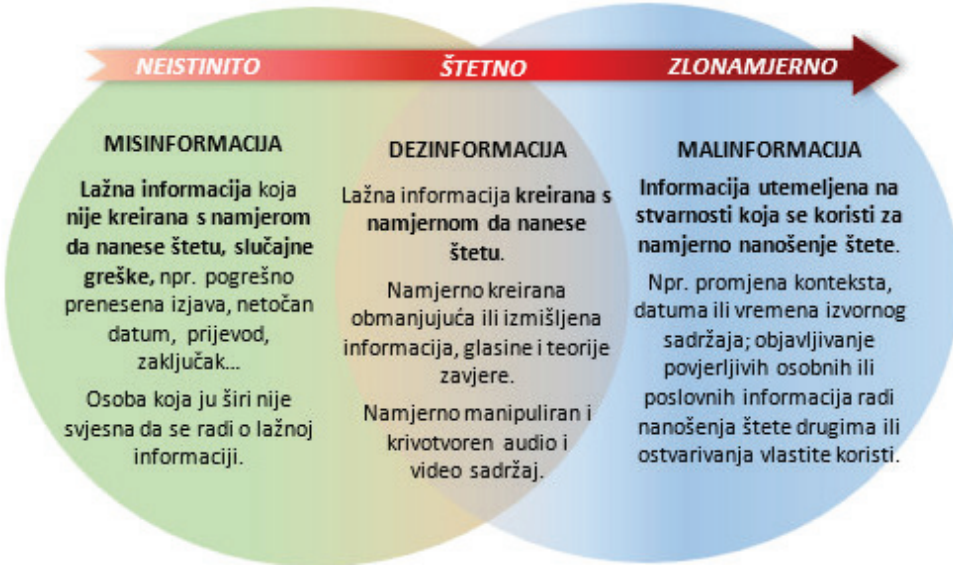
„Pojam dezinformacija označava dokazivo lažnu ili obmanjujuću informaciju koja je smišljena, iznesena i širi se radi stjecanja ekonomske koristi ili namjernog zavaravanja javnosti te koja može naškoditi javnom interesu. Šteta javnom interesu uključuje ugrožavanje demokratskih političkih procesa i procesa donošenja politika, ali i javnog dobra kao što su zaštita zdravlja građana EU-a, okoliša i sigurnosti. Dezinformacije ne uključuju pogreške u izvješćivanju, satiru i parodiju, kao ni jasno naznačene stranačke vijesti i komentare." (Europska komisija, 2018).

Pojedine zemlje imaju interes za namjerno širenje lažnih informacija o suparnicima kao što su to radili Sovjetski Savez i Sjedinjene Američke Države tijekom hladnog rata. Dezinformacija može biti oblikovana kao propaganda, pa tako Sjeverna Koreja koristi propagandne dezinformacije kako bi svoje građane uvjerila u opravdanost postupaka njihovog vođe. Vrsta dezinformacija su i teorije zavjere kojima se objašnjava povezanost pojave virusa COVID-19 s razvojem 5G mreže.

Lažne vijesti su informacije koje ne odgovaraju činjenicama (nepostojeće ili iskrivljene činjenice). One su često namjerno izmišljene i distribuirane radi obmanjivanja s ciljem da konzument povjeruje u neistine ili sumnja u prave činjenice. Lažne vijesti karakterizira kratak životni vijek, ali širok doseg (viralnost). Takve vijesti su stvorene da bi čitateljima prenijele neistinitu ili iskrivljenu informaciju o

nekom, najčešće nedavnom događaju ili osobi i navele ih na pogrešne zaključke. Lažne vijesti su uži pojam od dezinformacije (Ciboci i sur., 2018: 8).

Slika 1. Vrste informacijskih poremećaja i njihov odnos



Izvor: prilagodili autori prema https://internews.org/impact/disinformation

Kao informacijski poremećaji spominju se još pojmovi poput misinformacije i malinformacije (slika 1). Misinformacija je naziv za pogrešnu, neistinitu ili netočnu informaciju koja nije stvorena s namjerom da nanese štetu drugima, a malinformacija je zlоćudna informacija utemeljena na stvarnosti koja se koristi za namjerno nanošenje štete (Wardle, 2019: 9). Iako su pojmovi dezinformacija i misinformacija naizgled slični, razlika je u njihovoj namjeri. Dok je dezinformacija namjerno pogrešna (iskrivljena, lažna) i nastala s namjerom da manipulira, dotle je misinformacija pogrešna zbog slučajnosti ili zabune (slika 1).

2. 2 Infodemija

Širenje dezinformacija o koronavirusu odvija se globalno i eksponencijalno, najčešće dijeljenjem sadržaja putem društvenih medija. Islam i sur. (2020) pratili su društvene mreže, informativne web portale i ostale online platforme u periodu od prosinca 2019. do travnja 2020., te otkrili 2311 glasina, lažnih vijesti i teorija zavjere o koronavirusu na 25 jezika, iz 87 zemalja. Direktor Svjetske zdravstvene organizacije (WHO) ustanovio je da se svijet ne bori samo s globalnom pandemijom uzrokovanom koronavirusom nego i s vrstom informacijskog poremećaja nazvanog infodemija ili epidemija informacija. Infodemija je fenomen preobilja informacija (istinitih i lažnih) o određenoj temi koje se nekontrolirano šire, što otežava pronalaženje jasnih i vjerodostojnih poruka, pouzdanih izvora i rješenja problema (Nielsen i sur., 2020).

Istraživanje o podložnosti dezinformacijama o COVIDu-19 i njihovom utjecaju na ponašanje provedeno na velikom uzorku ispitanika u Velikoj Britaniji, Irskoj, Španjolskoj, SAD-u i Meksiku otkriva da vjerovanje u dezinformacije o koronavirusu nije učestalo, iako nezanemariv udio ispitanika u svakoj anketiranoj zemlji takve dezinformacije smatra pouzdanima (Roozenbeek i sur., 2020). U istom istraživanju utvrdili su da postoji korelacija između podložnosti dezinformacijama i nepovjerenja u cjepivo protiv virusa COVID-19, te smanjene vjerojatnosti pridržavanja epidemioloških mjera. Infodemija o koronavirusu nepovoljno utječe na ponašanje ljudi. Velika količina zbunjujućih, lažnih ili obmanjujućih informacija i glasina koje se masovno dijele na društvenim mrežama mogu pogoršati tijek pandemije, poljuljati povjerenje građana u javno zdravstvo, pa čak i ugroziti živote (PAHO, 2020; Roozenbeek i sur., 2020; Islam i sur. 2020). Kao odgovor na infodemiju, Svjetska zdravstvena organizacija pokrenula je web stranicu Mythbuster gdje daje smjernice kako izvještavati javnost, odnosno činjenicama demantirati najčešće mitove o koronavirusu.

2. 3 Raširenost lažnih vijesti u Europi i Hrvatskoj

Prema istraživanju portala Statista (2020), 37 % stanovnika Europe susreće se s lažnim vijestima svakodnevno, lažne vijesti su najučestalije u Španjolskoj, a najmanje učestale u Finskoj (Statista, 2020a). Istraživanje Eurobarometra pokazalo je da su u Cipru, Bugarskoj, Grčkoj, Rumunjskoj, Malti i Italiji lažne vijesti veliki problem, dok je u Danskoj, Luksemburgu, Irskoj i Velikoj Britaniji to umjereno prisutno (McCarthy, 2018). Prema McCarthy (2018), 43 % ispitanika smatra da su lažne vijesti u Hrvatskoj veliki problem i isto toliko smatra da je to umjereni problem. Rezultati globalnog istraživanja ukazuju da se najviše lažnih vijesti pronalazi na društvenim mrežama (61 %), zatim na televiziji (51 %), a najmanje u tiskanim medijima (44 %). Zanimljivo je da se u istom istraživanju Hrvatska ističe kao zemlja u kojoj će konzumenti najvjerojatnije izbjegavati lažne vijesti (Watson, 2020).

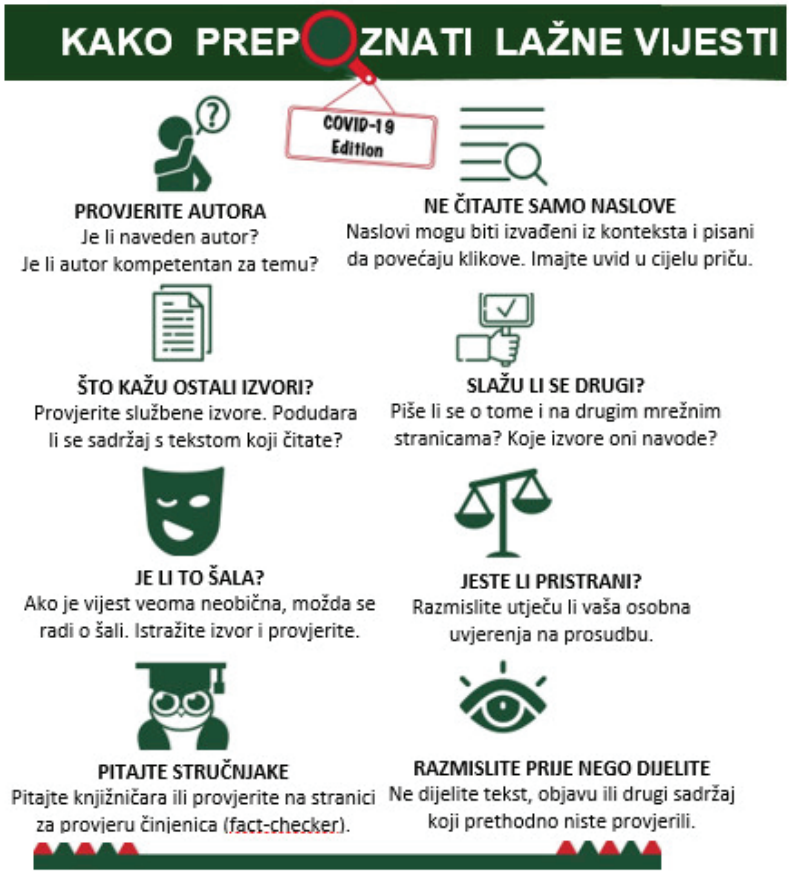
U Italiji je istraživanje na uzorku od 1009 ispitanika pokazalo da njih 79 % smatra kako je Facebook medij odgovoran za širenje lažnih vijesti povezanih s COVID-19 virusom (Statista, 2020b). Tijekom rujna 2020. godine provedeno je istraživanje u Velikoj Britaniji na uzorku od 576 ispitanika i utvrdilo da se oko 64 % ispitanika susrelo s lažnim ili obmanjujućim informacijama o koronavirusu barem jednom dnevno, najviše takvih ispitanika je u dobi od 16 do 24 godina, a samo 15 % ih je koristilo online servis za provjeru činjenica (Watson, 2021).

2. 4 Načini prepoznavanja lažnih vijesti

Informacijski izvori mogu se najjednostavnije provjeriti koristeći web tražilicu, unoseći tekst specifičan za određenu vijest. Specifičan tekst dat će preciznije rezultate, odnosno prikazat će se samo oni rezultati koji su prenijeli vijest u cijelosti ili djelomično (Dejanović, 2020: 63). Prilikom provjere informacijskog izvora preporučuje se provjeriti medij/izdavača, autora i reference. Poželjno je provjeriti tko je objavio vijest, tj. je li izvor pouzdan, na kojoj se domeni nalazi dotični sadržaj, datum objave vijesti, te objave drugih medija i izvora o navedenom sadržaju (Ciboci i sur., 2018), kao što prikazuje slika 2.

Postoje online servisi za provjeru činjenica (eng. *fact-checker*), koji su udruženi u mrežu pod nazivom *The International Fact-Checking Network* (https://www.poynter.org/ifcn/). U Hrvatskoj djeluje portal *Faktograf* (https://faktograf.hr/), a na razini Europske Unije djeluju servisi *EUvsDiSiNFO* (https://euvsdisinfo.eu/) i *EUfactcheck* (https://eufactcheck.eu/). Na globalnoj razini postoje web mjesta kao što su *Full Fact* (https://fullfact.org/) i *FactCheck* (https://www.factcheck.org/). Google također ima alat za provjeru istinitosti činjenica pod nazivom *Fact Check Explorer* (https://toolbox.google.com/factcheck/explorer). Prema izvješću Europske komisije (2018), smatra se da je mreža snažnih i neovisnih online servisa za provjeravanje činjenica ključni preduvjet u stvaranju zdravog digitalnog ekosustava.

Slika 2. Smjernice za prepoznavanje lažnih vijesti o COVID-19 virusu



Izvor: prilagodili autori prema https://www.ifla.org/node/93016

3. METODOLOGIJA ISTRAŽIVANJA

Za potrebe istraživanja s ciljem utvrđivanja načina informiranja (tradicionalni ili digitalni mediji), te uspješnosti u prepoznavanju lažnih vijesti osmišljen je online anketni upitnik, napravljen u alatu LimeSurvey. Anketni upitnik distribuirao se tijekom ljeta 2020. godine putem internetskih servisa

(mrežne stranice, e-pošta, društvene mreže). Upitnik čine 3 skupine pitanja. U prvom dijelu prikupljali su se opći demografski podaci o ispitanicima, zatim su slijedila pitanja o medijima putem kojih se ispitanici informiraju, a zadnju cjelinu činila su pitanja o prepoznavanju lažnih vijesti. Da bi se utvrdila stvarna sposobnost prepoznavanja lažnih vijesti, u anketnom upitniku su korištene izjave o Covid-19 virusu koje su se često pojavljivale u medijima. Ispitanici su trebali odgovoriti smatraju li te izjave istinitim ili lažnim. Ciljana skupina istraživanja bile su osobe u dobi od 18 do 28 godina koje studiraju (studenti), a istraživanju se odazvalo njih 29. Prikupljeni podaci obrađeni su korištenjem metode deskriptivne statistike, dok su obje hipoteze testirane primjenom t-testa za zavisne uzorke.

4. REZULTATI ISTRAŽIVANJA

Od 29 ispitanika u uzorku, 34 % ih je muškog, a 66 % ženskog spola. Ispitanici dolaze iz 7 različitih županija među kojima je najzastupljenija Primorsko-goranska (57,69 %), a potom Istarska županija (26,92 %).

Rezultati deskriptivne statistike na pitanja o učestalosti i načinima informiranja prikazani su u tablici 1. Najveći udio ispitanika o aktualnim događajima, novostima u zemlji i svijetu, te temama od interesa (npr. sport, moda, politika…) informira se svakodnevno. Pri tome pretežno koriste digitalne medije, 74 % ispitanika se izjasnilo da koristi jedan ili više digitalnih medija za informiranje, dok je upotreba tradicionalnih medija, pogotovo tiskanih, sporadična i u prosjeku iznosi 24 %.

Ovi rezultati su slični rezultatima istraživanja agencije Ipsos koja je provela istraživanje o medijskim navikama Hrvata u 2019. godini na uzorku od 1023 ispitanika i utvrdili su da je Internet glavni izvor informacija za 78 % ispitanika, a 91,6 % ispitanika koristi ga više puta dnevno (Poslovni.hr, 2019).

Tablica 1. Učestalost i načini informiranja

Pitanje		Ponuđeni odgovori	%	M	SD
Koliko često se informirate o aktualnim događajima, novostima u zemlji i svijetu, temama od interesa?		1 - nekoliko puta tjed.	34,48	1,86	0,64
		2 - svakodnevno	55,17		
		3 - više puta dnevno	10,34		
Koristite li za informiranje…?	tiskane medije	0 - ne	93,1	0,07	0,26
		1 - da	3,9		
	televiziju i/ili radio	0 - ne	58,62	0,41	0,50
		1 - da	41,38		
	„news" portale i web	0 - ne	27,59	0,72	0,45
		1 - da	72,5		
	društvene mreže	0 - ne	24,14	0,76	0,44
		1 - da	75,86		

Izvor: autori

Upitani koji medij smatraju najpouzdanijim izvorom informacija, najviše ispitanika je odgovorilo da su to televizija i radio (58,62 %), slijede informativni (tzv. *news*) portali i web (24,14 %), te tisak

(17,24 %). Treba istaknuti da niti jedan ispitanik društvene mreže ne smatra pouzdanim izvorom informacija. Dobiveni rezultati se bitno razlikuju od istraživanja agencije Ipsos prema kojemu 56,6 % ispitanika najviše vjeruje internetu i smatra ga najpouzdanijim medijem, a tek 28,2 % ispitanika televiziju vidi kao relevantan izvor informacija (Poslovni.hr, 2019).

Ispitanici su trebali procijeniti vlastitu sposobnost prepoznavanja lažnih vijesti kada na njih naiđu, koristeći pri tome skalu s 4 ponuđena odgovora (tablica 2). Čak 75,86 % ispitanika smatra da dobro ili jako dobro prepoznaje lažne vijesti.

Tablica 2. Percipirana sposobnost prepoznavanja lažnih vijesti

Pitanje	Ponuđeni odgovori	%	M	SD
Kako ocjenjujete vlastitu sposobnost prepoznavanja lažnih vijesti?	1 - slabo prepoznajem	0	3,10	0,77
	2 - donekle prepoznajem	24,14		
	3 - dobro prepoznajem	41,38		
	4 - jako dobro prepoznajem	34,48		

Izvor: autori

Zadnje anketno pitanje sastoji se od četiri izjave na temu koronavirusa, a izabrane tvrdnje učestalo su se pojavljivale na informativnim web portalima i društvenim mrežama (tablica 3). Dvije izjave su lažne, a dvije istinite. Ispitanici su trebali odgovoriti je li, prema njihovom mišljenju, navedena tvrdnja istinita ili lažna. Prilikom obrade, podaci su se kodirali tako da 0 označava netočan odgovor, a 1 točan. Najveći udio ispitanika točno je odgovorio da je zaraza COVID-19 virusom ozbiljnija od sezonske gripe (72,41 %). Većina ispitanika prepoznala je činjenicu o socijalnoj distanci kao učinkovitoj mjeri za sprječavanje širenja koronavirusa (62,07 %). Međutim, čak 62,07 % ispitanika smatra istinitom izjavu da farmaceutske kompanije imaju lijek za COVID-19 virus, ali ga odbijaju prodavati, što je lažna izjava. Treba napomenuti da se istraživanje provodilo tijekom ljeta 2020. godine kada cjepivo još nije bilo razvijeno. Također, veliki udio ispitanika (58,62 %) smatra da je virus COVID-19 stvoren u laboratoriju, što nije znanstveno potvrđeno (Lewis, 2020; McDonald, 2020). U istraživanju Nielsen i sur. (2020) provedenom u pet zemalja (Njemačka, Španjolska, Velika Britanija, SAD i Južna Koreja) četvrtina ispitanika također vjeruje da je koronavirus stvoren u laboratoriju. Slično, veliki broj njemačkih i kineskih studenata ne odbacuje teorije zavjere o COVID-19 virusu, bilo da je riječ o njegovom porijeklu (kinesko biološko oružje, razvila ga je CIA, Bill Gates) ili povezanosti s 5G mrežom (Rieger, 2020).

Tablica 3. Iskazana sposobnost prepoznavanja lažnih vijesti

Pitanje	Istina ili laž?	%	M	SD
Farmaceutske kompanije već imaju lijek za COVID-19 virus, ali ga odbijaju prodavati.	0 - netočan odgovor (istina)	62,07	0,38	0,49
	1 – točan odgovor (laž)	37,93		
Socijalna udaljenost učinkovita je mjera za sprječavanje širenja COVID-19 virusa.	0 - netočan odgovor (laž)	37,93	0,62	0,49
	1 – točan odgovor (istina)	62,07		
COVID-19 virus stvorili su znanstvenici u laboratoriju.	0 - netočan odgovor (istina)	58,62	0,41	0,50
	1 - točan odgovor (laž)	41,38		
Bolest uzrokovana COVID-19 virusom ozbiljnija je od sezonske gripe.	0 - netočan odgovor (laž)	27,59	0,72	0,45
	1 - točan odgovor (istina)	72,41		
Sveukupno	0 - netočni odgovori	46,55	2,14	1,25
	1 - točni odgovori	53,45		

Izvor: autori

Prosječan broj točnih odgovora po ispitaniku iznosi 2,14 ili 53,45 %. Samo je 17,24 % ispitanika točno prepoznalo (ne)istinitost za sve četiri izjave, a 10 % ispitanika nije dalo niti jedan točan odgovor.

5. TESTIRANJE HIPOTEZA

Prvom hipotezom (H1) želi se utvrditi postoji li kod studenata statistički značajna razlika u korištenju tradicionalnih i digitalnih medija za informiranje. Odgovori ispitanika o korištenju tiskanih medija, te televizije i radija upućuju na uporabu tradicionalnih medija, dok odgovori o korištenju informativnih portala i web-a, kao i društvenih mreža upućuju na uporabu digitalnih medija za informiranje. Provedbom t-testa za dva zavisna uzorka utvrđeno je da postoji statistički značajna razlika u korištenju tradicionalnih i digitalnih medija za informiranje ($t=6,716$; $p<0,01$). Studenti značajno više koriste digitalne medije ($M=1,48$) za informiranje u usporedbi s tradicionalnim medijima ($M=0,48$).

Drugom hipotezom (H2) želi se utvrditi postoji li statistički značajna razlika između percipirane i stvarne sposobnosti studenata u prepoznavanju lažnih vijesti. Stvarna sposobnost prepoznavanja lažnih vijesti dobivena je zbrajanjem točnih odgovora (istina ili laž) na četiri izjave o koronavirusu. Primijenivši t-test za dva zavisna uzorka utvrđeno je da postoji statistički značajna razlika između percipirane i stvarne sposobnosti prepoznavanja lažnih vijesti ($t=3,266$; $p<0,01$). Studenti su iskazali značajno manju stvarnu sposobnost prepoznavanja lažnih vijesti ($M=2,14$) od vlastite percepcije da mogu i znaju prepoznati lažnu vijest ($M=3,10$).

Navedeni rezultat navodi na zaključak da je potrebno više ulagati u educiranje studenata i podizanje svijesti o problemu prisutnosti dezinformacija i lažnih vijesti u medijskom prostoru. Europska komisija (2018) ističe da informacijska pismenost, uz cjeloživotni razvoj digitalnih vještina i kompetencija, posebno kod učenika i studenata, ima važnu ulogu u jačanju otpornosti društva na dezinformacije.

6. ZAKLJUČAK

U vremenu kada mrežne tehnologije i različiti internetski servisi omogućuju trenutan pristup ogromnoj količini informacija koje se jednostavno kreiraju, dijele i komentiraju sve je veći problem pronaći kvalitetne i istinite, pouzdane i provjerene informacije. Informacije pristižu iz različitih izvora – tradicionalnih i digitalnih, a učestala je pojava kontradiktornih informacija o istoj temi koje djeluju zbunjujuće na krajnjeg korisnika. Informacija u digitalnom obliku, bilo da se radi o tekstu, slici, audio ili video zapisu, jednostavno se može promijeniti i time zavarati osobe koje konzumiraju takav informacijski sadržaj. Stoga je važno znati razlučiti prave, istinite informacije od onih koje su neistinite i kreirane s lošom namjerom. Postoji nekoliko vrsta informacijskih poremećaja, a njihova zajednička karakteristika je da se plasiraju s namjerom obmanjivanja ljudi, tj. zbog manipuliranja drugima. Lažne vijesti su velik i globalan problem kojem treba posvetiti pažnju, te pokušati smanjiti protok lažnih vijesti i njihovo širenje. Nedovoljna informiranost i educiranost ključni su faktori zbog kojih konzumenti povjeruju u lažne vijesti. Značajnu ulogu u sprječavanju širenja lažnih vijesti ima svaki pojedinac ukoliko ne dijeli neprovjerene informacijske sadržaje putem društvenih medija.

Rezultati istraživanja provedenog na uzorku studenata pokazali su da za informiranje više koriste digitalne nego tradicionalne medije, što je u skladu s istraživanjima drugih autora. Većina studenata informira se svakodnevno. Važno je osvijesti činjenicu da kod studenata postoji značajan raskorak između stvarnog prepoznavanja lažnih vijesti i njihove percepcije sposobnosti prepoznavanja lažnih vijesti. Studenti su u prosjeku prepoznali 50 % (ne)istinitih vijesti, stoga bi valjalo poraditi na povećanju njihove informacijske i medijske pismenosti.

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Original scientific paper
https://doi.org/10.31784/zvr.9.1.7
Received: 1. 12. 2020.
Accepted: 2. 3. 2021.

WAYS OF INFORMING AND RECOGNIZING FAKE NEWS BY CROATIAN STUDENTS DURING THE COVID-19 PANDEMIC

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ABSTRACT

The problem area of this paper is informing and information manipulation. The paper studies the issues on information disorder and identifying fake news, as it is becoming a growing problem, especially in digital media that allow their viral dissemination. The paper describes the types of information disorders, with an emphasis on disinformation and fake news that are most often published with the aim of manipulating the audience. In addition, the terms misinformation, malinformation and infodemic are terminologically determined. The work analyses the ways of fake news spreading, from those spread by people – most often through social networks, to the use of computer programs (bots). In order to properly identify and respond to information disorders, guidelines and tools providing credibility verification of information content (online fact-checkers) are presented. Available researches suggest that the presence of fake news throughout the media is a growing global problem, especially at the time of the coronavirus pandemic, but it is not equally present in the countries worldwide. Croatia is mentioned as a country where people are able to recognize fake news. This original research provides the insight into the frequency and the most common ways the students get information, as well as their ability to identify fake news. Students prefer to be informed through digital media, while the use of traditional media is significantly less common. They consider television and radio to be the most reliable sources of informing, while the Internet (excluding social networks) comes second. Although most students consider themselves successful at recognizing fake news, the research findings indicate that their real ability to do so is significantly lower.

Key words: *informing, disinformation, fake news, infodemic, digital media, COVID-19*

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Izvorni znanstveni rad
https://doi.org/10.31784/zvr.9.1.8
Datum primitka rada: 27. 1. 2020.
Datum prihvaćanja rada: 5. 2. 2020.

PRIMJENA SNSQUAL MODELA U MJERENJU KVALITETE DRUŠTVENIH MREŽA

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SAŽETAK

Društvene mreže postale su važan alat za prijenos informacija i povezivanje pojedinaca. Iako ne postoji dobna granica za korištenje društvenih mreža, najčešće ih koristi mlađa populacija. Pregled literature pokazuje da postoji niz istraživanja kvalitete usluga u on-line okruženju, ali su rijetka ona koja istražuju kvalitetu društvenih mreža. U ovom je istraživanju, u svrhu mjerenja kvalitete društvenih mreža, testirana primjena SNSQUAL modela, kojeg su razvili Phillips et al. (2016). Model obuhvaća varijable koje opisuju jednostavnost korištenja, povjerenje, personalizaciju, pouzdanost i integraciju usluga na društvenim mrežama. Istraživanje je provedeno na uzorku studenata, te je prikupljen 341 ispravno ispunjen anketni upitnik. Prikupljeni podaci su analizirani primjenom metoda deskriptivne statističke analize, faktorske analize i analize pouzdanosti. Rezultati istraživanja ukazuju na visoku razinu percipirane kvalitete društvenih mreža. Ujedno se kvaliteta društvenih mreža u Hrvatskoj percipira kroz sljedeće dimenzije: informacije, jednostavnost korištenja, pouzdanost i sigurnost, integriranost i prilagođavanje.

Ključne riječi: *kvaliteta e-usluge, SNSQUAL, društvene mreže, mjerenje, faktorska analiza*

1. UVOD

Razvoj informacijsko-komunikacijske tehnologije i svakodnevno korištenje interneta utjecali su na promjene u privatnom i poslovnom životu pojedinaca. Te se promjene prije svega ogledaju u načinu komuniciranja i informiranja, pri čemu veliku ulogu imaju društveni mediji. Prema Kaplan i Haenlein (2010), društveni mediji su skup internetskih aplikacija temeljenih na Web 2.0 tehnologiji, koje omogućavaju stvaranje i razmjenu sadržaja koje su kreirali sami korisnici. Društveni mediji obuhvaćaju društvene mreže, blogove, multimedijske platforme, internetske forume, razne virtualne zajednice.

Društvene mreže, kao vrsta društvenih medija, omogućavaju korisnicima kreiranje osobnih profila, stvaranje sadržaja i razmjenu poruka s drugim korisnicima mreže (Boyd i Ellison, 2007). Omogućavaju brzu komunikaciju i interakciju, utječu na informiranost pojedinaca, te posljedično i na donošenje odluka o kupnji. Zbog toga se na društvene mreže više ne gleda isključivo kao na oblik zabave za

mlađu populaciju, već ih poduzeća sve češće koriste za promociju svojih usluga i proizvoda, te postaju važan marketinški alat na internetu.

Popularnost i rasprostranjenost korištenja društvenih medija i društvenih mreža potvrđuju podaci Global social media research summary (2019), prema kojima je u 2019. godini 45 % svjetske populacije aktivno koristilo društvene medije, dok je prema podacima Statista Report (2019), najpopularnija društvena mreža bila Facebook s više od 2,4 milijarde korisnika. U Hrvatskoj je u 2019. godini društvene mreže koristilo 54 % osoba. Najpopularnija društvena mreža bila je Facebook s više od 2 milijuna korisnika (Statista Report Croatia, 2019).

Važnost istraživanja kvalitete društvenih mreža ogleda se upravo u ulozi koju društvene mreže imaju u društvenom i ekonomskom smislu, te u pozitivnom utjecaju kvalitete usluga na zadovoljstvo i lojalnost klijenata. Iako postoji niz istraživanja kvalitete usluga u *on-line* okruženju, rijetka su ona koja istražuju kvalitetu društvenih mreža. Stoga ovo istraživanje ima dva osnovna cilja: prvo, ispitati kako korisnici percipiraju kvalitetu društvenih mreža, te drugo, utvrditi faktore koji opisuju kvalitetu društvenih mreža.

Rad je podijeljen u sljedeće cjeline. Nakon uvoda slijedi prikaz prethodnih istraživanja o konceptu kvalitete usluga i mjerenja kvalitete usluga u *on-line* okruženju. Zatim slijedi opis metodologije istraživanja. U četvrtom su poglavlju prezentirani rezultati provedene deskriptivne i multivarijatne statističke analize. Na kraju su navedeni glavni rezultati istraživanja.

2. TEORIJSKI OKVIR ISTRAŽIVANJA

Jedan od najčešće korištenih instrumenata za mjerenje kvalitete usluga u različitim uslužnim djelatnostima je SERVQUAL model kojeg su razvili Parasuraman *et al.* (1985, 1988). Prema njima, kvaliteta usluge je rezultat usporedbe očekivanja i percepcije dobivene usluge ili proizvoda, te se sastoji od pet glavnih dimenzija (dodirljivost, pouzdanost, odgovornost, stručnost i povjerenje te susretljivost).

S rastom korištenja interneta i njegove uloge u poslovnom i privatnom životu, prepoznata je i potreba istraživanja kvalitete e-usluga. Prema Parasuraman *et al.* (2005), kvaliteta e-usluge je razina na kojoj *web*-stranica omogućava uspješnu kupovinu i dostavu proizvoda i usluga.

Pregled literature pokazuje da je nekoliko autora u svojim istraživanjima navodilo osnovne dimenzije (elemente) kvalitete e-usluge. Zeithaml *et al.* (2002) su predložili jedanaest dimenzija kvalitete e-usluga: pouzdanost, odgovornost, pristup, fleksibilnost, jednostavnost upravljanja, učinkovitost, osiguranje/povjerenje, sigurnost/privatnost, poznavanje cijena, estetika, prilagodba/personalizacija. Prema Parasuraman *et al.* (2005), kvalitetu e-usluge čine učinkovitost, dostupnost sustava, ispunjenje, privatnost, odgovornost, korištenje i kontakt. Zhang *et al.* (2015) su zaključili da na kvalitetu e-usluga utječu praktičnost, točnost informacija, sigurnost i funkcionalnost. Ujedno, Farida *et al.* (2014) navode da se u istraživanjima o kvaliteti *web*-stranica kao najčešće dimenzije javljaju kvaliteta informacija, privatnost/sigurnost/osiguranje, pouzdanost/ispunjenje, kvaliteta usluge i kvaliteta sustava.

Iako je SERVQUAL model razvijen za mjerenje kvalitete „tradicionalnih" usluga, korišten je i u kontekstu mjerenja kvalitete e-usluga (Li *et al.*, 2002; Jiang *et al.*, 2002; Santos, 2003; Collier i Bienstock, 2006; Cristobal *et al.* 2007). Ipak, činjenica da se e-usluga po svojim karakteristikama razlikuje od „tradicionalne" usluge na čije karakteristike utječu i opipljivi elementi okruženja u kojem se pruža, dovela je do potrebe razvoja modela dizajniranih upravo za mjerenje kvalitete usluga u *on-line* okruženju.

U tu svrhu razvijeni su SITEQUAL (Yoo i Donthu, 2001), WebQual (Barnes i Vidgen, 2002; (Loiacono *et al.* 2002), eTailQ (Wolfinbarger i Gilly 2003), E-S-Qual (Parasuraman *et al.*, 2005), hijerarhijski model kvalitete e-usluge (Blut *et al.* 2015; Blut, 2016), SNSQUAL (Phillips *et al.*, 2016). Navedeni modeli u pravilu mjere kvalitetu e-usluga i kvalitetu *web*-stranica, dok SNSQUAL model (Phillips *et al.*, 2016) mjeri kvalitetu društvenih mreža, te je korišten i u empirijskom dijelu ovog istraživanja.

SNSQUAL model (*Social Networking Site Quality Model*) razvijen je u svrhu mjerenja kvalitete društvenih mreža (Phillips *et al.*, 2016). Početni model se temeljio na dimenzijama preuzetim iz SERVQUAL modela (Parasuraman *et al.* (1988) i WebQual modela (Loiacono *et al.* 2007), uz dodavanje elemenata koji su karakteristični za kontekst društvenih mreža (Chau i Lai, 2003; Zhang i Prybutok, 2005). Konačni model sastoji se od varijabli koje su grupirane u sljedeće dimenzije: jednostavnost korištenja, povjerenje, personalizacija, pouzdanost i integracija.

3. METODOLOGIJA ISTRAŽIVANJA

Osnovna svrha ovog istraživanja bila je mjerenje kvalitete društvenih mreža. Iz toga proizlaze sljedeći ciljevi istraživanja: (a) izmjeriti razinu percipirane kvalitete društvenih mreža i (b) utvrditi glavne dimenzije percipirane kvalitete društvenih mreža.

Upitnik za prikupljanje primarnih podataka u ovom istraživanju sastoji se od dva dijela, te je izrađen na temelju SNSQUAL modela (Phillips *et al.*, 2016). Prvi dio upitnika sadrži 26 varijabli s kojima se mjeri kvaliteta društvenih mreža, a odnose se na jednostavnost korištenja, povjerenje, personalizaciju, pouzdanost i integraciju. Ispitanici su razinu slaganja s navedenim tvrdnjama ocjenjivali na ljestvici s pet ocjena, s krajnjim vrijednostima „u potpunosti se ne slažem" (1) i „u potpunosti se slažem" (5).

Drugi dio upitnika dizajniran je za mjerenje demografskih karakteristika ispitanika, te uključuje sljedeće varijable: spol, razina studija, registrirane društvene mreže, vrijeme provedeno na društvenim mrežama, godine korištenja društvenih mreža, korištena društvena mreža i svrha korištenja društvenih mreža.

Istraživanje je provedeno na uzorku studenata preddiplomskog i diplomskog sveučilišnog studija koji su bili spremni sudjelovati u istraživanju. Uzorak je prigodni, iako se prilikom prikupljanja podataka nastojalo obuhvatiti studente svih godine studija, te tako osigurati uzorak koji po svojim karakteristikama ima svojstva reprezentativnosti. Prikupljanje podataka provedeno je tijekom svibnja 2019. godine. Prikupljeno je 344 upitnika, od čega je 341 upitnik bio ispravno ispunjen, te taj uzorak čini osnovu za analizu prikupljenih podataka.

Metode deskriptivne statističke analize korištene su za opis demografskih karakteristika ispitanika, te za ocjenu razine kvalitete društvenih mreža. Eksploratorna faktorska analiza primijenjena je za utvrđivanje faktorske strukture kvalitete društvenih mreža. Ujedno je pouzdanost mjerne ljestvice kvalitete društvenih mreža testirana izračunavanjem Cronbach alpha koeficijenata.

4. REZULTATI ISTRAŽIVANJA

U ovom dijelu rada prezentirani su rezultati provedene deskriptivne i multivarijatne statističke analize.

4. 1 Profil ispitanika

Demografski profil ispitanika prikazan je u tablici 1.

Tablica 1. Demografske karakteristike ispitanika (N = 341)

Varijabla	Postotak	Varijabla	Postotak
Spol		*Vrijeme provedeno na DM*	
Muški	26,4	Manje od 30 minuta	4,4
Ženski	73,6	30 minuta- 1 sat	13,5
		1 sat dnevno	20,8
Razina studija		2-3 sata dnevno	40,5
Preddiplomski	71,0	Više od 4 sata dnevno	20,8
Diplomski	29,0		
Registrirane DM		*Godine korištenja DM*	
1-2	42,8	Manje od 1 godine	1,2
3-4	44,0	1-2 godine	1,2
5-6	11,1	3-4 godine	11,7
više od 7	2,1	5-6 godina	22,6
		Više od 6 godina	63,3
*Korištena DM**		*Svrha korištenja DM**	
Facebook	76,0	Komunikacija	93,5
Twitter	0,6	Informiranje	64,2
Googleplus	6,7	Dijeljenje informacija	47,2
Linkedin	2,9	Pregledavanje informacija	61,3
Myspace	0,6	Igranje/zabava	33,4
Instagram	32,6	Učenje	28,7
Pinterest	4,4	Upoznavanje	27,0
Tumblr	1,5		

Napomena: DM – društvena mreža. *- moguće je zaokružiti više odgovora.

Izvor: rezultati istraživanja

Iz tablice 1 vidljivo je da u uzorku od 341 ispitanika prevladavaju žene (73,6 %). Većina ispitanika studira na preddiplomskom stručnom studiju (71 %) i na društvenim mrežama najčešće provede više od 2 sata dnevno (61,3 %). Oko 86 % ispitanika registrirano je na 1 do 4 društvene mreže, te ih oko 63 % koristi društvene mreže više od 6 godina. Najčešće korištene društvene mreže u uzorku su Facebook (76 %) i Instagram (32,6 %), dok Twitter, Myspace i Tumblr koristi manje od 3 % ispitanika. Osnovna svrha korištenja društvenih mreža je komunikacija (93,5 %), informiranje (64,2 %) i pregledavanje informacija (61,3 %). S druge strane, društvene mreže se najmanje koriste u svrhu učenja (28,7 %) i upoznavanja (27 %).

4. 2 Dimenzije percipirane kvalitete društvenih mreža

Prema rezultatima u tablici 2, prosječne ocjene pojedinih elemenata kvalitete društvenih mreža nalaze se u rasponu od 2,93 do 4,58. Najnižom prosječnom ocjenom ocijenjena je varijabla „vjerujem da su moji podaci sigurni", što ukazuje da ispitanici imaju podijeljeno mišljene o sigurnosti podataka na društvenim mrežama (niti se slažu, niti se ne slažu s navedenom tvrdnjom). Najvišom prosječnom ocjenom ocijenjena je varijabla „DM je jednostavna za korištenje". Prema tome, ispitanici u pravilu percipiraju društvene mreže jednostavnima za korištenje, te se u prosjeku u potpunosti slažu s navedenom tvrdnjom. Ukupna prosječna ocjena za percipiranu kvalitetu društvenih mreža iznosi 3,88, te pokazuje visoku percepciju kvalitete društvenih mreža.

Nadalje, cilj provođenja faktorske analize je izlučiti glavne faktore (dimenzije) percipirane kvalitete društvenih mreža. Faktorska analiza provest će se na 26 varijabli tj. elemenata kvalitete društvenih mreža.

Prikladnost za provođenje faktorske analize procijenjena je Kaiser-Mayer-Olkinovom mjerom (KMO) i Bartlettovim testom. Kao što je prikazano u tablici 2, KMO mjera ima visoku vrijednost, a Bartlettov test je značajan na razini 0,01, te se može zaključiti da su podaci prikladni za provođenje faktorske analize i za utvrđivanje faktorske strukture za percipiranu kvalitetu društvenih mreža.

Tablica 2. Rezultati faktorske analize i analize pouzdanosti za pojedine elemente kvalitete društvenih mreža

Varijable	A. S. (S. D.)	Faktorska opterećenja	Svojstvena vrijednost	% varijance	Cronbach alpha
Faktor 1			4,816	17,052	0,924
DM pruža pouzdane informacije	3,40 (0,991)	0,809			
Sveukupno informacije koje DM pruža su visoke kvalitete	3,41 (1,110)	0,799			
DM pruža točne informacije	3,45 (1,021)	0,776			

Varijable	A. S. (S. D.)	Faktorska opterećenja	Svojstvena vrijednost	% varijance	Cronbach alpha
Sveukupno smatram da DM pruža korisne informacije	3,70 (0,970)	0,753			
Zadovoljan sam informacijama koje DM pruža	3,73 (0,889)	0,713			
DM pruža relevantne informacije	3,77 (0,950)	0,662			
Faktor 2			3,831	13,769	0,900
Sučelje je jednostavno za korištenje	4,47 (0,725)	0,844			
DM mogu jednostavno koristiti	4,57 (0,706)	0,830			
DM je jednostavna za korištenje	4,58 (0,648)	0,825			
Sučelje je jednostavno za razumijevanje	4,38 (0,808)	0,796			
Jednostavno je koristiti društvenu mrežu	4,38 (0,775)	0,662			
Faktor 3			3,810	12,699	0,897
Administratori neće zloupotrijebiti moje podatke	3,23 (1,003)	0,766			
Vjerujem da su moji podaci sigurni	2,93 (1,198)	0,730			
DM je pouzdana	3,39 (0,954)	0,675			
Zadovoljan sam pouzdanošću	3,67 (0,931)	0,601			
DM se doima pouzdana	3,59 (0,959)	0,591			
DM daje dojam da ispunjava obećanja i obaveze	3,54 (0,921)	0,566			
Faktor 4			2,965	10,885	0,815

Varijable	A. S. (S. D.)	Faktorska opterećenja	Svojstvena vrijednost	% varijance	Cronbach alpha
DM se integrira sa ostalim web stranicama	4,11 (0,820)	0,742			
Web stranica se ne ruši često	3,99 (0,991)	0,679			
Pruža integrirane usluge	3,76 (0,826)	0,676			
Integrira se s ostalim web stranicama radi pružanja usluge bez prekida	3,79 (0,883)	0,636			
DM nema često tehničkih problema	3,79 (1,005)	0,617			
Faktor 5			2,639	8,795	0,816
DM omogućuje prilagodbu sadržaja informacija ovisno o potrebama	3,89 (0,871)	0,756			
DM omogućuje prilagodbu informacija ovisno o potrebama	3,94 (0,837)	0,751			
U mogućnosti sam biti u interakciji s DM	3,96 (0,827)	0,658			
DM mi omogućuje personalizaciju izgleda	3,70 (0,954)	0,455			
Ukupno	3,88		18,061	63,200	0,951
Kaiser-Meyer-Olkin (KMO)	0,931				
Bartlettov test	7372,452, ($p < 0,01$)				

Napomena: Primijenjena je metoda glavnih komponenata (*principal component analysis*). Metoda rotacije: *varimax* s Kaiser normalizacijom. Vrijednosti faktorskih opterećenja koje ne pripadaju određenom faktoru nisu prikazane. Vrijednosti u zagradi su standardne devijacije. A. S. – aritmetička sredina. S. D. – standardna devijacija.

Izvor: rezultati istraživanja

Kao što pokazuju rezultati u tablici 2, faktorskom analizom izlučeno je pet faktora koji objašnjavaju 63,2 % ukupne varijance svih izvornih varijabli. Sva faktorska opterećenja su pozitivna i imaju vrijednost veću od 0,4. Većina faktorskih opterećenja veća je od 0,60, što ukazuje na visoku (jaku) korelaciju između izlučenih faktora i njihovih pripadajućih varijabli. Ujedno, izlučeni faktori sadrže od 4 do 6

varijabli. Prema tome, svi izlučeni faktori zadovoljavaju kriterije koji prema Hair *et al.* (2010) upućuju na zadovoljavajuću faktorsku strukturu.

Na temelju opisa varijabli sadržanih u pojedinom faktoru, izlučeni faktori interpretiraju se na sljedeći način. Faktor 1 („informacije") sadrži šest varijabli koje se odnose na pouzdane, korisne, točne, relevantne i kvalitetne informacije koje pruža društvena mreža. Faktor 2 („jednostavnost korištenja") obuhvaća pet varijabli koje upućuju na jednostavno korištenje društvene mreže i njenog sučelja. Faktor 3 („pouzdanost i sigurnost") sadrži šest varijabli koje ukazuju na sigurnost podataka i pouzdanost društvene mreže. Faktor 4 („integriranost") sadrži pet varijabli povezanih s integriranom uslugom na društvenoj mreži i nedostatkom tehničkih problema. Faktor 5 („prilagođavanje") ima četiri varijable koje se odnose na mogućnost prilagođavanja potrebama korisnika društvene mreže.

Nadalje, tablica 2 sadrži i rezultate analize pouzdanosti. Cronbach alpha koeficijenti za izlučene faktore percipirane kvalitete društvenih mreža imaju vrijednosti od 0,815 do 0,924. Navedene vrijednosti ukazuju na jaku unutarnju dosljednost i stabilnost faktora. Cronbach alpha koeficijent za cjelokupnu ljestvicu percipirane kvalitete društvenih mreža iznosi 0,951, što prema Hair *et al.* (2010) pokazuje visoku pouzdanost ljestvice.

Prema navedenim rezultatima, „informacije", „jednostavnost korištenja", „pouzdanost i sigurnost", „integriranost" i „prilagođavanje" mogu se smatrati pouzdanim ključnim dimenzijama percipirane kvalitete društvenih mreža.

5. ZAKLJUČAK

Osnovna svrha ovog istraživanja bila je empirijski istražiti kvalitetu društvenih mreža testiranjem SNSQUAL modela. Istraživanje je provedeno na uzorku studenata, s obzirom na to da spadaju u dio populacije koja u znatnoj mjeri koristi društvene mreže u svakodnevnom komuniciranju.

Rezultati analize profila ispitanika pokazuju da je najčešće korištena društvena mreža Facebook, iako su ispitanici u pravilu registrirani na više društvenih mreža. Ispitanici pokazuju lojalnost prema društvenim mrežama koje koriste, s obzirom na to da ih je većina registrirana na društvenim mrežama duže od 6 godina. Nadalje, društvene mreže se najčešće koriste u svrhu komuniciranja, a najmanje za učenje i upoznavanje.

Analiza percepcije pojedinih elemenata kvalitete društvenih mreža pokazala je da je najvažniji element kvalitete društvenih mreža njihovo jednostavno korištenje. S druge strane, percepcija sigurnosti podataka i pouzdanosti društvenih mreža je osrednja, te ukazuje na blago nepovjerenje prema društvenim mrežama i zaštiti osobnih podataka. Ipak, ukupna prosječna ocjena svih elemenata kvalitete društvenih mreža iznosi 3,88, te pokazuje visoku razinu percipirane kvalitete društvenih mreža.

Rezultati faktorske analize pokazuju da se kvaliteta društvenih mreža u Hrvatskoj percipira kroz informacije, jednostavnost korištenja, pouzdanost i sigurnost, integriranost i prilagođavanje. Uspoređujući ove rezultate s prethodnim istraživanjima (Zeithaml *et al.*, 2002; Parasuraman *et al.*, 2005; Farida *et al.*, 2014; Zhang *et al.*, 2015), uočava se djelomično podudaranje u broju i

interpretaciji dimenzija na temelju kojih korisnici ocjenjuju uslugu u *on-line* okruženju. Prema tome, struktura dimenzija kvalitete e-usluga prilagođava se kontekstu istraživanja.

Prema tome, društvene mreže trebaju pružati pouzdane, korisne, točne, relevantne i kvalitetne informacije. Važnost ove dimenzije ogleda se u činjenici da su društvene mreže upravo nastale zbog brže i lakše razmjene informacija. Osim toga, i rezultati ovog istraživanja pokazuju da je jedna od osnovnih svrha korištenja društvenih mreža upravo informiranje.

Jednostavnost korištenja društvenih mreža odnosi se na lakoću ostvarenja ciljeva koje korisnici imaju prilikom korištenja društvenih mreža, te ukazuje na stupanj jednostavnosti korištenja usluga. Osigurava učinkovito korištenje društvenih mreža, tj. dostupnost sadržaja.

Pouzdanost označava sposobnost pružanja točne i pouzdane usluge, te ispunjavanje obećanja i obveza. Uz to, korisnici društvenih mreža žele biti sigurni da se s njihovim podacima neće postupati neovlašteno, te je sigurnost podataka bitan element kvalitete društvenih mreža.

Integriranost podrazumijeva ponudu usluga različitih ponuđača na jednom mjestu, tj. dostupnost usluga dogovorenih s drugim partnerima s jednog mjesta. Integrirane usluge omogućavaju korisnicima dostupnost personaliziranim uslugama koje se pružaju po nižim cijenama, što povećava vrijednost usluge za klijenta.

Konačno, prilagođavanje označava sposobnost društvenih mreža da prilagode sadržaje potrebama i željama korisnika. Na taj se način individualizira *on-line* iskustvo pojedinaca, što posljedično pozitivno utječe na učestalost korištenja društvenih mreža.

Prema tome, kvaliteta društvenih mreža je višedimenzionalan konstrukt, te objedinjava niz karakteristika koje se odnose na iskustvo korištenja društvenih mreža.

Preporuke za buduća istraživanja proizlaze iz ograničenja ovog istraživanja. Rezultati se temelje na uzorku studenata koji, iako čine dominantnu grupu korisnika, nisu jedini koji koriste društvene mreže. Uključivanjem u istraživanje drugih grupa korisnika (mlađih i starijih) osigurali bi se sveobuhvatniji rezultati. Ujedno, to bi omogućilo ispitivanje potencijalnih razlika i sličnosti u percepciji kvalitete društvenih mreža između različitih grupa korisnika. Nadalje, u ovom se istraživanju ne ispituje kvaliteta pojedinih društvenih mreža. U budućim se istraživanjima, stoga, može istražiti imaju li različite društvene mreže različitu strukturu dimenzija koje određuju kvalitetu pojedine društvene mreže. Također, bilo bi zanimljivo testirati povezanost između percipirane kvalitete društvenih mreža te zadovoljstva i lojalnosti njihovih korisnika.

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Original scientific paper
https://doi.org/10.31784/zvr.9.1.8
Received: 27. 1. 2020.
Accepted: 5. 2. 2020.

APPLICATION OF SNSQUAL MODEL IN MEASUREMENT OF SOCIAL NETWORK QUALITY

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ABSTRACT

Social networks have become important tool for disseminating information and connecting people. Although there is no age limit for using social networks, they are most frequently used by younger population. Literature review implies that there is number of service quality studies in on-line environment. However, there is a lack of studies about the social network quality. For the purpose of measuring social network quality, SNSQUAL model designed by Phillips et al. (2016) was tested in present study. The model comprised variables that describe ease of use, trust, personalization, reliability, and integration of services on social networks. The research was conducted among the students. A total of 341 valid questionnaires were gathered. Data was analysed using descriptive statistics, factor analysis and reliability analysis. Study results indicate high level of perceived social networks quality. In addition, social network quality in Croatia is perceived through following dimensions: information, ease of use, reliability and safety, integration, and customization.

Key words: *e-service quality, SNSQUAL, social networks, measurement, factor analysis*

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Izvorni znanstveni rad
https://doi.org/10.31784/zvr.9.1.9
Datum primitka rada: 12. 6. 2020.
Datum prihvaćanja rada: 21. 9. 2020.

FAKTORI ATRAKTIVNOSTI I IZGRADNJA MARKE POSLODAVCA IZ PERSPEKTIVE GENERACIJE Z

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SAŽETAK

U suvremenom, na znanju baziranom gospodarstvu, zaposlenici igraju iznimno važnu ulogu te mogu pridonijeti postizanju konkurentske prednosti. Upravo iz navedenih razloga poduzeća nastoje privući kvalitetne, vješte i znanjem oboružane zaposlenike te istovremeno potaknuti predanost kod postojećih. U tom se naporu sve više koriste marketinške tehnike i pristupi koji se temelje na poznavanju želja i potreba zaposlenika i potencijalnih zaposlenika. Provedeno istraživanje imalo je za cilj utvrditi važnost pojedinih faktora atraktivnosti poslodavaca u očima budućih posloprimaca i to u specifičnostima hrvatske nacionalne kulture. Povrh toga, istraživanjem se ukazalo na odnose i veze među pojedinim faktorima atraktivnosti te su prepoznate percepcije ispitanika prema obilježjima posla. Istraživanje je provedeno na uzorku od 72 ispitanika. Radi utvrđivanja međuovisnosti između pojedinih varijabli izračunat je Pearsonov koeficijent korelacije. Kako bi se bolje objasnile percepcije mladih prema obilježjima posla provedena je eksplorativna faktorska analiza. Provedenim istraživanjem prepoznati su najvažniji te najmanje važni faktori atraktivnosti, prepoznate su signifikantne razlike prema spolu, te veze među pojedinim varijablama. Povrh toga, istraživanjem su prepoznata tri faktora atraktivnosti, a to su sadržajna atraktivnost radnog mjesta, materijalni uvjeti rada te sloboda u obavljanju posla. Doprinos ovoga rada sagledava se u prepoznavanju veza među pojedinim varijablama ali i prepoznavanjem faktora atraktivnosti radnog mjesta u specifičnostima Republike Hrvatske te kod mlađe generacije koja ulazi na tržište rada. Sve navedeno može pomoći praktičarima osobito menadžerima marketinga i menadžerima ljudskih resursa u oblikovanju atraktivnih radnih okolina, sa dimenzijama koje će predstavljat adekvatan odgovor na potrebe korisnika.

***Ključne riječi**: faktori atraktivnosti poslodavca, marka poslodavca, generacija Z*

1. UVOD

Pojmovi marka poslodavca (engl. *Employer brand*) i izgradnja marke poslodavca (engl. *Employer branding*) relativno su novi pojmovi. U osnovi se temelje na pretpostavkama prethodno razvijenima u marketingu a koja su se odnosila na markiranje proizvoda, čiji je cilj u pravilu bio diferenciranje vlastitog proizvoda od proizvoda konkurencije. Tako "*Američko marketinško udruženje (AMA*) definira marku kao ime, pojam, znak, simbol ili dizajn, odnosno njihovu kombinaciju, korišteni u namjeni prepoznavanja dobara ili usluga jednog proizvođača ili skupine proizvođača, ili njihovog diferenciranja u odnosu na marke konkurenata" (Kotler, Keller, 2008:189). Izgradnja marke poslodavca također teži diferenciranju ali diferenciranju poslodavca u odnosu na druge poslodavce. Razlozi nastanka su višestruki, naime suvremenu ekonomiju karakterizira snažna utemeljenost na znanju pri čemu značaj ljudskog resursa, zaposlenika postaje od ključne važnosti te postaje faktorom konkurentske prednosti. U pravilu osobitih ili talentiranih zaposlenika uvijek nedostaje odnosno oni su ti koji mogu činiti razliku i snažno pridonijeti razvoju poduzeća. Upravo iz tog razloga poduzeća nastoje pridobiti na tržištu osobito talentirane pojedince. Tako se države i organizacije sve snažnije bore za privlačenje sposobnih, znanjem oboružanih i u raznim područjima vještih zaposlenika (Mahroum, 2000). Povrh toga, Backhaus i Tikoo (2004) navode da poduzeća koriste brendiranje poslodavca ne samo kako bi privukli potencijalne zaposlenike već i kako bi istovremeno potaknuli angažiranost i predanost postojećih zaposlenika kulturi te strategiji poduzeća. Valja, stoga primijetiti i istaknuti da se izgradnjom marke poslodavca postižu ciljevi na internom i na eksternom tržištu.

Kako bi se poduzeće moglo diferencirati te na tržištu plasirati jedinstvenu i atraktivnu vrijednosnu ponudu mora poznavati želje, potrebe i preferencije posloprimaca. Ovo je istraživanja provedeno upravo sa ciljem utvrđivanja važnosti pojedinih faktora atraktivnosti poslodavca u očima budućih posloprimaca (generacija Z) i to u specifičnostima hrvatske nacionalne kulture. Osim toga, cilj je bio ukazati na odnose i veze među pojedinim faktorima atraktivnosti te prepoznati percepcije ispitanika prema obilježjima posla.

Mnogi autor (Sivertzen *et al.*,2013; Edwards, 2010; Berthon *et al.*, 2005) navode da pojam brendiranja poslodavca sve više dobiva na značaju među praktičarima i istraživačima, no s druge se strane ističu da ovo područje još uvijek nije dovoljno istraženo (Berthon *et al.*, 2005; Backhaus, Tikoo, 2004).

Stoga, upravo zbog aktualnost i nedovoljne istraženosti teme, ovo će istraživanje pridonijeti novim spoznajama o faktorima atraktivnosti poslodavaca te odnosima i vezama među njima kao i o percepciji istih, među mlađom populacijom, što će produbiti saznanja u navedenom području.

Isto tako, navedena saznanja moći će koristiti praktičari u njihovim naporima u oblikovanju atraktivne radne okoline, nudeći i promovirajući pritom na internom ali i na vanjskom tržištu rada adekvatnu vrijednosnu ponudu i korisničko iskustvo, te na taj način privući najbolje zaposlenike i dodatno angažirati postojeće, a što će na koncu utjecati na stjecanje konkurentske prednosti.

2. PREGLED LITERATURE

Suvremeno gospodarstvo počiva na znanju uz prisutnost visoke razine konkurencije u svakom segmentu poslovanja. Valja također naglasiti da teoretičari i praktičari neprestano razvijaju nove

pristupe i koncepte kojih je cilj pobijediti konkurenciju, biti bolji, biti drukčiji. Tako Berthon *et al.* (2005) navode da je u suvremenom gospodarstvu prepoznata velika važnost intelektualnog, ljudskog kapitala u postizanju konkurentske prednosti, upravo stoga organizacije teže privlačenju novih kvalitetnih zaposlenika te zadržavanju postojećih. U tu svrhu razvijaju nove pristupe poput brendiranja poduzeća kao poželjnog poslodavca.

Backhaus i Tikoo (2004) navode da brendiranje poslodavca predstavlja napore poduzeća usmjerene jasnoj i nedvosmislenoj promociji, unutar i izvan poduzeća, onoga što čini upravo to poduzeće drukčijim i poželjnim poslodavcem. Edwards (2010) navodi da je izgradnja marke poslodavca još jedan od alata namijenjenih profesionalcima u području upravljanja ljudskim resursima, tako ističe da je to koncept koji obuhvaća mnoge aspekte marketinga i upravljanja ljudskim resursima. McLaren, (2011) s druge strane ističe da je marka poslodavca složen koncept koji, uz prethodno navedene, vuče svoje teorijske osnove iz niza drugih velikih područja, uključujući ekonomiju, strategiju, korporativnu komunikaciju, psihologiju i organizacijske vještine.

U njihovoj teoretskoj razradi, Backhaus i Tikoo (2004) ističu da pojam marka poslodavca predstavlja široki koncept u kojemu se mogu ubrojiti razne tehnike i aktivnosti zapošljavanja i zadržavanja zaposlenika ali sve koordinirane unutar strategije upravljanja ljudskim resursima. Isti autori (Backhaus, Tikoo, 2004) navode da se izgradnja marke poslodavca fokusira na razvoj imidža organizacije kao potencijalnog poslodavca, te predstavlja koncept koji se može koristiti u privlačenju potencijalnih zaposlenika (Sivertzen *et al.*, 2013).

Zapravo su kovanicu *marka poslodavca* prvi put koristili Ambler i Barrow (1996.) koji su je definirali temeljem koristi, kao paket funkcionalnih, ekonomskih te psiholoških koristi omogućene zaposlenjem u određenom poduzeću (Backhaus, Tikoo, 2004; Biswas, Suar., 2013; Berthon *et al.*, 2005).

Edwards (2010) u svojem istraživanju navodi da su to aktivnosti kojima se principi marketinga odnosno brendiranja primjenjuju u području upravljanja ljudskim resursima, a namijenjeni su ciljanoj skupini odnosno postojećim i potencijalnim zaposlenicima. Nadalje, Edwards (2010) navodi da u području upravljanja ljudskim resursima, brendirani proizvod predstavlja jedinstveno korisničko iskustvo zaposlenika (koje diferencira jednu organizaciju od druge), te nastavlja da upravljanje iskustvom zaposlenika (postojećih i potencijalnih) vodi do kreiranja vrijednosti i utjecaja. Isti autor (Edwards, 2010) nadalje navodi, da se jedinstveno korisničko iskustvo zaposlenika može identificirati uzimajući u obzir sve opipljive i neopipljive nagrade koje određena organizacija nudi svojim zaposlenicima, a uključuje i imidž i identitet organizacije, a sve to se komunicira putem promotivnih kampanja.

Backhaus i Tikoo (2004) navode da brendiranje ističe jedinstvene aspekte ponude ili okruženja određenog poduzeća. Jenner i Taylor (2009) navode da izgradnja marke poslodavaca predstavlja organizacijske napore da se internim i eksternim korisnicima priopći ono što ga čini poželjnim i drugačijim kao poslodavca.

Pojedini autori (Berthon *et al.*, 2005: 154) nadalje navode da poput tradicionalne marke i marka poslodavca ima vlastitu osobnost te teži pozicioniranju, stoga se marka poslodavca temelji na izgradnji imidža u umovima potencijalnih korisnika, i to kao mjesta koje je „sjajno za rad".

Pojmovi poput: reputacija, atraktivnost, imidž, vrijednost branda, koristili su se kako bi se opisalo što tražitelji posla prevladavajuće traže kada procjenjuju hoće li se javiti na ponudu ili natječaj za posao (Sivertzen *et al.*, 2013; Berthon *et al.*, 2005; Collins i Stevens, 2002).

Na koncu, Berthon et al. (2005:168) ističu da će oglašavanje namijenjeno zaposlenicima te izgradnja marke poslodavca još više pridobiti na važnosti u budućnosti. A oba ta pristupa se mogu uspješno razvijati samo ukoliko se dobro razumiju faktori koji pridonose „atraktivnosti poslodavca", kao konceptu koji je vrlo blizak pojmu marke poslodavca. Nužno je potom da organizacije uključe te faktore u izgradnju marke kako bi bile uspješne u privlačenju zaposlenika. Naime, organizacije teže biti atraktivan poslodavac sa ciljem da zaposle najbolje/najkompetentnije zaposlenike (Sivertzen *et al.*, 2013). Isti autori (Berthon *et al.*, 2005) ističu da koncept atraktivnost poslodavca obuhvaća koristi koje spoznaje potencijalni zaposlenik ukoliko se zaposli u određenoj organizaciji.

Sukladno prethodno navedenom "atraktivnost poslodavca" se odnosi na koristi koje potencijalni zaposlenik primjećuje kod pojedinog poslodavca, te što je veća percipirana atraktivnost poslodavca od strane potencijalnih zaposlenika to je veća vrijednost marke poslodavca (Berthon *et al.*, 2005). Nadalje, Tuzuner i Yuksel (2009) navode da se izgradnja marke poslodavca sastoji od tri koraka, prvo poslodavac odredi što je od posebne vrijednosti za postojeće i potencijalne zaposlenike, drugi korak predstavlja vanjsku promociju tog istog vrijednosnog prijedloga te zaključno potpuno uključivanje „obećanja marke" u kulturu poduzeća.

Uz prethodno navedene (Ambler i Barrow, 1996) funkcionalne, ekonomske i psihološke koristi i dimenzije atraktivnosti, Tuzuner i Yuksel (2009) u svojemu su radu prepoznali dvije dimenzije atraktivnosti: integrirana izgradnja marke (uključuje mogućnosti napredovanja, izazovne radne zadatke, dobru referencu, inovativna rješenja, jaku kulturu, etičnost, dobro vodstvo, tržišni uspjeh, internu edukaciju, inspirativne kolege, dinamičnu organizaciju, ravnotežu privatnog i poslovnog, prijateljski stav kompanije prema prirodi, mogućnosti međunarodne karijere, dobru reputaciju, siguran posao, rad na projektima, daljnje praćenje rada, raznovrstan posao, dobru geografsku situiranost poslodavca, zaposlenike iz raznih područja, zapošljavanje samo najboljih, malo prekovremenog rada, uzbudljivi proizvodi ili usluge, fleksibilno radno vrijeme) i konkurentnost (uključuje poticajno radno okruženje, poticajne plaće, mogućnost rada od kuće).

Berthon *et al.* (2005) ukazali su na pet faktora atraktivnosti i to: interesna vrijednost (ukazuje na atraktivnost poslodavca temeljem razine „uzbudljivosti" radnog okruženja, primjene novih načina rada, potrebe za kreativnošću zaposlenika i inovativnosti stvorenih proizvoda i usluga), društvena vrijednost (određuje koliko je poslodavac atraktivan posloprimcu temeljem radnog okruženja koje je zabavno, sretno, sa dobrim kolegijalnim odnosima te timskom atmosferom), ekonomska vrijednost (pojedinac je privučen s obzirom na iznad prosječnu visinu primanja, sigurnosti posla, mogućnosti napredovanja), razvojna vrijednost (određuje obim atrakcije pojedinca s obzirom na odavanje priznanja, osjećaja vlastite vrijednosti i pouzdanja, povezano i sa iskustvom napretka u karijeri i ulogom poslodavca kao dobre odskočne daske za buduća zaposlenja), konačno peti faktor je nazvan aplikativna vrijednost (ukazuje na razinu atrakcije pojedinca s obzirom na mogućnost zaposlenika da primjeni stečena znanja, da prenosi znanje, te radi u okruženju koje je okrenuto korisniku i humanitarno). Ovih pet dimenzija velikim dijelom odgovaraju te ponešto proširuju

faktore atraktivnosti na koje su prethodno ukazali Amber i Barrow (1996). Barber (1998) navodi da su osobito važni faktori atraktivnosti obilježja posla i radnog mjesta, ukupna primanja (nagrađivanje) te imidž poduzeća. Srivasta i Bhatnagar (2010) ukazali su na osam dimenzija: briga, poticajno okruženje, razvoj karijere, pouzdano i fer, fleksibilno i etično, pozitivan imidž poslodavca, globalno djelovanje.

No, kako pojedini autori ističu, faktori atraktivnosti radnog mjesta mogu se razlikovati ovisno o kulturnim okruženjima pojedinih zemalja (Sivertzen *et al.*, 2013; Berthon *et al.*, 2005), ali i ovisno o demografskim karakteristika ispitanika. Stoga postaje iznimno važno, s obzirom na generacijske specifičnosti, upoznati što je osobito važno generaciji koja ulazi na tržište rada odnosno Generaciji Z koja se proteže od srednjih 90-ih do ranih 2000.-ih godina odnosno čiji pripadnici imaju od 8 do 25 godina.

Sukladno Backhaus i Tikoo (2004) izgradnja marke poslodavca je pridobila pažnju praktičara ali je još nedovoljno istražena od strane znanstvenika. Sivertzen *et al.*, (2013) navode da izgradnja marke poslodavca predstavlja rastuće područje interesa i primjene, iako nije jednoznačan koncept. Berthon *et al.* (2005) navode da je, iako je pojam internog marketinga odavno poznat, marka poslodavca kao jedna od komponenti istog još uvijek nedovoljno razvijena i istražena, a osobito se to odnosi na „atraktivnost poslodavca" koja predstavlja prvi korak u procesu izgradnje iste.

3. ISTRAŽIVANJE PERCEPCIJE STUDENATA O POŽELJNIM POSLODAVCIMA I ELEMENTIMA POŽELJNOG RADNOG MJESTA U RH

3. 1 Metodologija istraživanja

Istraživanje stavova studenata, pripadnika generacije Z, o elementima radnog mjesta koji čine poslodavca poželjnim te o najpoželjnijim poslodavcima provedeno je na uzorku od 72 ispitanika. Prigodni uzorak studenata u uzorku istraživanja povezuje se sa određenim nedostacima u smislu ispitanikovog nedovoljnog iskustva u traženju posla, te posebne karakteristike skupine što čini otežanom generalizaciju rezultata (Berthon *et al.*, 2005) nadalje ne uzimaju se u obzir potrebe stvarno zaposlenih, no s druge strane istu ulogu igraju i kulturne razlike (Hillebrandt i Ivens, 2013). Valja primijetiti da će upravo studenti pripadnici generacije Z biti posebno ciljani od strane promotivnih kampanja poslodavaca kojima će se nastojat utjecat na njihov stav o poslodavcu, a bit će i metama regrutacijskih aktivnosti poslodavaca te su stoga odabrani u uzorak istraživanja.

Istraživanje je provedeno putem strukturiranog online upitnika koji je distribuiran studentima svih godina studija te svih smjerova tijekom predavanja te online putem, na matičnom fakultetu u razdoblju od 1. do 30. ožujka 2019. godine. Ispitanicima je osigurana anonimnost.

Cilj empirijskog dijela istraživanja bio je otkriti skrivene faktore percepcije atraktivnosti poslodavaca u očima budućih posloprimaca u specifičnostima hrvatske nacionalne kulture te utvrditi međuovisnost među varijablama.

Premda su od strane teoretičara razvijene mnoge ljestvice (Hilebrandt, Ivens, 2013; Frnandez-Lores, Gavilan, Avello, Blasco, 2015; Sengupta *et al.*, 2015; Berthon *et al.* 2005; Tuzuner, Yuksel, 2009), zbog specifičnosti hrvatske kulture u utvrđivanju poželjnih elemenata radnog mjesta razvijena je vlastita

ljestvica koja se dijelom oslanjala na prethodno predložene te korištene u istraživanjima portala moj.posao.net i Talentlyft. Anketni upitnik je dodatno proširen varijablama čiji je cilj bio izmjeriti stavove studenata o dodatnim specifičnostima poželjnog poslodavca te stavove studenata o određenim aspektima budućeg zaposlenja, a pridodana su i demografska pitanja.

Korištena je Likertova 5-stupanjska ljestvica dok su pojedina pitanja nudila dihotomne odgovore te je jedno pitanje bilo otvorenog tipa.

Od ukupno 72 ispitanika, 75 % ih je ženskog spola, dok je muških 25 %.

3. 2 Analiza rezultata istraživanja

Sukladno provedeno istraživanju ugodna atmosfera ($\overline{x}$=4,53), mogućnost napredovanja ($\overline{x}$=4,43) i siguran posao ($\overline{x}$=4,40), prepoznata su kao tri najvažnija faktora atraktivnosti poslodavaca. S druge strane, tri faktora sa najmanjom važnosti za studente-buduće posloprimce jesu mogućnost rada od kuće ($\overline{x}$=3,11), razina odgovornosti ($\overline{x}$=3,43), te uključenost u donošenje odluka ($\overline{x}$=3,53). Rezultati su prikazani u tablici 1.

Tablica 1. Faktori atraktivnosti poslodavaca

Varijabla		aritmetička sredina $\overline{x}$	standardna devijacija
VAR1	Visina plaće kao motivirajući faktor	4,35	0,73
VAR2	Beneficije poput godišnjeg odmora, službenog automobila ili prijenosnog računala	4,07	0,86
VAR3	Ugodna radna atmosfera među kolegama na radnom mjestu	4,53	0,69
VAR4	Posao u struci	3,76	1,09
VAR5	Mogućnost napredovanja	4,43	0,82
VAR6	Dobar imidž poduzeća kao poželjnog poslodavca	3,79	0,85
VAR7	Mogućnost daljnjeg usavršavanja i razvoja	4,26	0,86
VAR8	Zanimljivost posla	4,39	0,76
VAR9	Sigurnost radnog mjesta	4,40	0,83
VAR10	Važnost dobre reference za budućnost	4,21	0,86
VAR11	Uključenost/sudjelovanje u donošenju odluka	3,54	0,97
VAR12	Fleksibilno radno vrijeme	3,83	1,08
VAR13	Mogućnost rada od kuće	3,11	1,21
VAR14	Razina odgovornosti	3,43	0,85

Izvor: autori

Uz, u prethodnoj tablici navedene faktore atraktivnosti, dodatno je testirano još nekoliko njih radi sveobuhvatnijeg utvrđivanja stavova. Tako, studenti budući posloprimci u visokom postotku (74 %)

smatraju da je atraktivan poslodavac onaj koji u okvirima vlastitog poduzeća (putem podružnica ili drugih organizacijskih jedinica unutar sustava), omogućava rad diljem svijeta.

Valja istaknuti podatak da većina ispitanika (60 %) ne bi pristala na preseljenje izvan Hrvatske kako bi mogli raditi za svog poslodavca prvog izbora. Glede najpoželjnijeg poslodavca, ispitanici navode redom Infobip, Drogerie Markt-DM i Arena hospitality group

Radi utvrđivanja međuovisnosti između pojedinih varijabli izračunat je Pearsonov koeficijent korelacije te su rezultati prikazani u tablici 2. S obzirom na veći broj varijabli tumače se samo korelacije iznad 0,5. Prema rezultatima iz tablici postoji statistički značajna pozitivna povezanosti između varijable plaća i varijable godišnji odmor, službeni automobil i laptop (r=0,718, p<0,05). U tom smislu, budući zaposlenici očekuju da visinu plaće prate i ostali materijalni aspekti koji se odnose na pojedino radno mjesto.

Tablica 2. Matrica korelacije između odabranih varijabli

	VAR1	VAR2	VAR3	VAR4	VAR5	VAR6	VAR7	VAR8	VAR9	VAR10	VAR11	VAR12	VAR13
VAR1	-												
VAR2	**0,718***	-											
VAR3	0,355*	0,434*	-										
VAR4	-0,037	0,048	0,222	-									
VAR5	0,240*	0,237*	0,488*	0,398*	-								
VAR6	0,229	0,269*	0,427*	0,368*	**0,572***	-							
VAR7	0,166	0,185	0,451*	0,399*	**0,700***	**0,654***	-						
VAR8	0,158	0,173	**0,595***	0,332*	**0,609***	**0,581***	**0,597***	-					
VAR9	0,390*	0,451*	0,481*	0,183	0,278*	0,377*	0,382*	0,327*	-				
VAR10	0,156	0,312	0,411*	0,157	0,499*	**0,536***	**0,624***	**0,566***	**0,517***	-			
VAR11	0,212	0,193	0,312*	0,103	**0,519***	0,479*	0,419*	0,482*	0,318*	**0,612***	-		
VAR12	0,236*	0,363*	0,423*	0,268	0,405*	0,252*	0,325*	**0,512***	0,233	0,268*	0,326*	-	
VAR13	-0,076	0,088	0,233*	0,405	0,179	0,297*	0,190	0,290*	0,011	0,223	0,257*	0,406*	-
VAR14	0,298*	0,323*	0,230	0,035	0,356*	0,260*	0,170	0,367*	0,189	0,299*	0,325*	0,356*	0,282*

*p<0,05, n=72

Izvor: izračun autora

Nadalje, varijabla imidž potencijalnog poslodavca statistički je značajno pozitivno povezana s varijablama mogućnost usavršavanja i razvoja (r = 0,654), zanimljivost posla (r = 0,581), mogućnost napredovanja (r = 0,572) te dobrima referencama za budućnost (r = 0,536). U tom bi smislu potencijalni poslodavci radi privlačenja kvalitetnih mladih kadrova trebali u svojim natječajima i ostalim promotivnim aktivnostima namijenjenim regrutiranju kadrova trebali isticati navedene elemente kod opisa radnog mjesta. To dodatno naglašavaju ostale korelacije. Tako je primjerice varijabla dobra referenca za budući posao pozitivno i statistički značajno povezana s varijabala mogućnost usavršavanja i razvoja (r = 0,624), zanimljivost posla (r = 0,566), sigurnost radnog mjesta (r = 0,517) te uključenost u donošenje odluka (r = 0,612). Konačno, potencijalni zaposlenici zanimljivost

posla povezuju s ugodnom atmosferom na radnom mjestu (r = 0,595) te povezuju zanimljivost posla s očekivanom uključenošću za donošenje poslovnih odnosa (r = 0,512).

Kako bi se bolje objasnile percepcije mladih prema obilježjima posla provedena je eksplorativna faktorska analiza koja zbog malog uzorka ima ponajprije izviđajni karakter te može poslužiti kao podloga za buduća istraživanja. U tablici 3. prikazani su rezultati eksplorativne faktorske analize nakon izvršene rotacije faktora putem Varimax postupka. Za izvlačenje faktora korištena je metoda glavnih komponenti. Prema LR testu ($\chi^2 = 438,94$, $p < 0,05$) postoji statistički značajna razlika između nezavisnog modela i zasićenog modela odnosno postoje signifikantne korelacije između pojedinih varijabli zbog čega je primjena faktorske analize smislena. Nadalje KMO (Keiser-Meyer-Olkin) mjera prikladnosti uzorka iznosila je 0,795 te je bila veća od 0,5 što ukazuje na to da su prikupljeni podaci prikladni za provođenje faktorske analize. Iz konačnih rezultata isključena je varijabla „posao u struci" budući da je bila povezana samo s jednim određenim faktorom. Ukupno je izvučeno putem faktorske analize tri faktora čije su vlastite vrijednosti bile veće od 1. Tri faktora objašnjavaju zajedno 66 % ukupne varijance svih varijabli što se može smatrati primjerenim za ovakav tip eksplorativne studije.

Tablica 3. Eksplorativna faktorska analiza nakon Varimax rotacije

	Varijabla	F1	F2	F3	Arit. sredina
VAR1	Visina plaće kao motivirajući faktor	0,083	**0,877**	0,068	4,26
VAR2	Beneficije poput godišnjeg odmora, službenog automobila ili prijenosnog računala	0,109	**0,867**	0,209	
VAR9	Sigurnost radnog mjesta	0,480	**0,583**	−0,145	
VAR3	Ugodna radna atmosfera među kolegama na radnom mjestu	**0,547**	0,413	0,265	4,16
VAR5	Mogućnost napredovanja	**0,778**	0,166	0,212	
VAR6	Dobar imidž poduzeća kao poželjnog poslodavca	**0,779**	0,109	0,164	
VAR7	Mogućnost daljnjeg usavršavanja i razvoja	**0,864**	0,045	0,059	
VAR8	Zanimljivost posla	**0,754**	0,074	0,380	
VAR10	Važnost dobre reference za budućnost	**0,777**	0,185	0,077	
VAR11	Uključenost/sudjelovanje u donošenju odluka	**0,646**	0,119	0,230	
VAR12	Fleksibilno radno vrijeme	0,280	0,257	**0,711**	3,45
VAR13	Mogućnost rada od kuće	0,158	−0,176	**0,796**	
VAR14	Razina odgovornosti	0,152	0,361	**0,589**	
	Vlastita vrijednost	4,23	2,35	1,90	
	% objašnjene varijance	33	18	15	

n=72, izvlačenje faktora: Metoda glavnih komponenti, Rotacija faktora: Varimax

Izvor: izračun autora

U prvi faktor koji objašnjava 33 % varijance svih varijabli prema veličini faktorskih opterećenja mogu se ubrojiti varijable koje se odnose ugodnu atmosferu na poslu, mogućnost napredovanja, imidž poslodavca, zanimljivost posla, dobra referenca za budućnost te uključenost u donošenje odluka. S obzirom na sadržaj varijabli navedeni faktor 1 može se nazvati „Sadržajna atraktivnost radnog mjesta".

U drugi faktor koji objašnjava daljnjih 18 % varijance svih varijabli s obzirom na visinu faktorskih opterećenja mogu se uključiti varijable koje se odnose na plaću, godišnji odmor, službeni auto, prijenosno računalo te sigurnost posla. Navedeni faktor dva s obzirom na varijable koje se vezuju na njega može se nazvati „Materijalni uvjeti rada". Konačno u faktor 3 koji objašnjava dodatnih 15 % varijance svih varijabli s obzirom na visinu faktorskih opterećenja obuhvaća sljedeće varijable: fleksibilno radno vrijeme, mogućnost rada od kuće i razina odgovornosti. U tom smislu faktor 3 se može nazvati „Sloboda u obavljanju posla". Nakon eksplorativne faktorske analize izračunate su aritmetičke sredine za pojedine izvučene faktore. Rezultati su u skladu s prethodno analiziranim faktorima atraktivnosti posla iz Tablice 1. ispitanicima su najvažniji bili materijalni uvjeti rada (4,26), potom dodatni sadržaji atraktivnosti radnog mjesta (4,16) dok su faktori koji se odnose na slobodu u obavljanju posla bili ispitanicima najmanje važni (3,45)

Konačno, radi utvrđivanja postojanja razlika između demografskih varijabli i pojedinih tvrdnji ispitanika provedena je analiza putem t-testa samo za varijablu spol budući da su se kao uzorak u predmetnoj studiji koristili studenti. Prema rezultatima t-testa utvrđena je statistički značajna razlika ($t = 2,09$; $p < 0,05$) kod varijable sigurnost radnog mjesta kod koje su ispitanici ženskog spola u prosjeku iskazale veću važnost ($\overline{x} = 4,51$) u odnosu na osobe muškog spola ($\overline{x} = 4,05$). Nadalje, nisu utvrđene statistički značajne razlike s obzirom na spol prema faktorima dobivenih na temelju eksplorativne faktorske analize. Detaljnije objašnjenja rezultata daju se u narednom poglavlju diskusije i preporuke za buduća istraživanja.

4. ZAKLJUČNA RAZMATRANJA

Poduzeća diljem svijeta suočavaju se sa mnogobrojnim izazovima, zaposlenici koji mogu dodati vrijednost postaju važan čimbenik uspjeha u ekonomiji utemeljenoj na znanju, te se pogled na njih stubokom mijenja. Od troškovnog opterećenja zaposlenici postaju faktor konkurentske prednosti. Mijenja se stoga i filozofija upravljanja tim važnim resursom, te se razvijaju pristupi kojih je cilj pridobiti najbolje zaposlenike i istovremeno potaknuti postojeće zaposlenike na pružanje svoga maksimuma. Pristupi se uglavnom temelje na marketinškim principima zadovoljavanja potreba i želja korisnika odnosno u ovom slučaju zaposlenika i potencijalnih zaposlenika. Izgradnja marke poslodavca, iako izvorno marketinški pojam, danas obuhvaća pristupe i saznanja različitih disciplina poput upravljanja ljudskim resursima, psihologije, organizacijskog ponašanja i slično. Već ta činjenica ukazuje na to da se radi o složenom konceptu koji obuhvaća različite pristupe, ovisno o gledištu samog teoretičara odnosno praktičara. Zasigurno prepoznavanje faktora atraktivnosti predstavlja prvi korak u uspješnom oblikovanju prijedloga vrijednosti, korisničkog iskustva ali i uspješne promocije te pozicioniranja marke. Osobito je važno prepoznati faktore atraktivnosti kod mlade populacije koja upravo ulazi na tržište rada sa svojim specifičnim potrebama i željama. Temeljem provedenog istraživanja utvrđeno je da je za nadolazeću generaciju posloprimaca od osobite važnosti ugodna atmosfera, mogućnost napredovanja te sigurnost zaposlenja. Statistički

značajna razlika utvrđena je kod varijable sigurnost radnog mjesta, naime kod ispitanika ženskog spola iskazala se veća važnost navedene varijable u odnosu na osobe muškog spola.

Rezultati provedene studije u skladu su sa prethodnim spoznajama (Berthon, Ewing, Hah, 2005) prema kojima je plaća važan ali ne presudan faktor atraktivnosti radnog mjesta. Nadalje, sukladno provedenoj studiji 60% ispitanika ne bi pristalo na preseljenje izvan Hrvatske čak i u slučaju kad se radi o poslodavcu prvog izbora. Imidž kao jedan od elemenata atraktivnosti i izgradnje marke poslodavca pozitivno se povezuje sa mogućnošću usavršavanja i razvoja, zanimljivosti posla, mogućnosti napredovanja i dobrim referencama za budućnost.

Nadalje, istraživanjem su prepoznata tri faktora atraktivnosti koji obuhvaćaju različite varijable, a to su sadržajna atraktivnost radnog mjesta, materijalni uvjeti rada te sloboda u obavljanju posla. Prepoznati faktori oslanjaju se na Ambler i Barrow (1996) rezultate i njihove psihološke, ekonomske i funkcionalne faktore te dijelom potvrđuju i Berthon *et. al.* (2005) faktore atraktivnosti odnosno potvrđuju postojanje psiholoških te ekonomskih koristi dok se dijelom razlikuje faktor Sloboda u obavljanju posla. Nadalje, odgovaraju i nalazima Tuzuner i Yuksel (2009) koji su ukazali na dva faktora, integrirana izgradnja marke i konkurentnost. Stoga prepoznati faktori indikativno ukazuju na važne potrebe zaposlenika i potencijalnih zaposlenika koje treba zadovoljiti.

Sve navedeno zapravo može pomoći praktičarima osobito menadžerima marketinga i menadžerima ljudskih resursa u oblikovanju atraktivnih radnih okolina, sa dimenzijama koje će predstavljat svojevrstan odgovor na potrebe korisnika. Isto tako temeljem dobivenih saznanja moći će oblikovati prijedlog vrijednosti koji će biti ponuđen potencijalnim zaposlenicima te mogu biti osnova za oblikovanje izvrsnog zaposleničkog iskustva. Dobivena saznanja također se mogu koristiti u oblikovanju oglasa i natječaja sa ciljem regrutacije, naime mogu se isticati varijable koje su ovim istraživanjem utvrđene kao važne potencijalnim zaposlenicima odnosno posloprimcima.

Iako su provedena istraživanja eksplorativne naravni u ovom rastućem području interesa, postavljaju temelj za daljnja istraživanja te pridonose znanosti osobito prepoznavanjem veza među pojedinim varijablama ali i prepoznavanjem faktora atraktivnosti radnog mjesta u specifičnostima Republike Hrvatske te kod mlađe generacije koja ulazi na tržište rada.

Provedeno istraživanje ima i određena ograničenja, među kojima je zasigurno veličina i struktura uzorka te činjenica da nisu analizirane percepcije ispitanika s obzirom na različite tipove poslova i djelatnosti.

Kako prethodno navedeno radi se o eksplorativnom istraživanju sa mnogim ograničenjima koji ujedno predstavljaju osnovu za daljnja istraživanja ovoga prema zanimanju teoretičara i praktičara rastućeg područja interesa.

Rad je izrađen u okviru znanstvenog projekta *Percepcije i primjena holističkog marketinga u Hrvatskoj* pri Fakultetu ekonomije i turizma "Dr. Mijo Mirković", Sveučilište Jurja Dobrile u Puli. Mišljenja, nalazi i zaključci ili preporuke navedene u ovom radu odnose se na autora i ne odražavaju nužno stajališta Fakulteta ekonomije i turizma "Dr. Mijo Mirković" Pula.

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Original scientific paper
https://doi.org/10.31784/zvr.9.1.9
Received: 12. 6. 2020.
Accepted: 21. 9. 2020.

EMPLOYER ATTRACTIVENESS FACTORS AND EMPLOYER BRANDING FROM THE GEN Z PERSPECTIVE

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SUMMARY

In today's knowledge-based economy, employees play an important role, especially in gaining competitive advantage. It is for this reason that companies strive to attract skilled, high quality, knowledgeable employees and at the same time to stimulate engagement and commitment among current employees. In this effort, companies increasingly use marketing techniques and approaches that rely on a deep understanding of employees' and potential employees' needs and wants. This study was conducted with the aim of assessing the importance of each employer attractiveness factor in the eyes of future employees (Generation Z), taking into account the specificity of the Croatian national culture. Moreover, the paper identifies the relationships and the links between the attractiveness factors, and the respondents' perceptions of job characteristics. The research was conducted on a sample of 72 respondents. The Pearson coefficient was calculated to assess the interdependence between individual variables. In addition, an exploratory factor analysis was conducted to explain more in depth the perceptions of youth toward job characteristics. Based on the research results, the most and the least important attractiveness factors were identified, significant differences between genders were pointed out, and the links between the variables were highlighted. Moreover, three major attractiveness factors were identified - job content attractiveness, material working conditions and freedom in job performance. The contribution of this paper is based on the recognition of links between individual variables and also on the identification of job attractiveness factors in the specific context of the Republic of Croatia and in the eyes of the young generation ready to enter the job market. The findings may help professionals, especially marketing managers and human resources managers, in their efforts to develop an attractive job environment that provides an adequate answer to the needs of customers (i.e. employees and prospective employees).

Key words: *employer attractiveness factors, employer branding, Generation Z*

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Original scientific paper
https://doi.org/10.31784/zvr.9.1.10
Received: 20. 12. 2020.
Accepted: 6. 4. 2021.

EXPLORING THE CONSUMER-BASED BRAND EQUITY RELATIONS ON CROATIAN YOUTH FASHION MARKET

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ABSTRACT

Brand equity is considered a precious marketing concept for practitioners and scholars. This study is focused on the perceptual consumer-based brand equity approach and widely adopted Aaker's (1991) conceptualization with four primary dimensions: brand awareness, brand associations, perceived quality, and brand loyalty. These components represent the salient dimensions of a multidimensional brand equity index. The research followed the original 14-item Yoo and Donthu (2001) consumer-based brand equity measurement scale. The research hypotheses were successfully corroborated within the Croatian fashion youth market on a sample of college students (167). The results pointed out the associative relationships among all brand equity components, with the exemption of causal relation between brand associations and brand loyalty. The same exemption (brand associations) emanated from the investigation of causal relationships between brand awareness, brand associations, perceived quality, brand loyalty and the overall brand equity index. This study contributes to the previously assumed hierarchy order between consumer-based brand equity components and points out the marketing activities which precedes particular component enhancement.

***Key words**: Brand Awareness, Brand Associations, Perceived Quality, Brand Loyalty, CBBE model*

1. INTRODUCTION

Digital marketing experts estimate that an average American is exposed to around 4-10 thousand advertisements each day (RedCrow Marketing, 2015, https://www.redcrowmarketing.com/2015/09/10/many-ads-see-one-day/). Additionally, global consumers apathy remains, as almost half of them neither like nor dislike advertising, while 1/3 dislike it generally in 2019 and 2018 (Kantar Media, 2019:6). In today's economy of abundance, marketers are continually under pressure to justify market communication investments in the long run. They recognized brand equity as a unique marketing asset that can play a vital role in differentiating from competitors and ensuring long-term consumer loyalty.

The purpose of this paper encompasses verifying the applicability of the consumer-based brand equity model on the youth fashion (apparel and footwear) market in Croatia. Brand equity is considered a precious marketing and business concept for practitioners and scholars. This study is focused on the perceptual consumer-based brand equity approach and widely adopted Aaker's (1991) conceptualization with four primary dimensions: brand awareness, brand associations, perceived quality, and brand loyalty. The research's objectives encompass testing the associative and particularly causal relationship between these four components and the overall brand index construct to verify in the previous studies assumed hierarchy among these components. The results might suggest the possible path of marketing activities execution for practitioners and future validation of the results on other markets for scholars.

In the next section, a brief review of the topic's dominant views, with a short overview of the worldwide fashion market and hypotheses development, was given. Finally, the research framework, methodology and empirical results were displayed, followed by discussion and concluding remarks.

2. THEORETICAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT

2. 1 Brand equity

The high costs linked to the launch of the new products followed by high failure rates of new products and increasing costs of advertising and distribution represent some of the reasons for the continuous rise of interest in brand equity building (Crawford, 1993; Ourusoff, 1992, Aaker, 1991, cited in Pappu et al., 2005:143). The advantages of brand equity are notorious. According to Aaker (1991:15), brand equity provides value to customers by enhancing their interpretation and processing of information, confidence in the purchase decision, and user satisfaction. It also provides value to the firm by enhancing the efficiency and effectiveness of marketing programs, brand loyalty, prices and margins, brand extensions, trade leverage, and competitive advantage. Previous research corroborated a positive impact of brand equity on consumer preference and purchase intention (Cobb-Walgren et al., 1995), market share (Agarwal & Rao, 1996), consumer perception of product quality (Dodds et al., 1991), consumer price sensitivity (Erdem et al., 2002) and resilience to the product-harm crisis (Dawar & Pillutla, 2000, cited in Chrostodoulides & de Chernatony, 2010:44).

Brand equity was conceptualized back in the late 1980s, but the researcher's interest remains dynamic (for instance, just the Scopus database records 68 articles considering consumer-based brand equity topic in 2019 and 2020). However, the issue of universally acceptable brand equity definition was not resolved yet. Brand equity is considered a very complex concept that some authors compared its various conceptualizations with an ancient Indian "blind men and elephant" story (Ambler, 2003:41). So far, Farquhar's definition of brand equity as the added value endowed by the brand to the product gained the most consensus (1989, cited in Su and Chang, 2018:92). One of the most cited, Aaker's definition of brand equity from a cognitive psychology approach (1991:27) as a set of brand assets and liabilities linked to a brand, its name and symbol, that add to or subtract from the value provided by a product or service to a firm and/or to that firm's customers, opened up two main streams of research: consumer-based and firm-based brand equity (Christodoulides et al., 2015:309). Firm-based

brand equity is often perceived as an outcome of consumer-based brand equity. This study is focused on consumer-based brand equity, which Keller (1993:8) defines as the differential effect of brand knowledge on consumer response to the marketing of a brand.

2. 2 Consumer-based brand equity

Aaker's (1991) and Keller's (1993) definitions of brand equity guided many empirical studies of consumer-based brand equity (CBBE) over the past three decades. Tasci literature review (2021:172-175) revealed 83 studies (conducted between 1991 and 2020), which followed Aaker's or Keller's proposed CBBE structure. The lack of consensus regarding brand equity definition transferred onto little agreement on its constituent dimensions (Su & Chang, 2018:92) and lack of generally accepted scales to measure the brand assets (Christodoulides et al., 2015:308). Although numerous researchers somewhat changed the original components (Tasci, 2021: 171), Aaker's five assets of brand equity are the most commonly adopted model of CBBE (Aaker, 1991:15): brand loyalty, brand (name) awareness, perceived quality, brand associations in addition to perceived quality (as so-called primary or core assets) and other proprietary brand assets, like patents, trademarks, channel relationships, etc. Applying the consumer-based behavioural view of brand equity on these assets means measuring cognitive and behavioural brand equity at the individual consumer level through a consumer survey (Yoo and Donthu, 2001:2). This perception-based brand equity is measured from different perspectives, consumers (in general), customers (actual buyers), employees or residents (Tasci, 2021:170). Consequently, various CBBE measurement models were developed. For instance, a literature review by Szocs (2014:105-112) analyzed the 13 most essential models of CBBE measures, compiled from two (Chau and Ho, 2008) to seven brand equity dimensions (Erdem and Swait, 1998).

Brand equity topic gained moderate interest from Croatian scholars. For instance, Rajh (2002, 2006, 2009, 2019) researched a scale for customer-based brand equity measurement, Sinčić Ćorić and Jelić (2015), tested the applicability of Keller's concept in the B2B market, Vukasović (2016) researched CBBE on Croatian and Slovenian food market, etc.

2. 3 Fashion industry

The value of brand equity is easily noticeable in the global fashion (apparel and footwear) market, which accounted for 2.5 trillion $ in 2017 (BoF McKinsey FashionScope, McKinsey&Company, 2018:64), 519.5 bn EUR of European consumer expenditures on textile and clothing in 2018 (https://www.statista.com/topics/3423/clothing-and-apparel-market-in-europe), and employs over 300 millions people worldwide (Gazzola et al., 2020:1). The global fashion industry was (pre-Covid-19 crisis) expected to grow steadily by 3 to 4% and 4.5 to 5.5% in emerging Europe (BoF McKinsey Global Fashion Index, McKinsey&Company, 2019:98).

One of the most prominent market segment for fashion, especially the fast fashion industry, is a large population of young people (approx. 3.78 bn aged 30 or below globally, or 242 mln in Europe in 2020, United Nations, World Population Prospects, https://population.un.org/wpp/DataQuery/). Within this age group, college students (surveyed in this study) easily and quickly adopt fast fashion products because of their limited financial resources and tendency to wear

trendy and socially visible clothing (Su & Chang, 2018:91). Most survey participants belong to generations Y and Z, which accounted for 47% of worldwide luxury consumers and 33% of luxury purchases in 2018 (BCG-Altagamma, 2019: 19). The purchases of fashion luxury brands, account for over 30% of personal luxury goods (60 bln EUR worldwide purchases in 2018, D'Arpizio et al., Bain & Company, 2019:6;20).

2. 4 Research hypothesis development

Following the most generally accepted Aaker's (1991) approach (Su and Chang, 2018:92), this study applies a CBBE model, which captures four (primary) constructs: brand loyalty, perceived quality, brand awareness, and brand associations. These four brand equity dimensions are widely accepted and used by numerous researchers (e.g. Yoo et al., 2000; Pappu et al., 2005; Pike et al., 2010; Kim and Hyun, 2011; Buil et al., 2013, Vukasović, 2016).

A broadly utilized Yoo and Donthu (2001:6-9)[1] conceptualization of multidimensional brand equity construct proposed a three-dimensional model as a better fit than four-dimensional because a high correlation between brand awareness and brand associations suggested inseparability of those two constructs. However, these study combined Yoo and Donthu (2001:10-11) multidimensional brand equity (shortened: MBE) and unidimensional (overall) brand equity (shortened: OBE) framework with Buil et al. (2013:63-64) research of casual order among the dimensions of brand equity. According to the later framework, consumers' awareness of the brand leads to attitudes (e.g. perceived quality and brand associations), which in turn will influence attitudinal brand loyalty (Lavidge and Steiner, 1961; Gordon et al., 1993; Konecnik and Gartner, 2007, cited in Buil et al., 2013:63). Furthermore, some scholars (e.g. Brady et al., 2008; Chen, 2001; Nam et al., 2011, Cifci et al., 2016, cited in Su and Chang, 2018:95) argued that brand loyalty could be excluded from the brand equity construct as represents one of the consequences of brand equity. Therefore, the present study examines the view which considers brand loyalty as an outcome of brand equity. Furthermore, this research investigates the four dimensions CBBE model's causal relations, which emanated as a conclusion from Tasci (2021:186) meta-analysis.

Brand awareness refers to the strength of a brand's presence in the consumer mind. Aaker (1991:61-62) defines brand awareness as a potential buyer's ability to recognize or recall that a brand is a member of a certain product category. Aaker awareness pyramid suggests three levels of brand awareness, from simple brand recognition (aided recall test), brand recall (unaided recall) and top of the mind (first brand in the unaided recall). According to Rossiter and Percy (1987), brand awareness is the consumers' ability to identify or recognize the brand, while Keller (1993) composed brand awareness of both brand recognition and brand recall (Pappu et al., 2005:145). Following the Buil et al. (2013:63) and Su and Chang (2018:95) perspectives, the first three hypotheses examine the effect of brand awareness on perceived quality, brand associations, and brand loyalty:

[1] According to PlumX Metrics (https://plu.mx/plum/a/?doi=10.1016/S0148-2963(99)00098-3&theme=plum-sciencedirect-theme&hideUsage=true), the model developed and published by Yoo and Donthu in 2001 (i.e. the concerned article), were cited 1.161 times in Scopus, till November 2020.

H1. Brand awareness has a significant positive effect on brand associations.

H2. Brand awareness has a significant positive effect on perceived quality

H3. Brand awareness has a significant positive effect on brand loyalty.

Perceived quality, as defined by Zeithaml (1988:3), refers to "the consumer's judgment about an entity's (product's or service's) overall excellence or superiority." Within his CBBE framework, Aaker (1991:80-81) defines perceived quality as the customer's perception of the overall quality or superiority of a product or service concerning its intended purpose relative to alternatives. The results of the previous research suggests that high levels of perceived quality can enhance brand loyalty (e.g. Pike et al., 2010:444, Pike and Bianchi, 2016:127).

Brand associations were conceptualized by Aaker (1991:101) as "anything linked in memory to a brand." Brand associations represent the basis for purchase decisions and brand loyalty (Chen, 2001, cited in Su and Chang, 2018:96). The more brand associations embedded in a product, the more the product will be remembered by consumers. Brand associations may be derived from different sources, perceived value, brand personality and organizational associations being the essential predictor of brand equity (Su and Chang, 2018:93, Ahmad and Sherwani, 2015: 62). Perceived quality and brand associations precede and can enhance brand loyalty (Keller and Lehmann, 2003; Chaudhuri, 1999; Keller and Lehmann, 2003; Pike et al., 2010, cited in Buil et al., 2013:64); thus, the following hypotheses may be proposed:

H4. Brand associations have a significant positive effect on perceived quality.

H5. Brand associations have a significant positive effect on brand loyalty.

H6. Perceived quality has a significant positive effect on on brand loyalty.

Brand loyalty represents a measure of the customer's commitment to a brand, and it is considered the core of brand equity (Aaker, 1991:44). Oliver (1997, cited in Pappu et al., 2005:145) followed the behavioural approach. He defined brand loyalty as: "a deeply held commitment to rebuy or repatronise a preferred product or service consistently in the future, despite situational influences and marketing efforts having the potential to cause switching behaviour". Yoo and Donthu (2001:3) study refers to the brand loyalty as "the tendency to be loyal to a focal brand, which is demonstrated by the intention to buy the brand as a primary choice." According to Solomon et al. (2006:289), a brand loyalty means that consumer is actively (sometimes even passionately) involved with a favourite brand. Brand loyalty represents one of the main drivers of brand equity (e.g. Yoo et al., 2000; Atilgan et al., 2005; Yasin et al., 2007, cited in Buil et al., 2013:64).

Consistent with Yoo et al. (2000:201) CBBE model, this study employs a separate construct, overall brand equity, which was designed to measure the incremental value of the focal brand due to the brand name. As emphasized earlier, brand awareness is a predecessor for brand equity since consumers must be aware of the brand existence in the first place. Furthermore, overall brand equity depends on perceived quality since it is crucial to develop a positive evaluation of the brand in consumers' memories (Farquhar, 1989:29). The higher perceived quality leads to higher brand equity (e.g. Yoo et al., 2000:205; Kim and Hyun, 2011:434, Buil et al., 2013:64). However, some researchers consider brand awareness as a necessary but not sufficient condition to create value.

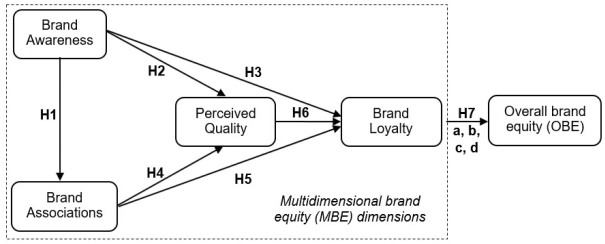
Therefore, they propose that brand awareness has a positive, though indirect, influence on brand equity (e.g. Buil et al., 2013:64, Vukasović, 2016:262). Consequently, the following hypothesis were proposed:

H7. Multidimensional brand equity components a) brand awareness; b) brand associations; c) perceived quality, and d) brand loyalty has a significant positive effect on the overall brand equity.

3. RESEARCH METHODOLOGY

As intimated before, Yoo and Donthu (2001:14) developed a multidimensional brand equity scale (MBE), for CBBE measurement, with ten items and an additional unidimensional measure of overall brand equity (OBE) consisting of four items, intended for a convergent validity check of the MBE. The OBE instrument was operationalized similar to the brand loyalty construct (Tasci, 2021:171). Yoo and Donthu (2001) scale followed Aaker's four (primary) assets but proved a three-dimensional model (brand awareness and brand association combined in one dimension) as the best fit. These scales were adopted and validated empirically by Washburn and Plank (2002:48, 59), who provided results supporting this three-factor model in the context of co-branded products and suggested more discriminant indicators improve the measurement of CBBE. However, other evidence says that brand awareness and brand association are distinctive dimensions of brand equity (e.g. Sinha et al., 2000; Sinha and Pappu,1998, cited in Pappu et al., 2005:144). Numerous researchers have successfully applied Yoo and Donthu (2001) compact fourteen items scale (e.g. Lökken et al., 2012:25, Ahmad and Sherwani, 2015:64). Consequently, it was translated and adapted for this research, including brand awareness and brand associations as separate dimensions. Figure 1. displays the conceptual model based on the associative relationships between CBBE dimensions (following You and Donthu, 2001:10) and the casual order perspective (following Buil et al., 2013:64 and Tasci, 2021:186) with brand loyalty as an outcome of brand equity. Furthermore, it involves the OBE construct designed by Yoo and Donthu (2001:11) for the MBE index's convergent validity.

Figure 1. Conceptual framework



Source: Research; adapted from Yoo and Donthu (2001), Buil et al. (2013), and Tasci (2021)

This study was conducted by asking respondents to evaluate the specific constructs with regard to their most prefered brand (within the apparel and footwear product categories), rather than a set of pre-specified brands (similar approach as in Christodoulides et al., 2015:314). Each respondent's top three favourite brands were extracted separately from a list of 13 apparel and

11 footwear brands. The final questionnaire also included five demographic variables (sex, age, occupation, education level, and household income). A seven-grade continuous Likert scale (1 = totally disagree, to 7 = totally agree) was employed to measure brand equity constructs. The online survey was performed among college students who represent a suitable sample of young fashion consumers. The data collection took place between May 11th and June 05th, 2020, and produced 203 valid responses. The final sample included only 167 observations from the young respondent's age less than 30, as reported in Table 1.

Table 1. Sample profile

Characteristics	*n*	*%*	*Characteristics*	*n*	*%*
Sex	*167*		*Age (years)*	*167*	
Female	141	84.43	≤ 22	73	43.71
Male	26	15.57	23 – 30	94	56.29
Education level:	167		*Occupation:*	*167*	
Lower and Middle	80	47.90	Economics/business/tourism	75	44.91
Middle-high and High	87	52.10	Engineering	19	11.38
Status:	167		Informatics/computing	15	8.98
Employed	25	14.97	Law	5	2.99
Unemployed	14	8.38	Liberal arts	25	14.97
Student	123	73.65	Medicine/biotechnology	21	12.57
Other	5	2.99	Other	29	17.37
Household income last year:				*167*	
Below average (hardly make our ends meet)				3	1.80
Average – enough for daily purposes and some savings				43	25.75
Above-average – we can save, go to trips, etc.				99	59.28
Considerably above average – we live a luxurious life				22	13.17

Source: Research

The measurement scales were assessed for reliability via Cronbach (1979) coefficient (results of the analysis performed by the GNU PSPP Statistical Analysis Software in Table 2.).

Table 2. Reliability test results

Concept	*No. of items*	*Cronbach α*
Brand loyalty	4	0.84
Perceived quality	2	0.84
Brand awareness	2	0.69
Brand associations	2	0.67
Multidimensional brand equity (MBE)	10	0.90
Overall brand equity (OBE)	4	0.84

Source: Research

The reliability analysis shows that the Cronbach alpha coefficient's value varies between 0.67 and 0.90 for each concept in the measurement instrument. The value of the Cronbach alpha coefficient for brand associations concept has to be calculated without the third reversely coded variable; however, it indicates an acceptable level of reliability.[2]

4. RESULTS

The statistical tool JASP (Version 0.14.1) JASP Team (2020, https://jasp-stats.org) was employed for descriptive and inferential statistical methods. ANOVA (for employment status) and t-test analyses (for other demographic characteristics) were performed to examine the differences regarding demographic variables, but no statistically significant results emerged.

Following the Yoo and Donthu (2001:11) analysis MBE index strongly correlates to a composite score computed from a simple sum of the mean scores of the brand equity dimensions. In this study, the MBE dimensions' composite score was 4.37 (or 61.37% of maximum grade). These results correspond with Yoo and Donthu (2001:10) score of 58.48% of the maximum grade for athletic shoes (four out of six brands matches in both studies). Comparatively, the mean values of MBE dimensions correspond, as well. Brand loyalty gained 47.39% of the maximum grade in this study, whereas Yoo and Donthu (2001:10) found 41.07%; perceived quality 70.74% versus 65.07% and brand awareness/brand associations (combined), 68.09% in this study versus 69.31% from Yoo and Donthu results.

The correlation analysis was performed to determine the variables' associative relationships (results in Table 3.).

Table 3. Pearson correlation matrix

Variables	BL	PQ	BAW	BAS	MBE	OBE
BL	1.0					
PQ	0.603***	1.0				
BAW	0.684***	0.656***	1.0			
BAS	0.471***	0.518***	0.659***	1.0		
MBE	0.881***	0.787***	0.877***	0.744***	1.0	
OBE	0.601***	0.574***	0.636***	0.495***	0.675***	1.0

Notes: BL = Brand Loyalty; PQ = Perceived Quality; BAW = Brand Awareness; BAS = Brand Associations; MBE = Multidimensional Brand Index; OBE = Overall Brand Index; *** All correlations are significant at $p < .001$

Source: Research

The results in Table 3. indicate that brand loyalty and brand awareness serve as the essential MBE index dimensions, followed by perceived quality and brand associations. Similar relations were determined considering the OBE index. Medium level of correlation coefficient (0.675 at $p < 0{,}001$) corroborates

[2] According to Leech et al. (2005:67), the Cronbach coefficient values should exceed 0.70, but the values between 0.60 and 0.69 are considered acceptable, which usually indicates a smaller number of items in the construct.

the Yoo and Donthu (2001:11) conceptualization of the OBE index for a convergent validity check of the MBE index (correlation coefficient were from 0.59 to 0.63 at $p < 0.0001$ in Yoo and Donthu study).

Apart from associative relationship check, this study aimed to examine the causal relations among the original Aaker's consumer-based brand equity dimensions (i.e. MBE index). Keller's customer-based brand equity pyramid (2001:7) set the path toward causal relationship investigation (although with different brand equity dimensions focus). This kind of relationship attracted less interest from scholars (e.g. Yoo and Donthu, 2001:12, Vázquez et al., 2002:40, Buil et al., 2013:64, Girrard et al., 2017:44).

The regression analysis was employed to determine the variables' causal relations (results in Table 4.). The representativeness requirement of the multiple regression analysis was verified via distribution normality analysis. The results pointed out that all skewness coefficients range between -1.091 and 0.322, i.e. within acceptable referential limits for normal distribution. The values of the kurtosis coefficient are within the +/- 1 range.

Table 4. Regression analysis results

Hyp.	Relationship	β	t	Sig.	Conclusion
H1	Brand Awareness → Brand Associations	0.974	39.045	0.000***	Supported
H2	Brand Awareness → Perceived Quality	0.533	6.954	0.000***	Supported
H3	Brand Awareness → Brand Loyalty	0.450	6.169	0.000***	Supported
H4	Brand Associations → Perceived Quality	0,476	7.538	0.000***	Supported
H5	Brand Associations → Brand Loyalty	0.003	0.042	0.966	Rejected
H6	Perceived Quality → Brand Loyalty	0.282	4.330	0.000***	Supported
H7a	Brand Awareness → OBE	0.253	2.767	0.006***	Supported
H7b	Brand Associations → OBE	0.134	1.934	0.055	Rejected
H7c	Perceived Quality → OBE	0.248	3.182	0.002***	Supported
H7d	Brand Loyalty → OBE	0.279	3.159	0.002***	Supported

Notes: OBE = Overall Brand Index; Sig.=significance; *** significance level at $p < 0.001$; ** significance level at $p < 0.01$; * significance level at $p < 0.05$

Source: Research

Examination of causal relations followed the model of CBBE with the most commonly used components and relations suggested by Tasci meta-analysis (2021:186), which consider brand loyalty as an outcome of brand equity. These relations were assumed with the first six hypotheses. The regression analysis results confirmed all hypotheses, except H5, i.e. that "brand associations has a significant positive effect on brand loyalty", which has to be rejected. The regression model demonstrated a high 'R' value (0.956), so there is a very high (strong) positive relationship between predictor variables (perceived quality, brand awareness and brand associations) and regressand (brand loyalty). The determination coefficient value ($R^2 = 0.915$) indicates that 91.5% of brand

equity variance can be predicted (explained) with independent variables. Furthermore, ANOVA analysis confirmed that the results are statistically significant, $F(3, 164) = 586.865$, at $p < 0.001$.[3]

Following the Yoo and Donthu (2001:11) and partly Buil et al. (2013:64) approach, the MBE components were tested as a predictor of an OBE construct. Multiple regression analysis confirmed all hypotheses, except H7b, that "brand associations have a significant effect on overall brand equity (OBE)." Consequently, hypothesis H7b have to be rejected. Multiple regression analysis included a model with perceived quality, brand awareness, brand associations and brand loyalty as predictors of overall brand equity (OBE). The regression model demonstrated an 'R' value of 0.960 and a very high (strong) positive relationship between predictors and regressand (OBE). The determination coefficient value ($R^2 = 0.922$) indicates that 92.2% of brand equity variance can be predicted (explained) with independent variables. Furthermore, ANOVA analysis confirmed that the results are statistically significant, $F(3, 164) = 479.113$, at $p < 0.001$.

5. DISCUSSION

This study attempted to corroborate distinct yet compatible brand equity perspectives of Yoo and Donthu (2001), Buil et al. (2013) and Tasci (2021) four dimensions CBBE model. These perspectives explored associative and causal relationships among the original Aaker's (1991) four CBBE dimensions. By utilizing the 14-item Yoo and Donthu (2001:12) measurement instrument and correlation analysis, this study determined the associative relations between all multidimensional brand equity components (MBE).

The examination of the causal effects implied that brand awareness leads to a positive effect on perceived quality and brand associations, brand associations enhance perceived quality, while perceived quality has a significant and positive effect on brand loyalty. These findings are consistent with previous studies (e.g. Yoo et al., 2000:205; Su, 2016:475, Su and Chang 2018:97). However, the confirmation of causal effect between brand associations (as a separate dimension in a four-component CBBE model) and brand loyalty as an outcome of brand equity (following the Buil et al., 2013, Pappu et al., 2005, and Tasci, 2021 approach) missed out. Probably, the low reliability of the brand associations part of the measurement scale (despite the item's exemption: "I have difficulty imagining my favourite brand in my mind") caused that brand associations do not affect the strength of brand equity, as found previously by various authors (e.g. Bridges et al., 2000, Ye and van Raaij, 2004; Pappu and Quester, 2006; Tong and Hawley, 2009; Kumar et al., 2013, cited in Ahmad and Sherwani, 2015:62). It also implies that a more appropriate measure of brand associations should be applied to separately analyze the influence of brand awareness and brand associations concept.

This research also found positive causal relationships among three brand equity dimensions (perceived quality, brand loyalty and brand awareness) and the OBE index (the regression coefficient vary between 0.248 and 0.279, all statistically significant at $p < 0.01$). The relation

[3] The values of R^2 imply that all tolerance values are considerably above the cut-off values (range between 0.041 and 0.078), as recommended by Leech et al. (2005:95), consequently, there is no multicollinearity issues.

between brand associations and brand loyalty was found non-significant. Consequently, the convergent validity check of the MBE index, confirmed via correlation analysis, was not repeated by regression analysis results.

Additionally, these results are comparable to studies conducted in similar industries. Buil et al. (2013:68) studied six brands in three categories (including shoes) and determined statistically significant low to high causal relations (from 0.083 to 0.704) among brand awareness, perceived quality, and brand associations (with three sub-dimensions), brand associations and brand loyalty, as well as between perceived quality, brand association and brand loyalty and overall brand equity (OBE). However, the existence of a causal relationship between perceived quality and brand loyalty was omitted. Comparatively, Vukasović (2016:262) tested Croatian and Slovenian food consumers and found no causal relationship between perceived quality and brand loyalty. The values of comparable coefficients among other brand equity dimensions and OBE index were established between 0.053 and 0.709 (statistically significant).

6. CONCLUDING REMARKS

The components (and sub-components) of the CBBE model varies considerably between researchers within the brand equity field, although the majority rely on Aaker's (1991) and Keller's (1993) conceptualizations. Consequently, various measurement scales were tested and (re) validated. However, various research instrument and models' application caused a deficiency in comparison opportunities and further application among scholars and practitioners. The lack of reliability for measuring the brand associations concept in this research might further improve the Yoo and Donthu based scales.

This study contributed to the CBBE model's research with the most commonly used (four) components and the proposed causal relations by the comprehensive, contemporary meta-analysis results (Tasci, 2021). The research results confirmed the causal relations between brand awareness, perceived quality and brand loyalty, and brand associations and perceived quality. These results also indicate the possible practitioners' path, e.g., enhancing promotion, storytelling, or referral programs, may lead to broader brand awareness and, consequently, improve organizational (brand) associations. Superior brand associations precede favourable brand quality perceptions, and finally, more brand loyalty from the consumers. These conclusions may be helpful to marketers in the youth fashion market but presumably, quickly transferred to other retail markets.

Limitations of the current study refer to the student sample, which prevents generalization of the results on actual consumers. Future research might consider the more consistent implementation of already widely adopted Aaker's (1991) and Keller's (1993) conceptualizations to achieve a similar level of accordance in the CBBE measurement instrument. The other suggestions for future research involve replicating the current study with actual young consumers and steering more attention to the fast fashion market.

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Izvorni znanstveni rad
https://doi.org/10.31784/zvr.9.1.10
Datum primitka rada: 20. 12. 2020.
Datum prihvaćanja rada: 6. 4. 2021.

ISTRAŽIVANJE RELACIJA MODELA POTROŠAČKE VRIJEDNOSTI MARKE NA MODNOM TRŽIŠTU ZA MLADE U HRVATSKOJ

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SAŽETAK

Vrijednost marke se smatra iznimno vrijednim marketinškim i poslovnim konceptom, kako za praktičare, tako i znanstvenike. Ova studija je fokusirana na percepcijski pristup potrošačkoj vrijednosti marke i široko prihvaćenu Aaker-ovu (1991) konceptualizaciju s četiri primarne dimenzije: svjesnost o marci, percipirana kvaliteta, asocijacije o marci i lojalnost marci. Ove sastavnice predstavljaju istaknute čimbenike više-dimenzionalnog indeksa marke. Ova studija slijedi izvorni mjerni instrument za mjerenje potrošačke vrijednosti marke s 14 tvrdnji koju su razvili Yoo i Donthu (2001). Istraživačke hipoteze su uspješno potvrđene na primjeru modnog tržišta (odjeće i obuće) za mlade u Hrvatskoj i to pomoću uzorka studenata (n = 167). Rezultati korelacijske i regresijske analize su dokazali postojanje inter-relacijskih i kauzalnih veza između svih sastavnica konstrukta potrošačke vrijednosti marke, s izuzetkom relacije između asocijacija o marci i lojalnosti marci. Istovjetni zaključak proizašao je iz uspješne verifikacije relacija između konstrukata svjesnosti o marci, percipirane kvalitete, lojalnosti marci i indeksa sveukupne vrijednosti marke. Pritom je također, izostala kauzalna povezanost konstrukta asocijacija o marci i indeksa sveukupne vrijednosti marke. Ova studija doprinosi prethodnim istraživanjima pretpostavljena hijerarhija odnosa između sastavnica modela potrošačke vrijednosti marke te upućuje na marketinške aktivnosti koje prethode snaženju pojedine komponente modela.

***Ključne riječi**: svjesnost o marci, asocijacije o marci, percipirana kvaliteta, lojalnost marci, model potrošačke vrijednosti marke*

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Preliminary communication
https://doi.org/10.31784/zvr.9.1.11
Received: 20. 11. 2020.
Accepted: 2. 2. 2021.

RELATIVE EFFICIENCY OF R&D IN EUROPEAN COUNTRIES

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ABSTRACT

This paper assesses the relative efficiency of R&D in the European countries using a nonparametric DEA approach across a group of 34 European countries. R&D is important driver of economic growth and since the resources allocated for R&D are limited, their efficient usage becomes increasingly important. This is further emphasised nowadays where world is faced with global pandemic which lead to reallocation of large amount of businesses and activities online. Considering that countries do not have to be equally efficient in all aspects of R&D, overall model as well as two specialised models (patent oriented and article oriented) are presented. Results of this study indicate that more than one-half of observed countries are R&D inefficient. Additionally, countries are in general more efficient when it comes to article orientation, rather than when it comes to patent orientation. In stage 2 of the analysis, countries are clustered into three groups based on the efficiency results of two specialised models obtained in stage 1 in order to identify characteristics of selected European countries based on their R&D orientation. The findings from this research can serve policy makers from European countries in providing directions for required efforts to enhance R&D efficiency.

Key words: *R&D, efficiency, data envelopment analysis, cluster analysis*

1. INTRODUCTION

R&D activities have a key role in enhancing the ability of a certain country to achieve economic growth and development. Resources that countries allocate to R&D are scarce and therefore should be used as efficient as possible. In order to achieve competitive advantage, efficiency and productivity of R&D operation is acquired (Werner and Souder, 1997). Although some empirical studies argue that expenditures on R&D have an immediate positive impact on current operating performance (Apergis and Sorros, 2014), while other studies argue that benefits can be visible in the long run (Gumus and Celikay, 2015; Ravšelj and Aristovnik, 2020), general opinion is that expenditures on R&D positively affect modern businesses and economic growth. One of the most important components of economic growth is technological development and therefore efficiency of R&D operations is crucial for companies, institutions and countries to be competitive

and to contribute to economic growth. That is why barriers to entry market should be more relaxed because due to research results of Cullmann, Schmidt-Ehmcke snd Petra Zloczysti (2009), they negatively affect market by reducing competition, lowering research efficiency and reducing the incentive for efficient innovation and allocation of resources. In addition, there is a positive relationship between innovation and migration inflows since workers from different cultural background possess different knowledge and capabilities (Aldieri, Kotsemir and Vinci, 2020; Niebuhr, 2010). Since governments and their regulation play a key role in R&D activity of every country, they have to re-evaluate their regulatory environment.

Importance of education and technology is constantly growing, especially nowadays when global pandemic took it to a new level. In the world where many businesses, including schools and universities, "overnight" started to operate in on-line environment and where huge amount of finances turned forward researches dealing with COVID 19, efficiency in area of technology and researches became even more important. Although R&D activities have been recognized as an important factor for economic development, publications dealing with this subject are limited. Different methods are used to asses R&D efficiency, but since most of them cannot deal with multiple outputs, DEA has been imposed as an appropriate technique. In addition, most researches approach the problem from company or industry level. There are not many papers that attempted to evaluate R&D efficiency or productivity on national level. However, this aspect is crucial to obtain policy implications that can be used in designing policy for specific country.

Different studies of R&D efficiency usually use expenditures on R&D and number of R&D personnel for inputs and number of patents as output variable (Werner and Souder, 1997). Choi and Hwang (2014) consider patents to be fundamental indicators of technology development efficiency. Since patents on its on cannot be considered to be the sole output, different types of output should be included in a research (Tsai, 1995). Building on it, Park (2015) accentuated that output that is intellectually property-related, include both, patents and publications. Chen, Hu and Yang (2011) highlighted the existence of different composition within every nations R&D. In such a way, private sector R&D, especially if funded by either foreign sources or by private businesses, plays a crucial role in improving scores of efficiency index in area of R&D that is patent oriented. On the other hand, journal-oriented (publication or article) R&D efficiency index is highly affected by performance of higher education institutions since their main objective is the publication of more academic papers.

Lee and Park (2005) identified characteristics of 27 Asian countries with respect to R&D efficiency. They created multiple R&D DEA models, one basic that includes all inputs and outputs and five additional that combine one input with all outputs and one output with all inputs. This allowed them to identify R&D characteristics of each of observed country. Wang and Huang (2007) evaluated relative efficiency of R&D activities across different countries. They suggested a model that measures overall R&D containing patents as well as academic publications as output variables. Research results indicate that more than one-half of the countries are not efficient in R&D activities. In addition, most of observed countries performed better in producing academic publications than in generating patents. Aristovnik (2012) evaluated relative efficiency of public education and R&D expenditures in selected EU and OECD countries. Research findings indicate

that, generally, less efficient, especially in R&D sector, are emerging market economies in the EU and OECD regions. This results support later research of the same author (Aristovnik, 2014) where relative efficiency of the R&D sector in the EU-27 is measured at the regional level. Regions from Netherlands, Germany and Austria showed highest relative efficiency opposed to regions from the Baltics, Eastern and Southern Europe where extremely low rate of knowledge production and efficiency is found. Kou, Zhang, Zhang, et al (2019) research was focused on influence of gender structure on R&D efficiency in China. They used four types of R&D outputs (papers, books, patents and standards). This R&D outputs are used together as well as individually in order to measure R&D efficiency based on gender structure. They used the multi-output stochastic frontier analysis and in general, when all four R&D outputs are considered jointly, R&D efficiency is higher when there is higher proportion of male R&D personnel. Despite that, when measuring R&D outputs individually, in case of papers and books, the higher proportion of female R&D personnel is positively related with higher R&D efficiency. When R&D efficiency is evaluated individually for patents and standards as R&D outputs, higher proportion of male personnel leads to higher R&D efficiency. Dobrzanski (2020) analysed the efficiency of spending on R&D in Latin America region and research results indicate that, higher spending on R&D in observed countries does not generate a proportional increase in innovative results. In addition, results show that more efficient countries in using resources are small, higher developed countries.

In this paper, relative R&D efficiency is measured at the level of 34 European countries (Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, North Macedonia, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom). Additionally, to define sources of (in)efficiency, two additional specialized models are presented – patent and article oriented models that serve as a base for stage two where specialized clusters of countries depending of their orientation are created. Furthermore, evaluation of R&D efficiency and its understanding and application is important for decision-makers in improving resource allocation and designing R&D policies. The aim of this paper is to evaluate relative R&D efficiency of selected European countries and group them based on their efficiency results to assess their R&D orientation in order to provide information to policy makers.

This paper contains 5 sections. After the Introduction, where in addition to presenting the aim of this paper, literature on efficiency evaluation in R&D is reviewed, the rest of the paper is organized as follows; Section 2 presents used methodology, i.e. data envelopment analysis (DEA) and cluster analysis, while Section 3 focuses on the model specification and data selection. Section 4 contain empirical research results from the two-stage approach. Section 5 concludes the paper.

2. METHODOLOGY

This study is conducted in two stages. In stage 1, DEA is used in order to evaluate relative R&D efficiency of 34 European countries. Additionally, DEA is used not only for overall R&D model, but also for two specific R&D models – patent oriented and article oriented. The results of the relative

efficiency of the specialized models were used as the input of the next stage. In stage 2, cluster analysis is used to group countries based on their patent and article relative efficiency results.

2. 1 Data envelopment analysis

DEA is a linear programming method that is originally presented by Charnes, Cooper and Rhodes (1978) based on production function estimation. It is used for evaluation of relative efficiency of homogeneous decision making units (DMUs). For every single DMU ratio between weighted inputs and weighted outputs is calculated. Result θ can vary between 0 and 1 where $\theta = 1$ indicates 100% of relative efficiency, while result lower than 1 ($0 \leq \theta < 1$) indicates relatively inefficient operation. DMUs that are find to be relatively inefficient are compared to the efficient ones. Efficiency frontier is also known as the best practice frontier. DMUs that are relatively efficient are positioned on a frontier and are unable to increase any output, without at the same time increasing any of their inputs or reducing any of the outputs remaining and vice versa, are unable to reduce any input, without at the same time reducing any of the outputs or increasing any of the inputs remaining. One of the main advantage of DEA is the capability of handling both, multiple inputs as well as multiple outputs. However, its main downside is sensitivity to variable selection. Any increase in number of inputs or outputs results in more DMUs positioned on efficiency frontier. With careful selection of only crucial variables, this limitation can be overcome.

There are two basic DEA models, CCR and BCC model. CCR model (Charnes, Cooper and Rhodes, 1978) is basic DEA model that assumes constant returns to scale (CRS) opposed to BCC model (Banker, Charnes and Cooper, 1984) that assumes variable returns to scale (VRS). While CRS implies that for each DMU, increase of each input causes proportional increase of each output, VRS implies that this connection does not necessary has to be proportional. Additionally, when building a model, beside returns to scale, model orientation should be chosen. There are input and output orientation in DEA models and selection depends on the goals of observed set of evaluated DMUs.

Although, DEA is originally developed for relative efficiency evaluation of DMUs from public sector, its application has soon been extended also in non-public sector because it can accommodate multiple inputs and outputs that are expressed in different units.. Nowadays, DEA application can be found in efficiency evaluation in healthcare (Dukić Samaržija, Arbula Blecich and Najdek (2018), Ozcan (2017), education (Arbula (2012), Arbula Blecich (2020), Arbula Blecich and Tomas Žiković (2016), Sîrbu, Cimpoieş and Racul, (2016), R&D (Dočekalová and Bočková (2013), Lee and Park (2005), banking industry (Tuškan and Stojanović, 2016) and many other areas.

Since in this paper output oriented BCC (VRS) model is used, it can be expressed as follows (Zhu, 2009:15):

$$Max\phi + \varepsilon(\sum_{i=1}^{m} s_i^- + \sum_{r=1}^{s} s_r^+)$$

subject to

$$\sum_{j=1}^{n} \lambda_j X_{ij} + s_i^- = x_{io} \qquad i = 1, \dots, m;$$

$$\sum_{j=1}^{n} \lambda_j X_{rj} - s_r^+ = \phi y_{io} \qquad r = 1, \dots, s;$$

$$\sum_{j=1}^{n} \lambda_j = 1$$

$$\lambda_j \geq 0 \qquad j = 1, \dots, n.$$

Where X_{ij} *is* i[th] input from j[th] DMU, X_{rj} is r[th] output produced by j[th] DMU and s_i^- and s_r^+ are inputs and outputs slacks. Output efficiency is defined with the value ϕ and the DMU is efficient if if and only if $\phi = 1$ and s_i^- and $s_r^+ = 0$ for all *i* and *r*.

2. 2 Cluster analysis

Cluster analysis is a multivariate statistical method that is used to group a sample of subjects based on a set of different variables in a way that similar subjects are members of the same group. In this study, countries are subjects and are grouped based on relative efficiency results of two specialised R&D models (patent and article oriented). After subject and variable selection, distance measure or measure of similarity has to be defined. Several different methods calculate the similarity or distance between the vector x=(x1,x2,...xp) and the vector y=(y1,y2,...yp). Squared Euclidean distance is frequently used distance measure in cluster analysis that can be expressed as follows:

$$d^2(p,q) = \sum_{i=1}^{n} (p_i - q_i)^2$$

Hierarchical methods treat every data point individually as a separate cluster. Agglomerative hierarchical method starts with individual objects as initial clusters and with each subsequent step merges two nearest clusters (bottom-up approach). Opposite to this method is divisive hierarchical method where all observations are at first contained in one cluster and with each subsequent step are split recursively (top-down approach). Given the nature of the research, this study uses hierarchical agglomerative method to form different R&D clusters from efficiency results of individual subjects. Starting point in this method are individual subjects (DMUs) that are treated as the initial individual clusters. In each step that follows, two clusters that are the closest connect. Connecting continues until the stop criteria is reached (Kaufman, Rousseeuw, 1990, 2005). In the paper hierarchical agglomerative clustering is conducted based on Ward's linkage method. At the beginning of the process, mean for each variable of each cluster is calculated. After that, calculation of the squared Euclidean distance to the arithmetic mean of each cluster for each subject is being made. After that, for all cluster members, the distances sum up. The clusters form in a way that clusters merge when their overall sum of deviation is the smallest. Process of cluster analysis can be shown through dendrogram. Main advantages of hierarchical cluster analysis is that it is easy to

implement and it can be widely used in different scientific areas, number of clusters that is required for the algorithm does not have to be specified and result of this analysis is dendrogram that is useful in understanding data and process of analysis. Limitations of this method are that it cannot deal with missing data, it does not work well with different data types as well as on data sets that are very large.

3. EMPIRICAL DATA

In accordance with relevant literature (Cullman, Schmidt – Ehmcke and Zloczysti, 2009; Lee and Park, 2005; Hall et al., 1986), since investments in R&D do not have immediate effect on R&D output, lag structure on inputs is used. Previous studies in generally agree that, between R&D inputs and outputs, there is a lag of three-to-five years (Lee and Park, 2005; Acs and Audretsch, 1991) wherefore in this paper inputs are averaged for the period from 2015 to 2018. Accordingly, for outputs data form 2019 is used. In analysis, for evaluation of relative efficiency is used software DEA Solver Pro 11.0, while for cluster analysis is used Stata I/C 15.0.

Three R&D models are presented (Overall model and two specialized models – the article oriented model and the patent oriented model) that provide insight into strengths and weaknesses of each observed country with respect to obtained R&D relative efficiency results. In R&D models, two input and four output variables are used that vary depending on model specifics. Combination of input and output variables for each model are presented in Table 1.

Table 1. Variable selection and model specifications

	Overall	Article oriented	Patent oriented
(I) GERD - Average 2015-2018 (mil EUR)	×	×	×
(I) Researchers (FTE) Average 2015-2018	×	×	×
(O) Patent application 2019	×		×
(O) Patent granted 2019	×		×
(O) Citable documents 2019	×	×	
(O) Citations 2019	×	×	

Source: Authors' calculation

Input variables are collected via Eurostat. GERD (Gross domestic expenditure on R&D in mil. EUR) represents aggregate R&D for a certain country. Total R&D personnel is measured in full time equivalent (FTE). Patent application (number of patent application by country of origin) and patent granted (patent granted by country of origin) are output variables collected from European patent office, while citable documents (citable documents include articles, reviews and conference papers) and citations (All period country citations to documents published in 2019) are collected from Scimago Journal & Country Rank. Statistics for input and output variables is presented in Table 2.

Table 2. Statistics on input and output variables

	(I) GERD	(I) Researchers	(O) Patent applications	(O) Patent granted	(O) Citable documents	(O) Citations
Max	96336.2	673176	26805	21198	188259	207745
Min	39.2565	1436.75	1	1	832	612
Average	10330.3	98501.1	2412.38	1774.03	35454.9	36013.7
SD	18821.5	147926	4978.87	3901.4	45931.2	48381.5

Source: Authors' calculation

When using DEA, it is important that all input and output variables have non-negative values. In addition, during the selection of appropriate inputs and outputs, positive correlation is mandatory. Input and output correlations are presented in Table 3.

Table 3. Input and output correlation coefficients for all variables

	(I) GERD	(I) Researchers	(O) Patent applications	(O) Patent granted	(O) Citable documents	(O) Citations
(I) GERD	1	0.95705	0.96381	0.96886	0.86229	0.85163
(I) Researchers	0.95705	1	0.86608	0.8742	0.95116	0.92392
(O) Patent application	0.96381	0.86608	1	0.99402	0.74785	0.75038
(O) Patent granted	0.96886	0.8742	0.99402	1	0.73728	0.73144
(O) Citable documents	0.86229	0.95116	0.74785	0.73728	1	0.99041
(O) Citations	0.85163	0.92392	0.75038	0.73144	0.99041	1

Source: Authors' calculation

Previous table shows presence of high positive correlation among all input and output variables. In DEA, highly correlated variables are common. Dyson et al. (2001), Ramirez Hassan (2008) argue that omission of highly correlated relevant variables can cause inconsistency of efficiency estimates of some DMUs. After selecting inputs and outputs, it is necessary to define an appropriate DEA model.

4. RESULTS AND DISCUSSION

Since analysis is conducted in 2 phases, results and discussion will also be presented in 2 phases that follow the research process.

4. 1 *DEA R&D relative efficiency results*

In selecting appropriate model in section 3, orientation and returns to scale have to be specified. Model orientation is selected based on specific DMU goals. In this paper output orientation is selected. Output-oriented approach is generally more appropriate when estimating R&D efficiency because countries tend to maximize their R&D outputs with disposable inputs. Beside orientation, in model selection appropriate returns to scale have to be chosen. The CCR model assumes constant returns to scale (CRS), while the BCC model assumes variable returns to scale (VRS). To decide what model is appropriate, data for Overall, Article oriented and Patent oriented models is tested with both, CCR and BCC models. Comparison of the results of CCR (CRS) – output-oriented and BCC (VRS) – output-oriented models is presented in following table. Results show substantial differences for all three tested models.

Table 4. Relative efficiency with the use of CCR (CRS) and BCC (VRS) output-orientation for three models

	Overall		Article oriented		Patent oriented	
	CCR-O	BCC-O	CCR-O	BCC-O	CCR-O	BCC-O
No of efficient DMUs	4	14	1	10	3	6
No of inefficient DMUs	30	20	33	24	31	28
Average efficiency	0.5115	0.8838	0.3608	0.8472	0.3142	0.4612

Source: Authors' calculation

Results for all three models show considerably higher average results with BCC than with CCR models. Additionally, the number of efficient DMUs with the BCC model for all three tested models is considerably larger than with the CCR model. Results indicate that VRS are present in R&D in selected European countries. Consequently, use of BCC model is recommended.

Table 5. Efficiency results for three R&D relative efficiency models – BCC-O

No.	DMU	Overall	Article oriented	Patent oriented
1	Austria	0.6638	0.6523	0.5458
2	Belgium	0.8238	0.8238	0.4755
3	Bulgaria	0.7125	0.6453	0.1351
4	Croatia	0.9425	0.9425	0.059
5	Cyprus	1	1	1
6	Czech Republic	0.7627	0.7526	0.1521
7	Denmark	0.9463	0.9463	0.6083
8	Estonia	0.8983	0.8983	0.2489
9	Finland	0.929	0.8059	0.8901
10	France	0.8442	0.5795	0.7517

11	Germany	1	0.8887	1
12	Greece	0.9878	0.9878	0.1409
13	Hungary	0.6539	0.6338	0.1161
14	Iceland	0.585	0.585	0.2294
15	Ireland	0.8504	0.8504	0.5222
16	Italy	1	0.9082	0.6077
17	Latvia	0.5782	0.5782	0.0857
18	Lithuania	0.6193	0.6059	0.1223
19	Luxembourg	1	0.5451	1
20	Malta	1	0.9999	1
21	Netherlands	1	1	1
22	North Macedonia	1	1	0.9992
23	Norway	0.9579	0.9579	0.2253
24	Poland	1	1	0.2013
25	Portugal	1	1	0.217
26	Romania	1	1	0.0782
27	Serbia	1	1	0.0352
28	Slovakia	0.7994	0.798	0.0926
29	Slovenia	0.6873	0.6773	0.2483
30	Spain	1	1	0.2896
31	Sweden	0.9746	0.9128	0.9746
32	Switzerland	1	1	1
33	Turkey	0.8323	0.8307	0.1677
34	United Kingdom	1	1	0.4597

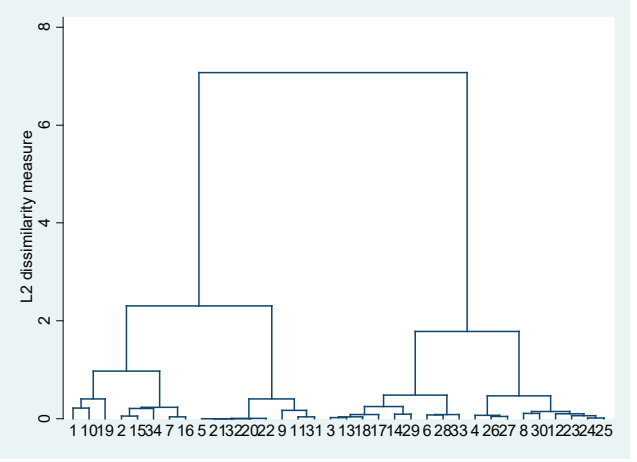
Source: Authors' calculation

If only overall model was observed, specific characteristics of different countries regarding article and patent orientation would not be revealed. Countries that achieved $\theta = 1$ (100% relative efficiency) where θ indicates the level of efficiency are relatively efficient while countries where $0 \leq \theta < 1$ are inefficient. It can be noticed that some countries are ranked relatively efficient in overall model, but are ranked inefficient in one or even all both model orientation. Likewise, Italy is evaluated to be relatively inefficient in both, article and patent orientation, but based on overall model is relatively efficient. It is due to new combination of inputs and outputs that form the new frontier of relative efficiency. These results confirm that analysis has to be carried out on each model orientation separately to provide results that are more accurate and detail.

4. 2 Cluster analysis based on specific R&D relative efficiency results

In the second stage of the analysis, cluster analysis is conducted in order to group different countries based on relative R&D efficiency results. Thus, strengths and weaknesses of countries will be revealed based on their R&D specialization. Results of relative efficiency obtained from specialized models (patent and article oriented) serve as an input for cluster analysis. This way, it is possible to separate groups of countries depending on their R&D orientation. To identify clusters, Ward's hierarchical clustering method is used to calculate the mean of each variable for each cluster. Cluster distances to the mean of the cluster are defined to be the squared Euclidean distance between countries. The process of successive clustering based on similarity of data is presented on the dendrogram below. On x-axis are countries (DMUs), and on the y-axis are distances.

Graph 1. Dendrogram for R&D clusters



Source: Author

Three clusters are identified based on results of relative efficiency of article and patent oriented R&D. Characteristics and member of clusters are presented in Table 6. Cluster 1 has 8, cluster 2 8 and cluster 3 18 members. Cluster 1 contains countries that are relatively in the middle according to patent orientation (mean = .6213625) and relatively least efficient according to article orientation (mean = .7882). In cluster 2 are positioned countries that are relatively most efficient in both, article orientation (mean = .9509125) and in patent orientation (mean = .9829875). Cluster 3 encompasses countries that are slightly more efficient in article orientation than countries positioned in cluster 1 and slightly less than countries positioned in cluster 2 (mean = .8472412), but are relatively least efficient in patent orientation (mean = .0741412).

Table 6. Characteristics of R&D efficiency clusters

Cluster		Article oriented	Patent oriented	
1	N	8	8	Austria, Belgium, Denmark, France, Ireland, Italy, Luxembourg, United Kingdom
	mean	.7882	.6213625	
	sd	.1734166	.1787516	
2	N	8	8	Cyprus, Finland, Germany, Malta, Netherlands, North Macedonia, Sweden, Switzerland
	mean	.9509125	.9829875	
	sd	.0740557	.0385605	
3	N	18	18	Bulgaria, Croatia, Czech Republic, Estonia, Greece, Hungary, Iceland, Latvia, Lithuania, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Turkey
	mean	.8274056	.1580389	
	sd	.1679547	.0741412	
Total	N	34	34	
	mean	.8472412	.4611618	
	sd	.1604353	.3636996	
Kruskal Wallis				
H(2)=		4.564	26.598	
p=		0.1021	0.0001***	
Dunn's test				
1-2		-2.046904	-1.334128	
p=		0.0203**	0.0911*	
1-3		-0.709776	3.243398	
p=		0.2389	0.0006***	
2-3		1.698809	4.813261	
p=		0.0447**	0.0000***	

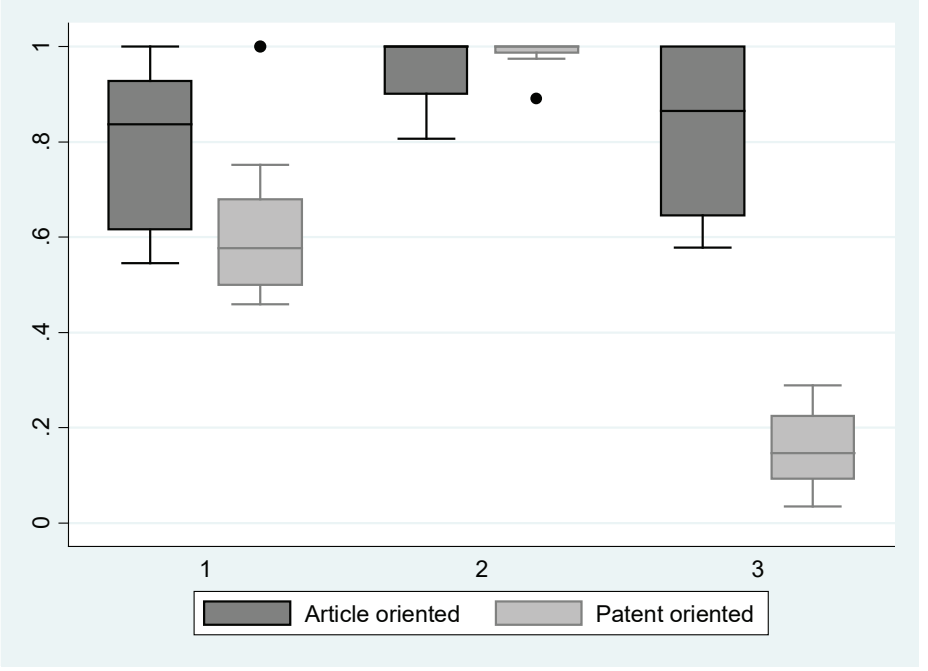
Note: ***, **, * denote significance at the 1%, 5% and 10% significance level.

Source: Authors' calculation

Since data do not follow the normal distribution, nonparametric Kruskal–Wallis test (K-W) is used to determine whether there are differences between mean ranks of the clusters for both specific R&D orientations. K-W is used when we want to compare more than two groups. Based on the results, we can conclude that there is a significant difference between all three clusters for, patent oriented efficiency results, while for article oriented efficiency results this cannot be stated on 10% significance level because p value is slightly over that value. The results are opposite to research of Chen, Hu and Yang (2011) that found that different nations have similar level of R&D efficiency when it comes to patents, while for journal publications their performance is quite different. After K-W nonparametric test, post hoc Dunn's pairwise comparison test is used to accurately

determine which specific group means are significantly different from the others. Dunn's test confirms significant difference between all clusters pairwise for patent oriented efficiency. For Article oriented efficiency, if we take results into consideration, since p value is on 10% mark, there is significant difference between cluster 1 and 2 as well as between cluster 1 and 3, but between cluster 2 and 3 we cannot confirm that there is significant difference. Countries positioned in cluster 2 and 3 have similar mean rank for patent orientation and they differ among themselves in article orientation that is significantly higher for countries in cluster 3. Cluster 1 has significantly higher results than cluster 2 in both, patent and article orientation, while in comparison with cluster 3 has significantly higher results for patent orientation and significantly lower results for article orientation. Above mentioned can be presented in form of box plot graph.

Graph 2. Box plot for Article oriented model and Patent oriented model for each cluster



Source: Author

Results presented show us that countries are more focused on article publication, rather on patent application and patent granted that is also discussed by Wang and Huang (2006). This is even more pronounced when observing mean rank of relative efficiency results of three clusters (article orientation – mean = .8472412); patent orientation – mean = .4611618). Although cluster 1 is relatively least efficient in article orientation (mean = .7882) its efficiency score is not that low compared to other two clusters (cluster 2 – mean = .9509125; cluster 3 – mean = .8274056). Regarding patent orientation, cluster 2 is most efficient (mean = .9829875) compared to cluster 1 (mean = .6213625) and cluster 3 (mean = .1580389). These results should point out how more attention needs to be focused on patents, especially in countries ranked in cluster 3. Patents

(application and granted) are among main R&D outputs and countries should make effort in this direction since previous research indicate that investment in R&D positively affects economic growth.

5. CONCLUSIONS

One of the indicators that reveals the competitiveness of a certain country is level of investments in R&D. Nevertheless, not only high level of investment is important, but its efficient usage. R&D resources are limited and, in order to use their full potential in boosting economic growth, they have to be used efficiently, especially nowadays when world is faced with global pandemic. Pandemic pushed educational, technical and research limits worldwide to a new level and forced countries, as well as private and public businesses to find new ways of operation.

This paper uses DEA to evaluate relative R&D efficiency in European countries. In addition to the overall DEA model that includes two inputs and four outputs, two additional R&D specialized models are presented – patent oriented and article oriented. This models share inputs (GERD and researchers), but based on their specialization, they have different outputs. For patent oriented model outputs are patent applications and patent granted, while for article oriented model they are citable documents and citations. In line with previous research, since the effect that investments in R&D have on R&D output is not immediate, lag structure on inputs is used. The empirical analysis is conducted in two stages. In stage 1, DEA is used in order to get R&D efficiency results for 34 countries. In addition to overall model, with two specialized models, relative efficiency results are also presented. In second stage cluster analysis is carried out to group countries based on their relative efficiency results of specialized models. Three different clusters are identified from which the countries' R&D orientation based on their relative efficiency results can be identified.

The research results reveal that, in general, countries are more efficient in article publishing rather than patent granted and application that is in line with research results of Wang and Huang (2006). Countries can be divided in tree groups. Group 1 represents countries that are least efficient in article orientation (although their results are close to results of group 2 and 3) and better than group 3, but worse than group 2 in efficiency of patent orientation. Generally, this group contains Central and Western European countries. Group 2 represents countries that are most efficient in both orientation and contains mostly developed Scandinavian countries and countries from Western Europe with addition of Cyprus, Malta and North Macedonia. Group 3 have low patent efficiency results and in the same way relatively high article efficiency. This group contains mostly Baltic countries as well as countries from Central and Southern (Mediterranean countries) Europe that is, regarding patent orientation in line with Aristovnik (2014) since his model contain patent applications and high tech patent applications as output variables. Research results can help decision-makers to get insight into sources of inefficiency. Although results, especially for some members of group 3 (e.g. Norway), are not in line with expectations, this paper deals with efficiency, not quality evaluation. Some of these countries deliver large output, but not large enough regarding resources used in output production.

However, this study has some limitations that should be addressed. When choosing inputs and outputs, quality of some data was unavailable. For example, citable documents are not divided based on quality of publication (indexation) because that kind of data was unavailable. Also, patent application and patent granted is available only as whole number, but monetary value of each patent or earnings arising from their application is not available. Other limitations derive from limitations of the methodology used. Sensitivity of efficiency results on selection of inputs and outputs, sensitivity of sample size as well as fact that results represent relative, not absolute efficiency are main limitations of DEA. Nevertheless, methodology limitations can be overcome by including only key inputs and outputs in the empirical analysis and by approaching to a specific problem consciously and carefully. Although applied to European country level, this model could be adapted to the needs of other countries as well as on regional or company level if implemented some adjustments. Future research should be directed towards finding ways to direct individual, company and country interest onto patent application and patent granted since this part of R&D is important for competiveness, as well as for economic growth, but based on research results, many countries underestimate its importance.

This scientific article was created as a part of the project "MI - yesterday, today, tomorrow" (UP.04.2.1.06.0018) financially supported by the European union within the European social fund, and as a part of the project "Impact of Intangible Capital in Croatian Economy" [uniri-drustv-18-166] financially supported by the University of Rijeka.

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Prethodno priopćenje
https://doi.org/10.31784/zvr.9.1.11
Datum primitka rada: 20. 11. 2020.
Datum prihvaćanja rada: 2. 2. 2021.

RELATIVNA EFIKASNOST ISTRAŽIVANJA I RAZVOJA EUROPSKIH ZEMALJA

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SAŽETAK

Rad vrednuje relativnu efikasnost istraživanja i razvoja europskih zemalja koristeći analizu omeđivanja podataka na uzorku od 34 europske zemlje. Istraživanje i razvoj važan su pokretač gospodarskog rasta, a budući da su resursi koje ima na raspolaganju ograničeni, njihovo učinkovito korištenje postaje sve važnije. To se dodatno ističe u današnje vrijeme kada se svijet suočava s globalnom pandemijom koja je dovela do toga da se je veliki dio poslovanja prebacio na on-line. S obzirom na to da države ne moraju biti podjednako učinkovite u svim aspektima istraživanja i *razvoja, predstavljen je cjelokupni model kao i dva specijalizirana modela (orijentirana na patente i na publikacije). Rezultati istraživanja pokazuju da je više od polovice promatranih zemalja neefikasno u području istraživanja i razvoja. Uz to, države su općenito efikasnije kada je riječ o usmjerenju na publikacije, a manje kada je riječ o orijentaciji na patente. U drugoj fazi analize, zemlje su grupirane u tri skupine na temelju rezultata efikasnosti dvaju specijaliziranih modela dobivenih u fazi 1. To je napravljeno kako bi se identificirale karakteristike odabranih europskih zemalja na temelju njihove orijentacije na istraživanje i razvoj. Rezultati ovog istraživanja mogu poslužiti kreatorima politika europskih zemalja u* pružanju us*mjerenja za potrebne napore za povećanje efikasnosti u području istraživanja i razvoja.*

Ključne riječi: *istraživanje i razvoj, efikasnost, analiza omeđivanja podataka, klaster analiza*

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Preliminary communication
https://doi.org/10.31784/zvr.9.1.12
Received: 1. 12. 2020.
Accepted: 18. 2. 2021.

EMPLOYEE ATTITUDES ON TQM IMPLEMENTATION AND JOB SATISFACTION IN PUBLIC HEALTH SECTOR

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ABSTRACT

The quality of service in the public health sector is an essential aspect that influences patient satisfaction. Providing quality in public health sector means delivering health service in an affordable, safe and effective manner, with minimal risk and harm for patients. In other words, it means fulfilling patients' needs and surpassing their expectations. In order to provide patients with good-quality and satisfactory service, many public health organizations implement quality standards that contribute with many benefits and advantages, among which employee satisfaction stands out. The objective of the research was to evaluate the attitude of employees in public health institutes towards the dimensions of job satisfaction and their perception of the level of TQM implementation, with regard to the employees' sociodemographic characteristics. In order to achieve this objective, ANOVA was used to test the hypotheses and determine the difference between observed sociodemographic characteristics with regard to the dimensions of job satisfaction and the application of TQM principles in research. Beside that, correlation coefficient was used to test the connection between overall job satisfaction and the level of TQM implementation (overall TQM principles). The findings suggest that level of education and the length of service have a significant effect on the differences in assessments among employees, while position in the workplace affects within certain dimensions of job satisfaction, as well as within their perception of the TQM implementation. Results have also shown that there is a statistically significant relationship between job satisfaction and the level of implementation of TQM principles. The present study provides valuable guidelines for public health sector managers since the results of the research indicate the level of perception of the implementation of TQM principles and job satisfaction dimensions with which employees are the most and the least satisfied, thus pointing

out to management in public health sector institutions the areas in which certain improvement measures should be implemented. As this study focuses specifically on Institutes of Public Health, future research could be expanded to encompass other public health institutions such as hospitals and private clinics as well as other sectors.

Key words: employees, job satisfaction, public health sector, quality principles, sociodemographic characteristics, TQM

1. INTRODUCTION

The connection between human resources and quality is an often-researched topic, especially regarding its potential impact on organizational performance, but only recently have organisations recognized human resources (employees) as a main source of competitive advantage, profitability, success and quality. This is supported by the fact that ISO 9001, one of the most widely spread quality standards in the world, emphasises the need to ensure the engagement and empowerment of all employees in order to successfully implement and maintain a quality system in a company.

The benefits of implementing quality principles are various and have been demonstrated in many studies (Avelini Holjevac, 1996; Priede, 2012; Carlos et al., 2016; Ismyrlis, Moschidis, Tsiotras, 2015), as will be elaborated in more detail later in the paper.

Satisfied employees are one of the crucial components of any successful and longstanding company. Therefore, this paper also presents papers investigating certain dimensions that lead to employee satisfaction or dissatisfaction.

Having in mind the small number of studies dealing with this topic in the Republic of Croatia, the authors have decided to thoroughly explore the mentioned constructs.

In order to explore the connection between job satisfaction and quality principles in more detail and better understand if, and to what extent, the sociodemographic characteristics of employees affect their job satisfaction within implemented quality systems; this paper provides an extensive literature review and presents research results based on original data collected for the purpose of this research.

The study was conducted in 2019. using a questionnaire composed on the basis of several structured questionnaires and adjusted to the specific features of public health. The sample included employees from Institutes of Public Health in Croatia that are certified by ISO 9001. A total of 281 employees participated in the research and the collected data were analysed using descriptive statistics, ANOVA and Pearson correlation coefficient.

The paper proceeds as follows. First, a detailed overview of studies concerning employee job satisfaction and the implementation of quality principles are presented. Then, the used methodology is described and results, presented. The final section includes the conclusion and research limitations, as well as future research recommendations for public health management.

2. LITERATURE REVIEW

Employee satisfaction is defined in many ways, but one of the most cited definitions is that of Locke (1976:1300) who stated that employee satisfaction can be defined as a "pleasurable or positive emotional state resulting from the appraisal of one's job or job experience". This definition clearly emphasizes the importance of positive surroundings as well as positive feelings about the job in order to feel satisfied. But for an employee to be satisfied, there are multiple dimensions that should be fulfilled to affect overall job satisfaction. Some of those dimensions are salary, relationship with superiors and colleagues, work conditions, advancement possibility, education, and more. Of course, depending on the individual, each of the dimensions contributes in varying degrees to overall job satisfaction.

Quality has been defined by famous quality gurus, such as Crosby, Juran, Deming and others, who have had a significant impact on the world through their numerous contributions and are considered instrumental in spreading the use of quality standards throughout the world. According to Crosby (1996:9), "quality is free", while according to Juran, quality can be defined as "fitness for use" (1999:4).

Despite different definitions, quality management systems are, according to numerous literature sources, highlighted as a necessary prerequisite for success in today's global world, due to the many advantages provided by these systems, such as a higher level of satisfaction for both employees and customers, increased profit and efficiency, improved competitiveness, enhanced sustainability, and many more. Only in recent times, however, have organizations come to realise that human resources are their most important resource and source of competitive advantage. Today it is absolutely clear that, to perform successfully, companies need professional, educated, motivated and engaged employees. In fact, ISO 9001, a basic quality standard around the world, identifies employees as one of the resources, among others, necessary for successful business performance.

Indeed, the indisputable link between employees and quality systems was the driving force behind this study, aimed at exploring the connection between those two main constructs (job satisfaction and application of TQM principles) – within public health institutions.

As in most countries, Croatian health system is comprised of public and private sector. Public sector encompasses the majority of health system with institutions like hospitals, Community health centres, and Institutes of public health. Being major institutionalized providers of activities aimed at early detection of people at risk (preventing diseases) and improving public health, Croatian Institutes of Public Health have been established in every county across the country to make health services available to everyone. Services provided by those institutions are essential for population health and, therefore, the quality of those services must be of the highest level. To ensure this, the management of the Institutes must be committed to quality, which includes the satisfaction of their employees. Having in mind stated, as well as the fact that within Croatian public health institutions, Institutes of Public Health, which present important part of the public health sector, are the most oriented ones toward quality standard implementation, they have been selected for this research.

The following section provides an overview of studies from the year 2000 onwards concerning employee job satisfaction, with special emphasize on employees in the public health sector, and

the implementation of quality principles, in general, and in the public health sector, in particular. At the end, the authors and their research results regarding the connection between job satisfaction and quality principles implementation in public health sector are presented.

Table 1. Employee job satisfaction

AUTHORS	RESEARCH RESULTS
Oshagbemi, 2000.	Job satisfaction is significantly correlated with length of service
Vouzas, 2004; Soltani, 2003; Soltani et al, 2004; Fotis Vouzas, 2007	The authors suggest placing greater emphasis on human resources than on work processes, bearing in mind the significant implications that this change would cause in the field of work organization, but also in understanding strategic human resource management
Martensen & Gronholdt, 2001; Matzler, Fuchs & Schubert, 2004; Delina, 2020.	Motivated and loyal employees represent value for the organization, they are more committed to continuous quality improvement and to a greater extent participate in the process of making decisions There is a relationship between employee engagement and satisfaction
Chen et al., 2006; Pisani, 2009.	Level of education influences job satisfaction Longer education was associated with significantly higher levels of general job satisfaction
Matzler and Renzl, 2007.	Trust, employee satisfaction and loyalty are significantly correlated
Buitendach, Rothmann, 2009.	Research results confirmed differences between job satisfaction and the age and race of employees
Unzicker, 2012.	Salary was highly correlated with job satisfaction
Sušanj and Šulentić, 2014.	Key factors of the communication climate are significantly correlated with job satisfaction
Kundu, Gahlawat, 2015.	Job satisfaction affects employees' intention to leave the workplace
Zardasht, Omed, Taha, 2020.	Rewarding and motivation are the most significant indicators of job satisfaction
Dziuba, Ingaldi, Zhuravskaya, 2020.	Satisfied employee devotes himself to work, performs orders better, cares for others and himself

Source: Authors' research

Research results indicate the need to focus on human resources, since their loyalty, engagement and motivation affect their job satisfaction. In addition to loyalty and motivation, some results point to salary and communication as the most important factors of satisfaction. Furthermore, job satisfaction also affects an employee's intention to leave the job and devote to work.

Table 2. Employee job satisfaction in the public health sector

AUTHORS	RESEARCH RESULTS
Bodur, 2002; Sur et al., 2004; Seo et al., 2004.	Working conditions and salary are the most important factors of health workers' dissatisfaction
Mosadeghrad, Yarmohammadian, 2006.	Leadership style is significantly related to employee satisfaction, while the greatest dissatisfaction was found in terms of salary, benefits and working conditions
Selebi, Minnaar, 2007.	All employees expressed low level of satisfaction with motivation, opportunity for creativity and innovation, independence, responsibility and recognition, while the main aspects of dissatisfaction were salary, working conditions, promotion opportunities and insufficient recognition from superiors
Mosadeghrad, Ferlie and Rosenberg, 2008.	Employees are moderately satisfied with their work and loyal to the organization they work for
Nikić et al., 2008.	Employees are satisfied with the teamwork and work they do, while they demonstrated dissatisfaction with the working conditions, amount of work they do and the impact they have on the organization
Mahmoud, 2008	There is a positive correlation between job satisfaction and level of education, leadership, organizational commitment and support
Ge et al., 2011.	Employees are moderately satisfied; stress and burnout are key factors of intrinsic and extrinsic job satisfaction
Celik, Hisar, 2012.	Job satisfaction and professionalism are significantly related. Education is a key component that affects job satisfaction
Talasaz, Saadoldin, Shakeri, 2014.	Job performance, job satisfaction, education and communication are directly correlated
Asegid, Belachew, Yimam, 2014.	Satisfaction with the work environment and group cohesion, individual responsibility and work in the hospital predict the intention to change jobs. In order to increase job satisfaction, it is required to make certain modifications
Parveen, Maimani and Kassim, 2017.	There is a statistical significance between the professional dimension and job satisfaction

Source: Authors' research

When it comes to job satisfaction in the public health sector in addition to the previously mentioned dimensions, the authors also emphasize the connection between job satisfaction and

dimensions such as professionalism, quality of working life (stress and burnout), job performance and education.

Table 3. Implementation of TQM principles

AUTHORS	RESEARCH RESULTS
Sun, Hui, Tam, 2000.	Employee engagement has a positive impact on TQM implementation, and business improvement. Furthermore, employees should be involved in TQM implementation process
Avelini Holjevac, Vrtodušić Hrgović, 2007.	Business excellence of a company is determined by the quality of products/services
Avelini Holjevac, 2007.	TQM is closely related to the business result and company's success; its main goal is to fulfil all customer needs
Kuo et al., 2009.	The quality system according to the ISO standard contributes to significant improvement of quality level and system efficiency
Priede, 2012.	ISO 9001 brings numerous business advantages – increased market competitiveness, process improvement and conquering new markets, and is one of the most often quality management systems in the world
Kathryn A. Boys, Anne E. Wilcock, 2014.	Insufficient emphasis is placed on human capital. Fostering a culture of quality in the organization requires time and necessary financial resources to implement quality principles in the field of employment, education and training
Sadikoglu and Olcay, 2014.	Insufficient employee involvement, commitment and awareness, inadequate organizational structure and lack of resources represent the main obstacles for TQM implementation
V. Ismyrlis et al., 2015; Carlos et al.,2016.	Certification according to the ISO 9001 has a significant impact on organizational results and can be a source of competitive advantage
Bakotić, Rogošić, 2015; Judeh, 2011.	Employee involvement, communication, empowerment, recognition and awards, positively affect the implementation of continuous improvement, factual approach to decision making and process approach There is a significant difference between employee involvement and educational level
Ismyrlis, Moschidis, Tsiotras, 2015.	Leadership commitment, communication and education are the most important factors for the successful operating of the quality system according to ISO 9001

Source: Authors' research

The authors point out that introducing quality system into the service sector brings many advantages that are closely related to company success. Furthermore, the research results confirm

other numerous advantages, ranging from increased competitiveness, and new markets and customers, to increased profits and increased customer satisfaction.

Finally, employee involvement, which includes education, communication and empowerment, positively contributes to quality system implementation.

Table 4. Implementation of TQM principles in the public health sector

AUTHORS	RESEARCH RESULTS
Abd Manaf, 2005.	All eight principles of the quality system are applied in hospitals. Physicians are the ones who support the implementation of quality system to the least extent
Wagner et al. 2006.	Few hospitals have implemented a quality system (Netherlands 4%, Hungary 0%, Finland 3%). Hospitals are partly focused on quality system documentation, cyclical improvement system and education, but patient participation has been neglected in all three countries
Dargahi, Rezaiian, 2007.	A significant correlation was found between employee knowledge, their behaviour, work-related activities and quality system
Lagrosen, Backstrom, Lagrosen, 2007.	Quality system requires leadership commitment in order to function successfully. Also, it's essential to strengthen the employees' role and enforce continuous improvement
Withanachchi et al., 2007.	Leadership, teamwork and ongoing oversight are key factors that have facilitated the implementation of the 5-s TQM model. Implementation of a TQM model undoubtedly improves performance
Lazibat, Burčul and Baković, 2007.	Only 18% of hospitals have been certified, while some of the institutions that have implemented a quality system still do not measure their patients' satisfaction level. When it comes to knowledge of basic terms related to quality, results for 4/5 terms indicated ignorance
Leatherman et al., 2010; Zabada, Rivers and Munchus, 1998.	Implementation of quality system principles can strengthen health systems
Talib, Rahman, Azam, 2011.	Central factors for TQM implementation in public health sector are leadership commitment, teamwork, process management, customer focus and their satisfaction, resource management, organizational culture and behaviour, continuous improvement and education were highlighted as
Sivasankar, 2013.	Most employees gave positive evaluations for quality system implementation in hospitals

Stoimenova, Stoilova, Petrova, 2014.	Quality management system according to ISO 9001 contributes to reducing errors, increasing operational efficiency in hospitals, and increasing patients' safety
Mosadeghrad, 2015.	Successful implementation of TQM depends on management involvement and commitment, internal and external customer focus, continuous improvement implementation, education, employee involvement
Jarrett, 2016.	The author proposes some more-appropriate methods for the supervision of public health services, in particular quality control methods and the need for TQM implementation

Source: Authors' research

The obtained results indicate that the employees of public health institutions positively evaluate the implementation of a quality system and that leadership commitments as well as the employees' commitment to quality are very important for the aforementioned.

Furthermore, the application of quality principles in the public health sector contributes to increasing efficiency and reducing errors in the workplace.

Depending on the country in which the research was conducted, the percentage of quality systems in hospitals also varies, but regardless of the application percentage, the need for greater patient participation and employee involvement is emphasized.

Table 5. TQM principles and employee job satisfaction in public health sector

AUTHORS	RESEARCH RESULTS
Ugboro, Obeng, 2000.	Employee empowerment and increased level of job satisfaction are directly related to leadership and application of TQM principles
Boon, Arumugam, Hwa,2005.	TQM elements significantly affect employee behaviour, especially their engagement at work, commitment to organization, and job satisfaction
Karia, Asaari, 2006.	Continuous improvement and preventive action significantly enhance job satisfaction and organizational commitment. Furthermore, employee empowerment and teamwork, training and education undoubtedly affect job satisfaction, involvement and commitment
Gregori, Napolitano et al., 2007.	Workplace and time spent in the same workplace are related to the implementation of TQM principles
Welikala, Sohal, 2008.	Employee empowerment is the main focus of a company with implemented TQM
Prajogo, Cooper, 2010.	TQM application can increase employee job satisfaction

Dragičević and Letunić, 2011.	Enhancement of job satisfaction and implementation of a quality system (ISO 9001) are correlated
Arsić et al., 2012.	Management commitment, employee education, teamwork, employee compensation and performance appraisal have a positive impact on employee satisfaction
Ooi et al., 2013.	TQM principles (leadership, process management, customer focus) significantly affect the quality of employees' working life (job satisfaction, commitment to the organization, involvement in the work)
Liu, Liu, 2014.	Quality systems increase job satisfaction and a sense of a belonging, and reduce workload and stress

Source: Authors' research

In the end, the results of the presented studies indicate a positive connection between the implementation of a quality system and employee job satisfaction. Furthermore, quality principles also positively affect employee engagement and their commitment to work, so it can be concluded that quality system implementation contributes to significant positive changes regarding employee satisfaction and more efficient hospital operation.

Although there are researches in the public health sector, there is a limited number of researches conducted in public health institutes in particular sector. Also, a limited number of studies explore the perception of satisfaction depending on various sociodemographic characteristics. Therefore, that was the motive for this research.

3. RESEARCH METHODOLOGY

The general objective of this study was to evaluate the attitude of employees in public health institutes towards the dimensions of job satisfaction (salary, relationship with colleagues, relationship with superior, job characteristics, advancement opportunities, acknowledgments, work conditions and education) with implemented quality systems, with regard to the employees' sociodemographic characteristics – level of education, position in the workplace and the length of service, as well as to find out is there a relationship between overall job satisfaction and level of TQM implementation (overall TQM principles).

In relation to that, four hypotheses were postulated:

H1: There is a statistically significant difference in attitudes towards job satisfaction and the application of TQM principles with regard to employees' level of education.

H2: There is a statistically significant difference in attitudes towards job satisfaction and the application of TQM principles with regard to employees' position in the workplace.

H3: There is a statistically significant difference in attitudes towards job satisfaction and the application of TQM principles with regard to employees' length of service.

H4: There is a strong correlation between overall job satisfaction and the level of implementation of TQM principles.

The questionnaire was constructed using several structured questionnaires from domestic and foreign literature, and adapted to the specific features of public health care in Croatia. When it comes to job satisfaction, the most common dimensions were taken into account (salary, relationship with colleagues, relationship with superior, job characteristics, advancement opportunities, acknowledgments, work conditions and education) based on multiple sources (SO GO SURVEY; Pupavac, Lipovaca, Secen, 2012; Employee satisfaction survey by Macedonian State Statistical Office and others). The application of TQM (leadership, improvement, people engagement, focus on processes and customers) was measured with items from Kanji model and ISO 9001:2015. The questionnaire consisted of three parts. The first part dealt with the sociodemographic data of the employees, while the second and third part focused on job satisfaction dimensions and the application of TQM principles, respectively. At the end of the first part of the questionnaire, employees were given the opportunity to express their recommendations for improvement.

In filling out the questionnaire, the employees were asked to rate each variable on a scale from 1 to 5; with regard to job satisfaction – 1 being "extremely dissatisfied" and 5 being "extremely satisfied" and with regard to the application of TQM principles – 1 being "not in the least" and 5 being "to a very large extent".

Prior to the main research, a pilot study was conducted. Based on the collected feedback, certain minor changes were made, upon which the main research was carried out from mid-April to early June 2019.

The sample was consisted of employees from Institutes of public health that have implemented and certified ISO 9001. The approval to participate in the research was sent to general directors of Institutes and upon their written consent, employees were contacted via e-mail consisting a link to anonymous Google form survey. A total of 710 employees of Institutes of Public Health in Croatia were given the opportunity to participate in the research. The response rate was 40% (281 employees).

Based on obtained sociodemographic characteristics of employees, it was concluded that the majority of the population is middle-aged, non-managerial level employees with finished graduated studies, that woman prevail over man and almost 80% of the employees have between 0-20 years of service in the Institute.

Cronbach's Alpha test was used to check the questionnaire's reliability. The results of the test indicated a satisfactory level of validity and internal consistency, thus allowing further analysis. Namely, the values of the individual dimensions were above 0.70, while the overall reliability of two main constructs (overall job satisfaction and overall – TQM principles) in the research was above 0.90.

Collected primary data were analysed using SPSS v.23, with descriptive statistics, ANOVA, and Pearson correlation coefficient. Arithmetic mean and standard deviation were calculated for each question, and the questions with the lowest and highest values of the arithmetic mean of the employees' answers were highlighted.

4. RESEARCH RESULTS

The employees rated job satisfaction with scores ranging from 2.91 (satisfaction with recognition for a job well done) to 4.06 (satisfaction with working hours):

Table 6. Descriptive statistics – job satisfaction

Variables	$\bar{x}$	Sd
Leadership	3,32	1,18
Relationship with colleagues	3,88	1,03
Opportunities for future advancement	3,02	1,30
Career progression	3,29	1,28
Salary compared to the work done	3,26	1,27
Teamwork	3,53	1,20
Communication with immediate superior	3,96	1,16
Other fees, such as transport to work	3,46	1,24
Possibility for continuous education	3,47	1,20
The content of the work you do	3,94	1,00
Ability to use knowledge and skills in workplace	3,86	1,02
Working hours	4,06	1,01
Workload	3,35	1,12
Availability of equipment and other resources necessary for the job	3,30	1,17
Recognition for a job well done	2,91	1,28
Evaluation and understanding of suggestions regarding job	3,29	1,14
Learning opportunities within working hours	3,21	1,25
General job satisfaction	3,73	0,98

Source: Authors' research

The standard deviation is greater than 1 for all variables, so in those cases the scatter of the data is greater than the arithmetic mean. Besides working hours, employees were very satisfied with communication with immediate superior, the content of the work they do, relationship with colleagues and ability to use knowledge and skills in, while some additional activities can be focused on opportunities for future advancement in business, learning opportunities within working hours, salary compared to the work done, career progression in organization, evaluation and understanding of suggestions regarding job, availability of equipment and other resources necessary for the job and leadership.

Employees rated general job satisfaction as satisfactory (3.73; SD 0.98), so it can be concluded that employees are satisfied with their jobs. But despite this relatively good score, it is obvious that there is still room for certain improvements which could help to achieve a higher level of employee satisfaction.

Furthermore, the employees rated the application of TQM principles with scores ranging from 2.77 (active use of the employee proposal collection system) to 4.04 (management's responsibility for quality in the organization):

Table 7. Descriptive statistics – TQM principles

Variables	$\bar{x}$	Sd
Management's responsibility for quality in the organization	4,04	1,02
Participation of heads of organizational units in the process of quality improvement	3,60	1,08
Leadership and employee motivation	2,93	1,19
Making decision based on facts	3,07	1,20
Providing feedback about employees results	3,13	1,20
Availability of funds required to meet the objectives of organizational units	3,23	1,12
Encouraging business communication through teamwork	3,19	1,19
Finding solutions as a team	3,26	1,17
Manager support in quality improvement	2,84	1,17
Information you receive about the results of your work	3,02	1,20
Resolving and processing complaints	3,23	1,19
Customer satisfaction assessment	3,33	1,11
Defining current and future requirement of service users	3,39	1,05
Use of information obtained from users to improve the service	3,52	1,08
Contribution of the internal audit results to the improvement of quality management system in the organization	3,55	1,14
Existence of a continuous improvement culture	3,35	1,10
Active use of the employee proposal collection system	2,77	1,23
Implementing improved service after detected error	3,23	1,17
Use of data from complaints to improve quality and resolve issues	3,20	1,19

Source: Authors' research

The standard deviation is greater than 1 for all variables, so in those cases the scatter of the data is greater than the arithmetic mean. In addition to the stated values, employees have indicated the need for enhancement regarding manager support in quality improvement, leadership and employee motivation, information they receive about the results of their work, and other variables, while the use of information obtained from users to improve the service, contribution of the internal audit results to the improvement of quality management system in the organization and participation of heads of organizational units in the process of quality improvement have been rated with high level of application.

A small number of questions in the questionnaire were intended exclusively for manager-level employees, because to answer to them, certain knowledge and information are required that not

all employees possess. Manager-level employees rated these variables with scores ranging from 3.51; SD 0.91 (measuring process results) to 3.72; SD 0.79 (defining processes according to user requirements). Furthermore, integration of quality principles into operational management (mean 3.57, SD 0.95) was rated little lower than clearly defined quality objectives (mean 3.70, SD 1.05). The standard deviation for only one variable is greater than 1, i.e., out of a total of four variables, three of them have a standard deviation less than 1, which in these cases indicates a small scatter of data from the arithmetic mean.

Table 8. Quality principles' application from the managerial aspect

Variables		N	%	$\bar{x}$	Sd
Integration of quality principles into operational management	Total	53	100,0 %	3,57	0,95
Clearly defined quality objectives	Total	53	100,0 %	3,70	1,05
Processes defined according to users requirements	Total	53	100,0 %	3,72	0,79
Measuring process results	Total	53	100,0 %	3,51	0,91

Source: Authors' research

The employees were given the opportunity to put forward suggestions for improvement. The majority of the 26 collected suggestions referred to the need for better organization of work, better information flow, and improved communication within the Institutes. Part of the suggestions also referred to reducing the workload and improving interpersonal relationships.

As mentioned above, the collected primary data were analysed using ANOVA and correlation coefficient. The test results for the observed sociodemographic indicators with regard to the observed dimensions of job satisfaction and the application of TQM principles using ANOVA are presented below (Table 9).

For the purpose of this research, the employees' educational level was divided into nine classes: primary education, secondary school education lasting less than three years, secondary school education lasting less than four years, secondary school education lasting four or more years, undergraduate university/professional study, graduate university/professional study, postgraduate specialist study, postgraduate scientific master's study and postgraduate university doctoral study.

The employees' position in the workplace was defined using several categories: top management, head of the organizational unit (e.g. service), head of the sub-unit, and other employees, while regarding their length of service they were divided into 5 categories: 0–10 years, 11–20 years, 21–30 years, 31–40 years and more than 40 years. The obtained results regarding stated are shown in Table 9.

Table 9. Results of ANOVA test

Variables	N	$\bar{x}$	Sd	p1	F1	p2	F2	p3	F3
Salary	281	3.3577	1.12330	**0.000**	8,034	0.159	1,742	**0.000**	15,530
Relationship with colleagues	281	3.7028	1.03758	0.136	1,563	0.130	1,896	**0.000**	6,573
Relationship with superiors	281	3.6388	1.04298	**0.000**	3,904	0.087	2,211	**0.000**	11,125
Job characteristics	281	3.8986	.94086	0.028	2,196	0.186	1,615	**0.012**	3,261
Advancement opportunities	281	3.1530	1.23335	**0.000**	3,640	**0.01**	5,517	**0.000**	8,488
Acknowledgments	281	3.1014	1.14620	**0.000**	4,935	**0.013**	3,666	**0.000**	10,452
Work conditions	281	3.5694	.89799	**0.000**	6,635	**0.020**	3,327	**0.000**	9,815
Education	281	3.3416	1.11276	**0.001**	3,339	**0.042**	2,772	**0.001**	5,074
General job satisfaction	281	3.7295	.98460	**0.000**	4,019	0.077	2,310	**0.000**	7,888
Overall job satisfaction	281	3.4762	.88212	**0.000**	4,710	**0.017**	3,440	**0.000**	12,163
Leadership	281	3.4110	.90441	**0.000**	4,353	0.077	2,301	**0.000**	7,766
Engagement of people	281	3.1127	1.04576	**0.000**	4,844	**0.004**	4,618	**0.000**	9,834
Focus on processes and customers	281	3.2909	1.00828	**0.000**	5,493	**0.023**	3,222	**0.001**	5,005
Improvement	281	3.2826	1.01151	**0.000**	5,558	**0.013**	3,652	**0.000**	6,387
Quality principles application from the managerial aspect	53	3.6226	.78695	0.635	,642	0.070	2,809	0.523	,813
Overall – TQM principles	281	3.2577	.94317	**0.000**	5,643	**0.011**	3,786	**0.000**	8,297

p1, F1 - Results of ANOVA test with regard to educational level

p2, F2 - Results of ANOVA test with regard to position in the workplace

p3, F3 - Results of ANOVA test with regard to length of service

Source: Authors' research

With a 95% ($p < 0.05$) confidence level, it can be stated that there is a statistically significant difference in the average scores for salaries, relationship with superior, job characteristics, advancement opportunities, acknowledgements, work conditions, education, general and overall job satisfaction, leadership, engagement of people, focus on processes and customers, improvement, and overall -TQM principles, when it comes to employees' educational level and length of service. Relationship with colleagues also demonstrated a statistically significant difference in the average scores when it comes to length of service, but not when it comes to educational level.

When it comes to the position held in the workplace, there is a statistically significant difference in average scores for previously mentioned variables, except when it comes to average scores for salary, relationship with colleagues, relationship with superiors, job characteristics, general job satisfaction, leadership, and quality principles application from the managerial aspect.

Therefore, we can state that the **hypothesis H1 and H3 are confirmed, while H2 is partially confirmed.**

Since obtained results demonstrated statistically significant results, Tukey HSD post hoc test was used to examine which arithmetic means differed significantly from one another:

- When it comes to education level, the results pointed out that for overall-TQM principles, focus on processes and customers, improvement, engagement of people and leadership, there is a statistically significant difference between employees with primary education and employees with completed secondary education/ undergraduate, graduate and postgraduate study, while for the remaining variables there is a difference between employees with secondary education and employees with a graduate degree study / postgraduate study ($p < 0.05$)
- When it comes to position in the workplace, the results pointed out that for overall-TQM principles, focus on processes and customers, improvement, advancement opportunities, recognition, work conditions and engagement of people there is a statistically significant difference between other employees and the head of the organizational unit/head of the sub-unit ($p < 0.05$)
- When it comes to length of service, the results pointed out that there is a statistically significant difference for all variables ($p < 0.05$) between employees employed from 0-10 years and the ones with longer length of service (11-20 years, 21-30 years and 31-40 years)

In order to examine the interrelationship between two variables – overall job satisfaction and level of implementation - overall TQM principles, a correlation was conducted and results presented in table 10:

Table 10. Results of Pearson correlation coefficient

		Overall – TQM principles
Overall job satisfaction	r	,862**
	p	,000
	N	281
**. Correlationn is significant at the 0.01 level		

Source: Authors' research

From the results shown in table 10., regarding the level of Pearson's correlation coefficient for overall job satisfaction and the level of implementation of overall TQM principles, it can be concluded

that there is a correlation of strong intensity ($r = 0,862$; $p < 0,01$), i.e., it indicates that the observed dimensions are very positively related and that **hypothesis H4 is confirmed**.

Data presented in Table 11 summarise the hypotheses testing in this research:

Table 11. Summary of hypotheses testing

	HYPOTHESIS	METHOD	RESULTS
H1	*There is a statistically significant difference in attitudes towards job satisfaction and the application of TQM principles with regard to employees' level of education.*	ANOVA	Confirmed
H2	*There is a statistically significant difference in attitudes towards job satisfaction and the application of TQM principles with regard to employees' position in the workplace.*	ANOVA	Partially confirmed
H3	*There is a statistically significant difference in attitudes towards job satisfaction and the application of TQM principles with regard to employees' length of service.*	ANOVA	Confirmed
H4	*There is a strong correlation between overall job satisfaction and the level of implementation of TQM principles.*	Pearson correlation	Confirmed

Source: Authors' research

The results of tested differences in the ratings of the observed constructs with regard to the selected sociodemographic characteristics demonstrate that education level and length of service significantly affect the differences in the employees' assessments. Furthermore, the results of conducted Pearson correlation indicate on correlation of strong intensity between the observed constructs.

The obtained results can be compared with the results of Judeh (2011), Mahmoud (2008) and Chen et al. (2006) who argued that level of education affects job satisfaction, while the study by Oshagbemi (2000) confirmed that the length of service is related to job satisfaction. The research results of Pisani (2009) demonstrate that a higher educational level was associated with significantly higher levels of job satisfaction.

Results obtained by Pearson's correlation can be compared to the ones by Mosadeghrad (2015) and Boon, Armugam and Hwa (2005) who confirmed the correlation between the TQM principles and job satisfaction dimensions.

5. CONCLUSION AND DISCUSSION

In today's global market, the quality of a service is pivotal, regardless of whether it is provided by a public or private institution, or in a developed or undeveloped country. Some sectors, such as public health sector, are particularly affected by strict requirements and higher expectations because their services concern human lives and the slightest mistake (insufficient quality) can be fatal.

The above implies that if the necessary level of quality is to be achieved, many preconditions need to be fulfilled, one of the most important ones being satisfied employees. Therefore, this study has integrated all the above stated – quality standards, job satisfaction and the public health sector – with the aim of exploring the attitudes of employees in public health institutes towards the observed dimensions of job satisfaction with the implemented quality system, with regards to employees' sociodemographic characteristics.

Cronbach's Alpha test results indicated a satisfactory level of validity and internal consistency. Values for individual dimensions were above 0.70, while the overall reliability of two main constructs in the research was above 0.90.

Descriptive statistics pointed out that employees rated job satisfaction with scores ranging from 2.91 (satisfaction with recognition for a job well done) to 4.06 (satisfaction with working hours), while general job satisfaction was rated as very good (3.73).

Employees rated the application of TQM principles with scores ranging from 2.77 (active use of the employee proposal collection system) to 4.04 (management's responsibility for quality in the organization), while manager-level employees gave scores ranging from 3.51 (measuring process results) to 3.72 (defining processes according to user requirements) in response to four extra questions that were relevant for that particular group of respondents. Even though management's responsibility for quality achieved the highest rate, management support and leadership have been rated lower, which indicates the area for improvement regarding management role that is crucial in both aspects.

Lower results for job satisfaction and TQM principles' application indicate the need for improvements on relation between superiors and employees. One of the measures can be focused on fostering employee recognition. If employees receive recognition for a job well done, it could encourage them to participate in proposal collection system.

The results of ANOVA indicated that educational level and length of service significantly affect the differences in assessment of the employees in all dimensions of job satisfaction and all analysed TQM principles., while position in the workplace affects the differences in assessment of the employees when it comes to certain dimensions (advancement opportunities, acknowledgements, work conditions, education, overall job satisfaction, engagement of people, focus on processes and customers, improvement and overall TQM principles). These results are consistent with those of other authors (Judeh, 2011; Mahmoud, 2008; Chen et al., 2006; Oshagbemi, 2000; Pisani, 2009).

Based on the above, hypotheses H2 is partially confirmed, while H1 and H3 are confirmed, meaning there is a statistically significant difference in attitudes towards the observed dimensions of job satisfaction and the application of TQM principles among employees, with regard to stated sociodemographic characteristics.

The results of Pearson's correlation coefficient indicate that overall job satisfaction and the level of implementation of TQM principles are very positively related, which confirms hypothesis H4.

It should be noted that this study has certain limitations. First, the research was conducted within institutes that have implemented and certified ISO 9001 and even though the collected sample was representative, future research should include other public health institutes or even other healthcare institutions.

Second, studies dealing with this topic were almost entirely from foreign literature sources, so there was limited comparison with similar studies in the domestic literature.

Also, some of the employees' sociodemographic data was used in analysis (length of service, position in the workplace and education level).

Overall, this paper makes valuable contributions to managers in public health sector. The results of the research presented in this paper can be used as guidelines for the management of other Institutes of public health, and generally - public and private health institutions in the Republic of Croatia and wider, and can also provide guidance for further research of key dimensions of employee satisfaction within implemented quality systems. Having in mind the obtained results, especially the fact that TQM principles are highly connected to employees' satisfaction, public health management should definitely take a step towards implementation of quality standards. Even though this analysis has shown that in general, employees in public health sector are satisfied with their job, it is important not to forget that there is always room for improvement; not only in work processes, but in every sphere of work life, because satisfied employees are the guarantors of quality and the strongest competitive advantage.

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Prethodno priopćenje
https://doi.org/10.31784/zvr.9.1.12
Datum primitka rada: 1. 12. 2020.
Datum prihvaćanja rada: 18. 2. 2021.

STAVOVI ZAPOSLENIKA O IMPLEMENTACIJI TQM-A I ZADOVOLJSTVU POSLOM U SEKTORU JAVNOGA ZDRAVSTVA

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SAŽETAK

Kvaliteta usluge u javnozdravstvenom sektoru važan je aspekt koji utječe na zadovoljstvo pacijenata. Naime, osigurati kvalitetu u javnom zdravstvu znači pružati zdravstvene usluge na pristupačan, siguran i učinkovit način, uz minimalan rizik i štetu za pacijente. Drugim riječima, to znači ispuniti potrebe pacijenata i nadmašiti njihova očekivanja. Stoga, kako bi pacijentima pružile kvalitetne i zadovoljavajuće usluge, mnoge javnozdravstvene organizacije implementiraju standarde kvalitete koji imaju mnoge prednosti, a među kojima se posebno ističe zadovoljstvo zaposlenika. Cilj ovog istraživanja bio je ispitati odnos zaposlenika u zavodima za javno zdravstvo sa implementiranim sustavom upravljanja kvalitetom, prema dimenzijama zadovoljstva poslom i njihovu percepciju razine provedbe TQM-a, s obzirom na sociodemografske karakteristike zaposlenika. Kako bi se to postiglo korištena je ANOVA za testiranje hipoteza i utvrđivanje razlike između promatranih socodemografskih karakteristika s obzirom na dimenzije zadovoljstva poslom i primjenu načela TQM –a u istraživanju. Uz to, korelacijom je ispitana povezanost između ukupnog zadovoljstva poslom i percepcije primjene ukupnih načela TQM-a. Dobiveni rezultati sugeriraju da stupanj obrazovanja i radni staž značajno utječu na razlike u ocjeni među zaposlenicima, dok pozicija na poslu utječe u manjoj mjeri, tj. kod određenih dimenzija. Rezultati također ukazuju na korelaciju jakog intenziteta između ukupnog zadovoljstva poslom i ukupnih načela TQM-a. Istraživanje obuhvaća vrijedne smjernice za upravljanje zdravstvenim ustanovama budući dobiveni rezultati istraživanja ukazuju na načela kvalitete i dimenzije zadovoljstva poslom kojima su zaposlenici najviše, odnosno, najmanje zadovoljni, te samim time usmjeravaju uprave zdravstvenih ustanova na područja u kojima je potrebno provesti određene mjere za poboljšanje. Budući je istraživanje posebno usmjereno na zavode za javno zdravstvo, buduća istraživanja se mogu proširiti na način da obuhvate i druge javnozdravstvene ustanove poput bolnica, ali i privatnih klinika, kao i ostale sektore.

Ključne riječi: *zaposlenici, zadovoljstvo poslom, zdravstveni sektor, načela kvalitete, socio-demografska obilježja, TQM*

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Preliminary communication
https://doi.org/10.31784/zvr.9.1.13
Received: 23. 11. 2020.
Accepted: 10. 2. 2021.

THE IMPORTANCE OF SOCIALLY RESPONSIBLE MARKETING PRACTICES ON THE HEALTY FOOD MARKET FROM THE PERSPECTIVE OF STUDENTS

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ABSTRACT

It is widely believed that young people are not overly concerned about their health or that they take excessive care of their eating habits. However, marketing experts see them as an extremely important and potentially large market, and consider all socially responsible business initiatives as long-term investments that will increase the value of the company. In the healthy food market, marketing practices are among the most important activities of socially responsible business. The purpose of this study is to explore the importance of different socially responsible marketing practices on the healthy food market. The questionnaire was administered to 519 students and the results were analysed using latent class analysis (LCA). Research results confirm the importance of understanding the influence of key demographic variables (gender and household income) on customers' perceptions of socially responsible marketing. An important limitation of the research is the number and selection of socially responsible marketing practices. There are only a few studies that segment the market based on socially responsible marketing practises. A suggestion for future research is to use longitudinal data with more marketing practices tested.

Key words: *Corporate social responsibility (CSR), Socially responsible marketing (SRM), Healthy food market, Student population*

1. INTRODUCTION

Marketing professionals are often criticized for the way they design and conduct business activities. They are often blamed for harming consumers and society with their activities. Many authors (Laczniak and Shultz, 2020; Čutura, 2018; Lončarić, 2009) have criticized Friedman's claim that the only social responsibility of business is to maximize its profits within the law, as a dubious and counter-productive notion. Lončarić (2009) claims that managers should make marketing

decisions based on the principles of ethics and social responsibility, while Stanic et al. (2016) state that socially responsible business represents a business model and management style in which the profit is realized in a socially responsible manner. The discussion of ethical behavior through marketing activities leads to the definition of social responsibility of marketing. It involves marketing behavior that is not oriented exclusively towards achieving marketing goals, i.e. market, sales, and profit goals of economic entities, but the one that at the same time also seeks to protect and strengthen the interests of society (Previšić and Ozretić Došen, 2004). Consumers are becoming increasingly socially conscious when making their purchasing decisions, which provides an incentive for companies to integrate social responsibility into their product offerings (Prendergast and Tsang, 2019). Consumption practice shows that the market is the most efficient and effective judge of social values and through their own consumption individuals can influence social change.

In recent years, both in the world and in the Republic of Croatia, interest in healthy food has increased. The importance of healthy food is promoted through various campaigns and in the media, which greatly influences consumer preferences. The healthy food market includes natural and organic foods. In 2016, the global organic market ranged from € 3 billion in Canada to € 38.9 billion in the US. At the EU level, it was worth € 30.7 billion with the highest consumption in Germany and France (€ 9.5 and € 6.7 billion respectively). In China, it amounted to € 5.9 billion. The sales of organic products in the EU increased from € 20.8 billion in 2012 to € 30.7 billion in 2016 (European Parliament, 2019). Although Germany is the leading market for organic products, Switzerland and the Nordic countries boast the highest levels of per capita consumption. European consumers have a high level of awareness for organic products at 61%, with a further 11% who are actively looking for such products. The places of purchase are mostly general retailers/stores or specialized organic retailers, while the appeal of different products differs between countries, e.g. the United Kingdom has the largest market for organic fish (http://www.statista.com). The EU's organic logo guarantees that EU rules are respected in production, and labelling is mandatory for pre-packaged food. For processed foods, the logo means that at least 95% of the ingredients are of organic origin.

The paper draws on an empirical study by Patino et al. (2014) on the importance of different marketing practices. Patino et al. (2014) examined the importance that consumers in the United States place on different socially responsible marketing practices, and researched whether the level of importance varies by race, gender and income. The subject of this research is the importance of socially responsible behaviour in the healthy food market. The aim of this paper is to explore the importance that customers attach to different types of socially responsible marketing practices.

Hur et al. (2015) claim that due to the growing interest in corporate social responsibility (CSR), many companies have been investing considerable effort to identify how consumer demographics relate to CSR. Despite that, Patino et al. (2014) notice that relatively less attention has been devoted to how demographic variables may influence the importance of different socially responsible marketing practices for consumers. Therefore, our aim is to analyze further the potential impact of two important socio-demographic variables, namely gender and income among student population. Rao and Tilt (2020) suggest that limited research has examined whether gender diversity has any influence on corporate social responsibility (CSR). Hur et al. (2015) argue that

marketers are concerned about better segmenting their marketing activities and emphasize the importance of gender in the market segmentation process. They also point out that their findings imply that the effects of CSR perception are not equal across gender and suggest that academics and practitioners need to identify the effect of gender on CSR. Regarding household income, Carvalho et al. (2010) state that the influence of customer perception on company social behaviour differs across low and high-income customers. Cambra-Fierro et al. (2020) also confirm the importance and impact of consumer income in the context of CSR in emerging markets. Therefore, we have additionally tested whether there are statistically significant differences in perceptions of the importance of different socially responsible marketing practices depending on the respondents' gender and household income. If marketers are to create a better world through socially responsible marketing, they require a comprehensive roadmap of what that means and where it leads (Laczniak and Shultz, 2020).

The environmental business segment and the increasing attention paid to healthy food has prompted us to reconsider all aspects of doing business in the healthy food market. With the increased presence of various negativities such as obesity, pesticides, contaminated food, GMO food and various diseases, the market for healthy food has grown. In this paper, young people's perception of the importance of the ten observed socially responsible marketing practices in the healthy food market is observed.

2. SOCIALLY RESPONSIBLE BUSINESS

2. 1 The concept of social responsibility

Corporate social responsibility (CSR) has a long history. Many scholars have proposed their own definitions that have developed, evolved and changed over time. However, although a unique definition does not exist, the essence of the concept is the same. Howard R. Bowen, who is considered the father of the term "Corporate Social Responsibility", offered one of the first definitions of this concept in 1953. His initial definition of CSR was: "Corporate social responsibility refers to the obligation of businessmen to pursue those policies, to make those decisions, or to follow those lines of action which are desirable in terms of objectives and values of our society".

Hopkins (2014) states that corporate social responsibility (CSR) is:

1. A process that is concerned with treating the stakeholders of a company or institution ethically or in a responsible manner. 'Ethically or responsible' means treating key stakeholders in a manner deemed acceptable according to international norms.
2. Social includes economic, financial and environmental responsibility. Stakeholders exist both within a firm or institution and outside.
3. The wider aim of social responsibility is to create higher and higher standards of sustainable.

In addition to numerous authors, organizations have also defined CSR. For example, the European Commission (2011) puts forward a new definition of CSR as "the responsibility of enterprises for their impacts on society" with the aim of:

1. Maximising the creation of shared value for their owners/shareholders and for their other stakeholders and society at large;
2. Identifying, preventing and mitigating their possible adverse impacts.

Corporate social responsibility has an internal and an external dimension (Pavić-Rogošić, 2012). Internal dimensions of CSR refer to various activities within a company and include employees, areas of investment in human capital, health and safety at work, change management, lifelong learning and empowerment of employees, better flow of information within the company, and better balance between work, family, and leisure. Internal CSR may also include the position of women, criteria for their promotion, equal pay of men and women, dismissal of workers, job security and the like. External dimensions of CSR extend the socially responsible business into the local community and involve a wide range of stakeholders: business partners, suppliers, consumers, public administration, local associations, etc. Socially responsible business integrates companies in their local setting. Companies contribute to their communities by providing jobs, paying taxes, caring for the workers' health and the stability and prosperity of the community in which they operate. The knowledge and skills of the local working population and the reputation that the company has in the local setting are important to them. They are involved in various ways in the local community, caring for the environment, fighting against corruption through transparent business, employing people with special needs, collaborating with the community, sponsoring various sports and cultural clubs and events, donations to charity, etc.

Laczniak and Shultz (2020) claim that CSR is a broad umbrella term, which reflects collective social expectations for business. There are many published research on CSR in Human resources, CSR operations, CSR Finance etc. They state that socially responsible marketing (SRM) is part of the broader domain of corporate social responsibility. Laczniak and Shultz (2020) suggest a normative definition of socially responsible marketing (SRM) at the theoretical core of which is the social contract, implicit understanding between the members of society and business organizations (including marketers), and its three elements: corporate citizenship, stakeholder orientation, and social/environmental sustainability. This complete definition of SRM additionally incorporates distributive justice as an important ethical measure and constructive engagement as its pragmatic compass for keeping a SRM focus.

Rudawska (2013) explains the changing role of marketing activities toward social responsibility. SRM activities have the potential to create stronger relationships between firms and customers and are an important source of value for customers. She further states that recent researches have revealed that companies that are perceived by the public as adopting more SRM practices are more likely to perform financially better than those companies that do not.

The following table provides an overview of previous research and elaborates on various socially responsible marketing practices.

Table 1. Elaboration of previous research on socially responsible marketing

"Corporate social responsibility practices in India: a comparative study of MNCs and Indian companies" Narwal, M., Singh, R., (2013)	The paper explores different corporate social responsibility practices and compares Indian companies and multinational corporations (MNCs) operating in India. The results show that there are minor differences in CSR practices of Indian companies and MNCs. The conducted factor analysis for MNCs and Indian companies resulted in the extraction of four factors that represent CSR practices: environmental marketing, sustainable development, local community support, and transparency and accountability. The difference is empowerment as the fifth factor in MNCs.
"Blinds up or down? The influence of transparency, future orientation, and CSR on sustainable and responsible behavior" Foscht T., Lin Y. and Eisingerich A. B. (2017)	The key role of business transparency in influencing sustainable and responsible user behavior is researched. Positive benefits of transparency vary depending on the future orientation of the company, corporate social responsibility (CSR) and the level of customer involvement. The results show that transparency has a direct and positive effect on customers' willingness to engage in sustainable and responsible consumption.
"Socially responsible human resource practices: disclosures of the world's best multinational workplaces" Frangieh C. G., Yaacoub H. K. (2018)	The authors encourage discussion of socially responsible practices implemented by the human resources departments of world`s best MNCs. Socially responsible human resource management aims to improve various aspects of an employee's life and fulfill an employee's social and personal expectations. They highlighted two important socially responsible human resource practices: equal career development opportunities and the integration of work and family practice.
"Corporate social responsibility in food retailing" Piacentini M., MacFadyen L. and Eadie D. (2000)	The motivation of food retailers to engage in socially responsible activities is investigated. The study sought to determine the scope of CSR activities and the company's motivation to operate. The authors found that the main motives for retailers to accept socially responsible business are space maximization, profitability, and customer pressures. Although some proactive companies recognized the benefits of being considered socially responsible, no company was driven primarily by philanthropic motives.

"Role of CSR in the consumer decision making process – The case of India" Sudeepta Pradhan (2016)	This study identified factors affecting a consumer's purchase intentions while purchasing goods from a socially responsible firm. In the Indian context, most respondents have confidence in CSR but price plays a highly crucial role. Most customers believe that the company should conduct responsible activities using its own resources rather than charging it from their customers.
"CSR – consumption paradox: examination of UK apparel companies" Mei Yu, Dongmei Cao (2018)	The research relates to consumer behaviour in relation to the corporate social responsible practices of 21 popular clothing companies in the UK. The results show that there is no significant difference of pro-social consumption for any group according to gender, education, occupation or income. Public awareness of CSR is still relatively weak and there is no significant correlation between consumer awareness of CSR practices and actual shopping behaviour. Finally, most consumers pay more attention to prices and quality than CSR-related products and are therefore unwilling to sacrifice for pro-social products or brands.

Source: Authors' research

3. RESEARCH MODEL

3. 1 Sample description and research methods

Empirical research was conducted among students of the University of Split during January and February 2020. For the purpose of the research, a survey questionnaire containing 32 questions was designed and administered via e-mail and social networks to include as many respondents as possible. The questionnaire consisted of three parts. The first part included demographic questions. The second part consisted of Likert-scale questions that included statements on the importance the respondents attach as customers to each of the socially responsible marketing practices when buying products in the healthy food market. The respondents had to specify their level of agreement on a five-point scale. In the third binary part (1/0) of the survey, the respondents answered whether the listed socially responsible marketing practices were important to them or not. A total of 519 questionnaires were administered, out of which 438 were fully filled out and processed. Latent cluster analysis, Mann - Whitney U test and Kruskal - Wallis test were used to process the data. The statistical programs Mplus (version 7) and SPSS (version 23) were used to assist in data processing.

3. 2 Research results

3. 2. 1 Descriptive analysis of collected data

In this part of the paper, the respondents' general characteristics are presented. Most of the respondents were female students. Out of the total number of respondents, 308 (70.32%) were female and 130 (29.68%) were male. With regard to the constituents of the University of Split, the sample is dominated by the students of the Faculty of Economics as a total of 188 respondents

(42.92%) were the students at this Faculty. A total of 69 respondents (15.75%) were the students at the Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, followed by 59 or 13.47% respondents from the Faculty of Humanities and Social Sciences with. Another 32 respondents, or 7.31%, attended the Faculty of Chemistry and Technology. Twenty-four respondents or 5.48% studied at the Faculty of Law. Thirteen respondents or 2.97% studied at the Faculty of Civil Engineering, Architecture and Geodesy, the Faculty of Medicine and the University Department of Professional Studies. Twelve respondents, i.e. 2.74% studied at the Faculty of Science. Two respondents studied at the Faculty of Kinesiology and two at the Academy of Arts, making 0.46% of the sample each. There was one respondent from the University Department of Forensic Sciences and one from the University Department of Health Studies, making each 0.23% of the sample.

According to their level of studies, 165 of the total number of surveyed students were at the undergraduate level of studies (37.7%), followed by 217 respondents (49.5%) at graduate studies, with least respondents at the postgraduate level, i.e. 56 of them (12.8%). With regard to the total monthly household income, most respondents, i.e. 128 of them (28.1%), had a monthly household income between HRK 6,000 and 10,000. Almost one quarter or 24.7%, i.e. 108 of them, had a total monthly household income between HRK 10,000 and 15,000. A total of 89 students (20.3% of the total number of respondents) stated they had the highest household income offered in this survey, that of more than HRK 15,000. Then, 67 respondents, or 15.3%, stated that their total monthly household income was HRK 4,000-6,000. Another 36 respondents or 8.2% of the total number of respondents had a total monthly household income between HRK 2,000 and 4,000. Finally, 15 respondents (3.42%) indicated that they had the lowest household income offered in this survey (HRK 2,000).

3. 2. 2 Latent cluster analysis

Latent cluster analysis (LCA) of a binary variable was conducted using Mplus (version 7) to identify consumer segments in the student population with regard to the importance they attach to different socially responsible marketing practices.

Table 2. Diagnostic validity tests

Models	Estimated parameters	$\chi 2$	df	Sig.	AIC	BIC	Entropy
1	10	690.501	993	>0.1	4462.084	4502.884	1
2	21	596.689	1.002	>0.1	3852.861	3938.539	0.842
3	32	459.504	990	>0.1	3747.440	3877.998	0.770
4	43	403.946	979	>0.1	3715.259	3890.696	0.768
5	54	355.545	967	>0.1	3699.733	3920.049	0.809
6	65	326.513	956	>0.1	3692.614	3957.809	0.789

Source: Authors' research

Diagnostic validity tests were conducted for models of different number of clusters to identify the optimal number of latent clusters (classes). Table 2 shows the validity statistics for the six models tested: chi-square test, Akaike information criterion (AIC), Bayesian information criterion (BIC), and entropy. The AIC is an estimator of out-of-sample prediction error and thus the relative quality of statistical models for a given data set. AIC and BIC estimate the relative balance between model suitability and parsimony, whereby lower values represent optimal balance and entropy values indicate the overall level of uncertainty in the latent class arrangement (higher values represent lower entropy level). While the chi-square ($\chi 2$) values decrease monotonically as the number of classes increases, the values of the information criteria as well as the entropy statistics suggest that the four-cluster model classifies consumers with least error. Although the Bayesian information criterion increases slightly compared to the three-cluster model, other indicators provides us with the conclusion that the optimal number of clusters in the model is four. The probability tests above 60% are diagonally visible in Table 3.

Table 3. Probability tests

Cluster	No	1	2	3	4
1	234	**0.906**	0.052	0.000	0.042
2	98	0.090	**0.798**	0.020	0.091
3	40	0.000	0.023	**0.958**	0.018
4	66	0.036	0.083	0.029	**0.851**

Source: Authors' research

The statistical analysis produced four clusters of students: "fully committed" cluster of respondents, making up 53.5% of the sample, "the moderates", i.e. respondents who are moderately interested in CSR, making up 22.4% sample, while uninterested comprise 9.2% and the locals 14.9% of the sample.

Table 4. Four-latent model of social responsibility

SOCIALLY RESPONSIBLE MARKETING PRACTICES	*Fully committed to CSR*	*Moderates*	*Uninterested in CSR*	*Locals*
Spread, frequency	*53.50%*	*22.40%*	*9.20%*	*14.90%*
1. The company does not discriminate in employment.	0.95	0.86	0.28	0.51
2. The company ensures good working conditions to its employees.	1.00	0.98	0.34	0.82
3. The company cooperates with local companies / farmers.	0.92	0.65	0.13	0.84
4. The company's business is environmentally friendly.	0.98	0.83	0.12	0.68
5. The company cares about its consumers (buyers).	1.00	0.90	0.30	0.97
6. The company sponsors events in the local community.	0.75	0.03	0.18	0.61

7. The company does not take advantage of vulnerable groups such as low-income employees and / or helpless employees.	0.99	0.83	0.24	0.68
8. The company's business does not harm animals.	0.98	0.91	0.26	0.38
9. The company donates to charity.	0.89	0.27	0.03	0.53
10. The company also caters for the part of the market made up of low-income consumers.	0.96	0.57	0.09	0.61

Source: Authors' research

Cluster 1 consists of 234 respondents who attach great importance to socially responsible marketing practices implemented by companies in the healthy food market. Almost all respondents stated that they attach great importance to nine out of ten tested marketing practices (Table 4), and especially to marketing activities related to companies providing good working conditions for their employees (100% of the respondents) and care about their consumers (100% of the respondents). The exception is the marketing activity "sponsoring events in the local community" that 75% of the respondents in this cluster find moderately important.

Cluster 2 consists of 98 respondents who are moderately interested in socially responsible marketing practices conducted by companies in the healthy food market. The respondents stated that the following marketing activities are extremely important to them: company ensures good working conditions to its employees (98%), cares about its consumers (90%) and does not harm animals (91%). The respondents from this cluster stated that "sponsoring events in the local community" (3%) and "donating to charity" (27%) are not important socially responsible marketing practices. Other marketing practices are moderately important to them.

Cluster 3 consists of the respondents who are uninterested in socially responsible marketing practices. They classified all practices as not being important to them. However, even in this cluster there are hints of importance for some of the tested marketing practices namely: the company does not discriminate in employment (28% of the respondents), ensures good working conditions to its employees (34%), cares about its consumers (30%), does not take advantage of vulnerable groups such as low-income employees and / or helpless employees (24%) and its business does not harm animals (26%).

Cluster 4 is made up of the so-called "Locals" thus named because all local topics are moderately to extremely important to them. For 97% of respondents from this cluster, it is extremely important that the company cares about its local consumers. Socially responsible marketing practices are very important to them, in particular the one where "the company ensures good working conditions for its employees" (82%) and the one where "the company cooperates with local companies / farmers" (84% of the respondents). They attach the least importance to marketing practice "the company's business does not harm animals" (38%).

3. 2. 3 Testing research hypotheses

H1: There is a statistically significant difference in perceptions of the importance of different socially responsible marketing practices depending on the gender of the respondents

The nonparametric Mann-Whitney U test was used to test the first hypothesis since it is a sequential measurement scale with two independent samples. Gender differences in the perception of the importance of different socially responsible marketing practices were tested. The data were processed by the computer program SPSS - version 23.

Table 5. Aggregate results of testing the gender difference and the difference with respect to the respondents' household income in the perception of the importance of ten socially responsible marketing practices

SRM practices	Mann-Wh. U	Wilcox. W	Z	Asy.Sig (2-tailed)	Chi-Square	df	Asy.Sig.
B1. The company does not discriminate in employment	17784.000	26299.000	-2.126	.033	4.696	2	.096
B2. The company ensures good working conditions to its employees	17629.500	26144.500	-2.578	.010	5.280	2	.071
B3. The company cooperates with local companies / farmers	16270.500	24785.500	-3.311	.001	.125	2	.939
B4. The company's business is environmentally friendly	15151.000	23666.000	-4.384	.000	2.742	2	.254
B5. The company cares about its consumers (buyers)	16443.500	24958.500	-3.537	.000	.729	2	.694
B6. The company sponsors events in the local community	17840.000	26355.000	-1.883	.060	5.685	2	.058
B7. The company does not take advantage of vulnerable groups such as low-income employees and/or helpless employees	15155.500	23670.500	-4.845	.000	3.132	2	.209

B8. The company's business does not harm animals	15135.000	23650.500	-4.452	.000	4.707	2	.095
B9. The company donates to charity	16254.500	24769.500	-3.244	.001	2.963	2	.227
B10. The company also caters for the part of the market made up of low-income consumers	15520.000	24035.000	-3.949	.000	8.473	2	.014

Source: Authors' research

Mann-Whitney U test results (B1: Z=-2.126, p=0.033; B2: Z=-2.578, p=0.010; B3: Z=-3.311, p=0.001; B4: Z=-4.384, p=0.000; B5: Z=-3,537, p=0.000; B7: Z=-4.845, p=0.000; B8: Z=-4.452, p=0,000; B9: Z=-3.244, p=0.001; B10: Z=-3.949, p=0.000;) show that at the 5 % level of significance there is a statistically significant difference between men and women in the perception of importance of nine socially responsible marketing practices. In the remaining socially responsible marketing practice (B6: The company sponsors events in the local community, Z=-1.883, p=0.060) there is a no statistically significant difference with a significance level of 5 %. Based on the results of the nonparametric Mann-Whitney U test, it can be concluded that the first research hypothesis is accepted and that there is a statistically significant difference between men and women in the perception of the importance of different socially responsible marketing practices in the healthy food market.

H2: There is a statistically significant difference in perceptions of the importance of different socially responsible marketing practices depending on the respondents' household income

The nonparametric Kruskal-Wallis test was used to test the second hypothesis since it is a sequential measurement scale with six independent samples. The difference with respect to the respondents' household income in the perception of the importance of different socially responsible marketing practices was tested. In table 5, the test results (B10: x2=8.473, p=0.014) show that, with a marginal significance of 5%, there is a statistically significant difference in the perception of importance in only one observed socially responsible marketing practices with regard to the respondents' household income. For the remaining nine socially responsible marketing practices (B1: x =4,696, p=0.096; B2: x2=5.280, p=0.071;B3: x2=0.125, p=0.939; B4: x2=2.742, p=0.254; B5: x2=0.729, p=0.694; B6: x2=5.685, p=0.058; B7: x2=3.123, p=0.209; B8: x2=4.707, p=0.095; B9: x2=2.963, p=0.227;), the test results show that there is no statistically significant difference in the perception of importance in relation to the household income. Based on the results of the nonparametric Kruskal-Wallis test, it can be concluded that the second research hypothesis is rejected since there is no statistically significant difference in the perception of the importance in nine out of ten observed socially responsible marketing practices with regard to the respondents' household income.

The study further investigated whether there are statistically significant differences in the perception of importance of the socially responsible marketing practices depending on the respondents' level of study. Since the intention of students after graduation is to find a job as soon as possible, in the

research, emphasis was put on employment and working conditions. The nonparametric Mann-Whitney U test was used because the students were divided into two independent samples: the undergraduate level of study (165 respondents) and a pooled group of respondents (273 respondents) consisting of graduate and postgraduate students, that are referred to as senior students.

Table 6. Test results of the difference in perception of the importance of two socially responsible marketing practices depending on the level of study

Test statistic	B1. The company does not discriminate in employment	B2. The company ensures good working conditions to its employees
Mann-Whitney U	19901,000	20572,000
Wilcoxon W	57302,000	57973,000
Z	-2,350	-1,983
Asy.Sig (2-tailed)	,019	,047

Source: Authors' research

The results of the Mann-Whitney test for both observed socially responsible marketing practices (B1: The company does not discriminate in employment, Z=-2.350, p=0.019; and B2: The company ensures good working conditions to its employees, Z=-1.983, p=0.047) show that there is a statistically significant difference in the perception of importance among senior students compared to undergraduate students as the former attach more importance to the two practices than the latter.

3. 3 Research limitations

The survey was conducted on a large number of respondents (438 of them), but if we take into account the size of the student population at the state level, as well as the total population buying in the healthy food market, the sample size in this survey is not entirely satisfactory. Further, the respondents were all from the same university. The obtained results are suitable for making indicative conclusions, while to create a complete picture it would be necessary to conduct research on a larger sample. An important limitation of the research is the fact that it was conducted at one point in time and, based on these results, no conclusions about the causality can be drawn.

Although the survey is anonymous, a social desirability response bias must not be overlooked. Another research limitation is related to a lack of previous similar research in Croatia that this research's results could be compared to. When developing the questionnaire for this research, the authors built on a research on the perceptions of the socially responsible marketing practices as seen by the the visitors of a festival in Baltimore, United States who singled out as the most important CSR practices. It should be pointed out that these visitors are different from people in Croatia, in cultural and developmental terms. The number of respondents in that study was very small (232 respondents) considering the total U.S. population. Therefore, an important research limitation is the number and selection of socially responsible marketing practices that may not be

identical for EU and US countries. For example, in both surveys, business transparency was omitted as an important socially responsible marketing practice in the fight against corruption, which is extremely important for developing countries.

4. DISCUSSION AND CONCLUSION

Besides the fact that this empirical research is one of the first studies dealing with student consumers' perception of SRM practices in Croatia, this paper additionally enriches marketing literature and sheds light on whether gender diversity and household income influence SRM practices. Recent research shows that the field of CSR research is becoming broader and more complex, but this paper suggests that there is a need for more studies exploring SRM practices. From the management standpoint, companies are responsible for developing socially responsible marketing practices, whereas from the marketing theory standpoint customer is the primary stakeholder. Numerous justified criticisms on a global level and ever greater consumer awareness have forced marketers to creatively design and implement socially responsible business activities in order to strengthen and protect the society as a whole. Research results indicate that it is important to understand the impact that the key demographic variables, gender diversity and household income, have on customers' perceptions of socially responsible marketing practices in the healthy food market. Our findings empirically demonstrate that gender plays an important role in shaping the perception of student population for various socially responsible marketing practices, which is not the case for income.

The results of the latent class analysis (LCA) partially confirm the findings of Patino et al. (2014). The differences between Patino et al.'s sample and the one used in this research primarily arise from the age structure and cultural characteristics of the respondents. The four-cluster model obtained by LCA proved to be empirically more appropriate than the five-cluster model obtained in Patino et al.'s (2014) research in the US. The first two clusters, "Fully committed" and "Moderates" are almost identical in most of the marketing activities researched in both surveys. The remaining two clusters, "uninterested in CSR" and "locals", differ thematically from the two US clusters where the emphasis is on marketing practices of non-discrimination in recruiting and donating the people in need, and the last cluster is characterized by a complete lack of care for compassionate practices for the disadvantaged people and animals. In addition to the fact that marketers are constantly concerned about better market segmentation, our findings show that the differences between the four clusters of student population in how they view the company's efforts in socially responsible marketing as consumers are rather profound. Despite the fact that this research is limited to one demographic group, it is indicative that if marketers want to use their socially responsible actions as a market differentiator, their messages to target segments must be different, creative and very carefully planned.

Having processed the set hypotheses, the research was extended to include some additional variables that were supposed to strengthen the connection between the observed practices and the perceptions of the student population. Thus, it was further investigated whether there are statistically significant differences in the perception of importance in those practices that are closely related to employment and working conditions depending on the respondents' level of study. The results showed that there is a statistically significant difference in the perception of importance

among senior students compared to undergraduate students. The probable reason for this is the fact that senior students are closer to looking for and getting a job, so they are more sensitive to these practices carried out by business entities. Furthermore, Toker et al. (2016) claim that the attitudes of students as consumers towards socially responsible companies positively change if they have had even a minimal training in CSR, SRM or business ethics during their studies. In order to change the behavior of existing consumers and direct them towards a more socially responsible consumption in the future, it is suggested that companies develop joint educational programs with higher education institutions.

The aim of this research was to draw attention to the importance of conducting socially responsible business, which in the authors' opinion is not sufficiently represented in Croatia and in other emerging markets. We agree with the opinion that SRM cannot be imposed on companies, since it must be understood and accepted by them (Rudwanska, 2013). Practically, our findings will help marketers in designing their SRM practices to change perceptions among students, especially those students in the "uninterested" cluster. Marketing professionals need to think about the specifics of each market individually and the characteristics of the cluster when creating, communicating and implementing socially responsible marketing practices. Limitations of this study may serve as a potential starting point for future studies. First, future research should be conducted on a larger and more representative sample of the entire population. Second, given the unquestionable development of society over time, future research should be conducted as a longitudinal research with a number of tested marketing practices in order to be able to follow the course of development of socially responsible business. Third, future research should examine the effects of other demographics (e.g. age, education, employment) on socially responsible practices.

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Prethodno priopćenje
https://doi.org/10.31784/zvr.9.1.13
Datum primitka rada: 23. 11. 2020.
Datum prihvaćanja rada: 10. 2. 2021.

VAŽNOST DRUŠTVENO ODGOVORNIH MARKETINŠKIH PRAKSI NA TRŽIŠTU ZDRAVE HRANE IZ PERSPEKTIVE STUDENATA

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SAŽETAK

Uvriježeno je mišljenje kako mladi ljudi nisu pretjerano zabrinuti za zdravlje niti vode pretjerano računa o prehrambenim navikama. Međutim, marketinški stručnjaci na njih gledaju kao na iznimno bitno i potencijalno veliko tržište te sve inicijative društveno odgovornog poslovanja smatraju dugoročnim ulaganjima koja će povećati vrijednost poduzeća. Na tržištu zdrave hrane među najvažnijim aktivnostima društveno odgovornog poslovanja nalaze se upravo marketinške prakse. Svrha studije je istražiti koliko su važne različite društveno odgovorne marketinške prakse na tržištu zdrave hrane. Istraživanje je provedeno na uzorku od 519 studenata, a rezultati su obrađeni pomoću latentne klaster analize (LCA). Rezultati istraživanja pokazali su značaj razumijevanja ključnih demografskih varijabli (spol i prihod kućanstva) na oblikovanje percepcije kupaca o društveno odgovornom marketingu. Bitno ograničenje istraživanja je broj i odabir društveno odgovornih marketinških praksi. Postoji svega nekoliko istraživanja koja segmentiraju tržište u odnosu na društveno odgovorne marketinške prakse. Buduća istraživanja trebala bi biti longitudinalna s više testiranih marketinških praksi.

Ključne riječi: *društveno odgovorno poslovanje, društveno odgovorni marketing, tržište zdrave hrane, studentska populacija*

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Preliminary communication
https://doi.org/10.31784/zvr.9.1.14
Received: 23. 9. 2020.
Accepted: 10. 2. 2021.

DATA MINING APPROACH FOR BUSINESS VALUE ANALYSIS IN BASKETBALL

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ABSTRACT

With the rapidly increasing volume of data, novel methods and technologies for their analysis, and opportunities to support decision-making processes emerge in the domain of sports analytics. This, in particular, applies to analysing athletes' performance and calculating related business added-value in major sports leagues such as the National Basketball Association (NBA). Specifically, the financial success of a team/franchise depends not only on the results of the games but also on the success of attracting marketable individuals who bring higher business value. In that regard, this paper aims to demonstrate the potential and importance of data mining methods to uncover the factors influencing the decisions related to the player selection based on individual results, physical characteristics, and professional contract salaries in the NBA. For the study, 22 datasets were integrated into three large datasets. The data covers the period from 1946 (when the league was founded) to 2017. Data mining models were developed in RapidMiner, enabling correlation, cluster and regression analysis. Change in the factors affecting the selection of new players in recent years was uncovered, while the classification revealed, for example, that more than 50% of players have below-average coefficients of efficiency and individual result contribution. An artificial neural network algorithm was used to identify discrepancies for players with high-salary contracts as many do not meet high-performance standards. The study demonstrates how classification and prediction models can serve sports analysts and managers in making decisions related to future professional contracts and predict future salaries for active players, among other contributions.

Key words: *sports analytics, data mining, player selection, classification, prediction*

1. INTRODUCTION

There is a proven need for methods, techniques and tools that can store and search huge amounts of data, identify patterns among them and present them at the level of specific reports, representing an analytical process that results in new knowledge (Ćukušić, 2011). The term Sports Analytics, also referred to as Statistics in Sports, denotes various processes and solutions related to data collection and management, predictive modelling and algorithms that facilitate finding valuable data for decision-making in sports. As a scientific field, Sports Analytics deals with the collection and analysis of past and real-time data on sports in general (Sarlis, Tjortjis, 2020). Analytics, in one form or another, has always been a part of sports – general statistics, such as the results of matches, or the number of passes or goals, provide the basis for reporting on various sports competitions. Recently, the importance of statistics and analytics in sports has increased, with an emphasis on measures that improve the likelihood of winning or may provide an "advantage" over the competition that has not yet revealed the value of those measures. Today, data on physical location, frequency of injuries and measurement of physical performance, as well as business values, are also collected (Wasserman et al., 2018). Analytics is widely used by professional sports teams to improve their field results. It is less apparent that the same organisations use analytics to enhance their business performance as well. On that topic, a survey by Troilo et al. (2016) focusing on the level of adoption of business analytics in professional sports organisations found that the use of analytics resulted in significant revenue growth. This particular domain of sports analytics is closely connected to increasing the efficiency and relevance in business-related decision-making to which this paper aims to contribute.

The contribution that this paper brings in this regard is elaborated in section 2. In section 3, the theoretical basis for the identification of relevant factors in one specific area of research and use of sports analytics – basketball-related business decisions are presented in section 3, while section 4 describes the methodology of data collection and processing. In section 5, insights are presented and discussed. In the concluding section 6, limitations and future research directions are presented along with trends and the managerial implications.

2. RESEARCH BACKGROUND AND CONTRIBUTION

In recent years, the availability of data and the complexity of data management boosted the development of areas such as data science, business intelligence, business analytics, data mining (DM), and data-driven decision making. It caused the advent of novel technical solutions, such as the ones that tackle big data management and artificial intelligence, also in sports (Ratten, 2020). Further to that, a trend of widening access to stored data has gained momentum with the availability of open data. Published by various institutions and organisations, open data is free to use by governments, businesses and individuals that look for social, economic and environmental benefits (European Data Portal, n.d.). To use this data, good knowledge of DM and machine learning (ML) techniques is a prerequisite. Modern DM and ML algorithms used in sports analytics include (Sarlis, Tjortjis, 2020) neural networks (NN) used for classification and prediction purposes, decision trees for predictive modelling, probabilistic classifiers and so on. This paper aims to contribute to the growing number of studies focusing on the potential of DM in sports.

More specifically, the potential of sports analytics and DM is explored here in one particular domain. As a team sport, basketball requires a comprehensive analysis of a significant number of parameters not only to understand the game but also to analyse strategies and business-related decisions. The National Basketball Association (NBA) is considered the world's leading professional basketball league and one of the most popular sports leagues in general worldwide. Since the income of each team in the league depends on its performance in the regular season and playoffs and its players, the tools that can aid in performance tracking and value analysis are of paramount importance. One of the most critical factors for a team's success is the performance of individual players (Chen et al., 2017). Understandably so, to help manage the individual and team performances, the league has attracted the attention of a high number of researchers and practitioners. One of the papers addressing the performance prediction of sports teams provides a good overview of the growing body of literature dealing with performance in the NBA (Li et al., 2019). Studies that aim to determine the effect of analytics on the team and player evaluation also emerge, e.g., Sarlis and Tjortjis (2020) analyse the background and indicators used in basketball federations and Euroleague games. The study demonstrates that basketball analytics can be used to understand the game and team performance. Similarly, Li et al. (2019) propose an approach to predicting the performance of a team based on data envelopment analysis coupled with a data-driven approach. Specifically, they present the analysis in two steps: the multivariate regression analysis to examine the relationship between the probability of winning and the outcome of a game, and then using the historical data for the player portfolio performance analysis to optimally select players and plan their playing time. The three studies (Chen et al., 2017; Li et al. 2019; Sarlis, Tjortjis 2020) focus on players' characteristics in relation to decisions about their contracts that include significant financial provisions. However, the authors focus either on one particular aspect or use a single method to confirm their theses. For example, Paulauskas et al. (2018), focus on players' performance variables and detect variability in performance as an essential aspect that coaches and recruiters analyse. Oved et al. (2020) analyse interviews and enrich performance metrics by using text classification to uncover player behaviour and risk aversion.

However, this paper takes on a broader, exploratory approach, starting from collecting a dataset containing almost 50 attributes to employing the most common data mining methods for both classification and prediction with a view to promote their use for business value analysis in sports. In that regard, it complements the listed studies that focus on optimising individual or team sports performance, by focusing on the potential for supporting business-related decisions and performance in sports. Consequently, the primary goal is to identify relevant factors that can affect the decision-making process of NBA teams' contractual provisions. Here, relevant factors are the elements for which there is a representative value that proves the existence of a relationship between the contracted salary and the personal or performance characteristics of the players. The secondary focus stems from the primary; it involves examining deviations in the results in an attempt to analyse the direction of development of the league. In that, the effect of physical characteristics on individual performance, changes in player selection preferences in the NBA draft, changes in player selection and other trends are discussed.

3. SETTING THE RESEARCH DOMAIN: DEFINING BUSINESS VALUE IN BASKETBALL

NBA is a professional basketball association that manages a competition under the same name. The association has been operating since 1946 and is considered one of the largest sports associations in the world. The competition is open to 30 teams/franchises from across North America organised into two conferences (western and eastern) (NBA.com, n.d.). It is divided into regular and elimination parts where the regular part has 82 games. In the elimination part, 15 best-placed teams per conference are involved. The teams with four elimination matches won continue, and the final game is played between the winners of the conferences. This event is one of the most-watched sporting events in the world.

The average value of an NBA team/franchise is estimated at $2.12B (Badenhausen, 2020) with an increase of 14% over the same period last year. Up to February 2020, there was no decline in value for any of the teams/franchises. The Golden State Warriors franchise had the highest growth in value (23%), while the Brooklyn Nets had the lowest (6%). Depending on the result achieved in the current competition year, teams are assigned corresponding probabilities and the rights to select young players entering the NBA Draft. The worse a team's score is in the current competitive year, the more likely it is to achieve a higher preferential position when selecting players in the NBA Draft (NBA.com, n.d.).

The intricate details and rules of the selection, player exchanges and preferential positions, transfers of rights to future contracts with players and other strategic decisions are exceptionally complicated. Only fundamentals of the process are taken into account here to demonstrate the effects and the potential of DM in strategic decision-making. What is essential are the guaranteed salaries in professional contracts that teams are obliged to pay during the contract term under predefined stipulations for a limited period with the possibility of extension. Guaranteed salaries for the first 14 positions in the NBA Draft for 2019, to provide an insight into the level of importance of related salary guarantee decisions are available in (RealGm.com, 2019). These positions are the so-called lottery pick (NBA.com, 2020) representing a selection of players to which the team that won the elimination phase of the competition is not entitled unless it is allowed by a previously signed contract with a team that can exercise its right to select from the lottery pick in the observed year. When signing professional contracts with players, the team must ensure financial value for the payment of the contractual obligation within a predefined range. This financial framework is called the Salary Cap (Miller, 2018). It represents the ceiling on the contractual obligations of the teams plus the Luxury Tax (for cases where the upper limit of the range is exceeded). These provisions ensure the liquidity of the teams and fair play but also control the competitiveness of competition. As of 2017, the defined ceiling is a salary of $109.14 million. Teams' contractual obligations for the next five competition seasons are available in Basketball Reference Contracts (2019).

Strategy-wise, it is interesting to review the financial situation of the Philadelphia 76ers and the reasons for the high contractual obligations over a long period. Namely, under the slogan "Trust the Process", the team has been targeting poor results in the competition seasons for years to secure the options for high-ranking lottery picks in the draft. Consequently, by selecting the best

young players, the club activated the then empty salary cap by signing those young players for an extended period and with high salaries to ensure the team achieved exceptional results in the future. The team's business strategy was under the scrutiny of the league's committees and possible future restrictions for such actions were considered but not imposed.

4. DATA COLLECTION AND METHODOLOGY

4. 1 Data

The goals of the study have been presented in sections 1 and 2 already. In the data preparation phase, 22 datasets were identified as relevant and downloaded from different sources, *kaggle.com*, *data.world, datahub.io, glassdoor.com*, and *basketball-reference.com* (listed in Figure 1). It was then integrated into a unique dataset that provides a relevant basis considering the study's purposes. After a series of data transformations, the set contains three different databases:

1. Statistics throughout an NBA career - averages and absolute values,
2. Time series of contracted salaries by players and teams, and
3. Time series and statistics by players - coefficients of efficiency and contributions to the results.

Figure 1. The list of databases used to compile the three datasets

Sezonski podaci.xlsx	30.5.2020. 13:09	Microsoft Office E...	11.661 KB
NBA Season Data.csv	30.5.2020. 12:05	Microsoft Office E...	8.875 KB
players.csv	30.5.2020. 9:57	Microsoft Office E...	1.047 KB
salaries_1985to2018.csv	30.5.2020. 9:57	Microsoft Office E...	784 KB
Seasons_Stats1.xlsx	29.5.2020. 21:43	Microsoft Office E...	5.041 KB
NBA_season1718_salary.csv	29.5.2020. 19:37	Microsoft Office E...	24 KB
Seasons_Stats.csv	29.5.2020. 19:37	Microsoft Office E...	7.141 KB
BPM.csv	26.5.2020. 19:48	Microsoft Office E...	621 KB
nba_extra.csv	26.5.2020. 16:00	Microsoft Office E...	82 KB
nba.csv	26.5.2020. 15:48	Microsoft Office E...	91 KB
players1.csv	2.3.2020. 10:10	Microsoft Office E...	260 KB
ranking.csv	2.3.2020. 10:10	Microsoft Office E...	12.446 KB
teams.csv	2.3.2020. 10:10	Microsoft Office E...	4 KB
games_details.csv	2.3.2020. 10:09	Microsoft Office E...	77.168 KB
games.csv	2.3.2020. 10:09	Microsoft Office E...	3.415 KB
Seasons_stats_complete.csv	27.10.2019. 15:35	Microsoft Office E...	7.292 KB
Player - Salaries per Year (1990 - 2017).xlsx	2.10.2019. 6:03	Microsoft Office E...	586 KB
NBA Players - Advanced Season Stats (19...	2.10.2019. 5:55	Microsoft Office E...	11.345 KB
player_data.csv	20.9.2019. 17:04	Microsoft Office E...	339 KB
Players (2).csv	20.9.2019. 17:04	Microsoft Office E...	275 KB
Seasons_Stats (2).csv	20.9.2019. 17:04	Microsoft Office E...	4.998 KB

Source: Authors

Following the transformations, the accuracy of individual data was verified through a random selection process. The accuracy of randomly selected rows was verified by comparing the

corresponding score values with the values from the representative online data source for NBA statistics (Basketball Reference, n.d.). In the process, the success of data transformations, merging and calculations was confirmed, making sure there were no deviations or inconsistencies. The final data set contains a total of 793.581 observations. The list of some of the attributes contained in the first database with explanations (taken from Basketball Reference Glossary, n.d.), where needed, is given in Table 1. The structure and the list of attributes in the second database are straightforward, pertaining only to players, their salaries in each season and the teams they played in. An excerpt of the third database is presented in Figure 2, while attributes are listed in Table 1.

Table 1. The list of attributes with abbreviations and definitions

1.	**Players**
2.	**Player ID**
3.	**Height**
4.	**Weight**
5.	**BMI** - Body Mass Index
6.	**G** - games played
7.	**GS** - games started or games played from the first minute
8.	**MP** - minutes played
9.	**FG** - field goals or successful throws (Note: the same is calculated for **2FG** and **3FG**)
10.	**FGA** - field goals attempt or number of attempted throws (also **2FGA** and **3FGA**)
11.	**%FG** - percentage of successful throws (also for **%2FG** and **%3FG**)
12.	**ORB** - offensive rebound or jump
13.	**DRB** - defensive rebound or jump
14.	**TRB** - total rebound or number of successful jumps
15.	**AST** – assists or number of passes
16.	**STL** - steals or number of stolen balls
17.	**BLK** - blocks or number of blocked throws
18.	**TOV** - turnover or number of lost balls
19.	**PTS** - number of points
20.	**perG** - average value per game for the entire career (calculated)
21.	**PER** - Player Efficiency Rating developed by Hollinger (2007) and calculated as in (Basketball Reference: Calculating PER, n.d.)
22.	**MP** - number of minutes played
23.	**%TS** - percentage of all successful throws
24.	**%ORB, %DRB, %TRB** - percentage of players' offensive, defensive and total rebounds
25.	**%AST** - percentage of players' assists
26.	**%STL** - percentage of players' steals

27. %BLK - percentage of players' blocks
28. %TOV - percentage of players' turnovers
29. BPM +/- (OBPM, DBPM) - Box Plus/Minus - individual result contribution of a player for time spent on the field (offensive, defensive)
30. WS (OWS, DWS) - Win Shares calculated as in (Kobat, 2018) representing the number of victories attributed to the offensive or defensive contribution of the observed player
31. VORP - Value Over Replacement Player or the result contribution of the player in relation to its predecessor
32. Rounded Position - natural position of the player on the field
33. %USG - Usage Percentage or percentage of player's active involvement in the team's play during his time in the field

Source: Authors

1978	IND	Ricky Sobers	25	79	3019	15.4	0.514	0.328	2.9	7.8	5.3	2.5	0.4	20.1	21.8	0,8	-0,4	0,4	2.4	2.4	4.8	0.076	1.8	10700000	75	190,5	198	89,81	24,75	1	25
1978	SEA	Fred Brown	29	72	1965	19.6	0.528	0.188	3	6.9	4.9	19.9	2.6	0.7	12.7	25	2	-0,5	1,6	4.1	2.5	6.7	0.163	1.9	10700000	75	190,5	182	82,55	22,75	1	30
1978	HOU	Calvin Murphy	29	76	2900	19.5	0.525	0.154	2	4	5	14.9	1.8	0.1	8.5	27.9	3,3	-3	0,3	7.5	-0.1	7.4	0.122	1.9	10800000	69	175,3	165	74,84	24,37	1	30
1978	NOJ	Pete Maravich	30	50	2041	17.6	0.492	0.22	2.3	6	4.2	26.1	2.2	0.2	15.3	30.1	1,5	-1,3	0,1	1.3	1.7	2.9	0.069	1	10800000	77	195,6	197	89,36	23,36	1	31
1978	NJN	Jan Van Breda Kolff	26	68	1419	7.5	0.435	0.421	4.3	12.8	8.3	9.1	1.6	1.7	17.4	10.9	-3,2	1,6	-1,7	-0.2	1.4	1.2	0.04	0.1	1100000	79	200,7	195	88,45	21,97	2	26
1978	NJN	Bob Carrington	24	37	1032	8.3	0.444	0.247	3.8	6.9	5.3	7.2	1.8	0.6	13.2	17.9	-2,7	-0,2	-2,9	-0.4	0.8	0.4	0.017	-0.3	1100000	78	198,1	195	88,45	22,53	2	25
1978	CHI	Cliff Pondexter	23	44	534	11.6	0.469	0.235	7.4	19.1	13.3	21.1	1.7	1.5	24.2	9.4	-1,4	1,3	-0,1	0.4	0.6	1	0.087	0.3	1100000	81	205,7	233	105,7	24,97	4	23
1978	PHO	Alvan Adams	23	70	1914	17.7	0.528	0.327	8.4	22.2	15.2	16.4	1.9	1.7	18.6	24.5	0,2	1,7	1,9	1.5	3.4	4.9	0.123	1.8	11100000	81	205,7	210	95,25	22,5	3	24
1978	PHO	Don Buse	27	82	2547	12.5	0.5	0.217	2.3	7.8	5	18.5	3.1	0.3	15.3	11.8	-0,8	1,7	0,9	2.4	3.6	6	0.113	2	11200000	76	193	190	86,18	23,13	1	28
1978	LAL	Jamaal Wilkes	24	51	1490	16.1	0.475	0.235	6	17.7	13	16.1	2.3	0.7	13.3	21	0,7	1,1	1,8	1.3	2	3.3	0.106	1.4	11300000	78	198,1	190	86,18	21,96	2	25
1978	ATL	Steve Hawes	27	75	2325	16.1	0.5	0.251	8.2	24.7	16.2	12.1	1.6	1.5	13.5	19	0	1,5	1,5	2.7	3.5	6.1	0.127	2.1	11400000	81	205,7	220	99,79	23,57	4	28
1978	BUF	Swen Nater	28	78	2778	16.9	0.543	0.274	10.8	28.8	19.9	11.4	0.7	0.9	16.8	19.2	0,8	0,4	1,2	4	2.8	6.8	0.117	2.3	11500000	83	210,8	240	108,9	24,49	5	28
1978	DET	John Shumate	25	62	2170	16.5	0.597	0.658	6.1	20.4	13.4	7.5	1.6	1	18.8	17.4	0,3	0,6	0,9	4	2.4	6.4	0.142	1.7	11500000	81	205,7	235	106,6	25,18	4	26
1978	NYK	Lonnie Shelton	22	82	2319	17.4	0.549	0.279	9.3	16.5	12.9	11.4	2.1	2.5	17	21.8	1,1	1	2,1	3.2	2.7	5.9	0.122	2.4	11600000	80	203,2	240	108,9	26,37	4	22
1978	POR	Lionel Hollins	24	81	2741	14.3	0.482	0.25	3.1	7.3	5.3	19.6	2.6	0.6	15.3	22.7	0	0,6	0,6	1.5	3.7	5.2	0.091	1.7	11700000	75	190,5	185	83,91	23,12	1	24
1978	NJN	Bernard King	21	79	3091	17.3	0.511	0.277	7.9	16	11.8	9.9	1.7	0.6	14.3	26	1	0	0,9	2.6	3.3	5.9	0.092	2.3	11900000	79	200,7	205	92,99	23,09	3	21
1978	CHI	John Mengelt	28	81	1767	14.5	0.535	0.353	2.5	5.4	4	19.9	1.4	0.1	13.7	20.6	0,3	-2,8	-2,5	3.2	0.6	3.9	0.105	-0.2	1200000	74	188	195	88,45	25,04	1	28
1978	NJN	Tim Bassett	26	65	1474	8.6	0.408	0.253	8.9	18.1	13.3	5.4	1.8	1.2	15.8	12.7	-3,1	1,3	-1,8	-0.7	1.8	1.1	0.036	0	1200000	80	203,2	225	102,1	24,72	4	27
1978	POR	Maurice Lucas	25	68	2119	17.3	0.502	0.273	9.3	20.9	15.3	11.9	1.3	1.4	14.8	24.2	0,3	0,9	1,3	2.2	3.5	5.8	0.131	1.7	12000000	81	205,7	215	97,52	23,04	4	26

Figure 2. Screenshot: part of a database containing data about efficiency coefficients

Source: Compiled by authors

4. 2 Methods

Standard DM projects progress through the following phases (Ćukušić, 2011): determining the goal of the study, data preparation, data mining, and evaluation and use of the knowledge. This good practice was followed here, whereby for the third phase – DM, several methods were used, specifically correlation analysis, regression analysis, cluster analysis and neural networks. Specifics of the methods are presented in Section 5.

4. 3 Data validity and restrictions

First insights pointed to some deviations in the data's representativeness as can be expected given this is a large dataset and the range of information it represents. Some of the variations can be excluded, having no statistical significance, while others are outliers, e.g.:

- Data without statistical value. In 2013/14 DeAndre Liggins played one game and spent one minute in the field during which he recorded one jump and one hit from one attempt (2 points scored for %FG=100). He thus logged the highest individual seasonal PER (129.1). To compare, Michael Jordan's highest PER is 31.7, and according to statistically significant data, it is still the highest PER in the league. DeAndre Liggins's PER (but also of some others) has no statistical value due to too few games and minutes played in the observed season.
- Outlier. The correlation between height and weight is +0.819 denoting a strong positive relationship. Correlation between weight and BMI index is +0.69 representing a medium-strong positive relationship; average BMI is 24.045. However, M.Bol with a height of 230 cm is the second tallest player in the history of the league, but with a weight of 91 kg, he has the lowest BMI index (16.98) in history. Another example is L.Orr, whose BMI index is 19.225 while his height is 203 cm. The difference between the two players' BMIs is 2.245, while the standard deviation of the population is 1.73.

For easier data management and to avoid contradictory conclusions, restrictions were set for including data into a statistically significant sample:

- Minimum number of matches played per observed season in the time series must be greater than 20 (G>20).
- Total number of games played in a career must be greater than 120, equivalent to 1.5 regular seasons (G>120).Effects on the team's results in terms of efficiency and result contribution coefficients are observed from 1979/80 onwards due to a lack of data used to calculate the coefficients:
    - In 1973/74 the league started logging offensive jumps (ORB), stolen balls (STL) and blocked shots (BLK).
    - In 1977/78 the league started logging lost balls (TOV).
    - In 1979/80 a 3-point line was introduced (3FGA, %3FGA, 3FG, %3FG).

Based on the insights into the effects of physical characteristics of the players on the decision-making on contracted salaries and selection of players, no restrictive conditions were set.

5. RESULTS AND DISCUSSION

5. 1 Correlation analysis

For the interpretation of correlation analysis, ranges as in Asuero et al. (2006) were taken as a reference: correlation 0.0–0.29 (non-existent); 0.3–0.49 (weak); 0.5–0.69 (medium-strong); 0.7–0.89 (strong); and 0.9–1 (very strong). Several relationships between the attributes were analysed and are presented hereinafter.

Correlation between physical characteristics of the players and salaries

The results indicate that there is no correlation between the physical characteristics of the players and their salary. While some analyses (e.g. Lam, 2012; Groothuis, Hill, 2013) consider that height is a determining factor for how much a player is paid, recent ones that take into account longer periods demonstrate that the correlation has become non-existent as the game changed (Curcic, 2019). A gradual decline in the correlation between height and weight is observed in four different decades, with a slight increase recently (Figure 3). Although the correlation coefficient does not indicate massive changes, considering the size of the database and the number of observations, this may point to more significant changes. Specifically, the physicalities of the players are of paramount importance for their position on the field (shorter players play guard position, forward position is played by medium-height players, and centre by higher players) (cf. Xiong et al., 2017). It led to examining how the changes in the physicalities and related field positions may have affected players' contribution to results.

Figure 3. Correlation between physical characteristics of the players and their salary per decade

1980. - 1989.

Attribut...	Year	Age	Salary	Height (...	Weight ...	BMI	Rounde...
Year	1	0.088	-0.002	0.045	0.052	0.027	0.033
Age	0.088	1	0.019	0.079	0.035	-0.048	0.048
Salary	-0.002	0.019	1	0.095	0.100	0.051	0.065
Height (c...	0.045	0.079	0.095	1	0.840	0.105	0.919
Weight (...	0.052	0.035	0.100	0.840	1	0.625	0.879
BMI	0.027	-0.048	0.051	0.105	0.625	1	0.288
Rounde...	0.033	0.048	0.065	0.919	0.879	0.288	1

1990. - 1999.

Attribut...	Year	Age	Salary	Height (...	Weight ...	BMI	Rounde...
Year	1	0.064	-0.007	0.000	0.083	0.150	0.018
Age	0.064	1	0.058	0.034	-0.069	-0.170	0.016
Salary	-0.007	0.058	1	0.015	0.014	0.005	-0.005
Height (c...	0.000	0.034	0.015	1	0.830	0.134	0.902
Weight (...	0.083	-0.069	0.014	0.830	1	0.661	0.862
BMI	0.150	-0.170	0.005	0.134	0.661	1	0.316
Rounde...	0.018	0.016	-0.005	0.902	0.862	0.316	1

2000. - 2009.

Attribut...	Year	Age	Salary	Height (...	Weight ...	BMI	Rounde...
Year	1	-0.102	0.003	0.007	0.031	0.044	0.001
Age	-0.102	1	0.020	-0.049	-0.116	-0.140	-0.076
Salary	0.003	0.020	1	0.009	-0.023	-0.047	-0.054
Height (c...	0.007	-0.049	0.009	1	0.808	0.165	0.912
Weight (...	0.031	-0.116	-0.023	0.808	1	0.711	0.855
BMI	0.044	-0.140	-0.047	0.165	0.711	1	0.343
Rounde...	0.001	-0.076	-0.054	0.912	0.855	0.343	1

2010. - 2017.

Attribut...	Year	Age	Salary	Height (...	Weight ...	BMI	Rounde...
Year	1	0.017	-0.038	0.010	0.033	0.044	0.007
Age	0.017	1	0.049	-0.008	0.021	0.049	-0.030
Salary	-0.038	0.049	1	0.005	0.030	0.044	-0.019
Height (c...	0.010	-0.008	0.005	1	0.811	0.137	0.924
Weight (...	0.033	0.021	0.030	0.811	1	0.688	0.865
BMI	0.044	0.049	0.044	0.137	0.688	1	0.318
Rounde...	0.007	-0.030	-0.019	0.924	0.865	0.318	1

Source: Authors

The analysis of the relationship between the physical characteristics, field positions and the results further revealed that:

- Over time, there is a decrease in the correlation coefficients between the position of the player on the field and the results-related variables %DRB, %TRB, %AST, %STL. The most significant is the decrease in correlation between a player's position and the percentage of stolen balls (%STL) equal to 0.178, representing a relative change of 32%. This indicates a decline in the strict differentiation between the positions they play and their roles.
- Further, in the four decades, a significant increase in average body weight was found, increasing from an average of 93.56kg (1980-1989) to 99.51kg (2010-2017), equivalent to +6kg or 6.36%. It is a significant increase, considering that the players' average height for the same periods has not changed much. It demonstrates an increase in physical fitness in response to demandingness of the league.
- There were pronounced changes in player selection preferences in the draft, e.g. from 2000 to 2009, of the 30 lottery picks of the first three preferential positions, 20 selected young players were reported as power forwards and/or centre positions with a height listed as 205 cm or more. This makes up 66.67% of the selected players in the top positions. From 2010 to 2019, out of 30 lottery picks of the first three preferential positions, ten players reported positions of power forward and/or centre, 33.33% of the selected players in the top positions in the draft. There is a pronounced decline in the selection of players in centre positions from the highest preferential positions (-50%). Important to note is that four players in the observed years are highly versatile players meaning they can play both power forward/centre position and guard positions. Demonstrating this shift, is, e.g., a decision by the Houston Rockets in 2019 to play with the starting lineup without a standard centre position. Teams are less and less trusting of centre position players who dominate the physical aspect of the game under the basket and are more oriented towards players from outside positions. It leads to an analysis of the potentials and probabilities for introducing a 4-point throw line as of recently. That would significantly change the game and would represent the biggest change since introducing the 3-point line in 1979/80.

Correlation between players' contribution to results and salaries

There is a weak to a medium-strong correlation between the salary and % USG (illustrated in Figure 4). Usage percentage defined as a mix of free throw attempts, field goal attempts and turnovers a player takes in relation to the amount of these the whole team takes, has been identified as one of the performance measures that somewhat affected the salary of NBA player already (Louivion, Pettersson, 2017). The correlation is more pronounced but still weak (0.452) from 2000 to 2009.

Figure 4. Correlation between players' contribution to results and their salary per decade

Attribut...	ORB%	DRB%	TRB%	AST%	STL%	BLK%	TOV%	USG%	Salary	
Salary	0.136	0.197	0.191	0.202	0.153	0.136	-0.160	0.325	1	**1980. - 1989.**
Salary	0.009	0.166	0.117	0.285	0.204	0.078	-0.141	0.362	1	**1990. - 1999.**
Salary	-0.080	0.137	0.055	0.348	0.187	0.055	-0.195	0.452	1	**2000. - 2009.**
Salary	-0.011	0.144	0.094	0.324	0.231	0.042	-0.085	0.377	1	**2010. - 2017.**

Source: Authors

Correlation between coefficients of efficiency and salaries

Correlations between coefficients of efficiency and salaries (Figure 5) can be observed over time; specifically, there is:

- a weak positive correlation between individual result contribution of a player for time spent on the field (defensive) and salaries;
- a strong positive correlation between Player Efficiency Rating, individual result contribution of a player for time spent on the field (offensive), offensive and defensive Win Shares, Win Shares Per 48 Minutes (WS/48) and salaries;
- a very strong correlation between individual result contribution of a player for time spent on the field (BPM), Win Shares (WS), Value Over Replacement Player (VORP) and salaries.

Figure 5. Correlation between coefficients of efficiency and their salary per decade

Attribut...	PER	OBPM	DBPM	BPM	OWS	DWS	WS	WS/48	VORP	Salary	
Salary	0.758	0.780	0.367	0.913	0.807	0.762	0.910	0.772	0.963	1	1980. - 1989.
Salary	0.735	0.746	0.393	0.918	0.810	0.773	0.895	0.723	0.961	1	1990. - 1999.
Salary	0.754	0.758	0.311	0.914	0.816	0.742	0.899	0.706	0.956	1	2000. - 2009.
Salary	0.696	0.720	0.337	0.900	0.812	0.747	0.886	0.697	0.955	1	2010. - 2017.

Source: Authors

Interestingly, the PER coefficient showing attacking efficiency has a weaker correlation with salary than some coefficients that take into account defense play. The DBPM coefficient is also weakly correlated to salary, indicating that the BPM coefficient may not be entirely suitable in defining key factors in defence play result contribution in relation to contracted salaries. In contrast, DWS being strongly correlated provides more precise insights into player-related defence performance contributing to results. One of the reasons can be the way the observed coefficients are calculated. Another surprising point is the strength of the correlation between the VORP coefficient and the salary, also analysed in a study by Wu et al. (2018). Several explanations can justify the strong correlation, one of which may be the team's decision to encourage a player who contributes more to the team than his predecessor to extend the contract for a longer period and for a higher salary to ensure long-term cooperation. The longer a player stays in the team, and his result contribution does not decrease, the VORP increases cumulatively with his contract's longer duration. Note that VORP is an upgrade of BPM (as discussed in Myers, 2020) which is also strongly correlated and so the observed result is logical. Therefore, there is no need for separate analysis of the effects of these two coefficients. Finally, when signing contracts with young players, the teams' policy is to offer them new deals after the first two years to ensure they stay with the team if he meets the criteria, this being characteristic for franchisees with high business value.

5. 2 Linear regression analysis

By examining contracted salaries since the 1980s, it is evident that salary growth is continuous following the trend of economic changes in the market. Here, the aim is to find a regression model focusing on the effects of changing independent variables on contracted salary over four decades. An attempt is made to define the parameters that affect the contracted salaries over time by observing exclusively the coefficients of individual and result contribution that have proven to be a strong indicator of salary increase. Special attention is given to multicollinearity as some of the observed coefficients are derivatives (BPM -> VORP). The model contains PER and VORP coefficients. It is important to reiterate that only data for players who meet the set restrictions are considered to, e.g., avoid short 10-day contracts signed due to unexpected circumstances that could alter the results and lead to erroneous conclusions. The results are:

Salary *(1980-1989) = 169.064,12 + 153.510,436**__*PER*__ *+ 3.450.148,353**__*VORP*__

Salary *(1990-1999) = 1.225.926,703 + 75.578,015**__*PER*__ *+ 3.533.683,621**__*VORP*__

Salary *(2000-2009) = 713.588,421 + 121.773,908**__*PER*__ *+ 3.494.101,867**__*VORP*__

Salary *(2010-2017) = 888.584,937 + 89.381,649**__*PER*__ *+ 3.825.705,414**__*VORP*__

Several conclusions could be drawn:

- There is a large increase in the constant (base value) of the contracted salary in conditions when the value of the coefficients is zero. This sudden growth began in 1987 due to an increase in the Salary Cap (from 1987 to 1990 by 180%). It continued into the 1990s when it was 199% by the end of the decade. The teams started signing "lifetime" contracts with key players. The growth continued to this day but never again at such progressive rates.
- PER proves to be a volatile parameter for decisions related to salaries. It is less used due to the popularisation of other efficiency measures that include the player's defensive performance. PER accounts for all player's contributions using one number. Its peak is its beginning (1980s), but it remains a popular statistic for monitoring the attacking performance of players even though studies (Sigler, Compton, 2018) show it may be insignificant concerning salary.
- VORP as an indicator gains in importance. It has a very strong impact on the contracted salaries (as presented and discussed already). By all accounts, it is a very interesting coefficient of individual contribution with high statistical value, see e.g. (Sawant et al., 2019).

5. 3 Cluster analysis

Cluster analysis was performed as a classification method to identify very good and extraordinary (all-stars) players in particular. This method has been used, e.g. in deliberations about new positions in the field differentiating between up to nine positions/clusters (Hussain, 2019; Kalman, Bosch, 2020) and to determine which NBA superstars are the most alike (Nibras, 2018). Standard k-means method was used with the number of clusters set to four, representing:

- below-average individual seasonal results,
- average and good individual seasonal results,
- very good and excellent individual seasonal results and
- extraordinary individual seasonal results.

The attributes used for classification into clusters were: contracted salary, PER, BPM, WS and VORP coefficients. Salary is presented as an average value per cluster for all players in a specific cluster. For more straightforward interpretation and understanding, the minimum, maximum and average values for the observed attributes of all players are presented in Table 2 (note that restrictive conditions presented above also apply).

Table 2. Descriptive statistics for observed attributes

Attribute	Minimum	Maximum	Average
PER	3	31.7	14.44
BPM	−5.9	12.2	−0.25
WS	−1.6	21.2	3.687
VORP	−2	12	1.006
Salary	$600.000	$36.700.000	$5.927.939,82

Source: Authors

The results of clustering (Table 3) and the number of player seasons per clusters:

- Cluster 1 (below-average): 5.855 (54%),
- Cluster 2 (average and good): 2.419 (20%),
- Cluster 3 (very good and excellent): 1.885 (17%),
- Cluster 4 (extraordinary): 675 (9%).

Table 3. Cluster analysis results

	Below-average results	Average and good results	Very good and excellent results	Extraordinary results
PER	12.42	15.038	17.207	22.044
BPM	−1.839	0.312	2.01	5.015
WS	1.719	4.129	6.652	10.895
VORP	0.011	1.106	2.49	5.135
Salary	$1.560.119,56	$6.654.195,95	$13.256.870,03	$20.745.333,33

Source: Authors

Surprisingly, as many as 54% of players whose data meet the restrictive conditions achieve below-average results. This percentage would have been even higher if the restrictions had not been set as it would have included players from the development league and players without permanent contracts. Since 1980, only 675 franchise player seasons have been achieved by individual players - the term franchise player stands for a key player that the whole franchise builds their game and business opportunities upon. Considering that most of these players achieve exceptional results over time (season after season), if the actual number of players who achieved this level of results were further examined, the number of franchise players would not exceed 100.

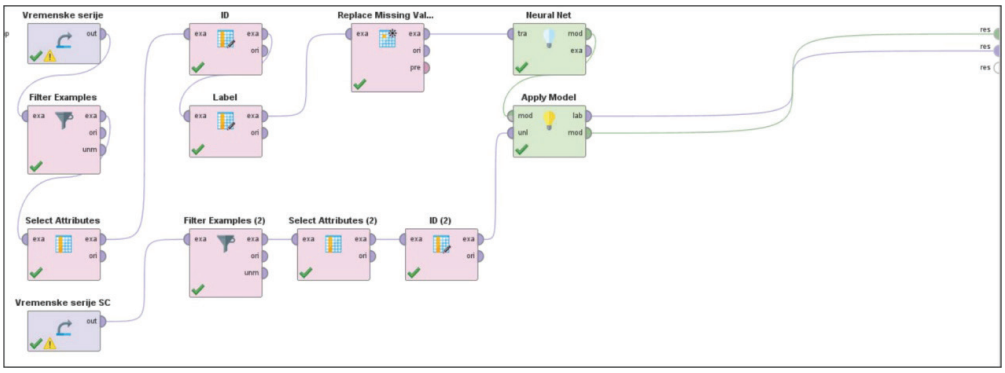
5. 4 Predictive analysis using artificial neural network

Predictive modelling is based on the results presented so far: the correlation between the players' salaries is the strongest with the coefficients of efficiency and individual contribution to results. The linear regression model directed the focus to main coefficients that affect the salaries meeting the conditions of statistical significance, but also the conditions of multicollinearity. In cluster analysis, four player groupings were formed based on their salary, coefficients of efficiency and contribution to results. Finally, the model based on NN algorithms seeks to determine the conditions for an increase or decrease in salaries for active players based on their performance contributions. NN feature is available in RapidMiner Studio with a basic setup for a deep learning artificial NN (Hai-Jew, 2018), providing a good environment for experimentation and salary prediction. The default settings were used (feed-forward neural network trained by a back-propagation algorithm) as described in RapidMiner Documentation (n.d.) In addition to the previously set restrictive conditions, to make the results more reliable and the decision-making potential of the model realistic, more criteria have been fixed:

- only active players are included in the analysis,
- only players from clusters 3 and 4 are included,
- individual result contribution is set starting from 2010,
- in addition to the attributes salaries, PER and VORP, the model takes into account other attributes such as Usage Percentage and True Shooting Percentage to reduce the effect of the VORP coefficient on the salary.

The DM model predicting the salary per player (illustrated in Figure 6) yielded some interesting results (excerpt in Figure 7). Out of the high-performing active players in clusters 3 and 4, the players with the highest recommended contract reduction are T. Allen (-1.5M$), B. Wright (-1.72M$), C. Parsons (-1.29M$), J. R. Smith (-3.28M$), J. Noah (-1.86M$), N. Batum (-2.08M$), G. Hill (-3.24M$), B. Griffin (-1.72M$), A. Bogut (-2.79M$), and W. Matthews (-2.71M$) among others. Interestingly, in the following seasons, they all achieved a significant decline in individual score contribution over the next few seasons. The prediction based on the NN algorithms to reduce contracted salaries proved to be accurate (supported by some popular sources, e.g. Nerkar, 2019).

Figure 6. Data mining model in RapidMiner 9.6



Source: Authors

The basketball player with the highest recommended cut is surprising – it is suggested that K. Durant's salary be reduced by $5.4M. The reason is that he was injured for a long time, so his contribution is 0. Consequently, the results cannot be considered statistically significant because the model does not reflect all relevant decision-making data as it lacks injury-related statistics. Players who were also recommended reduced salaries, but who did not achieve a decline in the following seasons are K. Leonard (-2.79M$) and R. Westbrook (-2.55M$). The reason for the recommendation is that the two players did not manage to achieve result contributions on par to their high salaries according to the model until 2014/15 (not including the observed season). R. Westbrook was mostly injured earlier in the season (similar to K. Durant), while K. Leonard only met the conditions for entering the cluster 4 (extraordinary players) in 2014/15 (his salary was as high as for players in cluster 4, yet his result contribution was sub-par). Some of the players with the highest recommended salary increase are K. Middleton (+2.04M$), M. Gortat (+2.29M$), R. Gobert (+1.57M$), J. Harden (+1M$), and G. Monroe (+1.9M$), among others. Looking at their performance, Middleton, Gobert, and Harden justified the recommended increase in salaries. After several good competitive seasons, Monroe achieved a sharp drop in the contribution to results, while Gortat, as a league veteran, made a good contribution to results for a short time, followed by a logical drop.

Figure 7. Salary prediction results per player

Player	prediction(S...	Salary ↑	PER	TS%	USG%	VORP
Andrew Bogut	13210571.964	16000000	15.800	0.565	13.200	2.400
Gordon Hayw...	17175962.233	16400000	20.200	0.567	26.200	3.600
Klay Thomps...	15490094.091	16500000	20.800	0.591	27.600	2.900
Nicolas Batum	14420486.556	16500000	13.100	0.516	14.600	3.100
Kyle Korver	16213495.645	16600000	14.800	0.699	14.400	3.300
Al Horford	16739192.490	16900000	21.400	0.563	22.200	3.400
John Wall	17714290.702	17000000	19.900	0.523	26.100	3.900
Kyle Lowry	16255281.446	17200000	19.300	0.527	25.400	3.400
Tyson Chand...	17797531.474	17300000	20.100	0.697	12.800	3.600
DeMarcus Co...	17295489.821	17300000	25.200	0.545	34.100	3.400
George Hill	14161809.854	17400000	21.500	0.579	23.800	2.400
Kyrie Irving	17737497.098	17700000	21.500	0.583	26.200	3.700
Wesley Matth...	14990546.281	17700000	16.100	0.586	19.800	3
Rudy Gobert	19573822.407	18000000	21.600	0.627	14	4.300
Paul Millsap	17393484.747	18300000	20	0.565	23.800	3.700

Source: Authors

6. CONCLUSIONS

The study's primary aim was to showcase the potential of DM methods for identifying the key factors that may affect the decision-making process behind signing new or extending contracts with professional basketball players. As the compiled dataset was comprehensive, containing data from four decades, the analysis revealed several continuing trends that can also be of relevance to stakeholders in the basketball business, this being a secondary aim of the study. With these two aims in mind, standard research methods were employed, such as correlation analysis, linear regression modelling, k-means clustering, and NNs for prediction.

Positive correlations between the coefficients of efficiency of the players and the contributions to teams' results with contracted salaries were found albeit with different strengths of correlation. No significant relationship was found between players' physical characteristics and salaries, while weak positive correlations were observed with the attributes denoting contribution to results. In terms of physical characteristics, it is noteworthy that changes can be observed over time, and the highest-paid positions are not those typically dominated by highest players anymore. This, in turn, affects the preferences regarding the decisions about selection of new players, as well as the way the game takes place. PER and VORP proved to be the two main factors in the linear regression model. The effect of the PER coefficient on salaries decreases over time, while the effect of the VORP coefficient increases. VORP is also strongly correlated with salaries. Apart from the strong effect, VORP is characterised by stability, while the same cannot be confirmed for the PER coefficient. In terms of salaries, due attention has been given to a progressive increase in Salary Cap, particularly pronounced from the late 1980s to late 1990s. Particular groups from under-performing to over-

performing players were then classified into four groups using cluster analysis using coefficients of efficiency and individual result contribution. This revealed that more than 50% of players achieve below-average results. In reality, the percentage is higher since restrictive conditions were set disregarding, e.g., development league players and players with short-term contracts. Apart from demonstrating the potential for player segmentation and classification, DM/deep learning algorithms for salary prediction were also presented. The NN algorithms predict future salaries for active players. Interesting discrepancies have been identified, especially for players with high-salary contracts where many do not meet high-performance requirements/standards. Still, the prediction model has an important shortcoming as it disregards player injuries and thus, cannot be used by sports managers and analysts as-is because the results can be skewed. Nevertheless, the prediction model proved to be accurate in estimating the decline in the result contribution of players approaching the end of their careers and younger players who just started their careers.

There are several other limitations to the study. It should be noted that conclusions about individual player results per season are not always easily quantifiable. For example, athlete B.Wallace is considered as one of the greatest defensive players of all times and the next Hall-of-Fame contender despite his average and/or very good individual career numbers (PER: 15.5; BPM: 2.5; WS: 6.23; VORP: 2.41). His contribution on the pitch and the general image of being a "driving force" (Paine, 2020) could not be comprehensively evaluated exclusively through statistics, also because the defense statistics inform coefficients like PER to al lesser degree. Consequently, future research should reconsider dividing players into categories of those who are more offensive- and those who are more defensive-oriented. Furthermore, to include more data in particular related to defense statistics, in-game player tracking data can be used to strengthen the conclusions related to individual differences and functional variability, as in Sampaio (2015). As mentioned already, important limitation relates to the NN algorithm used in this study that provides a good analytical environment for experimentation in terms of salary prediction, but only for those players who stayed healthy during observed seasons. The model cannot assume that some players had weaker results due to injury, and it can propose a significant wage drop which would be a wrong assumption. In future studies, injury-related data thus has to be taken into account. The algorithm also does not consider newly signed contracts for the same or new teams with apparent salary changes, "pulled-down or up" to player's older salary. It could assume that the player signed a new, improved contract for zero result progression, so these scenarios will have to be labelled in future studies.

In terms of implications of the study, and in line with the findings that the teams that employ analysts are more effective at scouting and compensating players (Huang, 2016), the paper provides an overview of the analytical process supported by data mining tools and possible research avenues. However, sports analysts and managers have to be aware that even with all the analyses, it is difficult to predict how a player's career will pan out (Weinberg, 2019). Yet, it is clear that there is considerable potential in using both the classification and prediction models based on NNs for salary-related decisions. Even with the set conditions and limited attributes selected, the open data served well the demonstrative purposes of this study.

This work has been supported by the Croatian Science Foundation (project No. IRP-2017-05-7625).

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Prethodno priopćenje
https://doi.org/10.31784/zvr.9.1.14
Datum primitka rada: 23. 9. 2020.
Datum prihvaćanja rada: 10. 2. 2021.

PRISTUP RUDARENJU PODATAKA ZA ANALIZU POSLOVNE VRIJEDNOSTI U KOŠARCI

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SAŽETAK

Povećanjem obujma generiranih podataka, te pojavom metoda i dostupnih tehnologija za njihovu analizu, otvaraju se nove prilike za podršku procesima donošenja odluka u domeni sportske analitike. Navedeno se posebno odnosi i na analizu performansi sportaša i izračun dodane poslovne vrijednosti koju pojedinci nose u velikim sportskim natjecanjima kao što je National Basketball Association (NBA) liga. Financijski uspjeh klubova tako ne ovisi isključivo o sportskom rezultatu nego i o uspješnosti privlačenja marketinški isplativih kadrova koji sa sobom nose veću poslovnu vrijednost. U tom kontekstu, cilj ovog rada je demonstrirati potencijal i važnost metoda rudarenja podataka kako bi se istražili čimbenici koji utječu na donošenje odluka o selekciji igraćih kadrova temeljem ostvarenih individualnih rezultata, fizičkih karakteristika i pratećih iznosa profesionalnih ugovora. Za potrebe istraživanja kreirana su 3 velika seta podataka, uređena i integrirana temeljem 22 različita seta podataka iz otvorenih izvora. Podaci obuhvaćaju razdoblje od osnivanja lige 1946. godine do 2017. godine. Prilikom provođenja analize u alatu RapidMiner razvijeni su modeli za korelacijsku, klaster i regresijska analizu. Prepoznata je promjena ključnih čimbenika koji su utjecali na odabir novih igrača posljednjih godina, dok je klasifikacijska analiza otkrila da, na primjer, više od 50% igrača ima ispodprosječne koeficijente učinkovitosti i individualni doprinos rezultatu. Izrađen je i model s umjetnim neuronskim mrežama za utvrđivanje odstupanja kod igrača s ugovorima s visokim plaćama od kojih mnogi ne udovoljavaju visokim standardima performansi. Među ostalim doprinosima, ova studija prikazuje kako modele klasifikacije i predviđanja mogu razvijati sportski analitičari i menadžeri pri donošenju odluka povezanih s formiranjem profesionalnih ugovora i predviđanju budućih plaća aktivnih igrača.

Ključne riječi: *sportska analitika, rudarenje podataka, selekcija igračkog kadra, klasifikacija, predikcija*

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Prethodno priopćenje
https://doi.org/10.31784/zvr.9.1.15
Datum primitka rada: 25. 11. 2020.
Datum prihvaćanja rada: 18. 1. 2021.

MULTIKULTURALNA KOMUNIKACIJSKA STRATEGIJA

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SAŽETAK

Ovim radom definiraju se smjernice u implementaciji multikulturalne komunikacijske strategije, kao i važnost te strategije za razvoj javnih i privatnih organizacija u Republici Hrvatskoj. Analiza migracijskih, turističkih i izvoznih trendova jasno ukazuje da u Republici Hrvatskoj postoji snažna potreba za implementacijom multikulturalne komunikacijske strategije. Multikulturalna komunikacijska strategija predstavlja komunikacijski okvir koji omogućuje učinkovitu interakciju pripadnika različitih kultura. Tu je strategiju moguće opisati kao „master ključ" koji otvara više brava, od kojih svaka ima svoj vlastiti ključ. Multikulturalna komunikacijska strategija primarno se oslanja na konvergentne komunikacijske taktike. Da bi se implementirao takav oblik komunikacije preporučljivo je slijediti šest osnovnih smjernica, a to su: empatija, fleksibilnost, fokusiranost, višejezičnost, uključivost i interaktivnost. Empatija predstavlja sposobnost identifikacije osjećajnih stanja sugovornika, koja se poboljšava postavljanjem dubinskih pitanja i aktivnim slušanjem. Fleksibilnost podrazumijeva sposobnost prilagodbe, koja se ostvaruje kroz minimiziranje osobne pristranosti. Fokusiranost podrazumijeva osnaživanje primarno onih konverzacija koje olakšavaju suradnju. Osim kroz korištenje većeg broja jezika, višejezičnost se najlakše postiže slikama i simbolima koji su razumljivi većem broju ljudi, bez obzira na jezik kojim govore. Uključivost se najčešće provodi kroz sudjelovanje u donošenju relevantnih političkih i poslovnih odluka. Osim kroz digitalne komunikacijske kanale, interkativnost se ostvaruje i na sve ostale načine koji omogućuju razmjenu informacija s ciljnom skupinom korisnika. Multikulturalna komunikacija najlakše se realizira u situacijama u kojima postoji obostrana potreba za suradnjom i razumijevanjem. Osim u tržišno orijentiranim organizacijama, multikulturalnu komunikaciju potrebno je implementirati i u javnom sektoru, a naročito u područjima kao što su promet, zdravstvo, obrazovanje, zakonodavstvo i javna administracija.

Ključne riječi: *poslovna komunikacija, multikulturalnost, interkulturalnost, multikulturalna komunikacijska strategija*

1. UVOD

U suvremenom društvu gotovo da i ne postoji uspješna poslovna organizacija koja nije suočena s izazovom multikulturalnosti u poslovnoj komunikaciji. Menadžeri čije tvrtke posluju međunarodnom tržištu, a čak i oni čije tvrtke posluju na lokalnom tržištu, sve češće su primorani razvijati multikulturalne komunikacijske vještine kako bi uspješno surađivali s pripadnicima različitih kultura. Među najvažnije čimbenike koji povećavaju potrebu za implementacijom multikulturalne komunikacijske strategije ubrajaju se sljedeći procesi: nastojanje da se proizvod i/ili usluga ponudi pripadnicima različitih kultura; snažne migracije stanovništva; niski i negativni prirast stanovništva koji zahtijeva uvoz stranih radnika; te visoka orijentiranost na turističke i prometne usluge. Navedeni čimbenici naročito su aktualni u Republici Hrvatskoj, a slične je procese moguće prepoznati i u ostalim zemljama Europske Unije. U kontekstu multikulturalne komunikacije, sve što vrijedi za glavne, odnosno dominantne kulture, vrijedi i za različite subkulture, budući da i jedne i druge obuhvaćaju skup normi, sustava vrijednosti i obrazaca ponašanja, koji razlikuju jednu grupu ljudi od neke šire grupe kojoj pripadaju. Žele li izbjeći potencijalne probleme i nerazumijevanje, organizacije koje vlastite proizvode odluče nuditi pripadnicima različitih kultura svakako bi trebale obučiti svoje djelatnike o specifičnim karakteristikama tih kultura. Dok su u prošlosti kulture diferencirane isključivo prema pripadnosti etničkim skupinama, nacijama, vjerskim obilježjima i jezicima, danas se kulture uglavnom promatraju u širem kontekstu, pa tako kad pričamo o multikulturalnosti, pripadnike jedne te iste kulture može povezivati prvenstveno životni i/ili glazbeni stil, a ne nužno i pripadnost istoj etničkoj skupini (npr. subkultura elektroničke glazbe).

Pred izazovom multikulturalne komunikacije ne nalazi se samo menadžer europskog brenda koji se nastoji probiti na kineskom tržištu, već i menadžer lokalnog restorana nekoliko ulica iza vaše kuće, koji osim komunikacije s osobljem, koje je najčešće sastavljeno od pojedinaca koji dolaze iz više različitih kulturnih okruženja, paralelno mora voditi računa o tome posjećuju li njegov restoran pripadnici različitih kultura i/ili subkultura. Ako je odgovor na prethodno pitanje potvrdan i/ili ako tek planira u svoj restoran privući neku specifičnu (sub)kulturnu skupinu ljudi, menadžer bi svakako trebao primijeniti multikulturalnu komunikacijsku strategiju, prilagoditi ponudu i obučiti svoje osoblje za prikladan način komunikacije s tom grupom ljudi. Kultura je fluidna kategorija koja se stalno mijenja i reprezentira kroz navike, običaje, stavove i ponašanja. Iako su kulture promjenjive, te unatoč tome što se, pod utjecajem globalizacije i međusobnog suživota velikog broja pripadnika različitih kultura u metropolitskim središtima, svakodnevno redefiniraju, razlike među preferencijama i obrascima ponašanja pripadnika različitih kultura često su značajne, a samim time i bitan element u (poslovnoj) komunikaciji.

Suvremeno društvo karakteriziraju snažne turističke i ekonomske migracije, te rast međunarodne trgovine, a što izravno utječe na značajnost multikulturalne komunikacije. Baldwin i Hunt (2012) interkulturalnu komunikaciju definiraju kao komunikaciju u kojoj su kulturne razlike dovoljno velike da utječu na proizvodnju ili potrošnju, a nastoje je razlikovati od međugrupne komunikacije, koja se događa kada naša percepcija vlastitog ili tuđeg društvenog identiteta (npr. rase, regije, religije, itd.) utječe na komunikaciju, čak i ako nema stvarnih kulturnih razlika. Naglašavajući važnost vizualnog definiranja predodžbe o kulturi Wiggins (2012) koristi različite metafore kao

što su metafora o ledenom brijegu, metafora o luku, genealoško stablo, podloga i kavez. Dok raspravlja o interkulturnoj komunikaciji Al-Araki (2015) koristi metaforu ruksaka i ljestvi, te zaključuje da su sve osobe potencijalno sposobne integrirati se u bilo koje društvo identifikacijom svojih ruksaka (koji se pune tijekom procesa socijalizacije) te revizijom vlastitih navika i mentalnih sklonosti putem ljestvi (koje se predstavljaju svojevrsne premise uspješne komunikacije). Kumbier i Schulz von Thun (2009) nude pregled metoda, modela i primjera za uspješnu komunikaciju između različitih svjetskih kultura u duhu sveopće globalizacije, dok Blanchard et al. (2013) ističu potrebu za integriranjem kulturnih razmatranja u sustave s umjetnom inteligencijom kako bi se poboljšale naše interakcije. Prema istraživanju Culture Wizard-a (2016) 68 % ispitanika izjavljuje da su kulturni izazovi najveća prepreka produktivnosti globalnog virtualnog tima. Iako je samo 18 % ispitanika izjavilo da su njihove tvrtke izgubile poslovne prilike zbog kulturnih nesporazuma, broj propuštenih prilika vjerojatno je i veći od toga, a što jasno upućuje na ekonomski značaj ove teme (Culture Wizard, 2016).

I u Republici Hrvatskoj tema multikulturalnosti u posljednjih dvadeset godina postaje sve popularnija. Perasović (2002) tako ističe da svaka (kultura i/ili) subkultura posjeduje „simboličku strukturu" (slang, glazbu, stil odijevanja, simbole...), koju mnogi promatraju neovisno o pojedinačnim subjektima koji te stilove žive, pa je upravo zbog te „simboličke strukture" moguće da pojedinci, a ne isključivo skupine, pripadaju različitim subkulturnim stilovima života iako ih ne prakticiraju u potpunosti njihova značenja. Na primjer, netko se može izjašnjavati kao vjernik iako rijetko ili pak uopće ne prakticira ideale te vjere. Na isti način, netko se može identificirati kao sportski tip osobe i kupovati sportsku odjeću iako se izuzetno rijetko ili uopće aktivno ne bavi sportom. Mesić (2006) identificira različite oblike multikulturalizma kao što su konzervativni, kritički, liberalni, lijevo-liberalni i fluidni multikulturalizam, te ističe nedostatke različitih pristupa pri čemu liberalni zaobilazi pitanje kompetencije različitih etničkih grupa, lijevo liberalni reificira i esencijalizira identitete, dok fluidni tretira etničke identitete kao da su opcionalni. Stričević (2012) pojam multikulturalnost definira kao ideal skladnog suživota kulturno različitih skupina u kontekstu ideje pluralnog društva. Zebec (2016) provodi empirijsko istraživanje kojim pronalazi da se većina ispitanika (90 %) slaže ili se donekle slaže s time da su spremni izbjegavati stereotipe i predrasude u komunikaciji, dok Jagić (2006) provodi empirijsko istraživanjem kojim potvrđuje tezu da je turizam prvorazredni interkulturalni fenomen koji snažno promovira i stvara interkulturalni duh. Iako se ovom temom do sada bavio prilično široki krug autora, relativno je mali broj dostupnih izvora koji nude praktične upute za oblikovanje multikulturalne komunikacijske strategije. Svrha i cilj ovog rada je postaviti smjernice u oblikovanju multikulturalne komunikacijske strategije, te analizirati značaj multikulturalnosti u društveno-ekonomskom razvoju Republike Hrvatske. Da bi se ostvario postavljeni cilj ovim radom nastoji se odgovoriti na sljedeća pitanja:

- Što je to multikulturalna komunikacijska strategija?
- Koliki je značaj multikulturalne komunikacije za Republiku Hrvatsku?
- Koje su praktične smjernice u implementaciji multikulturalne komunikacijske strategije?

Ovaj rad namijenjen je svima koji žele unaprijediti vještinu komunikacije u multikulturalnim okruženjima, a naročito studentima ekonomskih usmjerenja i menadžerima suvremenih poduzeća

koji bi rješenja ponuđena u ovom radu mogli i trebali koristiti u unapređenju konkurentnosti i senzibilnosti vlastitih organizacija. Osnovna hipoteza provedenog istraživanja je da organizacije koje posluju na tržištu Republike Hrvatske imaju snažnu potrebu za implementacijom multikulturalne komunikacijske strategije. Prihvaćanje i uvažavanje kulturoloških razlika, otvara novi prostor za dijalog i suradnju koja ne bi bila ostvarena među grupama i/ili pojedincima koji negiraju i/ili nisko vrednuju multikulturalnost.

2. METODOLOGIJA

Multikulturna komunikacija se događa kad su pripadnici jedne kulture u nekoj vrsti interakcije s pripadnicima druge kulture. Komunikacija se odvija verbalnim i neverbalnim putem, što znači da pri upoznavanju nama strane kulture moramo učiti i o značenju izraza lica, tonu glasa kojim se govori, tjelesnim pokretima i gestama prilikom komunikacije, osobnom prostoru među sugovornicima i još nizu važnih neverbalnih simbola i običaja druge kulture kako bismo ostvarili što bolju komunikaciju i razumijevanje. U situacijama kad nastoje komunicirati s nekim tko ne dijeli njihove norme, stavove i pravila ponašanja, pojedinci su primorani uložiti dodatnu energiju za učenje i prilagodbu, pri čemu redefiniraju vlastite stavove i obrasce ponašanja, a to nije uvijek jednostavno i ugodno. Kompleksnost se dodatno povećava kad želimo istovremeno komunicirati s većim brojem pripadnika različitih kultura. Multikulturalna komunikacijska strategija predstavlja komunikacijski okvir oblikovan na temelju preporuka koje omogućuju istovremenu interakciju s većim brojem pripadnika različitih kultura. Provedeno istraživanje oslanja se na komunikacijsko adaptivnu teoriju (engl. *Communication Adaptation Theory* – CAT) koja se zasniva na vezama između jezika, konteksta i identiteta (Giles, Ogay, 2007), te na Hallovu teoriju interkulturalne komunikacije koja razlikuje kulture visokog i niskog konteksta (Hall, 1990). Komunikacija u kulturi visokog konteksta može biti prilično zahtjevna za osobu koja ne razumije "nepisana pravila" kulture u kojoj se vrlo malo toga uzima "zdravo za gotovo". Istodobno, u kulturi s niskim kontekstom najčešće ne postoje dodatna, odnosno "skrivena" značenja . Iako nastoji biti fleksibilna na način da korisnicima koji to traže nudi dodatna objašnjenja, strategija multikulturalne komunikacije preferira okruženje niskog konteksta, budući da to umanjuje šanse za nesporazum. Prema komunikacijsko adaptivnoj teoriji, osim što komunikatori svoj stil komunikacije često prilagođavaju publici, odnosno pojedincu, grupi ili društvu općenito, način na koji se komunikacija odvija snažno je povezan s kontekstom i pozicijama moći. Iako kritičari s pravom upozoravaju na opasnost pretjeranog redukcionizma, te na opasnu pretpostavku racionalnosti (jer ljudi nisu uvijek racionalni, nego samo onda kad to odluče biti), ova teorija podrazumijeva da postoje dva osnovna procesa u komunikaciji, a to su: konvergencija i divergencija. Konvergencija predstavlja proces kroz koji pojedinac prilagođava komunikacijske obrasce u interakciji tako da oni više sliče govornim obrascima njihove publike, dok se divergencija odnosi na postupke i strategije kojima komunikatori nastoje istaknuti razlike između sebe i onih s kojima komuniciraju. Multikulturalna komunikacijska strategija primarno se oslanja na konvergentne taktike, dok divergentne taktike koristi daleko rjeđe, a najčešće samo onda kad ih odluče koristiti naši sugovornici. Primjenom različitih znanstvenih metoda kao što su metoda analize, sinteze, deskripcije i metoda sustavnog mišljenja nastoji se pronaći odgovor na to kako oblikovati učinkovitu multikulturalnu komunikacijsku strategiju. Sustavno mišljenje je univerzalno primjenjivi okvir za pronalaženje suptilnih međuovisnosti i veza između elemenata

u kompleksnim sustavima koji olakšava upravljanje i djelovanje u skladu s prirodnim procesima društveno-ekonomskog okruženja (Senge, 2010). Osim analize društvenih kretanja koji ukazuju na značaj multikulturalne komunikacije za Republiku Hrvatsku, autori predlažu originalne i univerazlno primjenjive strateške smjernice za implementaciju multikulturalne komunikacijske strategije.

3. ANALIZA TRENDOVA KOJI UKAZUJU NA ZNAČAJ MULTIKULTURALNE KOMUNIKACIJE U REPUBLICI HRVATSKOJ

Migracije tj. kretanja stanovništva imaju dvije osnovne sastavnice: imigraciju i emigraciju. Pojam imigracije objašnjava useljavanje na određeno područje dok emigracija označava iseljavanje. Iako u nekim prenapučenim sredinama može vrijediti i obratno, imigracija iz ekonomske perspektive najčešće predstavlja pozitivnu oznaku ukupnog kretanja stanovništva budući da povećava dostupnost radne snage i bogatstvo ponude, a smanjuje cijenu rada. Emigracija, s druge strane, iz ekonomske perspektive se najčešće promatra kao negativni proces u kretanju stanovništva koji dovodi do smanjenja dostupne radne snage i ponude, te do povećanja cijene rada. Kada se promatra razlika između broja useljenih i iseljenih iz određene zemlje u određenom razdoblju, ta se razlika naziva migracijski saldo ili migracijska bilanca. Ako je broj imigriranih veći od broja emigriranih tada je migracijski saldo pozitivan, a ako je broj emigriranih veći od broja imigriranih imamo negativan migracijski saldo. O nultom migracijskom saldu ili ravnotežnoj migracijskoj bilanci govorimo kada se izjednači broj imigriranog i emigriranog stanovništva (Wertheimer-Beletić, 1999.).

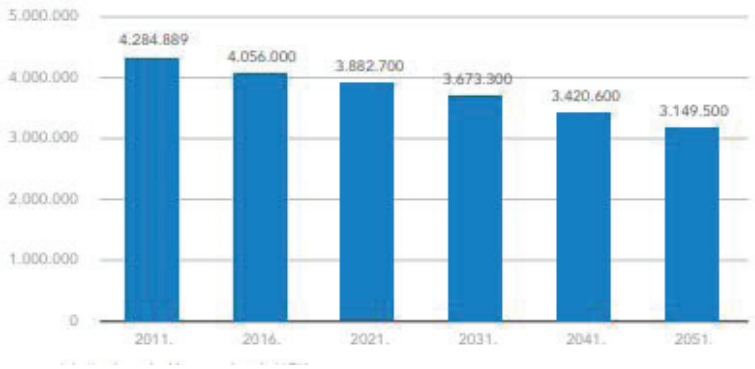
Tablica 1. Migracije stanovništva Republike Hrvatske od 2015. do 2019. godine

	2015.	2016.	2017.	2018.	2019.
Doseljeni iz inozemstva	11.706	13.985	15.553	26.029	37.726
Odseljeni u inozemstvo	29.651	36.436	47.352	39.515	40.148
Migracijski saldo	−17.945	−22.451	−31.799	−13.486	−2.422

Izvor: DZS (2020)

Prema podacima iz tablice 1, Republika Hrvatska je u promatranom razdoblju od 2015. do 2019. godine imala kontinuirani negativni migracijski saldo koji je nešto ublažen tek u 2019. godini. U razdoblju od 2015. do 2019. godine iz Republike Hrvatske u inozemstvo se odselilo 193.102 osoba, dok se u istom razdoblju iz inozemstva doselilo 104.999 osoba, što čini ukupan migracijski saldo od -88.103 osoba. Trenutni demografski trendovi vrlo se negativno odražavaju na gospodarstvo Republike Hrvatske. Prirodni je prirast na nacionalnoj razini negativan od 1998. godine, a u posljednjim godinama sve je snažnije naglašen, pa je tako u 2017. godini bio je negativno rekordan sa 16,9 tisuća više umrlih od živorođenih (HGK, 2019). Nastave li se negativni demokratski trenovi Republika Hrvatska će do 2051. godine izgubiti čak četvrtinu današnjeg stanovništva (vidi grafikon 1).

Grafikon 1. Broj stanovnika Republike Hrvatske, demografske projekcije do 2051. godine



Izvor: Akrap (2015) i HGK (2019:4).

Kao što je vidljivo u tablici 2, u Republiku Hrvatsku u 2019. godini je iz inozemstva doselilo 37.726 osoba. Raznolikost u dobi doseljenog stanovništva potvrđuje potrebu za razvojem multikulturalnosti u svim sferama našeg društveno-ekonomskog okruženja.

Tablica 2. Broj doseljenih stanovnika iz inozemstva u Republiku Hrvatsku prema starosti i spolu u 2019. godini

Dob	*Ukupno*	*Muškarci*	Žene
0 – 4	559	285	274
5 – 9	411	201	210
10 – 14	326	179	147
15 – 19	1.414	1.029	385
20 – 24	5.061	3.944	1.117
25 – 29	5.412	4.257	1.155
30 – 34	5.118	4.218	900
35 – 39	4.667	3.908	759
40 – 44	3.991	3.281	710
45 – 49	3.348	2.715	633
50 – 54	2.525	1.986	539
55 – 59	1.692	1.268	424
60 – 64	1.188	748	440
65 – 69	944	539	405
70 – 74	488	294	194
75 i više	582	295	287
Ukupno	**37.726**	**29.147**	**8.579**

Izvor: DZS (2020)

Podaci u tablicama 1. u 2. jasno ukazuju na potrebu za implementacijom multikulturalne komunikacijske strategije, ne samo u privatnom već i u javnom sektoru. Osim u tržišno orijentiranim organizacijama, multikulturalnu komunikacijsku strategiju potrebno je implementirati u svim ostalim segmentima našeg društveno-ekonomskog okruženja, kao što su javni promet, zdravstvo, obrazovanje i javne administracija. Prikazani podaci ukazuju na rast priljeva stanovništva istočnih kultura, a naročito iz Azije što također upućuje na potrebu za implementacijom multikulturalne komunikacijske strategije.

Tablica 3. Pregled doseljenog stanovništva u RH od 2015. - 2019. godine prema geografskim regijama iz kojih osobe dolaze

Regija	2015.	2016.	2017.	2018.	2019.	Ukupno u promatranom razdoblju
Europa	-	-	-	-	-	
Europska unija	4.382	5.555	5.860	6.256	7.644	29.697
Ostale europske zemlje	6.133	7.077	7.739	17.515	25.309	63.773
Azija	475	447	419	903	3.113	5.357
Afrika	118	92	87	128	175	600
Sjeverna i Srednja Amerika	310	506	424	486	568	2.294
Južna Amerika	82	83	109	125	181	580
Oceanija	131	135	150	197	230	843
Nepoznato	75	90	765	419	506	1.855

Izvor: DZS (2020)

Kako je i vidljivo u tablici 4, osim samog povećanja broja godišnjih kvota dozvola javila se i potreba za diversifikacijom vrsta samih dozvola. Tako se u 2018. i 2019. godini pojavila potreba za uvrštavanjem novih kvota za potrebe premještaja unutar društva i provedbu strateških investicijskih projekata, a što je izravna posljedica globalizacije, sve većeg otvaranja tržišta Republike Hrvatske, te povećanja stranih investicija. Uz utvrđene godišnje kvote dozvola za zapošljavanje stranaca, u praksi se koriste i dozvole za zapošljavanje stranaca izvan dozvoljenih godišnjih kvota. Te se dozvole izdaju ako neka organizacija zatraži dozvolu za zapošljavanje osobe u djelatnosti koja nije navedene u Odluci o godišnjoj kvoti dozvola za tu kalendarsku godinu.

Tablica 4. Kvote dozvola za zapošljavanje stranaca u RH od 2015. - 2019. godine

Godina	*Ukupna godišnja kvota dozvola za zapošljavanje stranaca*	*Godišnja kvota za produženje već izdanih dozvola za zapošljavanje stranaca*	*Godišnja kvota dozvola za novo zapošljavanje stranaca*	*Godišnja kvota dozvola za sezonski rad*	*Godišnja kvota dozvola za osobe premještene unutar društva*	*Godišnja kvota dozvola za provedbu strateških investicijskih projekata*
2015.	1.730	1.500	215	15	-	-
2016.	3.115	800	2.300	15	-	-
2017.	7.026	1.800	5.211	15	-	-
2018.	31.000	9.000	21.210	540	250	-
2019.	65.100	15.000	41.810	6.540	250	1.500

Izvor: Vlada RH (2014, 2016a, 2016b, 2017, 2018)

U tablici 5 prikazan je broj ukupno izdanih dozvola za zapošljavanje stranaca u promatranom razdoblju od 2015. do 2019. godine. Prikazani podaci nedvojbeno ukazuju na to da se slika stanovništva u Republici Hrvatskoj značajno mijenja, a što zahtijeva strateške promjene u organizaciji i komunikaciji, odnosno veću senzibilizaciju društva prema multikulturalnosti.

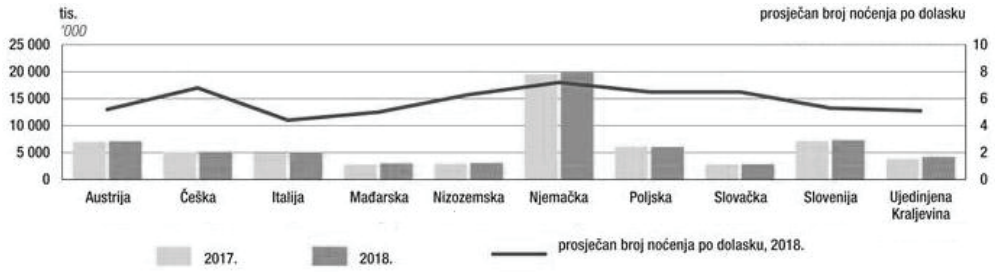
Tablica 5. Izdane dozvole za rad od 2015. - 2019. godine

Godina	*Ukupno izdano dozvola za zapošljavanje stranaca*	*Godišnje povećanje (%)*
2015.	2.563	-
2016.	3.399	32,62 %
2017.	7.400	117,71 %
2018.	20.769	180,66 %
2019.	49.317	137,45 %

Izvor: MUP RH (2020)

Snažna orijentacija hrvatskog gospodarstva na turizam dodatni je moment koji osnažuje navedenu potrebu. Na grafikonu 2 vidljivo je da su Republici Hrvatskoj 2017. i 2018. godine najveći broj noćenja ostvarili turisti iz Njemačke, Slovenije i Austrije. Broj pripadnika različitih kultura (i subkultura) koji turistički posjećuju našu zemlju stalno se povećava, a da bi privukli goste različitih kultura potrebno je detaljnije proučiti njihove kulturne obrasce i preferencije, te u skladu s time oblikovati ponudu. Jedan od primjera takve prilagodba jest implementacija Halal certifikata koji turistima omogućuje održavanje vjerskih obreda i pripremu prilagođene prehrane. Budući da muslimani predstavljaju gotovo jednu četvrtinu ukupne svjetske populacije, prema procjenama stručnjaka svjetsko halal turističko tržište u 2017. vrijedilo je čak 160 milijardi USD (Dugonjić, 2018).

Grafikon 2. Noćenja stranih turista prema zemlji prebivališta koji su u 2017. i 2018. godini posjetili Republiku Hrvatsku



Izvor: DZS (2019a)

Implementacija multikulturalne komunikacije naročito je važna prilikom oblikovanja proizvoda i usluga koje se nastoji plasirati na inozemna tržišta, a što često podrazumijeva i komunikaciju s pripadnicima drugih kultura.

Tablica 6. Izvoz RH u tisućama kuna u 2017. i 2018. godini prema ekonomskim grupacijama

	2017.	2018.	Index (2018 / 2017)
Ukupno	104 600 956	107 913 440	103,2
Države članice EU-a	67 866 858	74 188 818	109,3
Zemlje Efte	1 700 313	1 905 308	112,1
Zemlje Cefte	18 234 030	18 185 221	99,7
Zemlje OPEC-a	1 604 236	1 795 565	111,9
Ostale europske zemlje	3 590 098	3 293 047	91,7
Ostale azijske zemlje	3 566 873	3 737 799	104,8
Ostale afričke zemlje	2 212 041	1 088 032	49,2
Ostale američke zemlje	5 448 867	3 461 899	63,5
Oceanijske zemlje	265 219	149 288	56,3
Neraspoređeno	112 421	108 464	96,5

Izvor: DZS (2019b)

Prema podacima u tablici 6. Republika Hrvatska najviše izvozi u zemlje EU i zemlje Cefte koje obuhvaćaju Bosnu i Hercegovinu, Srbiju, Crnu Goru, Albaniju, Sjevernu Makedoniju i Moldaviju. U zemlje Efte izvoz se u promatranom razdoblju povećao za 12.1 %, a od toga najviše u Island, Švicarsku i Norvešku. U zemlje Europske Unije, u promatranom razdoblju izvoz je porastao za 9.3 %, a od toga najviše u Rumunjsku i Finsku. U zemlje OPEC-a izvoz se ukupno povećao za 11.9 %, a od toga se naročito povećao izvoz u Irak, Kongo i Nigeriju. U azijskim zemljame od 2017. do 2018. godine izvoz se povećao za ukupno 4.8 %, a od toga naročito u Libanon, Tajland i Filipine.

4. RASPRAVA

Nema dvojbe da kultura utječe na komunikaciju, a da oboje mogu utjecati i na organizacijske procese. Otvaranje novim tržištima i ulagačima, te sve veći broj stranih radnika u Republici Hrvatskoj jasni su pokazatelji da se naše društvo mijenja. Republika Hrvatska relativno je mala zemlja koja zbog demografskih i ekonomskih karakteristika nema drugog izbora nego biti otvorena prema suradnji s pripadnicima drugih kultura. Upravo stoga od velike je važnosti da kao društvo počnemo prihvaćati promjene, te da krenemo prilagođavati vlastite komunikacijske strategije novim izazovima. Da bi u tome bili uspješni, moramo učiti o drugim kulturama, te razumjeti i prihvatiti razlike kao nešto pozitivno što nam može pomoći u društveno-ekonomskom razvoju. Sve industrije ili sektori, pa čak i oni koji su donedavno bili primarno usmjereni na lokalno tržište i kulturu, poput obrazovanja, u budućnosti bi trebali biti sposobni prilagođavati vlastite proizvode i usluge različitim kulturama i tržištima. Snažan priljev stranih radnika, pojačana imigracija, kao i sve snažnija nastojanja za izvozom lokalnih proizvoda i usluga na međunarodna tržišta, navode javne i privatne organizacije u Republici Hrvatskoj da se suoče s izazovima multikulturalnosti. Neki od najboljih pristupa u razvoju multikulturalnog okruženja su aktivni rad na ublažavanju kulturalnih barijera (npr. zapošljavanje pripadnika različitih kultura), učenje o stranim kulturama (npr. čitanje literature i posjeti stranoj kulturi) i implementacija multikulturalne komunikacijske strategije koja će olakšati komunikaciju i suradnju s pripadnicima različitih kultura. Unatoč tome što se širenjem spoznaja specifičnoj kulturi može unaprijediti komunikaciju i suradnju s pripadnicima te kulture o kojoj smo nešto više naučili, kompleksnost se dodatno povećava kada nastojimo istovremeno surađivati i komunicirati s većim brojem pripadnika različitih kultura. Da bi supješno poslovali na međunarodnom tržištu i/ili surađivali s pripadnicima drugih kultura u multikulturalnim timovima potrebno je primijeniti multikulturalnu komunikacijsku strategiju.

U praksi postoji više vrsta komunikacijskih strategija, od onih koje se primjenjuju u komunikaciji u „četiri oka" do onih koje omogućuju plasman proizvoda na međunarodno tržište. Komunikacijska strategija koju koriste suvremene organizacije temelji se na viziji, misiji i vrijednostima organizacije, na specifičnim ciljevima (vidljivost u zajednici, javna podrška, financijska dobit,..), te na raspoloživim resursima (npr. financijske mogućnosti i tehnologija). Komunikacijska strategija predstavlja unaprijed definirani obrazac u struji odluka kojim se definira ciljeve komunikacije, ciljne skupine kojima se obraćamo i komunikacijske kanale koje koristimo. Komunikacijskom strategijom organizacija prenosi svoju osnovnu poruku zajednici u kojoj djeluje. Interkulturalna komunikacija podrazumijeva interakciju između dvaju ili više pripadnika različitih (sub)kultura, koja omogućuje nadvladavanje (sub)kulturnih barijera (Auwalu Issa et al., 2015). Interkulturalnu komunikaciju moguće je promatrati kao komunikaciju koja se odvija u interkulturalnom simboličkom okruženju (Arasaratnam, 2013:48). Prema Lustigu i Koesteru (2007:46) interkulturnu komunikaciju je moguće definirati kao simbolički, interpretativni, transakcijski i kontekstualni proces u kojem ljudi iz različitih kultura stvaraju zajednička značenja. Multikulturalna komunikacijska strategija predstavlja specifičan komunikacijski okvir koji omogućuje istovremenu učinkovitu interakciju pripadnika različitih kultura. To je radni i komunikacijski okvir koji smanjuje probleme koji mogu nastati u komunikaciji s pripadnicima različitih kultura. Primjenom predloženog komunikacijskog okvira, organizacije i pojedinci postaju uspješniji u komunikaciji unutar multikulturalnog okruženja.

Sama činjenica da neka organizacija svoju komunikacijsku strategiju nije prilagodila pripadnicima neke specifične kulture, smanjuje njezinu šansu za suradnjom i trgovinskom razmjenom s tom kulturom. Budući da su suradnja i trgovinska razmjena put općeg društvenog razvoja, koristi od implementacije multikulturalna komunikacijske strategije trebali bi imati sve poslovne i javne organizacije u Republici Hrvatskoj. U tablici 7 prikazane su smjernice u implementaciji multikulturalne komunikacijske strategije.

Tablica 7. Šest smjernica u implementaciji multikulturalne komunikacijske strategije

PROBLEMI	**PREDUVJETI**	**SMJERNICE**	**KOMPLEKSNI FAKTORI**
• Ne poznajemo kulturu osobe i/ili grupe • Nesporazum proizlazi zbog razlika u komuniciranju	• Zainteresiranost • za sugovornika i postavljanje dubinskih pitanja • Aktivno slušanje koje omogućuje razumijevanje	*EMPATIJA*	• Sugovornici su iz zatvorene kulture • Sugovornici koriste kulturu koja je bitno različita od naše
• Primjenjujemo samo jedan kanal komunikacije • Nismo sposobni ublažiti odlike vlastitog stila • komunikacije	• Postojanje više komunikacijskih • kanala • Ublažavanje odlika vlastitog • stila komunikacije	*FLEKSIBILNOST*	• Sugovornici su članovi kulture visokog konteksta • Komunikacija s osobama čiji se komunikacijski stil razlikuje od našeg
• Sugovornici ne žele komunicirati o nekoj temi • Nepostojanje plana i jasnog cilja	• Jasna ideja o tome što želimo postići • Interes sugovornika	FOKUSIRANOST	• Sugovornici koriste preširoka objašnjenja • Sugovornici nisu zainteresirani za temu
• Sugovornik ne govori niti jedan od ponuđenih jezika • Ne poznajemo jezik sugovornika	• Prevedeni materijali i upute • Koristimo se jezikom i simbolima koji ciljana publika razumije	*VIŠEJEZIČNOST*	• Sugovornik loše govori jezik kojim komuniciramo • Sugovornici su osobe s invaliditetom

• Isključivi pogled na svijet u kojem nema mjesta za drugačije mišljenje	• Uvjerenje o tome da su različitosti dio cjeline • Poštivanje razlika, budući da perspektiva utječe na naše stavove i odluke	*UKLJUČIVOST*	• Sugovornici dolaze iz kultura koje su bile ili su još uvijek u sukobu • Komunikacija se odvija u zatvorenoj sredini
• Korisničko sučelje je suviše složeno za razmjenu informacije • Niska razina personalizacije i prilagodbe korisniku	• Sugovornik koristi komunikacijski kanal kojim želimo komunicirati (npr. mobilne aplikacije) • Koristimo sve dostupne kanale komunikacije	*INTERAKTIVNOST*	• Sugovornici imaju nisku razinu znanja u korištenju naprednih tehnologija • Korisnicima su naši kanali komunikacije teško dostupni

Izvor: izradili autori

Empatija predstavlja sposobnost identifikacije osjećanih stanja naših sugovornika, a podrazumijeva iskrenu zainteresiranost za sugovornike koja se unapređuje postavljanjem dubinskih pitanja i aktivnim slušanjem. Multikulturalna komunikacijska strategija nastoji svima pružiti priliku da se predstave kako bi se lakše identificiralo njihove preferencije i navike. Čak i prije nego se pripadnicima različitih kultura odlučite postaviti dubinska pitanja koja otkrivaju njihove preferencije i navike, pobrinite se da saznate barem osnovne informacije o pripadnicima različitih kultura i subkultura s kojima nastojite komunicirati. Postavljanje dubinskih pitanja koja olakšavaju razumijevanje sugovornika i izbjegavanje „kulturoloških pogreški" najčešće se tumači kao pozitivno nastojanje koje unapređuje komunikaciju. Kad se želi saznati specifične informacije o sugovornicima, dobro je unaprijed pripremiti specifični set pitanja, odnosno metode i tehnike (npr. simboli, mobilne aplikacije, upitnici) koje će olakšati upoznavanje i razmjenu informacija. Aktivnim slušanjem, koje podrazumijeva postavljanje većeg broja podpitanja, te analizom prikupljenih informacija moguće je značajno unaprijediti međusobno razumijevanje, te otkriti prilike za unapređenje suradnje koje ne bismo otkrili bez da smo takva pitanja postavili. Iako ideje i stajališta sugovornika mogu biti suprotstavljena našima, važno je razumjeti da takve spoznaje unapređuju ukupnu kvalitetu odnosa i spoznaje o specifičnoj temi koje kasnije možemo iskoristiti u nekoj drugoj prilici. Empatija s pripadnicima različitih kultura, podrazumijeva i kreiranje jasnih i lako razumljivih poruka i uputa koje olakšavaju prilagodbu.

Fleksibilnost podrazumijeva sposobnost prilagodbe, koja se ostvaruje kroz minimiziranje osobne pristranosti. Na osobnoj razini svi bismo trebali biti spremni prepoznati vlastite pristranosti i pretpostavke koje utječu na to kako komuniciramo s drugima. Sposobnost prilagodbe sugovornicima omogućuje razmjenu informacija bez obzira na kulturne vrijednosti, norme i ponašanja koje se mogu razlikovati među publikom (Stobierski, 2019). Osobe iz kultura šireg konteksta žele i

trebaju više vremena kako bi upoznali sugovornika i donijeli odluku. U kulturama užeg konteksta pojedinci ulažu nešto manje vremena na upoznavanje i relativno brzo donose odluke. Ukoliko se ne primjenjuje fleksibilnost u količini dostupnih informacija i vremenu dostupnom za donošenje odluka, prilikom komunikacije članova kulture užeg konteksta i članova kulture šireg konteksta lako može doći do nesporazuma jer jedni drugima mogu biti nerazumljivi. Dok će jedni željeti provesti vrijeme sa sugovornikom, drugi će nastojati što je moguće prije prijeći na bit komunikacije. U toj se situaciji i jedni i drugi mogu osjećati uvrijeđeno. Dok jedni smatraju da im sugovornik troši dragocjeno vrijeme i zanima se za osobne detalje o sugovorniku, drugi smatraju da je direktan pristup nepristojan ili da je sugovornik pretjerano suzdržan. Multikulturalna komunikacijska strategija omogućuje fleksibilnost korištenjem većeg broja različitih komunikacijskih kanala (email, telefon, mobilna aplikacija, web, sastanci u živo), susprezanjem karakteristika osobnog komunikacijskog stila (na opće prihvatljivu razinu) te pružanjem osnovnih sažetih informacija i poveznica na detaljnije informacije, a što sugovornicima omogućuje brzo ili sporo donošenje odluka ovisno o njihovim osobnim preferencijama.

Fokusiranost podrazumijeva osnaživanje primarno onih konverzacija koje olakšavaju suradnju. Kad organizacija ima jasnu predodžbu o tome što komunikacijom želi postići, te ako uspije pridobiti pažnju sugovornika, puno je manja vjerojatnost da će doći do nesporazuma. Iako razgovor o širem rasponu tema može omogućiti višu razinu svjesnosti o različitim kulturnim obrascima, normama i vrijednostima, u multikulturalnoj komunikaciji gubitak fokusa predstavlja vrlo sklizak teren. Neke teme zahtijevaju široka objašnjenja, koja često oduzimaju previše vremena, a time se potencijalno umara sugovornike, te potencira rasprave koje troše vrijeme i energiju koja je mogla biti uložena u neku drugu važniju aktivnost. Upravo stoga, kad organizacije nastoje komunicirati s većim brojem pripadnika različitih kultura, najbolje je zadržati fokusiranost na osnovne ciljeve komunikacije.

Višejezičnost omogućuje lakše razumijevanje među pripadnicima različitih kultura koje govore različitim jezikom. Iako nije uvijek slučaj da pripadnici različitih kultura govore različitim jezikom, težnja da se sadržaj ponude sugovornicima na njihovom (materinjem) jeziku vrlo je važan dio multikulturalne komunikacijske strategije. Čak i kad se služe stranim jezicima, ljudima je daleko lakše komunicirati na njihovom prvom jeziku. To potvrđuju empirijska istraživanja prema kojima 9 od 10 internet korisnika kojima engleski jezik nije prvi jezik, radije posjećuju internet stranice na svom prvom jeziku, dok ih samo 53 % izjavljuje da su spremni koristiti i englesku verziju stranice, ako nije dostupna ona na njihovom jeziku (Gallup, 2011:5). Da bi u većoj mjeri privukli kvalificirane ljudske potencijale iz strateških djelatnosti, te turiste i investitore koji dolaze iz ostalih kultura u Republici Hrvatskoj je potrebno ponuditi širi spektar obavijesti i uputa na stranim jezicima, te redizajnirati obrazovni proces na način da bude bolje prilagođen pripadnicima različitih kultura koje nastojimo pridobiti za život, rad i boravak u našoj zemlji. Osim kroz korištenje većeg broja jezika, višejezična komunikacija najlakše se ostvaruje slikama i simbolima koji su obično razumljivi većem broju ljudi, bez obzira na jezik kojim govore.

Uključivost se temelji na uvjerenju da su različitosti dio cjeline. Spoznaje o tome da je sve u našem okruženju visoko međuovisno i povezano, kao i spoznaje o tome da perspektive iz koje nešto promatramo mogu bitno utjecati na prikladnost odgovora, suvremene pojedince upućuju na poštovanje i uvažavanje različitosti. Ukoliko želite uspješno surađivati i komunicirati s pripadnicima

različitih kultura, izuzetno je važno da poštujete njihovu kulturu, a time i njihove stavove i preferencije. U suvremenom društvu svima je dopušteno da budu drugačiji, dokle god ne narušavaju slobodu i sigurnost ostalih članova društva. Jedna od prvih kompanija u svijetu koja je počela primjenjivati multikulturalnu komunikacijsku (a time i prodajnu) strategiju jest talijanska tvrtka Benetton Group S.p.A. Ova tvrtka danas je jedan od najvećih modnih brendova, koja se bavi prodajom odjevnim predmeta u otprilike 5000 prodajnih mjesta širom svijeta (www.benettongroup.com). Kao što to napominje Kotarski (2019), u Europi primarni problem nije diskriminacija useljenika, već njihova samoizolacija. Da bi multikulturalna komunikacijska strategija ponudila sinergijske učinke nužno je da postoji iskrena obostrana želja za suradnjom i komunikacijom. U praksi se uključivost najbolje provodi kroz sudjelovanje u donošenju relevantnih političkih i poslovnih odluka, poput onih vezanih uz oblikovanje proizvoda i usluga, te kroz angažiranje članova različitih kultura u poslovanju organizacije.

Interaktivnost predstavlja proces (učinkovite) razmjene informacija između više različitih subjekata i objekata. Kada je podržana suvremenim informacijsko-komunikacijskim tehnologijama, digitalna interakcija omogućuje učinkovitu identifikaciju korisničkih zahtjeva i preferencija, a samim time jednostavniju multikulturalnu komunikaciju. Među osnovne zadaće učinkovite interakcije ubrajaju se jednostavnost razmjene informacija, sposobnost učinkovitog reagiranja na zahtjeve korisnika i personalizacija. Kreiranjem komunikacijskih kanala i poruka koje su prilagođene različitim kulturnim skupinama, organizacije uspijevaju istovremeno komunicirati s većim brojem različitih skupina korisnika. Iako je implementacija mobilnih aplikacija i ostalih interaktivnih tehnoloških rješenja koja omogućuju dinamičnu interakciju s korisnicima, zaposlenicima i suradnicima standardni dio komunikacijske strategije najuspješnijih poslovnih organizacija u svijetu, na našem tržištu još uvijek postoji veliki broj privatnih i javnih organizacija koje ne koriste takva interaktivna rješenja, a što znači da samim time i propuštaju prilike za komunikaciju i suradnju koje iz toga proizlaze. Osim kroz digitalne komunikacijske kanale, u kontekstu multikulturalnosti, interkativnost se ostvaruje i na sve ostale načine putem kojih je moguće komunicirati s ciljnom skupinom korisnika.

5. ZAKLJUČAK

Unatoč povremenim problemima do kojih interakcija s pripadnicima različitih kultura može dovesti, multikulturalizam zbližava ljude i obogaćuje njihovo iskustvo. Kad se komunikacija i suradnja među pripadnicima različitih kultura zasniva na kognitivnoj, emocionalnoj i osjećajnoj empatiji na temelju koje su sugovornici spremni prilagoditi vlastite komunikacijske obrasce, ne samo kroz korištenje višejezičnih i fokusiranih interaktivnih informacijsko komunikacijskih rješenja, već i na način da zaista teže uključivosti i suradnji, tada se kreira novi prostor za kreiranje sinergijskih učinaka u multikulturalnom okruženju. Multikulturalna komunikacijska strategija može se opisati kao „master ključ" koji otvara više brava, od kojih svaka ima svoj vlastiti ključ. Glavni nedostatak multikulturalne komunikacijske strategije proizlazi iz toga što su pripadnici određenih kultura zatvoreniji, a time i manje spremni prakticirati fleksibilnost koja podrazumijeva ublažavanje odlika osobnog komunikacijskog stila. Unatoč tome što uvažava razlike, multikulturalizam uslijed snažne interakcije istovremeno i razgrađuje razlike među pojedincima te na taj način pogoduje obogaćivanju i promjeni svake kulture.

Provedena analiza jasno upućuje na to da bi organizacije u Republici Hrvatskoj trebale što prije implementirati vlastite multikulturalne komunikacijske strategije, koje će u sinergiji s gospodarskim, demografskim i imigracijskim strategijama, te povezanim politikama, omogućiti unapređenje ekonomske stabilnosti i konkurentnosti hrvatskog gospodarstva. Pri definiranju imigracijske politike, svakako bi trebalo favorizirati profile stručnjaka koji trenutno nedostaju na tržištu i one koji će biti potrebni u budućnosti sukladno strategiji gospodarskog razvitka. Osim toga, menadžeri hrvatskih poduzeća trebali bi što je moguće prije krenuti s razvojem komunikacijskih i marketinških strategija kako bi se na vrijeme pripremili za izazove međunarodnih tržišta.

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Preliminary communication
https://doi.org/10.31784/zvr.9.1.15
Received: 25. 11. 2020.
Accepted: 18. 1. 2021.

MULTICULTURAL COMMUNICATION STRATEGY

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ABSTRACT

This paper provides guidelines for the implementation of the multicultural communication strategy, and emphasizes its significance for the development of public and private organizations in the Republic of Croatia. The analysis of migration, tourism and export trends clearly indicates a strong need for the multicultural communication strategy among Croatian organizations. The multicultural communication strategy is a communication framework that enables the simultaneous and effective interaction between individuals with different cultural backgrounds. This strategy can be described as the master key that opens a set of locks, each of which also has its own key. Multicultural communication strategy relies primarily on convergent communication activities. In the implementation stage it is recommended to follow six basic guidelines: empathy, flexibility, focus, multilingualism, inclusiveness and interactivity. Empathy implies understanding, which can be enhanced by asking in-depth questions and listening actively. Flexibility implies the ability to adapt, which is achieved through minimizing personal bias. Focusing means empowering conversations that facilitate collaboration. Multilingualism is most easily realized by images and symbols that are understandable to a wider audience regardless of the language being spoken or cultural aspects. Inclusiveness is most often implemented through participation in relevant political and business decisions. Apart from digital communication channels, interactivity is realized in ways through which the target group of users can exchange information. Multicultural communication is most easily conducted in situations where there is a mutual need for cooperation and understanding. In addition, multicultural communication strategy is particularly needed in the public sector areas such as transport, health, education, legislation and public administration.

Key words: *business communication, multiculturalism, interculturality, multicultural communication strategy*

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Review article
https://doi.org/10.31784/zvr.9.1.16
Received: 7. 12. 2020.
Accepted: 2. 3. 2021.

THE INTELLECTUAL CAPITAL IN THE PUBLIC SECTOR: A TAXONOMY OF INTANGIBLES TO PUBLIC ORGANIZATIONS

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ABSTRACT

The Intellectual Capital theory emerged mainly from analyses and observations in business sector based on the growing importance of intellectual capital as a production factor and on its contribution to create value and competitive advantages. The importance of managing intellectual capital is also recognized in public organizations although the theory reveals differences in application to the public sector and is less developed in this environment. In fact, most methodologies to manage intellectual capital were developed in the business area and research at public sector level did not verify the same attention. In literature it is possible to realize that although there are some studies that analyse the management of intellectual capital in the public sector, there are few studies that suggest methodologies specific to this sector. Thus, this article aims to discuss the main aspects about the applicability of intellectual capital theory to the public sector and to propose a taxonomy of intangible assets appropriate to this sector through critical review of main contributions of literature. The analysis allowed finding several arguments that justify the application of the theory to public sector. It also allowed suggesting a classification of intellectual capital based on the intangible assets considered relevant to public sector namely the set of the followed categories: Human capital, Structural capital, Relational capital, Services capital and Public Commitment capital.

Key words: *Intellectual capital, Public sector, Intangible assets, Intellectual capital management, Intellectual capital categories*

1. INTRODUCTION

The transition to an economy based mainly on intangible assets allowed the emergence of scientific research fields as intellectual capital (IC). Over the last decades numerous studies have been conducted in search for methodologies to improve IC management mainly in the business area where the research was more intense and pioneer and where the first and most popular models appeared. The research in public sector did not verify the same intensity and persistence

and consequently this area had less attention from researchers. In literature it is possible to realize that even though there are some studies that analyse the management of IC in the public sector, only a limited number propose methodologies specific to this sector. In this context, stands out the work of Cinca et al. (2001), Queiroz et al. (2001; 2005), Queiroz (2003; 2006) and Verdún et al. (2011) that suggest models and some indicators of IC management designed to public sector.

Although the theory is less developed in public sector, it does not mean that IC is less relevant and several arguments justify the application of the theory to this sector. In fact, the intangibility underlying the concept of IC is present in daily life of public organizations as well as in its objectives (mainly of social nature), output (mostly services) and resources (such as knowledge). However, the application of IC theory has differences in the business and public environment. It is necessary to consider that in private and public sectors the organizations may have different objectives and there are also differences in IC components, in addition to other particularities that are not comparable. Thus, this paper intends, through critical review of literature, to contribute to the discussion of the main aspects about the applicability of IC theory to public sector and to suggest a taxonomy of intangible assets appropriate to this sector. The paper is organized as follows. The next section introduces theoretical background of IC and discusses the main aspects about the applicability of theory to public sector. The third section presents some studies on IC in this sector. The fourth section presents a classification of intangible assets relevant to public sector. And the last one presents main conclusions.

2. DEVELOPMENT OF IC THEORY AND APPLICABILITY TO THE PUBLIC SECTOR

The modern IC theory and the most intense development of research happened on the 1990s of the last century. The concept of IC was popularized with the scientific texts, studies and books published mainly of Kaplan and Norton (1992), Brooking (1996), Edvinsson and Malone (1997), Roos et al. (1997), Stewart (1997) and Sveiby (1997). The recognition that IC creates value and competitive advantages to organizations attracted an increasing interest for the topic.

The concept has many definitions and interpretations that derive from different approaches of business-related disciplines such as strategic management, human resources, economics, accounting and finance. The World Intellectual Capital/Assets Initiative (WICI, 2016:14) presents a very complete definition: "*Intellectual Capital encompasses the internal (competencies, skills, leadership, procedures, know-how, etc.) and external (image, brands, alliances, customer satisfaction, etc.) intangibles which are dynamically inter-related and available to an organization, thereby enabling it to transform a set of tangible, financial and human resources into a system capable of pursuing sustainable value creation.*" IC concept is frequently understood, as is in this definition, equivalent to intangibles or non-physical resources and is often defined as a set of intangible assets[1], including

[1] According to WICI (2016:13) intangible assets are the positive intangible resources of an organization which are the drivers of its long-term competitive differentiation and advantage. This description of intangible assets unlike the one in financial accounting (IASB Conceptual Framework for Financial Reporting and IAS 38), does not require that intangibles are owned or controlled by an organization, only have to be available and/or utilized by the entity with the aim of generating value (WICI, 2016:36).

those that are not reflected into the current financial statements. According to Zambon et al. (2020:13) the concept of IC embodies a subset of unaccounted intangibles usefully employed in the activities of an organization. The terms IC and intangible assets have been associated and widely used in literature, the first more acceptable in management area, and the second if the approach is accounting (Zambon et al., 2020:21; Verdún et al., 2011:2). Since, it is not an aim of this review to discuss differences in these and others similar concepts that appear in literature, this paper used indistinctly the terms considering intangible assets as IC elements.

IC is commonly categorized in human, structural and relational capital, a traditional tripartite classification. Table 1 presents a comparison of classifications suggested by some of the most popular models of IC management.

Table 1. Som classifications of IC components

Authors	Model	Classification of IC components
Kaplan and Norton (1992)	Balanced Scorecard	Financial perspective; Customer perspective; Internal business process perspective; Learning and growth perspective
Brooking (1996)	The Technology Broker	Market Assets; Human-centered assets; Intellectual Property Assets; Infrastructure assets
Edvinsson and Malone (1997)	Skandia Navigator	Model: Financial focus; Customer focus; Process focus; Renewal and development focus; Human focus IC: Human capital and Structural capital: Customer capital and Organizational capital: Innovation capital and Process capital
Roos et al. (1997)	The IC distinction tree IC-Index	Human capital: Competence; Attitude; Intellectual Property Structural Capital: Relationships; Organization; Renewal and development
Stewart (1997)	The elements of IC	Human capital; Structural capital; Customer capital
Sveiby (1997)	The Intangible Assets Monitor	Internal Structure; External Structure; Employee competence

Source: Author

IC theory became popular in the private sector, being less developed in the public sector (Joia, 2009:1384; Meirelles et al., 2017:89). However, any executive in the private or public sector manages intangible assets and recognizes its importance for managing and making better decisions even though, with some exceptions, these are not included in their accounts and financial statements (Queiroz et al., 2005:212). Contrary to the interest that the private sector has shown in the identification and valuation of intangible assets, which includes the elaboration of "IC balance sheets" as an attachment that goes along with the annual accounts, the public sector has made less effort in this regard (Cinca et al., 2001:4; Queiroz et al., 2005:215). To Cinca et al. (2001:20) regardless of the importance of financial information, the public sector represents an ideal framework for the application of ideas underlying IC theory, arguing that a good management of intangible assets can help public sector institutions to achieve its objectives.

At the public sector level, managers regularly have to make decisions involving intangible assets (ex. a global event where benefits such as image are difficult to quantify; the introduction of information technology in public services where benefits such as citizen satisfaction are difficult

to measure), which require large investment volumes and whose benefits are not fully perceived or possible to be measured (Cinca et al., 2001:4). Despite this, public organizations realize the importance of identifying intangible assets in order to make better decisions and show the public the quality of their management processes (Cinca et al., 2001:5). According to Cinca et al. (2001:6), Queiroz (2006:6) and Queiroz et al. (2001:3; 2005:217) intangibility is an aspect with high presence in the public sector, so the application of IC theory to this sector must consider its differences in relation to the private sector. The following are some aspects discussed by Cinca et al. (2001), Queiroz et al. (2001; 2005), Queiroz (2003; 2006), Marques (2005), Wall (2005) and Joia (2009) that justify the applicability of IC theory to public sector.

1 - Intangible objectives

In the private sector intangible assets are used mainly to achieve objectives of profitability and of value creation to shareholders (Queiroz et al., 2005:224). Differently, the public sector has essentially intangible objectives, many of a non-financial nature such as national security, administration of justice, raise the general level of culture, seeking to offer quality services (Queiroz, 2003:159; 2006:7; Queiroz et al., 2005:217; Marques, 2005:440). The achievement of this diversity of objectives can often not be measured in a quantitative way (Wall, 2005:293), and therefore, indicators such as stock prices or the analysis of financial ratios, may have limited use in this situation (Cinca et al., 2001:6; Queiroz et al., 2005:217; Queiroz, 2006:7). Thus, the theory of IC allows proposing alternative indicators to measure the degree of fulfilment of the objectives of a public organization.

2 - Intangible output

Wall (2005:294) considers that public sector organizations have always used their resources to achieve mainly intangible results. Although the public sector sometimes produces tangible goods, such as roads, the final product of public administrations is mostly services, which are essentially intangible in nature (Queiroz et al., 2005:217; Cinca et al., 2001:6; Queiroz, 2003:160; Marques, 2005:446). For the valuation of tangible goods, costing systems are developed that allow knowing the productivity, analysing the cost-benefit, managing stocks, controlling the quality of the product or the manufacturing processes. When valuing services, many of the concepts developed for physical assets are not applicable, and quality indicators are crucial in this field. Even quality controls take different forms for tangible goods and services, implying in this second case the application of specific procedures such as surveys to measure the degree of satisfaction (Queiroz et al., 2005:218; Cinca et al., 2001:6; Queiroz, 2003:160; 2006:8). This characteristic supports the application of the theory.

3 - Intangible resources

The production factors traditionally considered such as raw materials, machinery, capital, human resources and, knowledge, had preferential uses according to the epochs and sectors concerned, the first three being classified as tangible and the last two as intangible assets (Queiroz et al., 2005:218). If machinery was decisive for industrial companies and capital for the financial companies, then more recently for knowledge-based organizations, is preponderant the intensive use of knowledge in which human resources and ICTs play a central role. In the Public Sector, intangible resources

such as knowledge and human resources play a more important role and raw materials, machinery and capital play a less prominent role (Cinca et al., 2001:6; Queiroz et al., 2005:218; Queiroz, 2003:160; 2006:8). To Wall (2005:294) public sector organizations have traditionally been, although the gap has narrowed, more intensive in human capital. Queiroz et al. (2005:218) consider that many public administrations fall into the category of knowledge-based organizations, something that will be accentuated with the development of e-government. This circumstance also favours the application of the theory.

4 - Internal management tool / Lower urgency in quantifying

The usefulness of intangible assets in the internal management of organizations is related to the decision making of managers, with different perspectives for private companies and public organizations. In private companies, intangible assets serve to earn money in which its monetary quantification is important especially in situations of sale or alienation, whereas in the public sector the issue of quantification is not the only one that is prominent and demanding, which facilitates the implementation of IC theory (Queiroz et al., 2005:219; Marques, 2005:446; Queiroz, 2006:8).

5 - External presentation and transparency

Public organizations seek to report their activities to citizens about the functions they perform in which, in addition to data on compliance with legalities, budget execution and economic, efficiency and effectiveness indicators, it becomes also important from the perspective of IC, to present information on efforts to optimize the rationality of internal organization, how to develop human resources, how to improve its image, how to improve social well-being and the environment, among others (Queiroz, 2003:161; 2006:8). For Queiroz et al. (2005:219-220) if at the business level, IC is considered more as an internal management tool, in the public sector it would be necessary to regulate and control the presentation of documents on intangibles to avoid ruinous investments or unnecessary waste. They consider that transparency in the publication of information by public administrations should be considered a true intangible asset for these entities.

6 - Social and environmental responsibility

Queiroz et al. (2005:220) refer that many companies see this responsibility as an expense but also as intangible assets that improve their image, and often publish information about the repercussions of their actions on society and environment in documents attached to the annual accounts. In the case of public organizations the requirement must be higher, this commitment must not be considered merely as something that will improve their image and should be part of its objectives (Queiroz, 2003:160; 2006:7).

7 - Low incentive to adopt new management techniques

Joia (2009:1384) indicates as an obstacle to the implementation of IC projects in public administration the low motivation for adopting new management practices in this environment. It is common for public sector management to slowly adopt innovations of the private sector, in which the latter in a struggle for survival and when operating in a competitive environment needs to quickly adopt the best management practices (Queiroz et al., 2005:220; Queiroz, 2003:159).

Queiroz et al. (2005:221) refers that public sector has been more averse to innovation and that this lack of stimulus is a negative factor that does not favour the adoption of new management techniques, which also occurred with the analysis of intangible assets. These authors refer that the public sector is slower to adopt the measurement and registration of intangible assets, due to the situation of natural monopoly and lack of competition from some organizations, which is not the best way to stimulate its development. To Queiroz et al. (2005:221) and Queiroz (2006:7) the modern management of the public sector has as its flag the attention to the public and the quality of services, which justifies a reflexion on the possibilities of IC.

8 - Lower room for manoeuvre of manager

Queiroz et al. (2005:221) and Queiroz (2006:8) refer that although the ideas underlying IC are attractive for application in public organizations, they recognize that its implementation is difficult. This situation is due to the fact that managers are subject to rules and bureaucratic and rigid procedures that hinder their room for manoeuvre, being subject to higher control and demand for transparency in management (Queiroz et al., 2005:221; Queiroz, 2006:8). Joia (2009:1384) also indicates as an obstacle to the implementation of IC management projects in public administration the little room for manoeuvre to which public managers are subjected.

The use and application of IC theory has differences in business and public environment. According to Queiroz et al. (2005:224) although many ideas proposed in the models developed for private companies can be used to implement in the public sector, not all aspects are in fact comparable. One first aspect concerns with the valuation of intangible assets. Cinca et al. (2001:7) consider that while companies are interested in the monetary quantification of these factors, something indispensable in situations such as sales and mergers, a manager in the public sector may not be as interested in the monetary value of an intangible asset, but more in its rational use. Another aspect is that many models applied in the business sector explain IC concept based on the difference between a company's market value and its book value, something that is not easily translated into the public sector. Indeed, public organizations do not have a market value to allow the calculation of IC value (Joia, 2009:1385). Cinca et al. (2001:8) and Queiroz et al. (2001:7; 2005:224) explain that in this logic it does not make sense to calculate the market value of a city council or a police service. Market value is not the only concept that is hardly applicable in the public area, some accounting concepts may have no meaning or mean something different in the public context such as net income, working capital, brands, customers, among others (Queiroz et al., 2005:224). For example, concerning the concept of brands, in public sector it makes more sense to talk about image or reputation, an important intangible asset to attract investments to a city, university, hospital, etc. which will in turn help to fulfil the organization's objectives (Cinca et al., 2001:8; Queiroz et al. 2005:225).

In addition to these accounting issues, Cinca et al. (2001:8) and Queiroz et al. (2005:224) argue that must be considered differences in the meaning of IC components in private and public sectors. The category of customer capital does not have the same meaning in public sector given the lack of competition and choice option of citizens (Cinca et al., 2001:8). Therefore, instead of indicators such as the percentage of customers retained or sales from new customers it will make more sense

for example to obtain a citizen satisfaction index (Queiroz et al., 2005:224). In the category of organizational capital, Queiroz et al. (2005:225) highlight aspects such as administrative processes and innovation. In relation to the first, it is necessary to consider the different organizational culture in public sector, which is based on a less flexible system towards change, a bureaucratic administration, where administrative processes are very controlled and, where transparency in management is fundamental (Cinca et al., 2001:8; Queiroz et al., 2005:225). As for innovation, in public sector this role and responsibility is often attributed to universities or research centres (Queiroz et al., 2005:225). With regard to human capital, the public sector also presents particularities, both in the way of attracting employees and in human resources management in general (Queiroz et al., 2005:225). Queiroz et al. (2005:225) also mention that almost all models highlight the importance of human capital, considering people as the basis for generating other types of IC, a philosophy that comes in line with the importance that employees have in public organizations.

Despite these differences, many of the contributions and indicators proposed in the private sector are of relevance to public sector (Cinca et al., 2001:8; Queiroz et al., 2005:225). However, the design of methodologies for measuring and managing IC elements in public sector organizations enables a more complete and systematic view of its reality.

3. STUDIES ON THE MANAGEMENT OF IC IN THE PUBLIC SECTOR

Over the last decades numerous studies have been conducted in search for methodologies to improve IC management. In literature it is possible to realize that most methodologies that were developed to manage IC appeared in the business area. The research at public sector level did not verify the same persistence and determination. Despite this, it is possible to see that the first examples of studies in public sector were made by applying some of the pioneering methodologies. Joia (2009:1385) presents the examples of: Sveiby (1997) who applied IC theory in the Department of Social Assistance in Adelaide, Australia; and Dragonetti and Roos (1998) that analysed AusIndustry - public agency associated with the Australian Department of Industry, Science and Tourism. Cinca et al. (2001:7) mentions, as an example, the Balanced Scorecard model by Kaplan & Norton (1992) that was used in a pioneering way in the management of Charlotte City, USA. Queiroz et al. (2001:10) refers that the Balanced Scorecard was applied in Spain in the pilot experience of the Barcelona Public Road Actuation Sector; and the Business Navigator, whose initial application was done in the Skandia Insurance Company, was adapted by Edvisson and Stenfelt (1999) to the public sector developing the concept of National IC as a source of wealth creation in countries. Another example was Bontis (2004:15) that developed a national index of IC for the Arabian region using the "IC-navigator", a version modified of "Skandia Navigator" of Edvinsson and Malone (1997) adapted to nations.

This application was not entirely direct and these methodologies had to be adapted to the analysed reality, since they were not designed directly for the public sector. Thus, it is recognized that this application cannot be done without objections and difficulties (Cinca et al., 2001:7). In fact, it is necessary to consider that in private and public sectors the organizations have different objectives and therefore there are differences in the IC components that can be considered on the

methodologies. Over the past few decades there have been some studies that try to overcome these problems of applicability of the theory. In general, studies try to identify dimensions of IC (human, structural, relational, organizational, among other categories) important for a better management of public organizations. Table 2 present some studies that analyses IC in public sector and the dimensions that were considered to describe IC.

Table 2. Studies and dimensions of IC in the public sector

Studies	Intellectual capital categories	Public organizations analysed
Cinca et al. (2001)	Internal organization, External structural capital, Human capital, Social and environmental commitment	Spanish City councils
Queiroz et al. (2001) Queiroz (2006)	Internal organization, External relations, Human capital, Social and environmental commitment	
Queiroz et al. (2005)	Internal organization, External Relations, Human capital, Social and environmental commitment, Transparency	
Queiroz (2003)	Human Capital, Internal organization, External relations, Quality, Transparency	Spanish City councils
Mello et al. (2003)	Human Capital, Structural capital, Relational capital, Transparency	Brazilian Legislative Assemblies
Wall (2005)	Human capital, Customer capital, Organizational capital	Public sector organizations in Northern Ireland
Bailoa and Silva (2009)	Human capital, Structural capital, Relational capital, Transparency	Portuguese city councils
Joia (2009)	Human capital, Organizational capital, Relational capital, Innovative capital	Central Bank and courts of justice in Brazil
Hyrkäs et al. (2009)	Human capital, Relational capital, Structural capital	Finnish city councils
Eccel (2010)	Human capital, Internal organization, External relations, Quality, Transparency	Brazilian public banking institution
Verdún et al. (2011)	Human capital, Organizational capital, Technological capital, Business capital, Social capital, Cultural capital	Public Administration of Uruguay
Schuh et al. (2013)	Human capital, Structural capital, Citizen capital, Transparency	Brazilian city councils
Gubiani et al. (2013)	Human capital, Structural capital, Relational capital	Brazilian university
Bailoa (2015; 2016)	Services capital, Democratic capital, Relational capital, Organizational capital	Portuguese city councils
Monteiro et al. (2016)	Human capital, Relational Capital, Structural capital	Brazilian army audit unit
Costa (2016)	Human capital, Structural capital and Relational capital	Portuguese university
Laskari et al. (2016; 2017)	Human capital, Structural capital, Relational capital	Greek public sector services
Meirelles et al. (2017)	Human Capital, Internal organization, External relations, Quality, Transparency	Brazilian public educational institution
Braendle et al. (2017)	Human capital, Social capital, Structural capital	Public entities of Gulf cooperation council region
WICI (2016)	Financial Capital, Manufactured Capital, Human Capital, Organisational Capital, Relational Capital, Natural Capital	
Rodrigues (2018)	Human Capital, Internal organization, External relations, Quality, Transparency	Brazilian public educational institution
Bohnenberger et al. (2019)	Human capital, Structural capital, Relational capital	Brazilian city councils
Budiarso (2019)	Physical capital, Human capital, Structural capital	Indonesian public sector firms

Source: Author

Analysing table 2, it can be seen that the dimensions most studied are human, structural and relational capital, that is, the traditional tripartite classification of IC. The emphasis on human capital shows the importance that the availability of qualified employees, with adequate training and integrated into a favourable work environment, is an essential condition for organizations to achieve their goals. The assets of structural capital include work procedures, accumulated knowledge, ways of approaching problems, structural organization, the level

of internal bureaucracy, the ability to work in groups, information systems, among others, which represent the organization's work processes and objects essential to improving the quality of services offered to the public. The assets of relational capital include the entity's relations with citizens in general, users of services, suppliers, companies, government entities, collaborations, agreements and alliances, and also the image, reputation, public recognition and the organization's credibility, which are valued by society and fundamental for the organization to increase capital flows and development opportunities.

In addition to these assets, appear in some studies other dimensions that have not been included in the existing models developed for private companies and considered decisive in the management of public organizations, such as social and environmental aspects, transparency and quality, although with less focus than the other dimensions in the various analyses. The dimensions that refer to social and environmental commitments include the set of actions that organizations implement both to improve the well-being of the population and to favour the environment, in order to provide a better quality of life and development. The transparency dimension include the set of actions related to the publication and disclosure of information in order to make possible to inform citizens about governmental action and, also, a higher control of public management, fundamental aspects for the reduction of corruption situations in the management of public funds, in order to allow a major participation of citizens in government decisions and activities. The quality dimension is fundamental for the development of the main activity of public sector organizations, which consists mostly in the provision of services. Therefore, the improvement of quality of services shows the concern of organizations with the satisfaction of citizens and is perceived by their participation in public services.

Among the presented studies, it was possible to find models for management of IC in the public sector as the models of Cinca et al. (2001), Queiroz et al. (2001; 2005), Queiroz (2003; 2006) and Verdún et al. (2011). These models present classifications of intangible assets and suggest some indicators of IC management especially for public organizations. Cinca et al. (2001:9), Queiroz et al. (2001:7) and Queiroz (2006:10) classify IC in four categories: internal organization, external relations, human capital, social and environmental commitment. Queiroz et al. (2005:230) also propose a model with similar dimensions of the last referred but classifying IC in five dimensions adding the category of transparency. For each category, intangible assets are defined and, to quantify them, some indicators are suggested. Queiroz et al. (2005:229) refer that this procedure is not free from difficulties, since the indicators have practical limitations because they can present a partial or distorted image of the organization, especially when using indicators that try to quantify intangible concepts. As the public sector can include organizations such as municipalities, universities, firefighters, hospitals, etc., each entity can adapt the scheme, which is considered as a generic guide, and needs to select and adapt the appropriate indicators (Queiroz et al., 2001:9; 2005:230). Another study to be mentioned is that of Verdún et al. (2011) which classify IC elements into six categories: human, organizational, technological, business, social and cultural capital. As in the models mentioned above, to each category a set of indicators relevant were selected.

In another study Queiroz (2003:209) classifies IC elements into five categories that include the three traditional dimensions of IC (human, structural and relational capital) and highlights two

more groups of intangibles: quality and transparency. The model has two main parts that resemble a traditional balance sheet, with an intellectual asset and an intellectual liability in which are registered the positive attitudes or actions that may contribute to increase IC and the negative ones that may generate an intellectual liability (Queiroz, 2003:214). Queiroz's model (2003) was the methodological reference for the studies of Mello et al. (2003), Bailoa and Silva (2009), Eccel (2010), Meirelles et al. (2017) and Rodrigues (2018).

Research exposed on table 2 presents some diversity both in the methodologies used, either the organizations studied that in the case of public sector can be organizations of different types. The diversity and exploratory nature of studies brings difficulties in generalizing or confirms the results and to adopt general implications (Chen, 2011:3597; Liu, 2013:128). In fact, the dimensions in which IC is subdivided not always converge, and in each situation are adjusted for cases studied. Chen (2011:3593) after conducting a series of studies refers that the concept got different dimensions when applied to different industries.

4. THE INTANGIBLE ASSETS OF RELEVANCE TO PUBLIC SECTOR

The last sections analysed the state of art on the management of IC in public sector. Based on the main contributions of literature this section intends to define the intangible assets appropriate to public sector organizations, since one of the objectives of this paper is to suggest a possible taxonomy. Cinca et al. (2001:8) and Queiroz et al. (2005:224) argue that a management model for the public sector that includes indicators of intangible assets should help to show the importance of these to achieve the objectives of the institution. The model should highlight how intangible assets are used to improve the quality of services offered to the public, must show the relevance in achieving excellence in management and, it must reflect the institution's commitment to social and environmental development (Cinca et al., 2001:8; Queiroz et al., 2001:6; 2005:224). Thus, following these recommendations, the set of categories of IC considered relevant to public sector were (table 3): Human capital, Structural capital, Relational capital, Services capital and Public Commitment capital.

The first three categories correspond to the traditional tripartite classification of IC. Human Capital encompasses human resources, their knowledge, abilities and attitudes, including as intangible assets: Education and professional training of civil servants; Labour conditions (the work environment, safety, possibilities of promotions, and incentives); Permanent training and learning; and Satisfaction with management. Structural Capital includes the processes, procedures and working methods that enable the organization to function and includes: Organizational structure; Organizational culture; Work processes; and Information systems. Relational Capital represents the organization relations with several players in its external environment, and includes as assets: Relations with stakeholders (suppliers, government agencies, investors, associations and other institutions); Connections and partnership network (partnerships, collaborative projects, cooperation networks and other agreements and alliances); and the Image of organization (marketing, social networks, promotion and participation in events).

Table 3. Taxonomy of Intangible Assets to Public Sector

Categories of IC	Human Capital	Structural Capital	Relational Capital	Services Capital	Public Commitment Capital
Intangible Assets	• Education and professional training of civil servants • Labour conditions • Permanent learning and training • Satisfaction with management	• Organizational structure • Organizational culture • Work processes • Information systems	• Image of organization • Relations with stakeholders • Connections and partnership network	• Service quality • Citizen satisfaction • Know-How • Innovation	• Transparency • Citizen participation • Social commitment • Environmental commitment

Source: Author

Services Capital is not presented as a main category in other models despite the final product of public sector being mostly services. The category of Services capital is considered because the provision of public services is a key objective of public organizations and therefore of public administration. Thus, this category includes as intangible assets: Service quality; Citizen satisfaction; Know-How; Innovation. The category of Public Commitment Capital also does not appear in other models, and is justified by the very nature of public organizations and their objectives for improving social well-being that are expressed by a commitment with society. Thus, this category includes the commitments of: Transparency (to improve accountability, credibility and transparency trough the disclosure of information and its accessibility as the publication of budgets and accounts reports, legislation, meetings minutes, etc.); Citizen participation (to improve dialogue, relationship and participation of citizen as the possibility of making suggestions and complaints, surveys, newsletters, among others); the Social commitment (which refers to the measures taken by public organizations in the social sphere, therefore, to improve the well-being of the population); and, the Environmental commitment (the measures taken in order to safeguard and favour the environment).

To each category it is suggested the definition of indicators to represent and quantify the diverse intangible assets. Each organization must incorporate those indicators that consider appropriate in accordance with its objectives and strategies. It is also suggested to quantify the organization level of IC and for that it can be used a scoring system to produce an indicator or a performance index of IC that could allow monitoring the evolution of the development of the organization IC and therefore contribute to its management and decision support.

5. CONCLUSION

The topic addressed in this paper intended to be a reflexion about the management of IC in public sector. To fulfil first objective the main aspects about the applicability of IC theory to this sector

were discussed. It was possible to realize that IC theory became popular and intense in the private sector but research in public sector did not verify the same intensity lying less developed. However, on literature it was possible to find several arguments that justify the application of the theory to public sector namely, the fact that intangibility underlying the IC concept is present on the objectives, output produced and resources used by these organizations; the need for transparency; the higher demand for social and environmental responsibility; despite difficulties in this application, such as less incentive for the adoption of new management techniques and less room for manoeuvre of manager, among other justifications. Despite the application of IC theory has differences in the private and public sector, many ideas proposed on business area can be useful to public sector but there are aspects that are not comparable. The need to adapt the methodologies was also highlighted, since the models developed in the business environment and some concepts that were designed specifically for private companies are difficult to apply in the public area.

This work also presented some studies that try to overcome these problems of applicability of the theory. In general, studies try to identify categories of IC important for a better management of public organizations. The dimensions that stand out in most studies were human, structural and relational capital, that is, the traditional tripartite classification of theories in this area. Nevertheless, other dimensions related to aspects considered critical in the management of public organizations, such as social and environmental responsibility, transparency and quality, emerged, although in a smaller number of studies.

In the specialized literature it is possible to find a multiplicity of methodologies developed to the management of IC in business sector. However, it was also possible to find the application of IC concept to the public sector management and yet, other research paths, as on the territories management and on digital networks management. Nevertheless, the diversity and exploratory nature of studies brings difficulties in generalizing the results and the dimensions in which IC is subdivided not always converge, and in each case are adjusted for cases studied. The diversity of methodologies is justified by the fact that in each area in which the research takes place (business, public sector, territories, digital networks) there is a specific set of intangible assets that are decisive to achieve the objectives of the organizations concerned.

Thus, based on the main contributions in the literature, this paper also suggested a classification of intangible assets appropriate to public sector. The IC categories were defined based on the importance and role of the diverse intangible assets to achieve the objectives and mission of public organizations. The set of categories considered were: Human capital, Structural capital, Relational capital, Services capital and Public Commitment capital. The classification presents two categories that don't appear as main categories in other models. In one hand, the Services capital, because the final product of public sector are mostly the provision of public services. On the other hand, the Public Commitment capital, that is justified by the very nature of public organizations objectives which intends improving social well-being that are expressed by a commitment with society in terms of transparency, citizen participation and, social and environmental commitment.

The models and studies presented in this paper show that there is a line of investigation that confirms the relevance of IC in the public sector, allowing recognizing the importance that intangible assets

have for the strategic management of public organizations. This reflexion allows concluding that the strategic management of intangible assets in organizations of public sector is just as on private sector a source to obtain sustained competitive advantages. The appropriate use of intangible assets allowed by an adequate management methodology contributes to create value. So, it is expected that this work could contribute to the research of methodologies to improve IC management in public sector.

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Pregledni rad
https://doi.org/10.31784/zvr.9.1.16
Datum primitka rada: 7. 12. 2020.
Datum prihvaćanja rada: 2. 3. 2021.

INTELEKTUALNI KAPITAL U JAVNOM SEKTORU: TAKSONOMIJA NEMATERIJALNIH ULAGANJA U JAVNE ORGANIZACIJE

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SAŽETAK

Teorija intelektualnog kapitala proizašla je uglavnom iz analiza i zapažanja u poslovnom sektoru na temelju rastuće važnosti intelektualnog kapitala kao proizvodnog čimbenika i na njegovom doprinosu stvaranju vrijednosti i konkurentskih prednosti. Važnost upravljanja intelektualnim kapitalom je, također, prepoznata u javnim organizacijama, iako teorija otkriva razlike u primjeni na javni sektor i u ovom je okruženju manje razvijena. Naime, većina metodologija za upravljanje intelektualnim kapitalom razvijeno je u poslovnom području, a istraživanja na razini javnog sektora nisu dobila istu pozornost. Iz dosadašnjih istraživanja proizlazi da, iako postoje neke studije koje analiziraju upravljanje intelektualnim kapitalom u javnom sektoru, mali je broj studija koje sugeriraju metodologije specifične za ovaj sektor. Stoga se u ovom članku analiziraju glavni aspekti primjenjivosti teorije intelektualnog kapitala na javni sektor i predlaže se taksonomija nematerijalne imovine prikladna za ovaj sektor kritičkim osvrtom na glavne doprinose u literaturi. Analiza je omogućila pronalazak nekoliko argumenata koji opravdavaju primjenu teorije u javnom sektoru. Također, omogućila je i prijedlog klasifikacije intelektualnog kapitala na temelju nematerijalne imovine koja se smatra relevantnom za javni sektor, odnosno, niz sljedećih kategorija: ljudski kapital, strukturni kapital, relacijski kapital, kapital usluga i kapital javnih obveza.

Ključne riječi: *intelektualni kapital, javni sektor, nematerijalna imovina, upravljanje intelektualnim kapitalom, kategorije intelektualnog kapitala*

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Review Article
https://doi.org/10.31784/zvr.9.1.17
Received: 23. 1. 2020.
Accepted: 5. 3. 2020.

TAXONOMY OF ACADEMIC PLAGIARISM METHODS

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ABSTRACT

The article gives an overview of the plagiarism domain, with focus on academic plagiarism. The article defines plagiarism, explains the origin of the term, as well as plagiarism related terms. It identifies the extent of the plagiarism domain and then focuses on the plagiarism subdomain of text documents, for which it gives an overview of current classifications and taxonomies and then proposes a more comprehensive classification according to several criteria: their origin and purpose, technical implementation, consequence, complexity of detection and according to the number of linguistic sources. The article suggests the new classification of academic plagiarism, describes sorts and methods of plagiarism, types and categories, approaches and phases of plagiarism detection, the classification of methods and algorithms for plagiarism detection. The title of the article explicitly targets the academic community, but it is sufficiently general and interdisciplinary, so it can be useful for many other professionals like software developers, linguists and librarians.

Key words: *plagiarism methods, plagiarism classification, plagiarism detection, plagiarism cases*

1. INTRODUCTION

The probability that two people with no mutual influence write an identical non-trivial text or produce the identical non-trivial work is very small, and some studies such as Alzahrani et al. demonstrate that it is even impossible (S. M. Alzahrani et al., 2012). The publication of other people's thoughts, words, or deeds, without a clear indication of the source, is called plagiarism. Plagiarism is prohibited in all countries by law (Kumar & Tripathi, 2013).

Plagiarism (Lat. *plagiare* = to steal; Lat. *plagere* = to kidnap; Lat. *plagiarius* = kidnapper, seducer, plunderer) is the partial or complete taking of someone else's intellectual or artistic work, without the clear indication of their authorship. There is a universal consensus on the definition of plagiarism. With very minor variations of the expression, most researchers (M. Y. M. Chong, 2013; Culwin & Lancaster, 2001a, 2001b; Kumar & Tripathi, 2013; Lancaster, 2003; Lukashenko

et al., 2007; Zu Eissen & Stein, 2006) use the definition found in Merriam-Webster's Dictionary, which defines plagiarism as the act of using someone else's words or ideas without giving credit to original author (Merriam-Webster Dictionary, 2016). Encyclopedia Britannica defines plagiarism as the act of taking the writings of another person and passing them off as one's own (Encyclopedia Britannica, 2018). The Cambridge University Press, Oxford Dictionary and University of Oxford define plagiarism as the use of the ideas or works of other people and pretending that they are one's own (Cambridge University Press, 2018; Oxford Dictionary, 2018; University of Oxford & Encyclopedia Britannica, 2018). Meuschke and Gipp define academic plagiarism as the taking of someone else's ideas or expressions without giving recognition to the original authors or sources according to academic principles (Meuschke & Gipp, 2013). Plagiarism.org considers plagiarism and plagiary to be fraud which includes the theft of someone else's work and the subsequent lying about that theft (Plagiarism.org, 2017). Williams considers plagiarism as "a form of cheating and is generally regarded as being morally and ethically unacceptable" (Williams, 2005:3). Probably the most prevalent statement/definition that expresses the core of the problem was given by Bouville: "Plagiarism is a crime against academia" (Bouville, 2008:311–322).

Plagiarism is a problem that has been growing steadily for decades and occurs at all academic levels. Teachers and professors struggle with students who do not know or do not care about norms forbidding and sanctioning plagiarism. Journal editors and reviewers want to preserve and improve the reputation of their journals. Mentors and universities take care of their reputations when accepting theses of their PhD students. These are just a few examples where detection of academic plagiarism is of crucial importance.

Academic plagiarism is the most common object of plagiarism during education and in academic articles. Academic plagiarism refers to plagiarizing (the whole or part of) several types of documents: source code, seminars, critical reviews, professional and scientific articles and non-literal books. Word academic indicates that this type of plagiarism most frequently appears in the academic community. This also means that in the academic context plagiarism is a particularly worrying phenomenon present at all academic levels.

Plagiarism is associated with several *related terms:* forgery, design piracy, brand piracy, replica and copyright infringement. The first three are termed as industrial plagiarism. *Forgery* or imitation is a product that is presented as an original, so the forger makes efforts to convince buyers that they are selling the original product. *Design piracy* is the marketing concept used by manufacturers to capitalize on the customer interest for a product by designing a product that resembles a well-known brand. *Brand piracy* is a situation where a manufacturer cannot protect their name and products in particular country because someone did it before them and with whom it is necessary to reach a financial agreement. *Replica* is a new production of a product from the original manufacturer or the owner of the production and selling rights. *Copyright infringement* is the intensive use of someone's work without permission, with or without the acknowledgment of another author (Aktion Plagiarius, 2018). The economic consequences of industrial plagiarism are severe, and some estimates indicate that 10% of world trade is industrial plagiarism that brings a loss of 200 - 300 billion euros and 200 thousand jobs per year (Aktion Plagiarius, 2018).

Our research was conducted in three distinct phases. The first phase includes a database and journal research papers relevant to the domain of academic plagiarism. The second phase includes analysis of selected research papers and identification of current classifications and taxonomies. The final phase included systematisation of the collected data, classification of academic plagiarism, and related discussion about approaches and phases of plagiarism detection, the classification of methods and algorithms for plagiarism detection.

During the first phase, we performed a search to find research papers addressing the topic of plagiarism in the academic community, plagiarism classification and plagiarism identification methods. Research articles were searched for in relevant databases: Scopus, Web of Science and EBSCO. In order to further extend the search, several selected databases were also included in the search: ScienceDirect database by Elsevier, IEEE Xplore Digital Library and ACM Digital Library. The database search was performed using the following search keywords: "plagiarism", "academic plagiarism", "plagiarism methods", "plagiarism classification", "plagiarism identification". Journals on the other hand were examined by title and abstract, each issue separately.

After the introduction in the first section, the second section describes methods of plagiarizing text. In the third section we give an overview of the current classifications and a new one is proposed, which is implemented according to several criteria. The fourth section is dedicated to the approaches, phases, strategies, methods and algorithms for plagiarism detection. The fifth section contains the final and concluding thoughts.

2. PLAGIARISM METHODS

According to Alzahrani et al., unless the original sources are cited correctly, plagiarised parts can arise from paraphrasing, summarising of an original text, combining, reconstruction, generalisation or specification of concepts (S. M. Alzahrani et al., 2012).

Maurer et al. recognise nine methods of plagiarism (Maurer et al., 2006): copy-paste – the verbatim copying of a text; the plagiarism of ideas – the use of similar concepts and thoughts that are not commonly recognised; paraphrasing – grammatical amendments, the use of synonyms, change of word order in a sentence, the use of other words and expressions for the same thoughts; artistic plagiarism – the use of other media for fundamentally the same work; the plagiarism of code – the use of source code, algorithms, classes or functions without licences or references; the lack of links to sources – the existence of quotation marks, but insufficient information about the source, links which are no longer valid; incorrect/imprecise use of quotation marks; disinformation of references – a reference points to a wrong or non-existent source; plagiarism by translation – a translation without reference.

TurnitIn (one of worldwide plagiarism detection software) developers, distinguishes (a) methods of academic plagiarism and (b) the plagiarism of research papers methods (Turnitin Europe, 2016). In the *methods of academic plagiarism*, it lists the following: the submission of someone else's work as one's own, to fulfil a specified teaching obligation; the copying of words or ideas without giving credit to the original author; copying most of the words or ideas that compromises the work; submitting an already submitted work (e.g. from another colleague); not using quotation

marks when quoting; giving incorrect data about sources; the use of someone else's sentences by using substitute words; using someone else's ideas without referencing. The same source (Turnitin Europe, 2016, pt. 1, p. 5) lists the following *methods of research plagiarism*: "claiming authorship on a paper or research that is not one's own; citing sources that were not actually referenced or used; reusing previous research or papers without proper attribution; paraphrasing another's work and presenting it as one's own; repeating data or text from a similar study with similar methodology without proper attribution; submitting a research paper to multiple publications; failing to cite or acknowledge the collaborative nature of a paper or study".

Deep learning is a form of machine learning which solves the problem in unsupervised and simultaneous representative learning by enabling computer-building of complex concepts from simple ones (Goodfellow et al., 2016). It dominates in new research of unsupervised machine learning and has proven to be very effective in solving problems in the field of computer assisted natural language analysis, as it creates very high-quality vector representation of words, so both the syntactic and the semantic similarities of texts can be measured. Since deep learning models generate vector space representation of words and sentences with built-in semantic meanings (Zhang et al., 2018), vectors can be used to generate alternated texts by choosing similar sentences and/or words.

3. PLAGIARISM CLASSIFICATION

Many authors distinguish a lot of plagiarism types, but there is a great distinction in the depth and width of approach.

3. 1 Related work

One of the first academic plagiarism classifications was made by Martin, who distinguishes verbatim copying, paraphrasing, plagiarism from secondary sources, paper structure plagiarism, plagiarism of ideas and plagiarism of authorship (Martin, 1994).

Park lists five types: collusion (one author claims the credit of a group), commission (the agreed submission of someone else's work), duplication (the same paper in two different contexts), copying/paraphrasing, and submission (someone else's work without the knowledge of the original author) (Park, 2004).

Maurer *et al.* separates plagiarism into categories depending on the intentions of the plagiarists: accidental, unintentional, intentional and self-plagiarism (Maurer et al., 2006).

Schwarzenegger and Wohlers distinguish seven types of plagiarism: complete plagiarism, plagiarism by translation, copy/paste plagiarism, paraphrasing, self-plagiarism, ghostwriter and quoting out of context (Schwarzenegger & Wohlers, 2006).

Roig distinguishes two basic types of academic plagiarism: plagiarism of ideas and plagiarism of text (Roig, 2006). However, the latter is further analysed in great detail as follows: plagiarism verbatim, mosaic (patchwriting and paraphragiarism), inappropriate paraphrasing, paraphrasing

and summarising (of others' work), self-plagiarism, duplicate and redundant publication, data augmentation or fragmentation, inappropriate manipulation of references, citation stuffing, citing sources that were not read or thoroughly understood, reduced recognition of borrowing, selective reporting of literature, selective reporting of methodology, selective reporting of results and ghost authorship. Roig also specifies as many as 27 detailed guidelines to avoid plagiarism.

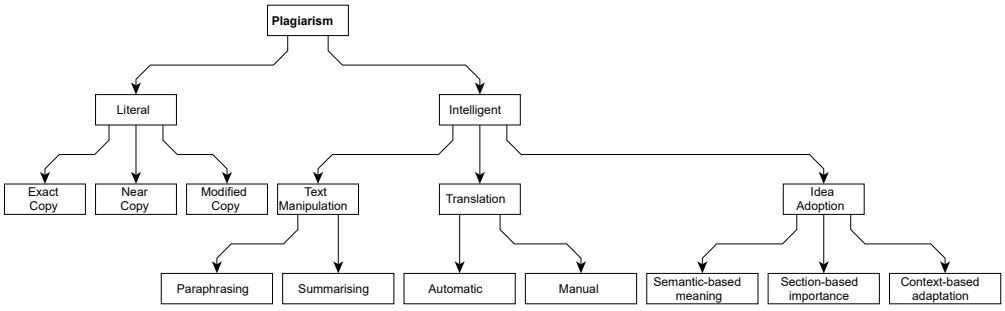
Joy *et al.* consider the plagiarism taxonomy within four mutually complementary aspects: the plagiarism source, the plagiarism method, the plagiarism object and the extrinsic aspect of plagiarism (Joy et al., 2009). The result is a taxonomy with six categories of plagiarism (plagiarism and copying, referencing, deception and inappropriate collaboration, ethics and consequences, source code plagiarism, plagiarism of the source code documentation) and their 23 sub-categories.

Kakkonen and Mozgovoy offered a quite different classification: verbatim copying, plagiarism by paraphrasing, technically disguised plagiarism, deliberate incorrect use of literature and heavy plagiarism, wherein the last category includes a) the use of someone else's ideas, concepts, thoughts; b) translation, c) ghostwriter and d) artistic plagiarism (Kakkonen & Mozgovoy, 2010).

Alzahrani *et al.* propose a plagiarism taxonomy shown in Fig. 1 (Alzahrani et al., 2012). The basis of their taxonomy is the behaviour of the author during plagiarism, in other words the plagiarism method. Based on the plagiarist's behaviour, Alzahrani et al. distinguishe plagiarism between literal and intelligent plagiarism. The literal is simpler and is further divided into three stages of copying. Intelligent plagiarism is a serious academic dishonesty where plagiarists try to hide, obfuscate, and change the original work in various intelligent ways, including text manipulation, translation, and idea adoption.

In two studies of plagiarism detection supporting tools published by very similar group of authors (Foltýnek et al., 2020; Weber-Wulff et al., 2013), they used to distinguish three types of plagiarism: verbatim copying, paraphrasing, and applying technical tricks. The authors focused more on plagiarism techniques.

Graph 1. Taxonomy of Plagiarism



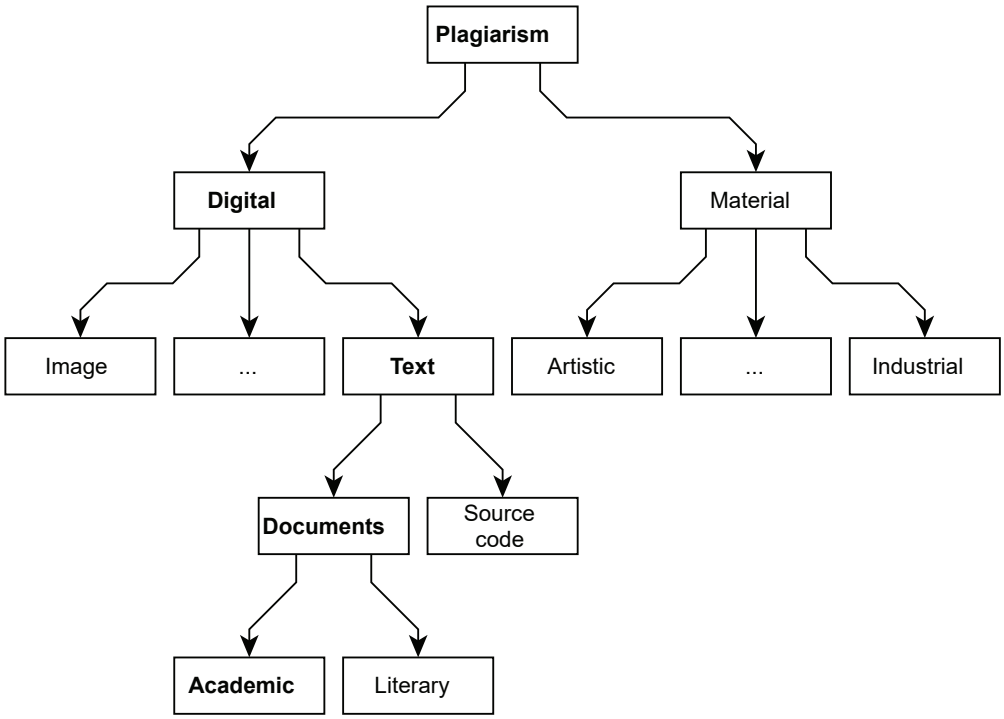
Source: Alzahrani et al. (2012)

3. 2 Proposed classification

In this section, we propose a new, comprehensive classification of plagiarism. In the widest sense, plagiarism can be categorized into types according to several criteria. According to the source and intention (Fig. 2), the plagiarism objects can be material (industrial, artistic) and non-material. Those non-material could be originally in the digital form (texts, source code and alike) or can be digitalised (artistic paintings, songs and alike). Text plagiarism can be divided into academic and literary (Meuschke & Gipp, 2013). Literary plagiarism causes artistic and direct financial loss to the original author while academic plagiarism can cause academic and indirect financial loss. The systematic verification of digital text documents, i.e. their originality, and generally, the systematic struggle against plagiarism is dominantly carried out in and by academic circles (Vrbanec & Meštrović, 2017).

According to the criteria of the technical implementation of plagiarism, academic plagiarism can be divided into the following types (Beames, 2012; Juričić, 2012): *clone or complete plagiarism* – the insinuation of someone else's document as being one's own; *translation* – the translation of someone else's document from another language without quoting the authorship and the author's permission; *copy* – a document which contains a significant portion of text from one source, without significant changes; *substitute* – the keywords and expressions in a document have been changed, however the document has retained the initial meaning and content of the original document; *remix* – a document in which other documents have been paraphrased and put together in a way that they act as a conceived whole; *self-plagiarism* – the use of one's earlier documents without appropriate references; *hybrid* – a document in which correctly quoted parts and those copied are combined; *mashup* – the inconsistent mixture of documents of various sources without correct citation; *waste* – a document which includes citations from non-existent or incorrect sources; *aggregator* – a document in which the sources are correctly cited but contains no originality; *repetition* – a document which includes the corresponding citations but sticks too much to the text or structure of the source documents; *ghost-product* – a document which is the result of the service (most often paid) of some other author than the one who signed it.

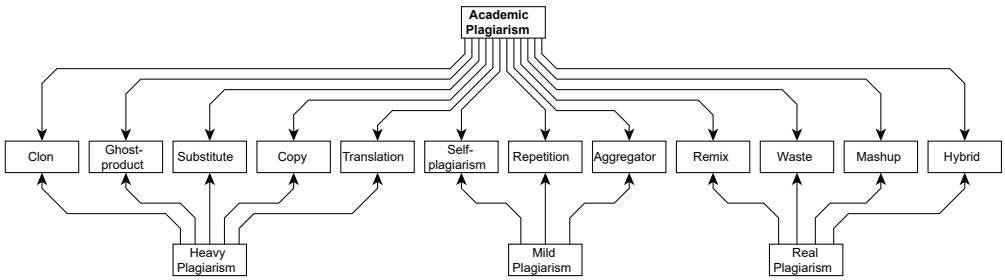
Graph 2. Objects of Plagiarism



Source: Authors

According to the potential severity of the consequences, the previous classification could be reduced to three categories: heavy, real and mild plagiarism. *Heavy plagiarism* includes clone, translation, copy, substitute, and ghost-product. Here both the intentions and potential damage from plagiarism are the greatest, and the plagiarist is the most ruthless or very naïve. *Real plagiarism* includes remix, hybrid, mashup, and waste. In the academic community such plagiarism is common, especially in meeting student obligations. It is difficult to distinguish the intention, ignorance, or naiveté of the author of plagiarism, and their detection is also difficult. *Mild plagiarism* includes self-plagiarism, aggregator and repetition. From a moral, ethical and legal standpoint, this category of plagiarism is the most benign, but it is certainly not allowed or justified.

Graph 3. Types of Academic Plagiarism



Source: Authors

As we can see in Fig. 3, these two classifications are not mutually completely independent. That is easier to realise if we introduce one more pragmatic criterion of classification: the potentiality of automatic detection, i.e. the plagiarism detection complexity criterion. So, within the classification by type, we can divide all types of plagiarism into those which are easy or difficult to detect, which result in the matrix shown in Table 1 and illustrated in Fig. 3. Easy or simple detection means that it is possible to detect them with automated software systems for plagiarism detection, whilst difficult or complex detection means that the plagiarism analysis of a human expert is needed.

Table 1. Category / complexity of detection matrix

Category	**The complexity of detection**	
	Simple	*Complex*
Heavy plagiarism	Clone, Copy, Substitute	Translation, Ghost-product
Real plagiarism	–	Remix, Hybrid, Mashup, Waste
Mild plagiarism	Self-plagiarism, Repetition	Aggregator

Source: Authors

According to linguistic origin, we can classify plagiarism as monolingual and plagiarism by translation. Plagiarism by translation can arise by the translation of documents from one or more languages, and the precondition for their automatic detection is usage of automatic translation software as a module for plagiarism detection software but this is barely satisfactory even for the main world languages and not for the rest of them.

4. PLAGIARISM DETECTION

In 1927 Charles Bird "*first researched the application of statistical methods in the detection of plagiarism with multiple choice answers*" (Chong, 2013). In the 1960s, the first methods were developed aiming to detect plagiarism of texts with multiple choice answers, whereas the first systems for plagiarism detection of written texts were developed in the 1970s for source code, and in the 1990s for natural languages (Chong, 2013).

The first papers about the plagiarism of texts and source code date from the 1970s (Alzahrani et al., 2012). They predominately dealt with the plagiarism detection in source code written in Pascal and C programming languages.

Twenty years later, papers appeared in which statistical computer methods of the detection of copying were presented in natural languages. In the 1990s scientists began to publish papers about the academic plagiarism and so Samuelson polemicized about the ethics and infringement of authors' rights in the case of self-plagiarism (Samuelson, 1994).

At the turn of the millennium, authors mainly dealt with the problems of detecting plagiarism in closed systems within academic institutions and web plagiarism. Contemporary researchers are trying to (1) improve the existing systems to make them more efficient and effective, (2) use the semantic and stylistic similarities of documents and (3) find methods of extracting knowledge from them. In order to reduce the complexity of determining the measure of the semantic similarities of documents and to make the organisation of the information and knowledge contained within them easier, some contemporary researchers use ontologies (Harispe et al., 2014; Leroy & Rindflesch, 2005; Patwardhan et al., 2003), particularly when it concerns the problem of word-sense disambiguation (WSD).

4. 1 Classifications

Lancaster and Culwin classified the approaches to plagiarism detection according to five criteria (Lancaster & Culwin, 2005):

Traditional classification

In traditional classification documents are calculated either by attributes (Attribute Counting Systems) or by structures (Structure Metric Systems). Lancaster and Culwin considers such classification incomplete, because some systems have an approach which does not belong to either of the two classes.

Classification according to the type of corpus which is processed

According to the *types of documents* which are being processed, the corpus of documents can be formed by source code, text documents or both. According to the *source of documents*, the corpora can be internal (documents available to an organisation), external (all Internet sources) or mixed. According to the *method of work*, access can be with or without tokenisation.

Classification according to the availability of the plagiarism detection system

According to the *setting*, they can be local or on the web. According to the *openness*, they can be public or private.

Classification according to the number of documents which are simultaneously processed

A metric is used which can be singular, paired, and corporal (n - dimensional; n = number of documents in a corpus).

Classification according to the complexity of the metrics used

Metrics can be superficial or structural.

According to Maurer *et al.*, the strategy of plagiarism detection should be carried out in three phases (authors call them methods) (Maurer et al., 2006):

1. The use of local documents' repository, i.e. the comparison of a verified document word-by-word with potential sources of plagiarism.

2. The comparison of a verified document with all available web sources in a way that the characteristic parts or sentences are compared, not the whole documents.

3. The use of stylometry i.e. an algorithm for a linguistic analysis that compares the style of sequential sections of an observed document and draws attention to the inconsistency and change of style, which indicates the increased probability of plagiarism.

Culwin and Lancaster identify a four-phase model for the plagiarism detection (Culwin & Lancaster, 2001a): (1) a collection phase in which documents fill the repository of all relevant documents, (2) a detection phase in which a software system recognises the suspicious pairs of documents, (3) a confirmation phase in which a human expert confirms or rejects doubt about plagiarism and (4) an investigation phase in which a human expert confirms the plagiarism and determines sanctions for the plagiarists.

Williams states three strategies, which we could call an evolutionary approach in the anti-plagiarism efforts (Williams, 2005:5): "Various strategies can be employed by academics to police plagiarism, ranging from simple Web search techniques used by individual lecturers, to the employment of easy-to-use freeware capable of tracking plagiarism between cohorts of students, as well as to quite elaborate systemic approaches involving the engagement of commercial plagiarism detection agencies."

4. 2 Methods

In the processes of plagiarism detection, the plagiarism detection methods and algorithms are key elements. An ideal algorithm for the plagiarism detection should be able to determine (Kakkonen & Mozgovoy, 2010):

1. Verbatim copying of initially digital documents and digitalised analogue sources.

2. Paraphrasing in the forms of the addition or removal of words or letters, the addition of intentional spelling and grammatical errors, substitution of words with synonyms, changing of word order in sentences or expressions, and changes in grammar or style.

3. The detection of technical tricks which attempt to exploit the weaknesses of existing automatic systems for the plagiarism detection, such as the use of fonts which are similar in appearance, but are different by code, the use of white letters in place of spaces to confuse plagiarism detection software, and the use of images of text instead of text, etc.

4. Intentionally incorrect referencing in a form of wrong or inaccurate marking of quotation marks, deliberately inaccurate or non-existing references, and use of outdated links to sources.

5. Heavy plagiarism is the plagiarism of ideas (similar concepts or thinking beyond that generally known, without correct referencing), plagiarism of translated text (translation without the acknowledgment of the original author), the use of the text of a ghost-writer, and artistic plagiarism (someone else's work in another medium).

With such an ideal algorithm, we are getting closer to the development of existing and new methods, algorithms and methodologies.

Today we can classify the developed methods into two classes: *external* (extrinsic) and *internal* (intrinsic), whether the evidence for plagiarism is sought by comparing potential plagiarism with a potential original or whether it is sought within the document itself (Chong et al., 2010).

Lukashenko *et al.* distinguish two classes of methods: *methods for prevention* which are time-consuming but have long-term effects and *methods for detection* which are short-term and have rapid effects (Lukashenko et al., 2007). According to same authors, (p. 1), methods of prevention are "precautions with which the goal is to prevent the development of illness." They do not act as rapidly as the methods of plagiarism detection; however, their effect is long-term, and therefore very desirable. Williams supports the attitude that the main course of prevention is the assigning of innovative and interesting tasks and that in addition to prevention there must also be deterrence, which discourages attempts at plagiarism due to unprofitability and the potential penalties (Williams, 2005).

Methods of prevention include the propagation of a policy of honesty and integrity which strives to influence the awareness of the whole of society, more precisely, conscientiousness, morality, ethics, attitude and so on..., the education of all the people or stakeholders of the system. Considering that it is difficult to influence the whole society without a great political agenda, it is necessary to influence the very important organised sections: the science, higher and secondary education so that they systematically promote the values of so-called academic integrity. An adequate system of penalisation i.e. the adoption of regulations and penalties for their violation on a social or systemic level must follow methods of detection. These two methods act as prevention and treatment. According to Turnitin Europe, a method of the prevention of academic plagiarism should include (Turnitin Europe, 2016) the education of students by professors; the adoption, open disclosure, and promotion of a policy of academic integrity; a developed system of penalisation proportional to the degree of plagiarism, the consequences and the intention of plagiarists; systematic raise of awareness among the students through discussions and within the syllabus of individual courses; teachers should help students with examples of proper referencing and should have plagiarism in mind during the creation of tasks; the use of plagiarism detection software, with the free usage for students so that they themselves would be able to practice.

Statistical methods do not strive to "understand" the document. These methods do not always strictly extract statistical values from the documents. In addition to the frequency of words, they also calculated their weighted values. In the statistical values, some authors include various

measures of distance (Li et al., 2004): the Hamming distance, the Euclidean distance, the Lempel-Ziv distance, compression distance, information distance and normalised information distance. According to our experience, K-character statistics is effective too; for example, 2-character reliably identifies the language in which the document is written, 3-character classifies the document. Statistical methods are often the components of other methods.

Methods of the copying detection include algorithms that can be divided into four subcategories (Aho, 2014; Michailidis & Margaritis, 2001; Stein, 2007; Stein & Zu Eissen, 2006; Stephen, 1992).

- Classical algorithms or algorithms for the comparison of character strings are numerous e.g. Brute-Force (Naive), Knuth-Morris-Pratt, Boyer-Moore, Boyer-Moore-Smith, Boyer-Moore-Horspool, Boyer-Moore-Horspool-Raita, Simon, Colussi, Galil, Apostolico-Giancarlo, Turbo-BM, Reverse Colussi, Sunday algorithms (Quick Search, Optimal Mismatch, Maximal Shift) and Ratcliff/Obershelp. Some of the algorithms can search text similarity of several sources, e.g. Commentz-Walter, Hume, Baeza-Yates.
- Suffix automation algorithms are Reverse Factor, Turbo Reverse Factor, Suffix Tree and the Aho-Corasick algorithm.
- Bit-parallelism algorithms are the Shift-Or algorithm, Shift-And and BNDM.
- Examples of algorithms and methods of using summaries are the algorithms Harrison, Karp-Rabin, Running Karp-Rabin Greedy String Tiling, Las Vegas, Monte Carlo, winnowing (Schleimer et al., 2003), Wu-Manber's algorithm for multiple samples (Wu & Manber, 1994), the method of chunking (Stein & Zu Eissen, 2006) etc. They use a cryptographic hash function such as MD5 to obtain summaries from small or large parts of a text. The sensitivity of the algorithm determines the size of the text. Even the slightest alteration of the text changes the summary. Similarity matrices are created from the summaries of the two documents which are compared (Stein, 2007). These methods are demanding according to the necessary computing resources (Stein & Zu Eissen, 2006).

The methods of detecting paraphrasing and semantic similarities are two groups of related methods, and they are here together because detecting paraphrasing has the consequence of detecting semantic similarity, while detection of semantic similarity reveals paraphrasing. The detection of semantic similarities is a threefold problem (Chong, 2013; Ram et al., 2014): the detection of lexical changes, changes of the text structure and the most complex of them – the detection of paraphrasing. Examples of these methods are: Natural Language Processing – NLP methods (Chong et al., 2010; Chong, 2013), Morphological Analysis (Marsi & Krahmer, 2010), Syntactic Parsing – a method of comparing the meta-information of documents, methods of the automatic extraction of summaries (Aliguliyev, 2009; Das & Martins, 2007; Spärck Jones, 2007), Keyword Similarity (Stein & Zu Eissen, 2006), a method of tokenisation (Lujo, 2010), and Deep Learning methods (Le & Mikolov, 2014; Mikolov et al., 2013; Pennington et al., 2014) that create a vector space of words, sentences, or phrases with embedded semantic meaning. Alzahrani and Salim use fuzzy semantic similarity (Alzahrani & Salim, 2010), whereas Hsiao *et al.* use "fuzzy strengths as a function of the semantic proximity between two objects" (Hsiao et al., 2014, p. 2), given that plagiarism is not

always completely obvious to determine (Chong, 2013, p. 1). The semantic similarity of a text is defined according to the following criteria: a different vocabulary, changes of vocabulary within the same text, incoherence of text, identicalness of punctuation, amount of similarity among the texts, same spelling mistakes, equal statistical distribution of words, same syntax, equally long sentences, same sequence of themes, consistent use of the same phrases and expressions, frequency of words, preferences in using short or long sentences, readability of text, references which are missing in the list of literature (Clough, 2000). In the field of the semantic similarities of texts (Harispe et al., 2014; Marsi & Krahmer, 2010; Zervanou et al., 2014), artificial intelligence methods are being intensively developed, natural language processing methods, data mining, methods of stylometric analysis of text, methods of extraction and presentation of knowledge and meaning from documents (Jakupović et al., 2013; Rauker Koch et al., 2014; Pavlić, Jakupović, et al., 2013; Pavlić, Meštrović, et al., 2013; Rajagopal et al., 2013), data and natural languages (graphical methods of the presentation of knowledge such as BG (Basic Conceptual Graphs) and NOK (Nodes of Knowledge), data models, semantic networks, neural networks, MultiNets method, HSF method for the representation of examples in natural languages). Stylometric methods (Zu Eissen & Stein, 2006) have become so reliable that the legislations of the USA, UK and Australia acknowledge the analyses carried out (Brennan & Greenstadt, 2009).

There are still no satisfactory solutions for finding obfuscated plagiarism. Promising research directions most often are quite demanding in terms of the required computing resources. Nowadays, these are Machine Learning, Deep Learning, and usage of high dimensional vector space. Therefore, when they can, researchers use *heuristics* as well (Dolan et al., 2004; El Bachir Menai & Bagais, 2011; Ganitkevitch et al., 2013; HaCohen-Kerner & Tayeb, 2017).

The methods and algorithms classification which can be used for the plagiarism detection is not unambiguous, because some of them use elements which could belong to several classes.

5. CONCLUSION

Plagiarism is a very dangerous and persistent phenomenon that is presented from different perspectives: history, development, theoretical classification, ways of creation and discovery, with an emphasis on the academic type of plagiarism. This phenomenon must be brought under control, and this can be done by automatically detecting it with the proper software. Discovering academic plagiarism is a task whose complexity varies from trivial to extremely complex, especially since there are many types and methods of their creation as well as combinations thereof. Today, increasingly reliable and efficient plagiarism detection methods, methods and algorithms are being developed. There is also software to detect it, but it is often powerless to detect complex types of plagiarism. In addition, this existing software often does not guarantee confidentiality or has restrictions on the number of documents submitted or the number of words in the document to be checked and they carry high costs. The most plagiarism detection software, once open and free, now are commercial or abandoned. And despite all of development, we still does not have the ability to effectively and reliably detect plagiarism. Yet, the plagiarism detection problem slowly converges into the category of solvable, computer-supported problems. There is a lot of potential for developing effective plagiarism detection software, based on open access to scientific databases

and deep learning models. In this sense it is very important for the effective deal with the academic plagiarism, international institutional support (political and financial) in the creation of open access databases into which scholars, researchers and scientists could freely upload their papers after primary being published. All scientific papers in those databases should be freely accessible to the overall interested public. These databases could be (a) the foundation for dissemination of knowledge and new scientific insights and discoveries, and (b) the source of papers (reference corpus) for (today's and future) plagiarism detection software. That should be strategic priority of academia and it should develop as freely and publicly available service.

This work has been supported in part by the University of Rijeka under the project: uniri-drustv-18-38.

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Pregledni rad
https://doi.org/10.31784/zvr.9.1.17
Datum primitka rada: 23. 1. 2020.
Datum prihvaćanja rada: 5. 3. 2020.

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Review Article
https://doi.org/10.31784/zvr.9.1.18
Received: 3. 4. 2020.
Accepted: 23. 4. 2020.

CHANGE IN THE TAX STRUCTURE OF THE REPUBLIC OF CROATIA AS A PRECONDITION FOR PENSION SYSTEM REFORM

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ABSTRACT

The pension system of the Republic of Croatia is subject to frequent inquiries, which can be summed up in two basic directions: the question of its financing, ie the rate of pension contributions that negatively affect the competitiveness of the economy, and the issue of pensions paid, which are often perceived as insufficient for the dignified life of pension beneficiaries. However, in the long run, the pension system will face the need for a thorough reform that will be caused by the longer life expectancy of the population and the increasing negative demographic tendencies that are particularly pronounced in the Republic of Croatia. The current contribution-based pension system will be less and less able to service its growing demands, and the reform needs to achieve two apparently conflicting goals: efficient financing while stimulating the competitiveness of the Croatian economy. It will be possible to achieve this by carefully devising a change in the tax structure and shifting the focus from income taxation to consumption taxation.

Key words: *pension system, tax structure, contributions*

1. HISTORICAL DEVELOPMENT OF THE PENSION SYSTEM

The system of generational solidarity is attributed to the German chancellor, Otto von Bismarck, who delivered a speech in 1881 in the Reichstag advocating that people who are too old to work or who cannot work and generate income be afforded a dignified life (Stein, 1897?). The term "peculium", which represents the amount of money that was allowed in the ancient Rome for slaves to dispose of and save for the purpose of redeeming liberty towards the end of his working life, which Bismarck then used in his speech, is at the root of the word "pension" which has grown worldwide (Sinn, 2004). The Bismarck bill was passed by the German Parliament in 1889 and subsequently adopted by numerous other states (Herbay, 2014). However, due to the changed circumstances today, this system is facing new challenges. Countries with the Bismarck system spend on average about ten percent of their gross domestic product on pensions (Conde-Ruiz and Gonzalez, 2016).

The first forms of pension funds and paid pensions in Croatia appeared in the mid-nineteenth century and were related to particular occupations, such as government officials and servants, and soldiers and their families. At the end of the nineteenth century, the beginnings of German pension insurance reached Croatia through Austria-Hungary, which is still being applied today in a somewhat changed form. Mining fraternities and mutual assistance organizations were established throughout Croatia, followed by the establishment of similar associations of workers in the construction and railways (Puljiz, 2007). Due to the outbreak of World War I and subsequently to the collapse of the Austro-Hungarian Monarchy, the pension system at the time failed to materialize, and workers' mutual assistance organizations went bankrupt. In 1922, a law was enacted to provide for uniform compulsory insurance of workers against the risks of old age, disability and death. In the same year, the Central Office for the Insurance of Workers, or the ancestor of today's Croatian Pension Insurance Institute, was established in Zagreb. The general workers 'pension scheme did not apply until 1937 because of adverse economic and political circumstances and because the social partners at the time could not reach an agreement on its financing, but the Central Office for Workers' Insurance still paid pensions to certain categories of insured persons, those taken over the succession of the Austro-Hungarian monarchy and those who have acquired a pension due to an accident at work or an occupational disease. Pension insurance was funded by contributions of three percent on wages and was paid by employers and workers. The retirement age was 70 years, like the one in German law of 1889, so that workers' pensions were hard to come by even if the functioning of the system was not hampered by the political and economic difficulties of the time. It is interesting that today's Croatian Pension Insurance Institute changed its name several times, but it is still housed in the same building that the then established Central Office for Insurance of Workers had built. After the end of World War II, the Central Institute for Social Security was established, and pension insurance based on generational solidarity was part of a single social security system. In the first period after the end of the war, the pension scheme was restricted to workers, war participants and war victims, while craftsmen and individual farmers remained outside the pension system. They were introduced into the system in the late 1960s and early 1980s, and their pensions were much lower than workers' pensions (Puljiz, 2008). From today's perspective, it seems almost unbelievable that in 1946 only 10,104 people received pensions (Brkašić et al, 2002). In 1971, there was a separation of pension from health insurance. In the years that followed, a number of international social security contracts were concluded covering Croatian workers abroad, and direct relations were established with German and Austrian pension providers, where about 80% of Croatian emigrants worked.

2. THE EFFECTIVENESS OF THE REFORMS IMPLEMENTED

After the independence of the Republic of Croatia, national pension and disability insurance funds for workers, sole proprietors and individual farmers were established. The transitional and economic crisis of the early 1990s and the war greatly hindered the transformation and functioning of the pension system in the early years of independence. With significant evasion of contributions, the number of new pensioners increased sharply at that time, with the simultaneous decline in the number of insured persons, ie those who had to finance the system based on intergenerational solidarity, so that the pension system found itself in a financially difficult situation that required

its reforms. The first reform came into force in 1999, most importantly raising the retirement age, extending the pension calculation period, changing the indexation method and a new way of calculating pensions using points, and tightening the criteria for obtaining disability pensions (Vukorepa, 2015). The measures were aimed at mitigating or stopping negative trends and stabilizing the situation and developments in the pension system. The emphasis of the 1999 reform was on financial sustainability rather than on expenditure cuts because once acquired pension rights are permanently guaranteed and cannot be reduced (Marušić, 2003). Although the measures temporarily improved the financial sustainability of the system in terms of reduced inflows of new retirees and lower growth in pension expenditures, they led to a significant difference in the amount of pensions acquired before and after the reform came into force. This disruption was corrected during 2007 and 2008, raising pension expenditures again, but with the difference that this increase is paid from the state budget (Butarin, 2020).

In 2002, under the influence of the World Bank, a new pension reform began (Stubbs and Zrinščak, 2009). This reform, based on three pillars, aimed at diversifying pension sources, increasing individual accountability for pensions and contributing to the long-term financial sustainability of the system (Puljiz, 2011). However, it should be noted that during the 2008 global recession, due to the fall in securities prices on the global financial markets, the viability of pension pain funds was called into question, which indicated that such a pension system had weaknesses (Olgić Draženović et al, 2018). In 2010, a gradual leveling of the conditions of age for women and men was adopted, an attempt was made to reward persons who became eligible for full retirement age and remain in the world of work, and discontinued early retirement. The aforementioned discouragement of early retirement through smaller pensions was not a penalization, but had a mathematical and economic justification, since such pensioners pay shorter and thus pay less for the system, while on the other hand they draw pension relatively longer (Vukorepa, 2011).

Today's pension system in Croatia, at least in formal terms, is a combination of a system of generational solidarity and capitalized savings. In addition to the security component, individual capitalized savings brings a component of equity to the pension insurance, since the insured person receives a pension that is in line with his / her previously paid contributions (Dujmović, 2011). It is a personal, individual savings of each policyholder that is capitalized which means that it is increased by a certain yield. Although funds from the insured are collected and managed by pension funds, which are divided into three risk groups according to investment strategies, the payment of pensions is made exclusively through mandatory pension companies. The first, main pension pillar is the system of generational solidarity, and it pays three quarters of the pension contributions, or 15 percent. The second pillar is a compulsory pension pillar of capitalized individual pension savings, in which 5 percent, or one quarter of pension contributions, is paid, while the third pillar represents additional, voluntary pension savings. However, there were also problems with the different pension levels of persons born between 1952 and 1961 who were able to choose whether to enter the second pillar or remain only in the first and persons born after 1961 who were by law had to enter the second pillar. Namely, the total pension to be paid from both pillars is lower than that paid only from the first pillar due to insufficient accumulation of funds in the second pillar. There were two reasons for this: a short pay period and insufficient growth in second-pillar

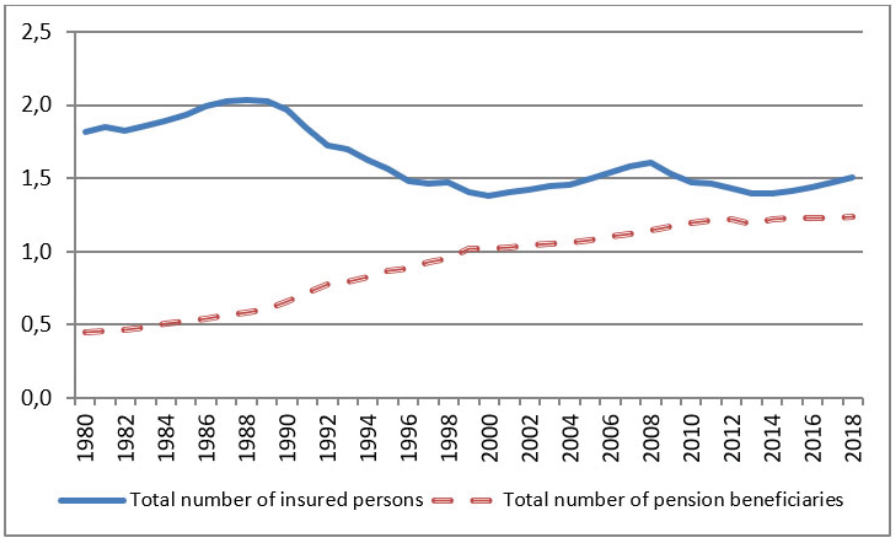
allocations, as was intended at the time of the adoption of the 2002 pension reform. Allocations for the second pillar have gradually increased to 10 percent, but so far have remained at the initially adopted 5 percent. This has led to the calculation of pensions for persons in both pension pillars being less favorable than for persons in the first pillar only. The most recent pension reform, the one from 2019, stipulates that future retirees receive a statutory allowance of 27 percent for a portion of the pension relating to second-tier funds if they are transferred from the second tier to the first tier or an allowance of 20.25 percent for pensions from the second pillar if the insured person does not wish to transfer these funds to the first pillar. The same reform penalized early retirement and wanted to raise the retirement age to 67. These changes sought to equalize the amount of pensions on the one hand, and to some extent relieve the pension system in the longer term, but due to public pressure, the shift in the age limit has been halted for the time being.

3. FINANCIAL CHARACTERISTICS OF THE PENSION SYSTEM OF THE REPUBLIC OF CROATIA

When Europe's first pension systems were in place, the retirement age was generally between 65 and 70 years. Due to the circumstances at the time and the average life expectancy at the time, this limit was such that few people even reached retirement, and if so, retirement generally did not last long. However, after the end of World War II, there is a significant reduction in the retirement age. A little later, due to the high unemployment occurring in Europe in the 1980s and 1990s, the practice of early retirement expanded into the life of the insurer in the 1950s. So, too, the institution of early retirement took root in Croatia, and in the mid-1990s, the average insured's retirement age was only 54 (Puljiz, 2005). In European countries, it was believed that this would solve the unemployment problem, that is, it would create more jobs for young unemployed people and that it would stimulate growth. By forcibly passivising one part of the working population contingent, the opposite was generally achieved: employers used early retirement to reduce labor and rationalize costs, and a large number of new retirees significantly increased the pressure on already overburdened pension funds. In Croatia, too, the pension system has been widely used as a means of alleviating social problems and rising unemployment. Within the pension system, economic problems that, by their very nature, belonged more to other social subsystems, such as social welfare in the narrow sense or the unemployment program, were often addressed at high and long-term costs (Marušić, 2003).

After 2000, a large decline in the number of insured persons was stopped, and since then their number has stagnated and ranges from 1.4 to 1.6 million, but on the other hand, the number of pensioners is increasing. Chart 1 shows trends in the number of insured persons and the number of pension beneficiaries.

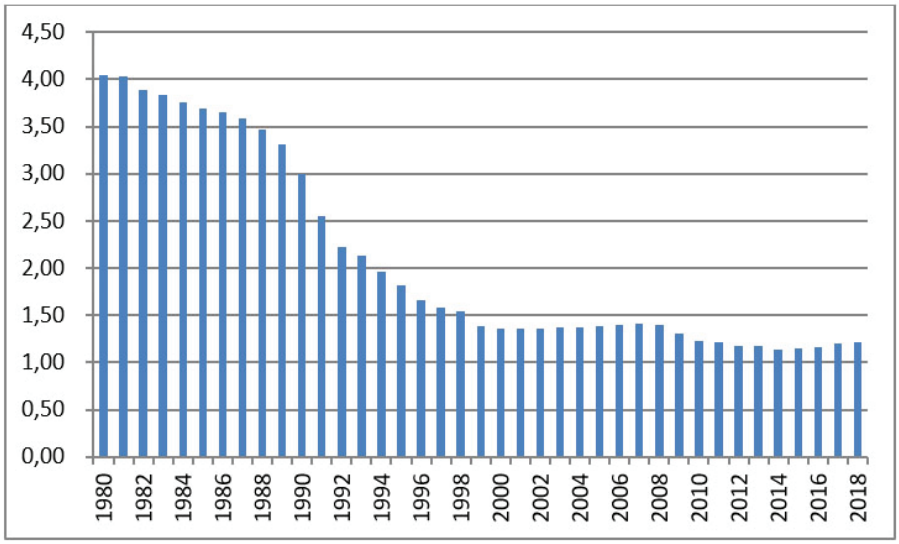
Chart 1. Trends in the number of insured persons and the number of pension beneficiaries in the Republic of Croatia, in millions



Source: HZMO (2019)

A look at the trends in the number of insured persons and the number of pension beneficiaries indicates the financial unsustainability of the pension system under the current conditions. The curve of the number of pension beneficiaries is steadily increasing, reaching 1.2 million at the end of 2018, while the curve of the number of insured persons, after a noticeable major decline in the early and mid-1990s, is stagnant and is about 1.5 million. The movement of the curves indicates that they may intersect in the near future, that is, there may soon be more pension beneficiaries than insured persons. It is a process that may be slowing down, but it is unlikely that trends can change and that process can be avoided. The difference in the number of insured persons and pension beneficiaries decreased from more than 1.3 million in 1990 to less than 0.3 million in 2018. An indicator that better describes this problem and is often used is the ratio of the number of insured persons to the number of pension beneficiaries, which is shown in chart 2.

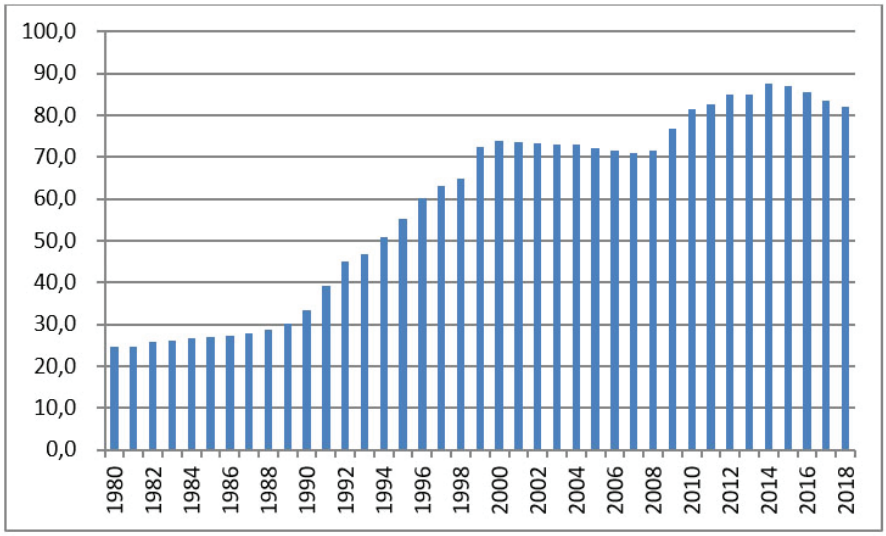
Chart 2. Changes in the ratio between the number of insured persons and the number of beneficiaries of pensions



Source: HZMO (2019)

In 1980, 4.04 insured persons paid contributions to one pension beneficiary. Funding for the pension system was significantly different in such circumstances than it is today, when only 1.22 insured persons pay contributions to one pension beneficiary. Although the most noticeable negative change occurred from the beginning to the mid-1990s, this ratio has been in constant decline throughout the period under review. As early as the 1980s, this ratio had fallen by more than 25 percent, or decreased from 4.04 to 3.00. In addition to the economic reasons and retirement conditions of that time, an important share in the mentioned change can be attributed to the factor of declining birth rate, or changes in the age structure of the population. This factor influences the decrease in the ratio over the whole observed time. A relatively larger decline, but in absolute terms very similar, occurred during the transition crisis and the war: from 3.00 to 1.81, or almost 40 percent. The decline in the ratio continues all the time, which indicates even more unfavorable ratios between the number of insured persons and the number of pension beneficiaries. The number of pension beneficiaries per 100 insured persons is shown in chart 3. This number is also called the system dependency ratio.

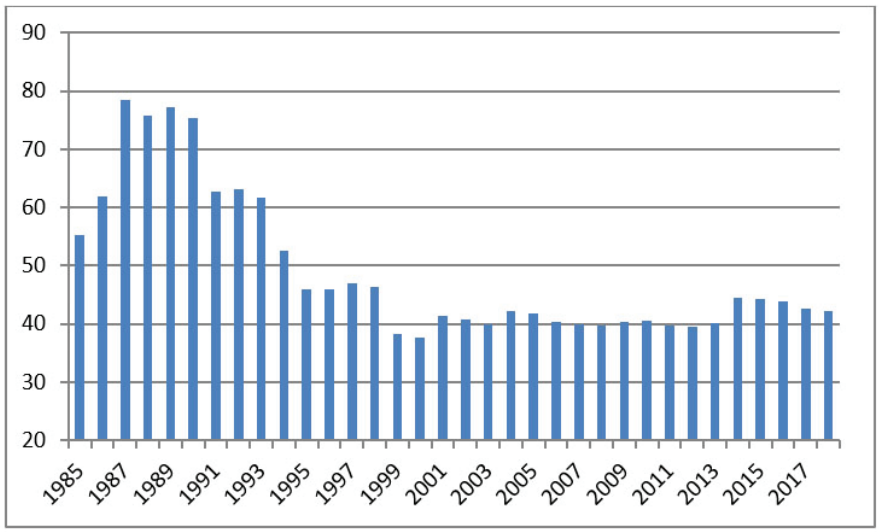
Chart 3. Movement of the number of pension beneficiaries per 100 insured persons



Source: HZMO (2019), author processing

The system's dependency ratio in Croatia since the second half of the 1990s is among the highest in the world. The figure of 82 pension beneficiaries per 100 insured persons in 2018, and its continuous increase since 1980, confirms two already pointed facts: first, that in the foreseeable future the number of pension beneficiaries will be equal to or greater than the number of insured persons, and second, that the amount of contribution based pensions will be so small that it will not be sufficient for life. Namely, assuming that the number of insured persons and the number of pension beneficiaries are equal, at the rate of 15 percent of the allocation for the first pension pillar, ie the generation solidarity pillar, the total cumulated pension funds will make up 15 percent of the total salaries. According to this, the average pension, if financed solely by contributions, would be in the amount of 15 percent of the average salary, which would lead to very unpleasant social consequences. Chart 4 shows the trend in the share of the average pension in the average wage over the last few decades.

Chart 4. Share of average net pension in average wage



Source: HZMO, 2019; 2019a

The average pension was decreasing by the end of the 1990s, and since then has remained stable at around 40 percent of the average wage. In 2018, it amounted to approximately HRK 2,640 and amounted to 42.3 percent of the average salary. It should be noted that the average pension consists of old-age, invalidity and survivors' pensions, and that the old-age pension is about five percent higher. However, it is a low level of pensions that leads to a difficult life for retirees and causes dissatisfaction with its comparison with length of service and years of payment of pension contributions. Further reduction of the average amount of pensions is therefore not realistic not only because of possible resistance, but also because of the fact that this would increase social problems. A system of generational solidarity in which costs and revenues are balanced can be expressed by the following equation (Willmore, 2004):

$$pR = swL$$

where p is the average amount of pension and R represents the number of pensioners. On the left side of the equation are system costs and on the right are funding sources. The contribution rate s, multiplied by the average wage and the number of employees L, represents the mass of funds collected, ie the sources of financing the pensions paid. From the previous equation, the required contribution rate can be calculated with the desired ratio of average pension to average salary and the ratio of number of employees and number of pensioners:

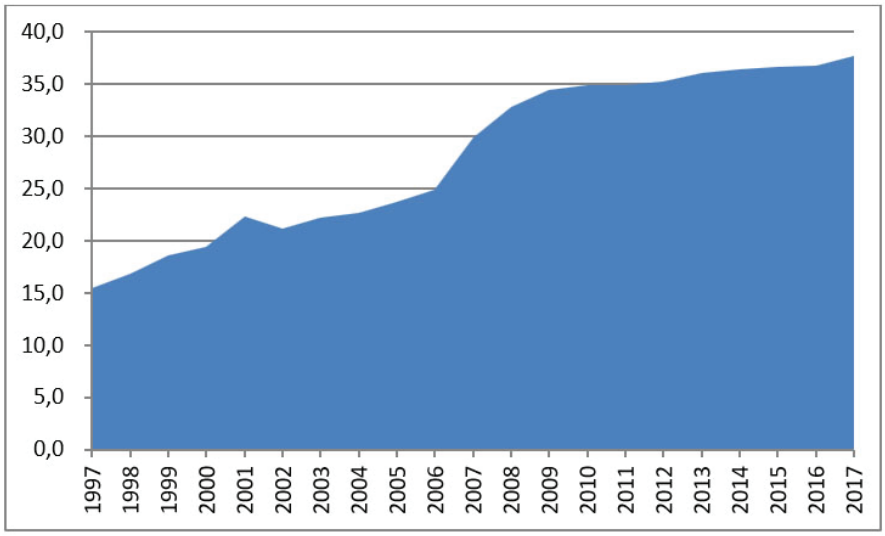
$$s = (p / w) / (L / R)$$

With productivity and wages rising, so are pensions, so the system is in balance as long as the number or ratio of employees and retirees is constant. As this ratio worsens, that is, the number of pension beneficiaries increases or the number of employees decreases, the system becomes unsustainable. It is necessary to either reduce the ratio of pensions to wages, which means reducing

them realistically, or increasing the rate of appropriation to maintain the existing level of pensions. Both measures are limited because neither the appropriations can be raised indefinitely nor the pensions can be significantly reduced.

The solution is either to raise the contribution rate, which would have a direct and negative impact on competitiveness and economic growth, or change the way pensions are funded through a change in tax structure. It should be borne in mind that raising the contribution rate has an economic margin of efficiency and that it would be a measure that would only temporarily solve the problem and would significantly impair competitiveness and jeopardize other macroeconomic objectives. Grdinić et al (2017) find in the sample of former transition countries the negative and statistically significant effects of social security contributions on economic growth both in the short and long term. Crnogorac and Lago-Peñas (2019) warn of the problem of the informal economy and tax evasion caused by an irreversible tax structure. Deskar-Škrbić (2018) goes a step further and finds that fiscal policy plays a very important role in stimulating the Croatian economy. Kotlikoff (2011) believes that the system needs to be thoroughly reformed because partial measures can hardly bring a viable solution. Moreover, he believes that the partial measures will make the situation even worse and that future generations will find the system in an even more difficult state than it is today. On the other hand, frequent changes in the tax structure suggest a precarious institutional environment that is considered one of the main derivatives of the economic growth of national economies (Buterin et al, 2018). Chart 5 shows HZMO expenditures for pensions and retirement benefits.

Chart 5. Movements in expenditures for pensions and retirement benefits, in billions of HRK



Source: HZMO, 2019; 2019a

Despite pension reforms, pension expenditures in the 21 observed years increased almost threefold, from HRK 15.4 billion in 1997 to HRK 39.2 billion in 2018. As this relative and absolute increase in the amount for pensions was not accompanied by an increase in the contribution rate, and there

was no increase in the number of insured persons, it is clear that the pension system lacks the money to function and must be moved from somewhere. Over the past three decades, several significant changes in the amount and manner of collecting pension contributions have occurred, and are presented in table 1.

Table 1. Overview of changes in pension contribution rates

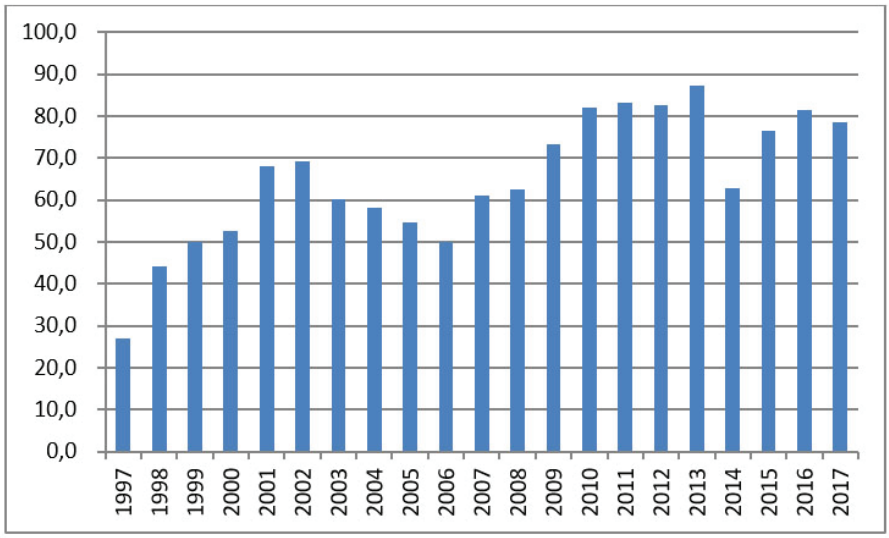
Year	Contributions from salary	Contributions on salary	In total
1991	9,50	9,00	18,50
1991	11,00	11,00	22,00
1994	13,50	13,50	27,00
1995	12,75	12,75	25,50
1998	10,75	10,75	21,50
2000	10,75	8,75	19,50
2003	20,00	0,00	20,00

Source: HZMO, 2019a

Since 2003, the pension contribution rate has not changed, totaling 20 percent. Insured persons in both pension pillars pay three quarters into the first pillar and one quarter into the second pillar. Although since 2000 there have been only salary contributions and no more salary contributions, both for the insured and the employer, this is generally not relevant. Namely, for both the worker and the employer, the amount of pay is important, one as income and the other as a cost category. While workers have the perception that wages are low and that work is poorly paid, employers have the impression that the same work is very expensive. Since contributions reduce net income, they are unpopular and considered as benefits to the state, and it is less important whether they are paid by the employer or the worker.

With the introduction of the second pillar, which pays a quarter of the revenues, since 2002 a transition cost has been incurred, that is, the long-term cost of the state related to the settlement of the deficit in the first pillar. The lack of money is covered by the state budget, and chart 6 shows how much HRK is paid for pensions and pension benefits for every HRK 100 collected pension contributions for the first pillar.

Chart 6. Amount of budget revenues for pensions and pension benefits per HRK 100 of income from pension contributions



Source: HZMO, 2019; 2019a, author processing

Since for every HRK 100 contributions collected, in order to pay pensions and pension benefits, it is necessary to provide around HRK 80 in the budget, it may be asked whether the pension system in the Republic of Croatia is still based on the German model of generational solidarity. The unfavorable ratio of insured persons and pension beneficiaries, which implies an insufficient mass of pension payment contributions, has led to the need for budgeting to be understood in itself. These interventions are increasing year by year. Table 2 shows the comparative movement of pension expenditures and contributions and budget revenues.

Table 2. Trends in pension system revenues and expenditures, in billions of kunas

Year	Expenditure on pensions and retirement benefits	Revenues from pension contributions	Revenues from the budget of the Republic of Croatia
1997	13,8	12,2	1,6
2000	19,5	12,8	6,7
2003	22,2	13,8	8,3
2006	24,9	16,6	8,3
2009	34,4	19,8	14,6
2012	35,2	19,3	15,9
2015	36,7	20,8	15,9
2017	37,7	21,1	16,6
2018	39,2	( )	( )

Source: HZMO, 2019; 2019a

Pension expenditures grew by 173.2 percent between 1997 and 2017, and contribution income grew by only 73.5 percent. To make up for that difference, budget allocations have increased more than tenfold. In 1997, the share of appropriations in pension expenditures was 11.9 percent, and by 2017 it had risen to 44.0 percent. Despite the increase in contributions collected in absolute terms, the focus of pension payments is slowly but surely shifting from contributions to taxes.

4. CONCLUSION

All the data presented indicate that contributions can be less and less counted and that in Croatia the system of generational solidarity as such, at least when it comes to pensions, does not exist in its original form. The payment of pensions and the functioning of pension insurance are increasingly dependent on Croatia's budgetary capabilities, so significant system reforms need to be made to take into account the objective constraints on the age structure of the Croatian population and the importance of the impact of the tax structure on the competitiveness of the economy.

The features of the major changes made to the Pension Insurance Act so far and a series of minor changes to the relevant laws are attempts to reduce the financial pressure in the long run, that is, attempts to create the assumptions for the long-term sustainability of the system. However, due to problems on the revenue side of the system, such changes do not mean much in the long run. The demographic problems faced by Croatia are directly linked to the future functioning of a pension system based on generational solidarity and are one of the factors behind its greatest limitation. Contributions have a distortive effect and, by themselves, adversely affect the competitiveness of the economy. Therefore, substantially increasing the contribution in order to possibly better fill the first pillar, that is, the pillar of generational solidarity, is neither a realistic nor economically wise nor justified option. Resolving the demographic issue is certainly at the heart of resolving this issue, but the effects of a pro-natalist policy would only be noticeable in a few decades, if it were to be adopted and successfully implemented. In the meantime, it is necessary to ensure the functioning of the system, that is, to take care of the revenue side in the conditions that are given and which can be predicted with greater or less certainty. This means that there is a need to change the regulatory framework, which primarily means a change in the tax structure and a shift from income taxation, ie from the collection of pension contributions towards a greater reliance on consumption taxation.

The publication of this work was funded by the University of Rijeka as part of the project "Smart Cities in the Function of Developing the National Economy" (uniri-drustv-18-255-1424).

This paper was funded under the project line ZIP-UNIRI-130-5-20

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Pregledni rad
https://doi.org/10.31784/zvr.9.1.18
Datum primitka rada: 3. 4. 2020.
Datum prihvaćanja rada: 23. 4. 2020.

PROMJENA POREZNE STRUKTURE REPUBLIKE HRVATSKE KAO PREDUVJET REFORME MIROVINSKOG SUSTAVA

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SAŽETAK

Mirovinski sustav Republike Hrvatske podložan je čestim propitivanjima koja se mogu svesti u dva temeljna smjera: pitanje njegovog financiranja, odnosno stopa doprinosa mirovinskog osiguranja koji negativno utječu na konkurentnost gospodarstva te pitanje visine isplaćenih mirovina koje su vrlo često percipirane kao nedovoljne za dostojanstveni život korisnika mirovina. Međutim, u dugom roku, mirovinski sustav suočit će se s potrebom temeljite reforme koju će uzrokovati sve dulji životni vijek stanovništva te sve izraženije negativne demografske tendencije koje su u Republici Hrvatskoj osobito snažno izražene. Sadašnji način financiranja mirovinskog sustava temeljen na doprinosima sve će manje biti u stanju servisirati njegove rastuće zahtjeve pa reformom treba postići dva naoko suprotstavljena cilja: učinkovito financiranje uz istovremeni poticajni utjecaj na konkurentnost hrvatskog gospodarstva. To će biti moguće ostvariti pažljivim osmišljanjem promjene porezne strukture i premještanjem težišta s oporezivanja dohotka prema oporezivanju potrošnje.

Ključne riječi: *mirovinski sustav, porezna struktura, doprinosi*

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Review article
https://doi.org/10.31784/zvr.9.1.19
Received: 28. 8. 2020.
Accepted: 2. 2. 2021.

ANALYSIS OF THE USE VALUE OF OLD HARDWARE USING OPEN SOURCE SOFTWARE

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ABSTRACT

At the beginning of the 21st century, Information and Communication Technologies (ICT) became an essential element of all spheres of life. The great opportunities these technologies provide are insufficiently used in many developing countries and one of the reasons for this is the lack of equipment. The aim of this paper is to present new areas for researches in the field of information systems, as well as showcase the opportunities and impacts of Open Source Software. The paper compares Microsoft Windows and GNU/Linux Ubuntu operating systems, the applicability and superiority of which have long been debated in the world of information technologies. The paper determines the possibilities for the prolonged use of old hardware by using open source software. In order to prove the applicability of these systems on old hardware, we have conducted tests that indicate the possibility of using both systems on the same hardware architectures.

Key words: *hardware, costs, open source software, testing, operating systems*

1. INTRODUCTION

The information and communication technologies (ICT) are a force that has changed many aspects of modern life (Oliver, 2002; Kraguljac & Milasinovic, 2016). The end of 20th and beginning of the 21st century marked an expansion of the use of computers in everyday life. This expansion was encouraged by a rapid technology development, which became cheaper and more available to ordinary users, both at work and at home.

Despite a drastic fall in equipment prices, for many developing countries, these prices are still high and for this reason, modern technologies are not available to many of their citizens. One of the potential solutions is the prolonged use of old hardware, which would give them an opportunity to follow modern trends. Computer systems managers make decisions about hardware - software selection, performance evaluation, capacity planning, and other resource variables based on actual data, accounting data, judgement, and assumptions about the resource consumption of the tasks being run (Zviran, 1999).

The problem is particularly pronounced with the activities that are almost exclusively financed from the budget, such as the education system, because the funds allocated for them are usually very modest. The higher education institutions are particularly affected and thus many students do not have an opportunity to acquire knowledge with the use of new technologies. The problem gets new dimensions having in mind the fact that these students should contribute to the much needed rapid development of their country as soon as they complete their education. Even countries that are able to purchase newer equipment face the similar problem, as this equipment quickly becomes outdated. Despite the strong presence of computers in everyday life and their unique role in the education system, the possibilities for their use in everyday work in schools in the Republic of Serbia are not even partially used. There are many reasons for this, starting from the lack of technical equipment in schools, through the lack of competence and motivation of teachers for this method of work, to acquiring habits for reaping benefits that the computers provide in the teaching process (Ibrahimovic, 2014).

According to the research carried out in Serbia (USAID, 2017), the biggest problems the citizens see in the functioning of educational institutions are poor condition and obsolescence of IT equipment and technology (29%), followed by extremely broad (44%) and old-fashioned (29%) curricula. In 2016, a failure to meet the technical conditions postponed the adoption of a new curriculum for the fifth and sixth grade of the primary school, which defines computer science as a compulsory subject in the Serbian education system. The key technical requirements that were not met are the availability of computers and Internet in schools, software licensing, system maintenance and staff training (Lipkovski & Radic, 2016).

2,800 classrooms are equipped with computers and Internet. However, seven percent of schools in Serbia do not have an Internet access and a total of 2,700 computers are missing (Lipkovski & Radic, 2016). The main cause that is stated is the lack of economic resources for the purchase of equipment and the irregularities in the use of the budget for the procurement of IT equipment. Thus, the Anti-Corruption Council of the Republic of Serbia analysed the costs of public purchases of computers, spare parts, maintenance services, software and license purchases. Considering that all local self-government units have reported extremely high costs for the procurement of computer equipment, and having in mind the fact that they state that the major problem that hinders their undisturbed operation is the lack of equipment, the question that reasonably arises is whether these procurement procedures have actually been implemented in the stated amount, which consequently raises the issue of corruption (SZBPK, 2016).

In order to achieve savings in the education system of the Republic of Serbia, one question has to be asked: Is it possible to leverage the existing IT resources, even outdated, to make (Andersen-Gott et al., 2012). "a shift in how commercial companies view open source software" following the role model of business users in the world?

In this regard, a moral obligation to contribute to open source is emphasized, which would use the knowledge as the main asset of educational institutions to reduce the costs of software licenses and improve the quality of the education system. In practice, open source software - OSS is often mentioned as low-cost software that could successfully replace well-known commercial software systems run by Microsoft and Apple (Viduka et al., 2017/a).

This solution is acceptable from the point of view of savings in software purchases, but the question remains about the continued use of old software in the teaching process with the acquisition of newer hardware (Viduka et al., 2017/b).

Many people see savings in the purchase price of new software, but they forget the fact that hardware is always replaced along with the new software, which increases the purchase costs for even up to 50% of the initial investment. On the other hand, the open source software advocates often point out that software is well-optimized (Borocz et al., 2018) and for this reason allows successful operation on old hardware.

The question that arises is whether it is possible to use old hardware to run new-generation software. In addition, it is also necessary to check other conditions, i.e. whether newer software is safe for computers and computer networks and the like. The old computers that are often encountered in users with a lower purchase power were used for testing.

These computers were purchased in the period from 2004 to 2014. The intention of this paper is not to determine which software systems are better, but to offer an alternative approach to the optimal use of old hardware by using modern software in education, business and everyday use.

The paper is structured as follows. The introductory part is followed by a review of Open Source Software and the motives for conducting such research. Then, the methodology behind the research and a review of previous similar research are explained. Ultimately, the obtained results are presented and discussed, conclusions are drawn and possible directions for future research are presented.

1. 1 About Open Source Software

Today, OSS is interpreted in two different ways – as "Free Software" and "Open Source". To understand this concept, it is important to understand that the free software in question is not always free, but may or may not be depending on the author's choice. In this context, the word "free" should be used as in "free speech", not as in "free beer".

Users of such software have the right to use, modify and share it with other users. This type of software has many advantages and it is widely used. In recent years, the term "Open Source Hardware" has been frequently used in science and education.

Users cite several important differences between GNU/Linux and Microsoft Windows, some of which are:

1. Linux is free. This is true for some variants. However, chargeable variants include customer support from the companies that develop it.
2. It is much safer, because there are very few or no viruses for Linux.
3. It is updated frequently, meaning that the errors found are corrected more quickly, which further affects stability and security.
4. It is more customizable. The user can tailor every aspect of the operating system to their needs and desires.

The file system used is ext4, unlike Windows where it is NTFS. This directly affects stability and data processing speed.

1. 2 Motive for this research

In recent years, various professional forums and social media groups have raised the issue of using Open Source software as a replacement for Microsoft Windows solutions. The topic most often discussed is the use of old hardware that uses Microsoft software, which has ceased to provide official support, and thus has become less secure. It is often related to users not having the money to buy new hardware or software from the same company, thinking about alternative software solutions that can run on older hardware. It is usually the more experienced users that recommend trying to use OSS, especially one of the GNU/Linux distributions. Most commonly suggested are Ubuntu, Lubuntu, Edubuntu, Kubuntu, Xbuntu, etc. Such recommendations almost always finish with claims that this software can extend the usage of old hardware with little or no investment.

Our aim was to scientifically test these claims and make test results available to potential users. Our goal is to enable as many users as possible to use computers in education and at home. One way to accomplish this is to take advantage of the old hardware that users already own. Additionally, when purchasing equipment, old computers are significantly less expensive while still offering the opportunity to work and learn. This furthermore reduces the digital divide between the rich and the poor, a problem of growing prominence in contemporary society.

The authors particularly strive to reduce the digital divide as much as possible in education, where it affects young people eager for knowledge. This is certainly just one of the suggestions for achieving that. An additional benefit is the reduction of electronic waste affecting our planet.

Our motive was to find out whether the claims made by experienced users on the utilization of hardware capabilities of older hardware were correct, and not to judge which software was better and more reliable. The aim was to establish facts using scientific methods, and make them publicly available to anyone who wants to prolong the use of old hardware. We believe that by providing scientifically confirmed facts and making them publicly available to experts and laymen alike, science fulfills one of its purposes in helping the economy, and society in general, to overcome obstacles and develop as quickly as possible.

Practical confirmation of these claims was obtained as a part of the project (By Clicking to Independence – Through Children's Village into the Virtual World) intended to enable young people (of legal age) without parental care to use computers and attempt to gain financial independence by guiding them into entrepreneurial waters. Their old classroom (Figure 1) was used as an example to prove the results of the tests obtained in our laboratory in practice . The hardware used by the aforementioned users was mainly obtained as a donation from companies that no longer had use for it. By installing OSS, we prolonged its usage. One of the biggest complaints of users (the students) about GNU/Linux installation was that very few games could be played on these computers. The teachers, on the other hand, found this advantageous as their primary purpose was for the students to use the computers for learning and working instead of playing games. Our experience with this test environment was identical to the following scientific tests.

Figure 1. The classroom we used for testing



2. METHODOLOGY

"GeekBench 2.4.3 Tryout (32-bit)" benchmark software (OTS, 2014) was used to measure hardware performance on two different eco-systems, i.e. operating systems. The first system was Microsoft Windows in three versions. The second system was GNU/Linux Ubuntu in two versions.

This software was chosen based on personal experience, recommendations of Internet users and because it is one of rare software that can be used on both operating systems (Microsoft Windows - MS and GNU/Linux) and in all test configurations.

The five computers configurations were selected for testing purposes and the following versions (32bit) were installed on them (Viduka, 2017):

- MS Windows XP Professional,
- Ubuntu Linux 12.04.1 LTS,
- MS Windows 7,
- Ubuntu Linux 14.04 LTS, and
- MS Windows 8 Pro.

The Ubuntu distribution of GNU / Linux was chosen because of its high popularity among users, as well as due to its visual and functional similarity with Microsoft software solutions to which users are already accustomed, which allows a relatively easy switch.

The testing results were compared, and based on these results, a discussion was conducted on the possibilities of using tested operating systems, older and newer, as well as software that comes with them.

3. PREVIOUS RESEARCHES

Open Source is a type of software that can essentially affect the business and economic characteristics of the software industry. In the last 10 to 15 years there have been a lot of researches on the application of Open Source Software (OSS) in business and education. An upward trend in the use of OSS in higher education in many countries of the world is evident (Van Rooij, 2007).

This topic is very popular in professional circles, but almost always the goal is to analyse the cost of procurement, as well as possible savings due to the application of OSS or switch to OSS. Even this research has a similar aim, but here savings are achieved through the use of an old, already existing, hardware. It is possible to view the topic from several angles - through economic, hardware and pedagogical factors, software can be seen as a craft of the future, its sociological, cultural, legal aspects, etc. can be measured. (Bonaccorsi & Rossi, 2003; Djordjevic et al., 2004; Singh & Seehan, 2012).

4. TESTING RESULTS

As noted above, the five computer configurations (laptops) with completely new operating systems and testing software were tested and the results shown in Tables were obtained. The computers that were tested and their hardware architecture are as follows:

A) LG Electronics GS50-6FH1 (2004)

- *Processor:* Intel Celeron M 1.40GHz @ 1.40 GHz (1 processor)
- *Processor ID:* GenuineIntel Family 6 Model 13 Stepping 8
- *Memory:* 1024 MB DDR SDRAM 167 MHz

B) Acer Aspire 3690 (2006)

- *Processor***:** Intel Celeron M 420 @ 1.60 GHz (1 processor)
- *Processor ID:* GenuineIntel Family 6 Model 14 Stepping 8
- *Memory:* 1024 MB DDR2 SDRAM 267 MHz

C) Hewlett-Packard Presario CQ61 Notebook PC (2009)

- *Processor:* AMD Turion II Mobile M500 @ 2.20 GHz (1 processor, 2 cores)
- *Processor ID:* AuthenticAMD Family 16 Model 6 Stepping 2
- *Memory:* 3021 MB

D) Acer Aspire 7739Z (2011)

- *Processor:* Intel Pentium P6200 @ 2.13 GHz (1 processor, 2 cores)
- *Processor ID:* GenuineIntel Family 6 Model 37 Stepping 5
- *Memory:* 3699 MB (4096 MB DDR3 SDRAM 534 MHz)

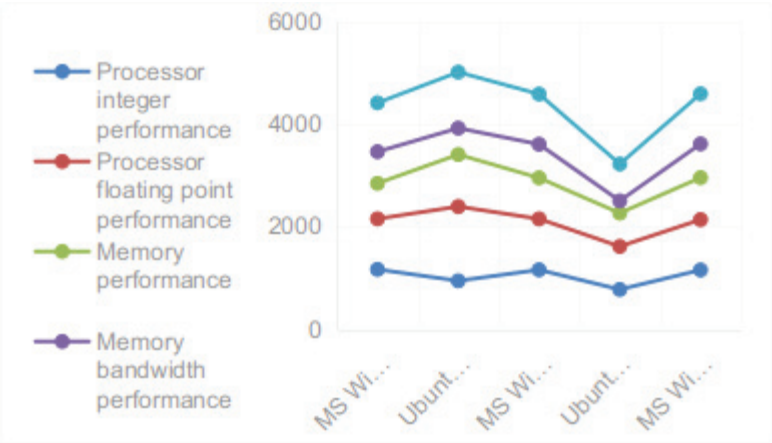
E) Hewlett-Packard HP EliteBook 840 G1 (2014)

- *Processor:* Intel Core i5-4200U @ 2.30 GHz (1 processor, 2 cores, 4 threads)
- *Processor ID:* GenuineIntel Family 6 Model 69 Stepping 1
- *Memory:* 2892 MB - 1 MHz.

Most computers used in the education system use MS Windows XP, for which Microsoft announced a support cessation in 2014, (Viduka & Basic, 2015) and the possession of this operating system also endangers the computers and networks that form a part of these computers. It is virtually impossible to install newer programs on such an old operating system, so there is also this restriction.

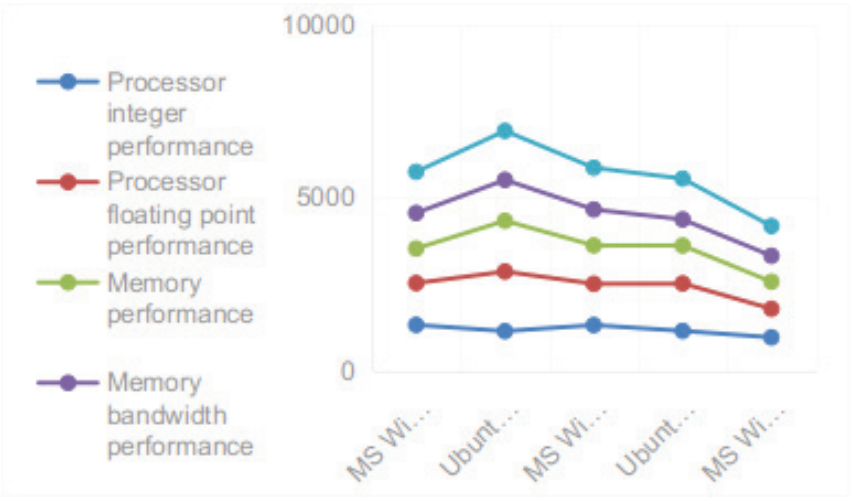
The testing results are shown below. The first computer is the computer purchased for technical purposes in 2004. (A1, A2, A3, A4 & A5, 2014) It has very outdated hardware architecture, but it can still be found in practice, especially in education. The results in Chart 1 show that the best results are achieved using the older version of GNU / Linux Ubuntu 12.04 LTS.

Chart 1. Testing results of Computer A



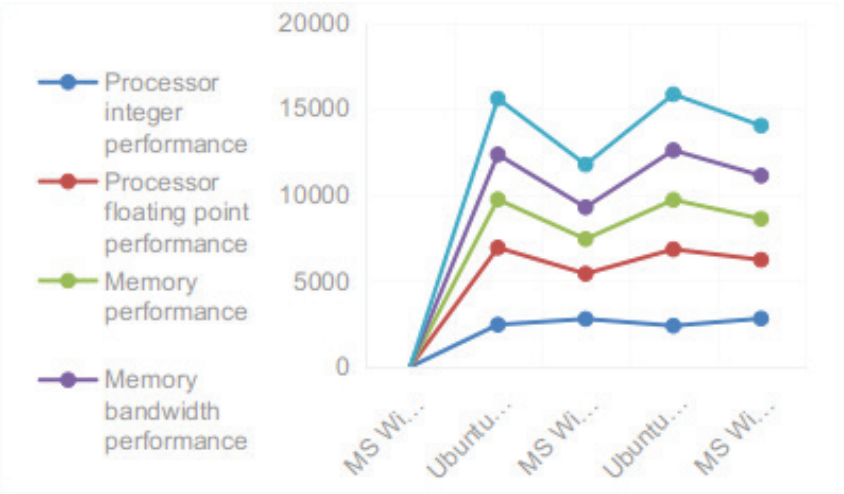
Below are the test results of the computer purchased in 2006. (B1, B2, B3, B4 & B5, 2014) Chart 2 shows that in this case the best results were achieved using the older version of the GNU / Linux Ubuntu 12.04 LTS operating system.

Chart 2. Testing results of Computer B



During the testing of the computer purchased in 2009 (C1, C2, C3 & C4, 2014), there was a problem in the installation of the MS Windows XP operating system and for this reason this column is empty. Chart 3 shows an absolute dominance of both GNU/Linux Ubuntu operating systems.

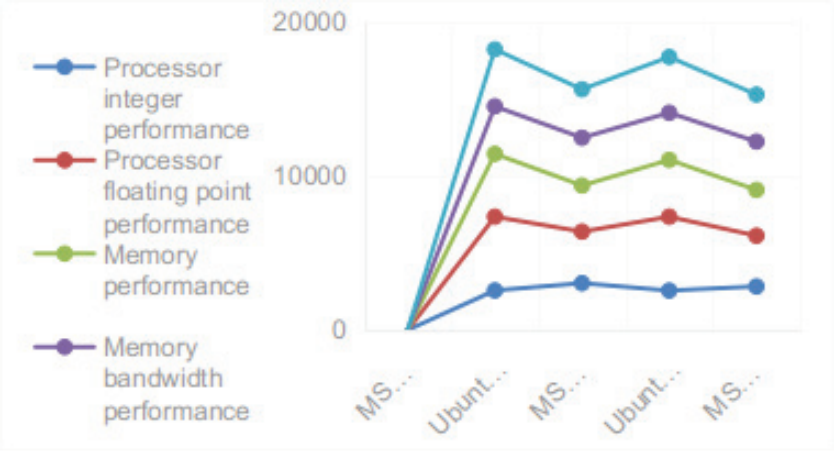
Chart 3. Testing results of Computer C



The problem with the installation of the MS Windows XP reoccurred on the fourth computer. Chart 4 (D1, D2, D3 & D4, 2014) shows the dominance of GNU / Linux Ubuntu operating systems.

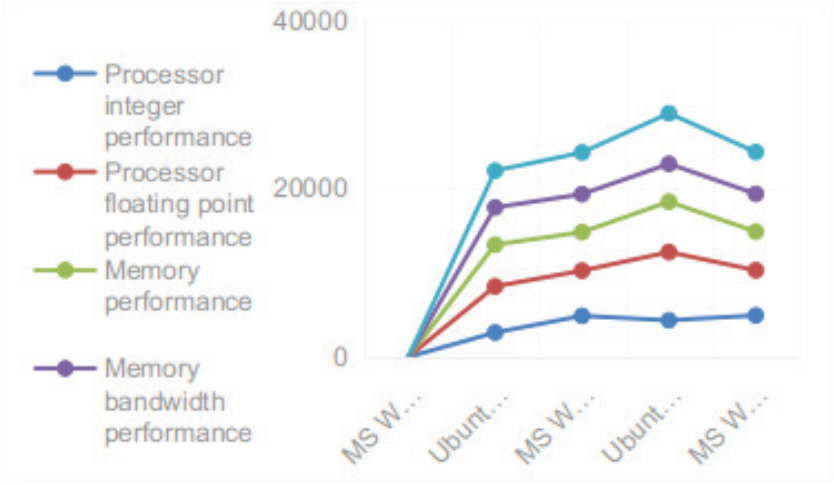
The differences in results can be seen only by looking at the numbers, however, this difference is even more pronounced in the work itself.

Chart 4. Testing results of Computer D



The last in a series of tested computers is the latest computer, which is often used today and which was purchased in 2014. (E1, E2, E3 & E4) Chart 5 also shows the dominance of GNU/Linux Ubuntu 14.04 LTS operating system.

Chart 5. Testing results of Computer E



The tables summarize the results of the tests that have been conducted. The links to the detailed results are available in the references at the end of the paper.

5. DISCUSSION OF TEST RESULTS

The computer technology market is large and rapidly evolving, and entails the development of necessary software, especially the operating systems, which have prominently developed in the last

few decades. But it still leaves an open question about the length of use of a specific computer can be used and with which software solutions.

The fight for market dominance will never stop, contributing to the creation of more stable, better and cheaper operating systems that can cope with the growing needs of users. The MS Windows and Linux singled out in this battle for the market of operating systems.

The users of these two systems often have discussions on which operating system is better and more usable. Microsoft took a large share of the market with Microsoft Windows, so we tried to compare this system with Linux and get an answer, which operating system is more applicable in the modern business, education or any other activity performed with the assistance of computers.

Some EU countries and their administrations are in the process of deciding to switch to OSS. This leads us to a conclusion that the demand for this profile of experts will grow. The users who have already used this software during their education, professional practice or privately, will have an advantage. It will be easier for them to upgrade the knowledge needed for the job. The opportunities for broader use of OSS that are noted here and the fact that it covers a wide range of services in various areas, especially in the Internet business, create opportunities for a higher percentage of youth employment, as well as development of entrepreneurship.

It can be clearly seen that GNU / Linux Ubuntu has shown better performance than MS Windows in all tests. The test results confirm the opinion that it has much better use of computer resources. We conclude that it is also possible to use older computers with the GNU / Linux operating system. The users often similarly rate other OSSs.

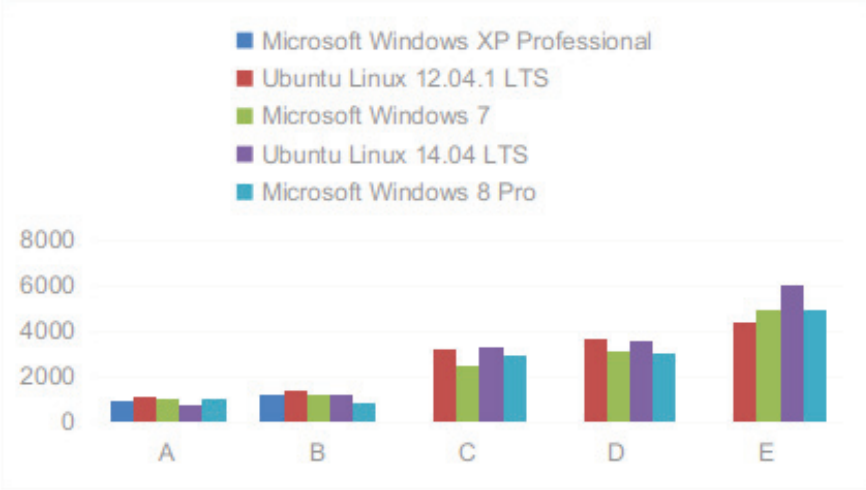
Although there have been claims that the GNU/Linux operating system has a problem with functioning on some types of hardware over the past years, this did not happen during this testing. A minor exception is the oldest computer that needed an external keyboard for the installation of the latest version of Ubuntu Linux.

At first glance, it seems that the difference in the results achieved is not convincingly beneficial for OSS. Therefore, it is important to note that there were no other application programs on computers with MS Windows versions, in addition to the operating system and testing programs. On the other hand, as a rule, the GNU / Linux Ubuntu comes with a number of applications installed that give users a wide range of opportunities for smooth operation, but also negatively affect the performance of the computer itself.

The tests have shown that the GNU/Linux (Ubuntu) operating system can be successfully used on the same computers as Microsoft Windows. This is important information especially for users who have older hardware, which is delivered and designed for use with the older Microsoft operating system.

Chart 6 shows the results summarized by the test software, which clearly indicate that GNU/Linux better uses the available hardware resources. The older computers were dominated by older Linux 12.04 LTS, but not with a big difference, while a newer version of Ubuntu GNU/Linux-a 14.04 LTS has a compelling advantage on newer computers.

Chart 6. Summary of Geekbench test



The plan for future research is to do more extensive tests, but only on the last two versions of the operating systems Windows and Linux Ubuntu.

6. CONCLUSION

Education and application of ICT, from the point of modern understanding of this phenomenon, are some of the basic postulates of the national interest of each country. The paper shows how the OSS project (GNU / Linux) can affect the development and improvement of education, but also other areas, and the benefits can be achieved in relation to the well-known commercial software packages. For many users this high-level view sounds nice, but the question that arises here is why most companies and individuals do not use open source software? One of the reasons is that only few years ago the open source operating systems (mainly GNU / Linux distribution) started to support enough hardware, deliver sufficiently usable applications and be at that level that does not to require advanced IT knowledge to be used by end users. The aim of the proposed model is to present another idea for research in the field of information systems, which has a different approach to the use of available hardware resources.

This paper tried to examine the connection and impact of software, primarily the operating systems, on the usability and price of the widely used hardware. Based on the tests that were carried out, it is clear that the OSS operates much better on older hardware compared to more common commercial software. The similar results were obtained for newer hardware. This claim affects the possibility of using old hardware that is currently available in many institutions, companies and homes, but also on the purchase price of new hardware and the fact that new hardware also requires new software that increases costs.

As this paper particularly focuses on education, we can conclude that this model has a good chance of success and can enable schools to continue teaching with old equipment. The use of

computers and equipment older than 10 years, can mean more hardware available for various tests and calculations, not just for standard work on desktop computers.

The old question about which of these two operating systems is better slowly loses its ambiguity. It is certain that the Linux is increasingly becoming a good alternative to Windows, even in areas where it has been long dominant. The strengthening of the Open Source concept enables Linux to accelerate its development, improve and adapt to users, making it more competitive and more reliable.

It is important to remember that although Linux is a free operating system, the investment costs themselves will not be decreased to a great extent, but a much more flexible, reliable and secure system will be obtained. All of the above leads us to a conclusion that Open Source Software can compete with commercial software in many segments.

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APPENDIX

Online A1-test resultati (2014): http://browser.primatelabs.com/geekbench2/2476062

Online A2-test resultati (2014): http://browser.primatelabs.com/geekbench2/2476091

Online A3-test resultati (2014): http://browser.primatelabs.com/geekbench2/2477565

Online A4-test resultati (2014): http://browser.primatelabs.com/geekbench2/2507047

Online A5-test resultati (2014): http://browser.primatelabs.com/geekbench2/2479924

Online B1-test resultati (2014): http://browser.primatelabs.com/geekbench2/2474860

Online B2-test resultati (2014): http://browser.primatelabs.com/geekbench2/2475398

Online B3-test resultati (2014): http://browser.primatelabs.com/geekbench2/2474868

Online B4-test resultati (2014): http://browser.primatelabs.com/geekbench2/2474947

Online B5-test resultati (2014): http://browser.primatelabs.com/geekbench2/2479946

Online C1-test resultati (2014): http://browser.primatelabs.com/geekbench2/2476367

Online C2-test resultati (2014): http://browser.primatelabs.com/geekbench2/2476318

Online C3-test resultati (2014): http://browser.primatelabs.com/geekbench2/2476581

Online C4-test resultati (2014): http://browser.primatelabs.com/geekbench2/2479867

Online D1-test resultati (2014): http://browser.primatelabs.com/geekbench2/2481531

Online D2-test resultati (2014): http://browser.primatelabs.com/geekbench2/2481554

Online D3-test resultati (2014): http://browser.primatelabs.com/geekbench2/2477315

Online D4-test resultati (2014): http://browser.primatelabs.com/geekbench2/2481564

Online E1-test resultati (2014): http://browser.primatelabs.com/geekbench2/2497201

Online E2-test resultati (2014): http://browser.primatelabs.com/geekbench2/2496936

Online E3-test resultati (2014): http://browser.primatelabs.com/geekbench2/2497225

Online E4-test resultati (2014): http://browser.primatelabs.com/geekbench2/2496956

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Pregledni rad
https://doi.org/10.31784/zvr.9.1.19
Datum primitka rada: 28. 8. 2020.
Datum prihvaćanja rada: 2. 3. 2021.

ANALIZA UPORABNE VRIJEDNOSTI ZASTARJELOG SKLOPOVLJA KORIŠTENJEM SOFTVERA OTVORENOG KODA

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SAŽETAK

Početkom 21. stoljeća informacijske i komunikacijske tehnologije (IKT) postale su ključni element u svim sferama života. Široki raspon mogućnosti koje ove tehnologije pružaju nedovoljno se koriste u mnogim zemljama u razvoju, a jedan je od razloga za to nedostatak opreme. Cilj je ovoga rada predstaviti nova područja za istraživanje u području informacijskih sustava, kao i prikazati mogućnosti i utjecaje softvera otvorenog koda. Rad uspoređuje operativne sustave Microsoft Windows i GNU/Linux Ubuntu, o čijoj se primjenjivosti i superiornosti dugo raspravlja u svijetu informacijskih tehnologija. Rad određuje mogućnosti za produljeno korištenje zastarjelog sklopovlja uporabom softvera otvorenog koda. Kako bi se dokazala primjenjivost ovih sustava na zastarjelom sklopovlju, provedeni su testovi koji upućuju na mogućnost korištenja oba sustava na istim arhitekturama sklopovlja.

***Ključne riječi**: sklopovlje, troškovi, softver otvorenog koda, testiranje, operativni sustavi*

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Pregledni rad
https://doi.org/10.31784/zvr.9.1.20
Datum primitka rada: 14. 12. 2020.
Datum prihvaćanja rada: 19. 1. 2021.

ZNAČAJ RAZVOJNIH BANAKA ZA FINANCIRANJE UBLAŽAVANJA I ADAPTACIJE KLIMATSKIH PROMJENA

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SAŽETAK

Klimatske promjene i globalne negativne posljedice zahtijevaju mjere za prilagodbu na održiviji model rasta i razvoja ekonomija. Stoga se kao prioritet nameće ublažavanje štetnih posljedica i poticanje održivog i klimatski otpornog gospodarstva. Jednu od ključnih uloga u procesu transformacije gospodarstava na nisko-ugljičnu budućnost imaju razvojne banke. Cilj rada je istražiti ulogu razvojnih banaka u klimatskim financijama kroz pregled literature i analizu podataka o klimatskim financijama država članica Odbora za pomoć u razvoju unutar Organizacije za ekonomsku suradnju i razvoj u razdoblju od 2012. do 2018. godine. Korišten je metodološki pristup analize postojećih teorijskih ishodišta i empirijska analiza dostupnih sekundarnih podataka. Očekivani doprinos ovog rada je u povećanju vidljivosti značaja razvojnih banaka kao kanala distribucije klimatskih financija koje su bile značajan dionik za transmisiju klimatskih financija od razvijenih ka slabije razvijenim državama.

Ključne riječi: *klimatske financije, razvojne banke, održivi razvoj*

1. UVOD

Zadnjih godina globalni održivi razvoj postao je vodeće načelo brojnih globalnih i nacionalnih dionika, kao proces ili program restrukturiranja ekonomskih, društvenih i tehničkih odnosa kako bi se zaštitila priroda i čovjekova okolina (Krstinić Nižić, Zubović, 2016). Istraživanja pokazuju da najveći utjecaj na klimatske promjene ima ispuštanje ugljikova dioksida u atmosferu, koji zbog

svojih svojstava pojačava učinak staklenika. U sljedeća dva desetljeća očekuje se porast temperature za oko 0,2 °C u svakom desetogodišnjem razdoblju, ako emisije stakleničkih plinova nastave rasti trenutačnim tempom (Šverko Grdić, Špoljarić, 2018). Ciljevi održivog razvoja[1] definirali su nove razvojne ciljeve i tendencije, a Pariški sporazum[2] je ojačao ambicije globalne zajednice u borbi protiv štetnih klimatskih promjena i razarajućih globalnih posljedica. Klimatske promjene i s njima povezani globalni humanitarni i ekološki problemi okupljali su nacije pod pokroviteljstvom Ujedinjenih naroda kako bi promovirali mjere prilagodbe i ublažavanja klimatskih promjena koje se dugo nazivaju ‹održivim razvojem›. Postignut je međunarodni konsenzus o razvoju politika i tijeku financijskih sredstava usmjerenih ka postizanju nižih emisija stakleničkih plinova i razvoja gospodarstva otpornog na klimatske promjene. Premda mnoge nerazvijene zemlje, pogotovo države niskog dohotka, nisu trenutno veliki izvor emisija, obvezale su se na pokretanje i provođenje tranzicije prema klimatski kompatibilnoj budućnosti (OECD, 2018). Europska Unija povećava razinu korištenja obnovljivih izvora energije u gospodarstvu. Prema zadnje dostupnim podatcima, u 2018. godini 17,9 % ukupne potrošnje energije se ostvaruje iz obnovljivih izvora. Ipak, ovakvim vrijednostima EU se još uvijek nalazi ispod propisanoga cilja od 20 %.

Kako bi se postiglo globalno smanjenje emisije stakleničkih plinova, posebno je potrebno ograničiti emisiju u sektorima poljoprivrede, šumarstva, korištenju zemlje, industriji, transportu i zgradama, a pogotovo u sektoru energije koji najviše doprinosi emisiji stakleničkih plinova i odgovoran je za otprilike 35 % ukupne emisije (IPCC, 2014). Nerazvijene države imat će snažnu potrebu za financiranjem velikih infrastrukturnih projekata kako bi se postigli ciljevi održivog razvoja, smanjila ranjivost i povećala otpornost prema štetnim klimatskim promjenama. Do sada te zemlje nisu uspjele doći do potrebnih razina međunarodnih javnih klimatskih financija (UNEP, 2016). U financiranju ovakvih vrsta projekata ključnu ulogu imat će razvojne banke, a pogotovo multilateralne razvojne banke koje su i danas ključni dionici u globalnim klimatskim financijama i u razvojnim financijama općenito. Multilateralne razvojne banke su financijske institucije u javnom vlasništvu sa specifičnim razvojnim ili političkim mandatom i ključne su u adresiranju novih izazova vezano za klimatske promjene.

Cilj rada je istražiti ulogu i važnost razvojnih banaka kao kanala za distribuciju klimatskih financija, kao i geografsku distribuciju odobrenih pomoći i programa za ublažavanje i suzbijanje klimatskih promjena. Osim detaljnog pregleda prethodnih istraživanja, izvršena je empirijska analiza podataka Organizacije za ekonomsku suradnju i razvoj u razdoblju od 2012. do 2018. godine. Radom je dokazana hipoteza kako su razvojne banke raznoliko i neujednačeno korištene kao kanal distribucije klimatskih financija od strane država članica Odbora za razvojnu pomoć OECD-a.

Rad se sastoji od šest cjelina. Nakon uvodnog dijela prikazan je pregled literature o klimatskim financijama, a zatim se daje osvrt na izvore sredstava i na geografski aspekt klimatskih financija. U sljedećem dijelu analizira se uloga razvojnih banaka u ublažavanju i prilagodbi klimatskim

[1] Novi program održivog razvoja do 2030. godine (Transforming our World: 2030 Agenda for Sustainable Development) usvojen je na Općoj skupštini Ujedinjenih naroda 25. rujna 2015. godine.

[2] Pariški sporazum o klimatskim promjenama je potpisan na Okvirnoj konvenciji Ujedinjenih naroda o promjeni klime (UNFCCC) u Parizu 2015. godine s glavnim ciljem ograničavanja globalnog zatopljenja na temperature „znatno ispod" 2 °C.

promjenama te završno rezultati predmetne analize. Posljednji dio rezerviran je za zaključna razmatranja.

2. PREGLED LITERATURE O KLIMATSKIM FINANCIJAMA I ULOZI RAZVOJNIH BANAKA

Literatura koja obrađuje tematiku klimatskih financija usmjerena je na nekoliko glavnih područja: učinkovitost klimatskih financija i uspješnost ostvarivanja zadanih ciljeva, analiza rizika povezanih s klimatskim financijama, privlačenje privatnih izvora sredstava za financiranje projekata povezanih s klimom, usporedba metoda i definicija za procjenu mobiliziranih klimatskih financija, nekonzistentnost definiranja klimatskih financija, pregled volumena i distribucije klimatskih financijskih tijekova, izazovi zemalja u razvoju s kojima se suočavaju prilikom tranzicije ka nisko-ugljičnoj i klimatski otpornoj ekonomiji, utjecaj razvojnih financijskih institucija na klimatske promjene te razvoj novih radnih mjesta kao posljedica korištenja klimatskih financija. Većina autora istražuje problematiku učinkovitosti klimatskih financija, uspješnost u ostvarivanju ciljeva kao i adekvatnost korištenja sredstava. Buchner *et al.* (2011) pronalaze da većina posrednika u sustavu klimatskih financija nije razvila dovoljno specijalizirane procedure za procjenu učinkovitosti klimatskih financija. Financiranje projekata povezanih s klimom uključuje mnoge rizike koje je potrebno primjereno procijeniti i pronaći načine ublažavanja i upravljanja predmetnim rizicima. Kennedy i Corfee-Morlot (2012) istražuju i rangiraju najznačajnije rizike u financiranju nisko-ugljičnih i klimatski otpornih projekata. Zaključuju da je politički ili rizik države najveći rizik za ovu vrstu projekata. Štoviše, potencijal za financiranje nisko-ugljičnih i klimatski otpornih projekata u zemljama niskog dohotka nije u potpunosti iskorišten zbog oskudnih osnovnih bankarskih usluga, slabog kapaciteta upravljanja rizicima i ograničene dostupnosti dugoročnih izvora financiranja.

Financiranje klimatskih namjena dostupno je iz javnih, ali i iz privatnih izvora. Javna financijska sredstva se usmjeravaju putem raznih institucija, razvojnih banaka, ministarstava, agencija te mogu biti bilateralni ili multilateralni prema načinu grupiranja i usmjeravanja sredstava. Odobravaju se u obliku darovnica, koncesijskih kredita ili garancija. Privatni izvori klimatskih financija najvećim dijelom odnose se na subjekte koji razvijaju projekte (engl. *project developers*) i korporacije (UNFCCC, 2015), komercijalne banke, institucionalne investitore i infrastrukturne fondove. Privatni sektor predstavlja 75 % globalnih tijekova klimatskih financija i esencijalan je za povećanje volumena klimatskih financija u okolnostima ograničenih javnih resursa (Buchner et al., 2012).

Tematiku privlačenja privatnih izvora financiranja ublažavanja i prilagođavanja klimatskim promjenama proučavali su: Brown *et al.* (2011), Agrawala *et al.* (2011), Whitley i Ellis (2012), Ockenden *et al.* (2012), Stadelmann i Michaelowa (2013), Caruso i Ellis (2013), Srivastava i Venugopal (2014), Würtenberger i Wils (2014), Caruso i Jachnik (2014), Stumhofer *et al.* (2015), Brown *et al.* (2015), Jachnik *et al.* (2015), Abeille *et al.* (2015), Pauw *et al.* (2015), McNicoll *et al.* (2017) te Broccolini et al. (2020). Snažan interes za proučavanje uloge i potrebe privlačenja privatnih financijskih sredstava za potrebe klimatskih financija može se opravdati činjenicom kako se bez privatnih izvora sredstava ne mogu postići ciljevi i obveze preuzete Pariškim sporazumom i Ciljevima održivog razvoja. Brown *et al.* (2011) proučavaju tematiku privlačenja privatnih izvora financija vezano za klimu. Caruso i Ellis (2013) uspoređivali su metode za procjenu mobiliziranih

klimatskih financija i utvrdili da je potrebno povećati usporedivost procjena i izvješća mobiliziranih klimatskih financija između država. Navedenu nekonzistentnosti potvrđuju i Ellis i Moarif (2015) i u svom radu zaključuju da izvješća država nisu usporediva, kompletna niti konzistentna, a to onemogućuje precizne i adekvatne procjene i analize. Izvještavanje o mobiliziranim privatnim financijama će postati obvezno po Pariškom sporazumu što je ključni izazov za razvijene države. McNicoll *et al.* (2017) analiziraju javno mobilizirane privatne financije za klimatske aktivnosti u Južnoj Africi između 2010. i 2015. godine. Rezultati istraživanja ukazuju da domaći javni akteri odrađuju najveću mobilizacijsku ulogu kroz pružanje potpore ciljanim politikama, a u manjoj mjeri sufinanciranjem na razini projekata. Širi prikaz javnih financijskih tijekova za razvoj infrastrukture u nerazvijenim zemljama od strane bilateralnih i multilateralnih razvojnih partnera utvrdili su Miyamoto i Chiofalo (2016). U radu je prikazan sveobuhvatan pregled volumena i distribucije financijskih tijekova, uključivši one kanalizirane operacijama privatnog sektora i one koje su mobilizirane od privatnog sektora kroz garancije, sindicirane kredite i kolektivne investicijske projekte. Tirpak *et al.* (2014) prikazuju devet tehničkih, političkih i izazova vezanih za kapacitet s kojima se suočavaju zemlje u razvoju, a odnose se na nekonzistentne definicije i kriterije za definiranje klimatskih financija, kao i nekonzistentne markere, indikatore i kodove za karakteriziranje financijskih podataka (po sektorima ili aktivnostima), nedovoljne institucionalne aranžmane koji uključuju nejasne uloge i odgovornosti različitih ministarstava, nedovoljni tehnički procesi i sustavi za identifikaciju i evidenciju troškova klimatskih financija, nedostatak informacija o klimatskim financijama koje pružaju nevladini dionici, nedostatak kapaciteta za nadgledanje različitih financijskih instrumenata, nedostatak podataka o privatnim financijama, nedostatak transparentnosti i predvidivosti.

Istraživanja koja procjenjuju utjecaj razvojnih financijskih institucija na klimatske promjene na makro razini su rijetke. Postoji samo jedna studija te vrste koju je proveo Te Velde 2011. godine. Provedena je regresijska analiza efekata razvojnih financijskih institucija (EIB, EBRD, IFC i CDC) na energetsku učinkovitost izraženu kao korištenje energije po 1.000 $ BDP-a. Rezultati pokazuju da IFC i EBRD vode ka većoj energetskoj učinkovitosti, dok takvih efekata nema za EIB i CDC na tom uzorku. Te Velde (2011) razvija općenitu metodologiju za procjenu agregatnog utjecaja razvojnih financijskih institucija na investicije i sposobnosti ovih institucija u poboljšanju energetske učinkovitosti. Dokazi upućuju da ove institucije povećavaju ukupnu investicijsku aktivnost i popravljaju energetsku učinkovitost u zemljama primateljicama. Zaključak je da jedan postotni bod povećanja investicija razvojnih financijskih institucija kao postotni dio od BDP-a vodi do 0,8 % promjene u omjeru investicija prema BDP-u. Jouanjean i Te Velde (2013) procjenjuju stvaranje direktnih i indirektnih poslova od strane raznih razvojnih financijskih institucija uz korištenje kvantitativnih metoda analize. Zaključeno je kako su međunarodne razvojne institucije omogućile razvoj 2,6 milijuna poslova u nerazvijenim zemljama u 2007. godini. Rezultati istraživanja ukazuju da je radna produktivnost povećana najmanje 3 % u dvadeset i jednoj državi niskog i srednjeg dohotka. Eschalier *et al.* (2015) u svom radu predstavljaju mogućnosti i izazove povezivanja tranzicije na nisko-ugljični razvoj s ciljevima razvojnog financiranja. Zaključeno je da razvojne financijske institucije mogu imati utjecaj na ublažavanje i adaptaciju klimatskim promjenama i na okolišnu održivost kroz tri kanala: a) podupiranjem nisko-ugljičnih, klimatski otpornih razvojnih modela moguće je ohrabriti i pokrenuti smjer javnih i privatnih investicija prema nisko-ugljičnim

projektima, ali i ubrzati promjene u regulatornom okviru. Ove institucije mogu igrati krucijalnu ulogu u omogućavanju pristupa kapitalu i rješavanju tržišnih neuspjeha, pomoći u razvoju nacionalnih, regionalnih i lokalnih razvojnih strategija i regulatornih okvira koji su koherentni sa nisko-ugljičnom tranzicijom, ostvarivanju suradnje s lokalnim bankama i financijskim institucijama u uspostavi zelenih kreditnih linija; b) stavljanjem adaptacije u fokus ove institucije mogu doprinijeti da se osigura da klimatski rizici budu sistematično uzeti u obzir u investicijskom odlučivanju i da se poduzmu adekvatne adaptacijske mjere; c) integriranjem financijskog rizika i prikladnim vrednovanjem investicija ove institucije mogu odigrati ulogu u poboljšanju integracije klimatskih i ugljičnih (regulatornih) rizika u investicijsko odlučivanje i osigurati poduzimanje adekvatnih adaptacijskih mjera.

Nastanak, funkcije i pozicioniranje razvojnih banaka u financijskim sustavima te područja koja financiraju istražena je u velikom broju radova. De Luna-Martínez i Vicente (2012) naglašavaju važnost uloge razvojnih banaka kao instrumenta vlada u promicanju ekonomskog razvoja. Pružanjem dugoročnih izvora financiranja, kreditnih garancija i ostalih usluga u infrastrukturi, kućanstvima i poljoprivrednom sektoru. Posebno je istaknuta uloga razvojnih banaka za vrijeme globalnih financijskih kriza i dokazuje kako su iste preuzele kontra cikličku ulogu kroz povećanje svoje kreditne aktivnosti u vrijeme kad su privatne banke smanjile financiranje privatnom sektoru. Thorne i du Toit (2009) definiraju razvojne banke kao oblik intervencije vlade u financijski sustav koji pokušava riješiti tržišne nedostatke u pružanju financijskih sredstava ili općenito ostvariti društveno-ekonomske ciljeve kao što je smanjenje siromaštva ili omogućavanje dostupnosti vlasničkog kapitala. Razvojne financije su definirane kao omogućavanje financiranja onim tržišnim segmentima (projektima, sektorima ili dijelovima stanovništva) koji nisu dovoljno servisirani financijskim sustavom.

Matić i Serdarušić (2009) naglašavaju ulogu razvojnih banaka u financiranju infrastrukturnih projekata i projekata posebne važnosti za pojedinu državu u okolnostima nezainteresiranosti komercijalnog bankarskog sektora.

3. IZVORI SREDSTAVA I GEOGRAFSKI ASPEKT KLIMATSKIH FINANCIJA

Klimatske financije su ključni koncept mobiliziranja kapitala u ublažavanju štetnih posljedica klimatskih promjena. Financiranje klimatskih pitanja uključuje službenu razvojnu pomoć (engl. *Official Development Assistance-ODA*), ostale službene tijekove sredstava (engl. *Other Official Flows-OOF*), privatne darovnice i privatna mobilizirana sredstva.

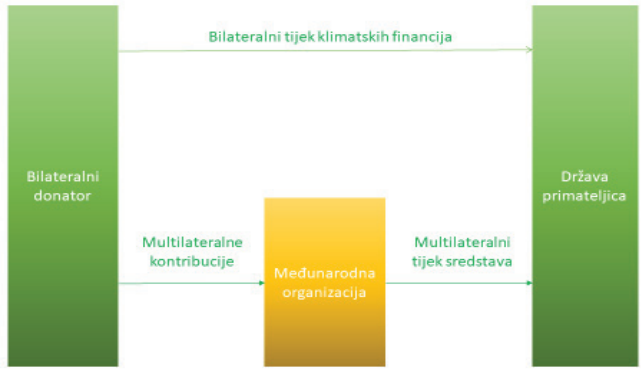
Klimatske financije se dijele na dvije glavne skupine:

- financiranje tzv. adaptacije ili prilagodbe – aktivnosti usmjerene na smanjenje ranjivosti i osjetljivosti ljudskih i prirodnih sustava na štetne posljedice klimatskih promjena te na izgradnju otpornosti i smanjenje izloženosti;
- financiranje tzv. *mitigacija* ili ublažavanja klimatskih promjena - odnose se na smanjenje emisije iz fosilnih goriva, poticanje alternativa u smislu korištenja obnovljivih izvora energije, sprječavanje uništavanja šuma i sl.

Većina financijskih sredstava usmjerava se u financiranje *mitigacije*. Prema podacima OECD-a (2018) za razdoblje od 2012. do 2018. godine, iz perspektive država donatora klimatskih financija, 69 % klimatskih financija ili 65 milijardi američkih dolara odnosilo se na projekte ublažavanja štetnih posljedica klimatskih promjena, a samo 31 % ili 30 milijardi USD na prilagodbu klimatskim promjenama. Vremenski obuhvat podataka uključuje razdoblje nakon globalne financijske krize 2007. / 2008. kada su financijska tržišta zabilježila povijesno niske cijene kapitala te pogodovala iniciranju i implementaciji novih projekata i strategija razvojnog bankarstva. Culpeper (2012) posebno naglašava važnost razvojnih banaka u zemljama srednjeg i nižeg dohotka.

Klimatske financije analizirane su na dva načina. Prva je perspektiva primatelja, koja obuhvaća sva sredstva primljena za klimatske namjene od strane bilateralnih i multilateralnih donatora. Druga perspektiva odnosi se na onu od strane donatora, a uključuje bilateralne kontribucije i sredstva koja su dodijeljena multilateralnim institucijama koje ih implementiraju u državama primateljicama. Sukladno navedenom, klimatske financije se usmjeravaju državama primateljicama na dva načina. Jedan od načina je bilateralni tijek klimatskih financija kojim država donator direktno usmjerava sredstva primatelju. Drugi način je korištenje međunarodnih organizacija kao kanala distribucije sredstava. Međunarodne organizacije primaju multilateralne kontribucije i usmjeravaju ih državama primateljicama. Navedeno je prikazano shemom 1.

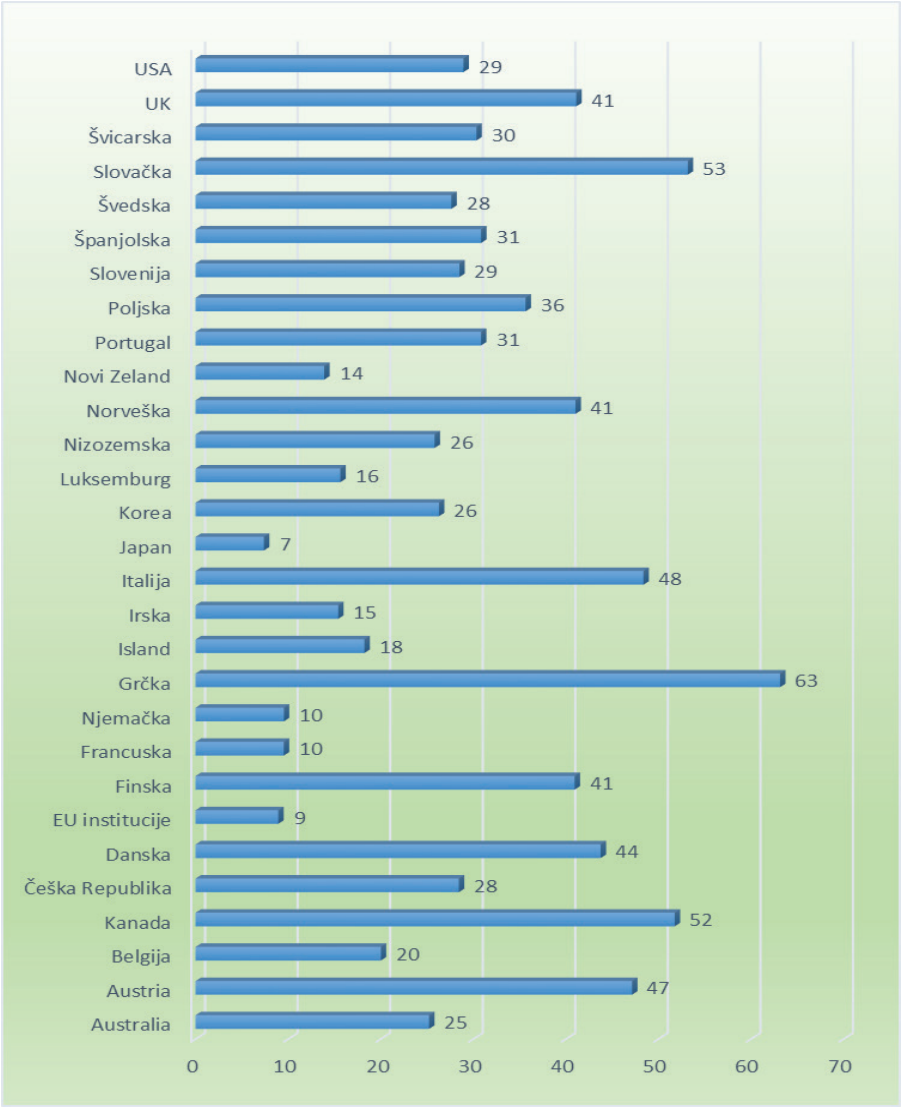
Shema 1. Tijekovi klimatskih financija



Izvor: OECD, 2018.

Grafikonom 1 prikazano je koliko su države donatori koristile razvojne banke kao kanal distribucije za klimatske financije. Najveći udio razvojnih banaka i fondova u ukupnim klimatskim financijama imaju Grčka 63 % i Slovačka 53 %, a najmanje Japan 7 %. Analizirajući podatke može se zaključiti da države koje nemaju tradiciju ulaganja u klimatske financije i nemaju razvijene vlastite kanale distribucije, koriste razvojne banke kao siguran način pravilne raspodjele sredstava, dok države koje ulažu značajna sredstva i imaju tradiciju financiranja projekata povezanih s klimom, s vremenom su razvile vlastite kanale distribucije, kroz razvojne agencije, ministarstva ili druge nacionalne institucije.

Grafikon 1. Udjeli klimatskih financija razvojnih banaka u ukupnim klimatskim financijama iz perspektive država primateljica u razdoblju od 2012. - 2018. godine (%)

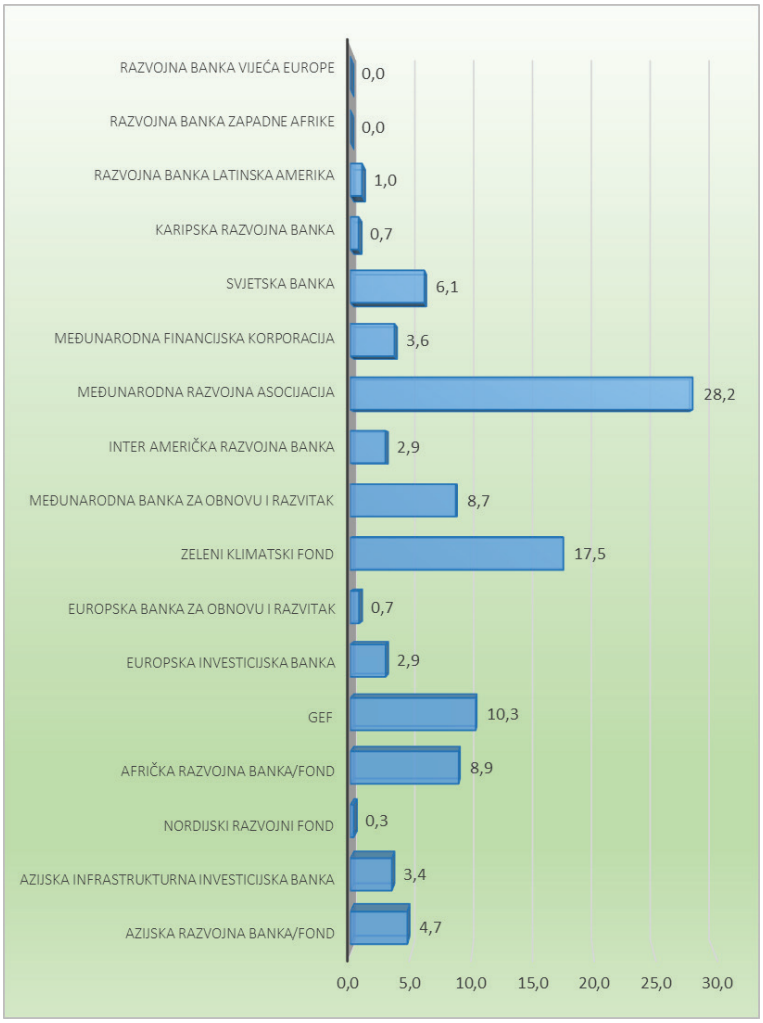


Izvor: izradili autori prema OECD (2019)

Prema integriranim podacima bilateralnih i multilateralnih klimatskih financija od 2012. do 2018. godine iz perspektive država primateljica, odobreno je 230,2 mlrd USD za klimatske financije. Pri tome je dio financiranja usmjeren putem razvojnih banaka i multilateralnih razvojnih fondova iznosio 37,9 mlrd USD ili 16,4 % od ukupnih odobrenih financijskih sredstava. Korištenje razvojnih banaka kao kanala distribucije za klimatske financije je raznoliko. Skandinavske države u prosjeku koriste razvojne banke kao kanal distribucije s udjelom od 38 %. Kanada i Sjedinjene Američke Države usporedive po geografskom položaju i razvijenosti, raznoliko koriste razvojne banke kao

kanal distribucije. Evidentno je kako geografski položaj, pripadnost regiji ili gospodarska razvijenost države ne utječu na korištenje razvojnih banaka kao kanala distribucije. Važnost pojedinih razvojnih banaka i multilateralnih razvojnih fondova iz perspektive država primateljica financijskih sredstava za klimatske namjene prikazan je grafikonom 2.

Grafikon 2. Udjeli razvojnih banaka i multilateralnih razvojnih fondova u ukupnim klimatskim financijama od 2012. - 2018. godine - perspektiva država primateljica

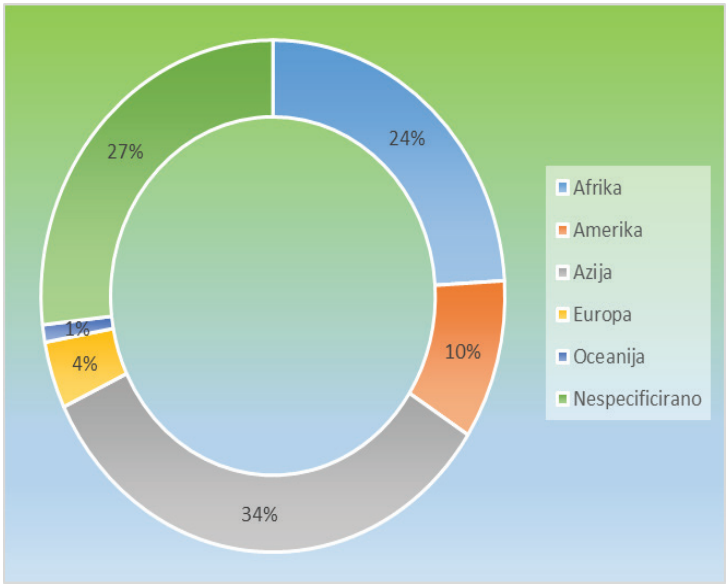


Izvor: izradili autori prema OECD (2019)

Dominacija Međunarodne razvojne asocijacije može se objasniti pripadnošću iste grupaciji Svjetske banke koja ima najveći udio u klimatskim financijama od multilateralnih banaka. Zeleni klimatski fond (eng. *Green Climate Fund – GCF*) osnovan je 2010. godine unutar Okvirne konvencije Ujedinjenih naroda o promjeni klime. Vidljivo je da postaje ključni financijski mehanizam za provedbu Pariškog sporazuma i ograničenje rasta globalne temperature. Geografska raspodjela

klimatskih financija istražena je temeljem podataka istog promatranog perioda, a zaključci analize prikazani su grafikonom 3. Velik udio klimatskih financija čiji primatelji nisu specificirani ukazuje na nedostatak podataka za sveobuhvatniju analizu.

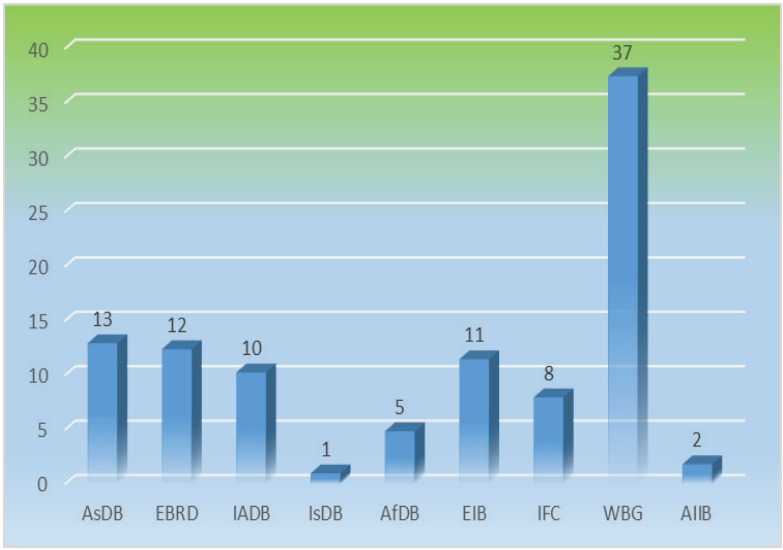
Grafikon 3. Geografska raspodjela klimatskih financija od 2012. do 2018. godine - perspektiva država primateljica



Izvor: izradili autori prema OECD (2019)

Analizom podataka o ukupnim iznosima klimatskih financija u promatranom razdoblju grafikonom 4 prikazani su udjeli pojedinih multilateralnih razvojnih banaka u istima. Dominacija Svjetske banke u klimatskim financijama je izrazita i sve ostale multilateralne banke imaju daleko manji opseg u klimatskim financijama. Jedan od razloga dominacije može se pronaći u činjenici kako je ista osnovana 1944. godine kao prva multilateralna razvojna banka i ima dugogodišnju tradiciju razvojnog bankarstva.

Grafikon 4. Udjeli razvojnih banaka u ukupnim klimatskim financijama od 2012. do 2018. godine - perspektiva država donatora (u %)



Izvor: izradili autori prema OECD (2019)

4. ANALIZA I REZULTATI ANALIZE ULOGE RAZVOJNIH BANAKA U UBLAŽAVANJU I PRILAGODBI KLIMATSKIM PROMJENAMA

Unutar stalno promjenjive strukture razvojnih financija, nacionalne razvojne banke, a pogotovo one iz nerazvijenih ekonomija, imaju veću i potencijalno transformacijsku ulogu u povećanju financija za nisku emisiju stakleničkih plinova i infrastrukturu otpornu na klimatske promjene u domaćem kontekstu. One mogu adresirati barijere za klimatske investicije specifične za pojedinu državu zbog svoje bliskosti tržištu i odnosu sa lokalnim javnim i privatnim dionicima. Nacionalne razvojne banke mogu biti začetnici održivog i odgovornog financiranja te pružati primjer ostalim nacionalnim financijskim institucijama odnosno imati učinak oponašanja i grupiranja. Utjecaj razvojnih financijskih institucija na klimatske promjene i okolišnu održivost izvršen je većinom u obliku procjene specifičnih projekata i inicijativa kroz studije slučajeva.

Razvojne banke izvještavaju pozitivne utjecaje na zaposlenost, na prihode javne uprave, na doseg kupaca i u nekim slučajevima okolišni, socijalni i upravljački ishod i razvojne utjecaje privatnog sektora, uz ograničenje dosega uslijed subjektivne ocjene i nedostatnih podataka kako bi precizno utvrdili efekti i rezultati. Dokazana je i pozitivna veza između investicija navedenih financijskih institucija i ekonomskog rasta. Massa *et al.* (2016) donose sveobuhvatan pregled literature o makroekonomskim efektima razvojnih financijskih institucija te zaključuju da iste imaju ključnu ulogu u pokretanju investicija i korištenju obnovljivih izvora energije u zemljama u razvoju. Pronađen je pozitivan i značajan utjecaj investicija razvojnih financijskih institucija na ekonomski rast i radnu produktivnost, koji potvrđuje transformacijski potencijal intervencija ovakve vrste.

Nacionalne, regionalne, bilateralne ili multilateralne razvojne banke su financijeri infrastrukture, a ova uloga se još može ojačati usmjeravanjem investicija u infrastrukturu koja je klimatski otporna i niske emisije. Njihova dodana vrijednost je trostruka: a) koncesijsko i nekoncesijsko financiranje novih projekata koji uključuju nisku emisiju te infrastrukturu otpornu na klimatske promjene u zemljama u razvoju; b) razvojne banke mogu privući komercijalne investicije za projekte kroz poboljšavanje povrata investicija obzirom na rizik kroz alate i pristupe ublažavanja rizika; c) razvojne banke mobiliziraju investicije direktno kroz potporu vladama u reformiranju investicijskih politika, uklanjanju prepreka investicijama i stimuliranju stvaranja tržišta kako bi se povećala klimatska akcija (OECD, 2018).

Ipak, razvojne banke ograničene su u svojem djelovanju jer blagotvoran učinak na klimatska pitanja zahtijeva djelovanje i sinergiju više dionika. Njihove aktivnosti ovise i pod utjecajem su vlasnika udjela u kapitalu razvojnih banaka, te je značajan i utjecaj na alokaciju sredstava od strane vlada klijenata, tj. država primateljica klimatskih financija. Vlade vlasnika udjela u razvojnim bankama utječu na rad bilateralnih i multilateralnih razvojnih banaka kroz pružanje kapitala i revidiranje politika i projekata. Dok aranžmani upravljanja nacionalnim razvojnim bankama i bilateralnim bankama mogu varirati, mnogi od njih su sastavni dio vladinog sustava te njihovi mandati i aktivnosti direktno ovise o signalima politike. Kontekst države, ali i regionalni kontekst imaju snažan utjecaj na ambicioznost razvojnih banaka u jačanju financiranja klimatskih pitanja i mobilizaciji komercijalnih investitora.

Nedostatak projekata spremnih za financiranje u nerazvijenim zemljama, rizici tečaja i valutni rizici, ali i međunarodno regulatorno okruženje vezano za financijsku stabilnost (Basel III regulativa) mogu umanjiti i spriječiti napore da se mobilizira komercijalni kapital za infrastrukturu niske emisije kao što su obnovljivi izvori energije (OECD, 2018; Ang *et al.*, 2017). Štoviše, nužno je da portfelj multilateralnih razvojnih banaka bude u skladu s Pariškim ugovorom odnosno da uključuje investicije koje aktivno podupiru ili ne podcjenjuju postavljene temperaturne ciljeve (Germanwatch i New Climate Institute, 2018). Jedan od problema učinkovitosti razvojnih banaka je ovisnost o političkim utjecajima. Vrlo često politički mandati ograničeni su na četiri godine, dok se orijentiranost razvojnih banaka na rješavanje problematike klimatskih promjena mora graditi dugoročnije, ali istovremeno i sustavno, promišljeno, ciljano i neometano. U globalnom smislu potrebno je poboljšati koordinaciju klimatskih inicijativa, putem razvojnih banaka i raznih multilateralnih fondova, kako bi se izbjegla kontraproduktivna kompeticija i preklapanje aktivnosti.

5. ZAKLJUČAK

Posljednjih godina razvojne banke su predvodnice i potpora u ostvarivanju nisko-ugljične ekonomije te u stvaranju gospodarstva otpornog na klimatske promjene. Multilateralne razvojne banke su po svojoj snazi, kapacitetu i mogućnostima financiranja jedan od najjačih dionika u klimatskom financiranju. Osim osiguravanja financijskih sredstava po uvjetima znatno povoljnijim od tržišnih, pružaju i pomoć u obliku tehničke pomoći, darovnica za specijalne namjene, pomoći u promjeni regulativa, pravila i u provođenju reformi.

Obzirom na značajna financijska sredstva koja će biti potrebna razvijenim i nerazvijenim državama, evidentno je kako se ta sredstva neće moći osigurati samo iz javnih izvora, već će biti potrebna privatna sredstva. Logika i način rezoniranja privatnih investitora je strogo tržišna, tj. traženje većih povrata na uloženi kapital, ako se preuzimaju veći rizici, a investicije povezane s klimom nose i veće rizike zbog nepoznanica financijske, tehničke i tehnološke prirode. U tom smislu uloga razvojnih banaka bit će još značajnija, jer one mogu pokriti rizike odobravanjem garancija odnosno biti poluga koja će omogućiti privatnom sektoru veći angažman i veću prisutnost u klimatskim financijama. Razvojne banke su prirodni kanal distribucije klimatskih financija obzirom na njihovu bliskost tržištu, kapacitete, znanje i sposobnost učinkovite alokacije sredstava. Razvojne banke i multilateralne razvojne fondove kao kanal distribucije klimatskih financija najviše koriste Grčka, Slovačka, Kanada, Italija, Austrija, Danska, Finska i Norveška. Najmanje se koriste u Japanu, institucijama Europske Unije, Njemačkoj i Francuskoj. Najveći udio u financiranju ublažavanja i usporavanja klimatskih promjena ima Svjetska banka.

Uloga razvojnih banaka u razvoju klimatskih financija kontinuirano se valorizira i unapređuje, a značajan napredak u transparentnosti i koordinaciji najznačajnijih razvojnih banaka učinjen je 2011. godine koja označava početak izrade zajedničkih godišnjih izvješća o uloženim klimatskim financijama. Koordinacija, zajednički nastup, izbjegavanje preklapanja financiranja, korištenje komparativnih prednosti svake od multilateralnih banaka veliki je doprinos budućnosti klimatskih financija. Naglasak je i na unapređenju i utvrđivanju efikasnosti klimatskih financija i postizanju ciljeva smanjenja emisije stakleničkih plinova te brže tranzicije ka nisko-ugljičnom gospodarstvu koje će biti otporno na klimatske promjene. U tom smislu potrebno je izraditi zajednički sustav indikatora koji će na usporediv način moći svjedočiti o efikasnosti implementiranih klimatskih financija i o uspješnosti pojedinih razvojnih banaka u provođenju tranzicije ka zelenom rastu i zelenoj ekonomiji.

Ovaj rad je financiralo/sufinanciralo Sveučilište u Rijeci projektom *uniri-drustv-18-61 i ZIP-UNIRI-130 5-20*

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Review article
https://doi.org/10.31784/zvr.9.1.20
Received: 14. 12. 2020.
Accepted: 19. 1. 2021.

THE IMPORTANCE OF DEVELOPMENT BANKS FOR FINANCING CLIMATE CHANGE MITIGATION AND ADAPTATION

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ABSTRACT

Climate change and global negative consequences require measures to adapt to a more sustainable model of economic growth and development. Therefore, mitigating the harmful effects and promoting a sustainable and climate-resilient economy is a priority. One of the key roles in the process of transforming economies into a low-carbon future is played by development banks. The aim of this paper is to investigate the role of development banks in climate finance through a review of the literature and analysis of data on climate finance of member states of the Development Assistance Committee within the Organization for Economic Cooperation and Development in 2012-2018. A methodological approach to the analysis of existing theoretical starting points and empirical analysis of available secondary data was used. The expected contribution of this paper is to increase the visibility of the importance of development banks as channels for the distribution of climate finance, which were significant stakeholders in the transmission of climate finance from developed to less developed countries.

Key words: *climate finance, development banks, sustainable development*

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Pregledni rad
https://doi.org/10.31784/zvr.9.1.21
Datum primitka rada: 1. 12. 2020.
Datum prihvaćanja rada: 2. 2. 2021.

EMPIRIJSKO ISTRAŽIVANJE STAVOVA KORISNIKA O SUPRIJEVOZU U REPUBLICI HRVATSKOJ

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SAŽETAK

U brojnim svjetskim gradovima broj stanovnika kontinuirano raste, a za iste to predstavlja velik problem obzirom da im infrastruktura nije bila dizajnirana da omogući kretanje tako velikog broja ljudi. Uslijed navedenog dolazi do zagušenja u prometu u urbanim područjima, zagađenja okoliša, rasta potrošnje neobnovljivih izvora energije, ali i porasta buke koju stvaraju vozila. Posljednjih godina se, kao moguće rješenje na sve veću potražnju za mobilnošću stanovništva, upravo javlja suprijevoz odnosno sustav dijeljenja automobila koji se temelji na načelu održivog razvoja. U proteklim desetljećima cestovna mreža se u većini država širila kao odgovor na sve veći broj automobila koje stanovnici posjeduju. Zbog porasta broja automobila uz gotove jednake parkirališne kapacitete kao u desetljećima ranije, većina osoba se sve češće susreće s problemom pronalaska parkirnih mjesta u urbanim središtima. Navedeno, ali i troškovi koje uz sebe veže posjedovanje osobnog automobila, utjecali su na značajan porast popularnost suprijevoza u svijetu. Svrha ovog rada je istražiti stavove korisnika o suprijevozu u Republici Hrvatskoj. Carsharing *organizacije omogućuju korisnicima kratkoročnu uporabu vozila iz voznog parka, ali i utječu na smanjenje potrebe za posjedovanjem privatnog vozila. Rezultati provedenog primarnog istraživanja pokazali su kako iako je prisutan na hrvatskom tržištu, suprijevoz koristi manji broj ispitanika. Ispitanici koji se koriste uslugama suprijevoza kao razloge navode manje troškove, izbjegavanje problema s traženjem parkinga te davanje doprinosa zaštiti okoliša. Pozitivno je što najveći dio ispitanika koji još nisu koristili usluge suprijevoza navodi kako će koristi usluge istog u budućnosti.*

Ključne riječi: *suprijevoz, mobilnost, gradski promet*

1. UVOD

Sve veća potreba za putovanjem odnosno za prijevozom do određenog odredišta uz značajan porast broja stanovnika u svijetu, dovodi do brojnih negativnih posljedica u urbanim sredinama kao što su zagađenje okoliša, prometna zagušenja koja su uzrokovana prevelikom koncentracijom vozila te potrošnjom neobnovljivih izvora energije. Suprijevoz pozitivno utječu ne samo na korisnike usluga sustava dijeljenja automobila već i na cjelokupno društvo, gospodarstvo i okoliš (Fournier *et al.*, 2015). Većina vozila koja se koriste u flotama za dijeljenje automobila su super mini ili mali obiteljski automobili. Upotrebom ekonomičnih malih automobila pružatelji usluga suprijevoza podržavaju korisničke naknade koje se ocjenjuju prema veličini vozila. Tako korisnik može donijeti svjesnu odluku o uštedi goriva i smanjenju emisije CO_2 kroz odabir vozila. Vozila za dijeljenje automobila u pravilu su novija od većine osobnih vozila, što znači da su poboljšanja u tehnologiji motora, učinkovitosti goriva i razine emisije ispunjena brže u vozilima za dijeljenje automobila nego u osobnim vozilima. Stoga svaki kilometar prijeđen automobilom koji se koristi za suprijevoz, rezultira s manje štetnih tvari u zraku i manje štetnih tvari za zdravlje kao i manjom potrošnjom goriva (Loose, 2010). Sudionici dijeljenja automobila emitiraju između 240 i 390 manje kilograma CO_2 po osobi godišnje (Nijland i van Meerkerk, 2017).

Dijeljenje automobila ima pozitivan učinak na okoliš smanjenjem potreba za vlasništvom nad vozilom članova i broja kilometara koje su njegovi članovi putovali, kao i poticanjem na veće korištenje alternativnih načina putovanja (Katzev, 2003). Suprijevoz može pozitivno utjecati na ekonomski razvoj na način da može povećati ekonomsku produktivnost tako što osobama koje traže posao, a ne mogu si priuštiti osobno vozilo, omogućuje upotrebu automobila ako je potrebno za traženje posla i zapošljavanje (Litman, 2000). Rast usluga dijeljenja automobila kao novog i održivijeg načina prijevoza usmjerava privatno vlasništvo prema korištenju usluga (Ferrero *et al.*, 2018). Zbog toga se suprijevoz javlja kao alternativa klasičnom obliku putovanja osobnim automobilom koja se temelji na načelu održivog razvoja.

Sukladno ranije navedenom cilj ovog rada je utvrditi stavove korisnika o suprijevozu u Republici Hrvatskoj. Dobiveni rezultati istraživanja poslužit će za utvrđivanje trenutnih preferencija korisnika kao i za uviđanje mogućnosti razvoja suprijevoza u prometnom sustavu Republike Hrvatske. Nakon uvodnog dijela, u sklopu drugog poglavlja analiziraju se karakteristike suprijevoza, odnosno definira se pojam suprijevoza te se analizira povijesni razvoj suprijevoza kao i modeli istoga. U sklopu trećeg poglavlja daje se pregled postojećih istraživanja, objašnjava se metodologija istraživanja i karakteristike uzorka, prezentiraju se rezultati provedenog primarnog istraživanja i iznose se ograničenja te preporuke za buduća istraživanja.

2. KARAKTERISTIKE SUPRIJEVOZA

2. 1 Pojmovno određenje suprijevoza

U literaturi se spominju dva pojma koja označavaju suprijevoz, a to su *carsharing* i *carpooling*. Suprijevoz se može definirati kao zajedničko putovanje dviju ili više osoba do određene destinacije tako da svi suputnici ravnopravno dijele troškove vožnje (engl. *carpooling*) ili korištenje vozila

organizacije koja posjeduje određeni broj osobnih automobila te nudi korisnicima mogućnost njihova korištenja pod određenim uvjetima (*engl.* carsharing) (Hirnig, Šikić i Gržin, 2017). Često dolazi do zablude između pojmova *carsharing* i *carpooling* koji se smatraju sinonimima, a nisu. Iako se značajno razlikuju u svojim ciljevima, poslovnim modelima, tehnologiji koju koriste te tržištu na kojem nastupaju ti pojmovi koji označuju suprijevoz imaju neka zajednička obilježja (Millard-Ball *et al.*, 2005):

- organiziranu grupu sudionika,
- jedno ili više dijeljenih vozila,
- decentraliziranu mrežu parkirnih lokacija smještenih blizu domova, radnih mjesta i stanica za prijevoz,
- unaprijed organizirano korištenje,
- najam za kratko vrijeme te
- samostalni pristup vozilu.

Pojam *carsharing* objedinjuje otvoreni pristup programu dijeljenih vozila koja su namijenjena povremenim putovanjima gdje je potreban automobil. Postoji razlika u govornim područjima engleskog jezika gdje definicija carsharinga ima različito značenje. U Velikoj Britaniji pojam carsharing podrazumijeva vozila u privatnom vlasništvu koja se dijele za određeno putovanje, dok se ta ista definicija u SAD-u odnosi na pojam *carpooling*. U SAD-u se za pojam *carsharing* koristi definicija vozila koja su u vlasništvu zasebne organizacije i koja se dijele između više različitih korisnika koji ih mogu koristiti u različito vrijeme. Ova definicija u Velikoj Britaniji opisuje pojam *Car clubs* (Millard-Ball et al., 2005). Pojam *carsharing* se često koristi u Europi. Litman (2000) opisuje *carsharing* kao uslugu najma automobila koja je namijenjena kao supstitut vozilu u privatnom vlasništvu.

2. 2 Prednosti i nedostaci suprijevoza

Ukoliko postoji bilo kakva nacionalna, regionalna ili lokalna podrška za sustave dijeljenja automobila putem političkih tijela, ista se temelji na doprinosu suprijevoza smanjenju prometa (Loose, 2010). Dijeljenje automobila smanjuje emisije i smanjenjem putovanja vozila i korištenjem novijih vozila koja štede gorivo – u mnogim slučajevima hibrida (Millard-Ball *et al.*, 2005). U prosjeku su vozila za dijeljenje automobila novija od većine osobnih vozila što utječe na stavranje manje štetnih tvari u zraku, manje štetnih tvari za zdravlje te manjom potrošnjom goriva (Loose, 2010). Nijland i van Meerkerk (2017) navode kako sudionici dijeljenja automobila emitiraju između 240 i 390 manje kilograma CO_2 po osobi godišnje, a što predstavlja između 13 % i 18 % njihovih emisija CO_2 u vezi s vlasništvom automobila i upotrebom automobila. Otprilike trećina do polovice tog smanjenja može se pripisati manjoj uporabi automobila, a ostatak do nižeg stupnja vlasništva automobila.

Suprijevoz također može ispuniti potrebe posebnih tržišnih niša. Na primjer, male tvrtke mogu koristiti dijeljenje automobila kao učinkovitiju i fleksibilniju alternativu posjedovanja automobila. Navedeno se posebno odnosi na vozila koja se koriste samo povremeno ako se u blizini ne nalazi uobičajena usluga iznajmljivanja automobila (Litman, 2000). Prednost sustava dijeljenja automobila

predstavljaju i značajne uštede korisnika. Mnoga kućanstva i poslovna poduzeća pridružuju se programu za dijeljenje automobila jer mogu uštedjeti novac na prijevozu (Millard-Ball *et al.*, 2005). Vlasništvo vozila glavni je trošak budžeta kućanstva koji može biti veliko opterećenje za kućanstva s umjerenim i niskim prihodima. Djelitelji automobila također mogu cijeniti vrijednost izbjegavanja zadataka održavanja i čišćenja vozila te sigurnosti bez neočekivanih računa za popravak (Litman, 2000).

Suprijevoz se ne može razviti sve dok se dovoljno potencijalnih korisnika u svakom području ne upozna s konceptom, ne shvati kako im to može koristiti te sve dok potencijalni korisnici ne razviju povjerenje u organizacije. Navedeno će zahtijevati obrazovanje i bolje marketinške aktivnosti. Organizacije koje pružaju usluge dijeljenja automobila također navode temeljni kapital kao jednu od prepreka kako bi bile osnovane. Ipak, suprijevoz podržava i podržan je od strane menadžmenta upravljanja potražnjom u prometu. Strategijama upravljanja potražnjom u prometu obuhvaćene su mjere kojima se povećava mogućnost putovanja i smanjuju poremećaji na tržištu kojima se potiče prekomjerno putovanje automobilima. Te strategije imaju sinergijski učinak što znači da su učinkovitije provedene zajedno nego odvojeno. Dugoročno gledano, one pomažu stvoriti raznovrsniji prometni sustav i smanjiti ovisnost o korištenju automobila u zajednici (Litman, 2000). Većina prepreka su lokalne, ali neka se pitanja bolje rješavaju na nacionalnoj razini. Mnogi su pružatelji usluge dijeljenja automobila izrazili interes za nacionalnom udrugom za dijeljenje automobila koja bi mogla pomoći u promicanju razumijevanja za regulatornu reformu i osigurati forum za umrežavanje i razmjenu podataka za operatora suprijevoza (Millard-Ball *et al.*, 2005).

Političko ograničenje je i to što je vjera u tehnologiju jača od podizanja svijesti o upravljanju mobilnošću. U političkim se krugovima širi nada da će moderna tehnologija vozila riješiti trenutne probleme izazvane prometom. U prošlosti je to, između ostalog, dovelo do spremnosti kreatora politika Europske unije kao i nacionalnih zakonodavaca da prihvate samoregulaciju u automobilskoj industriji radi smanjenja potrošnje goriva i povezane emisije CO_2. Suprotno tome, popratne mjere, poput podizanja svijesti među vozačima kroz upravljanje mobilnošću i informacijskim kampanjama, provedene su polusvijesno, ako su uopće provedene (Loose, 2010). Šolman, Presečki i Zubić (2010) navode kako nedostatak predstavlja i to što postoji mogućnost da pojedini korisnici nemaju osiguranu povratnu vožnju u slučaju vremenske nepodudarnosti obaveza nekih korisnika u odnosu na druge, posebno kod neformalnog oblika dijeljenja automobila. Zatim, nastaje gubitak potpune slobode u planiranju i realizaciji osobnih putovanja te je nužno privikavanje na novi tip automobila kojim korisnik još nije upravljao.

2. 3 Povijesni razvoj i modeli suprijevoza

U sklopu ovog potpoglavlja prvotno se daje kratak osvrt na povijesni razvoj suprijevoza, a zatim se pobliže objašnjavaju pojedini modeli suprijevoza.

2. 3. 1 Povijesni razvoj suprijevoza

Razvoj suprijevoza seže od 1940-ih godina kada je carsharing prvi put predstavljen. Kroz proteklih 80 godina, tržište dijeljenja automobila je u stalnom porastu kako su ljudi otkrivali da dijeljenje

automobila predstavlja učinkovitu metodu za ublažavanje rastućih cijena goriva i vozila (Erceg, 2014). Povijest suprijevoza u Europi započela je 1948. godine pokušajem osnivanja carsharing programa u Zurichu u Švicarskoj kada je zadruga Sefage (njem. *Selbstfahrergemeinschaft*) počela s djelovanjem. Ovaj rani pothvat uglavnom je bio motiviran pojedincima koji si nisu mogli priuštiti kupnju vlastitog automobila, pa su ga umjesto toga podijelili s drugima. Nakon Sefage u Europi su se pojavilo nekoliko pokušaja carsharing eksperimenata koji su započeli, ali ubrzo prestali s radom. Jedna od takvih inicijativa bila je poznata kao Protocip koja je započela 1971. godine u Montpellieru u Francuskoj (Shaheen, Sperling i Wagner, 1998). Slične inicijative u Europi bile su Witkar u Amsterdamu 1973. godine, zatim Green cars u nekoliko mjesta u Velikoj Britaniji u kasnim 1970.-ima te Vivalla Bil u Örebru u Švedskoj 1983. godine (Millard-Ball *et al*., 2005).

Uspješna iskustva carsharinga u Europi započela su u 1980.-ima u Danskoj, Engleskoj, Francuskoj, Irskoj, Italiji, Norveškoj, Škotskoj i Švedskoj. Četiri najaktivnije zemlje u Europi su bile Švicarska, Austrija, Nizozemska i Njemačka gdje je otprilike 200 *carsharing* organizacija bilo aktivno u 300 gradova. Europska *carsharing* oganizacija (engl. *Carsharing Association*) osnovana je 1991. godine kako bi podržala *carsharing* lobističke aktivnosti te daljnji razvoj *carsharing* organizacija u Europi. Iako su start-upovi *carsharing* organizacija bili subvencionirani, tipični operativni troškovi nisu bili subvencionirani u europskim *carsharing* organizacijama. Dvije najstarije *carsharing* organizacije su Mobility Car-Sharing Switzerland koja je proizašla iz pokušaja širenja dijeljenja automobila po četvrtima i tranzitnim stanicama u Švicarskoj; i StattAuto Berlin koji je uveden kao dio sveučilišnog istraživanja koje je pokazalo kako *carsharing* nudi održivu alternativu uobičajenom prijevozu u Njemačkoj (Shaheen, Sperling i Wagner, 1998).

Danas se suvremeno dijeljenje automobila proširilo na četiri kontinenta. Središnja Europa i dalje ostaje epicentar aktivnosti sustava dijeljenja automobila, a ostala rastuća tržišta razvila su se u Sjevernoj Americi, Aziji i Australiji. *Carsharing* je prisutan svugdje u svijetu uključujući oko 1000 gradova širom svijeta (MOVMI, 10.07.2019.). U Europi je sustav dijeljenja automobila prisutan u većini država, a to su: Austrija, Belgija, Danska, Finska, Francuska, Njemačka, Italija, Nizozemska, Norveška, Španjolska, Švedska, Švicarska; zatim Škotska, Engleska i Wales u Ujedinjenom Kraljevstvu te Kanada i Sjedinjene Američke Države u Sjevernoj Americi. Posljednjih godina trend dijeljenja automobila rapidno se razvija u Moskvi koja je sa 16500 vozila bila europski lider u 2018. godini, dok je na vrhu bio Tokio sa 19 800 vozila (Wagner, 2. 7. 2019.). U Aziji je carsharing prisutan u Japanu i Singapuru, a takve organizacije nalazimo i u Australiji (Shaheen i Cohen., 2007).

2. 3. 2 Modeli suprijevoza

Suprijevoz odnosno sustav dijeljenja automobila širok je pojam koji obuhvaća mnoštvo različitih poslovnih i operativnih modela. U mnogočemu su ti modeli slični i usko povezani sa zemljopisnim kontekstom i ciljanim tržištem. Primjerice organizacije za dijeljenje automobila u ruralnim područjima obično su organizirane različito, možda na osnovi suradnje ili na dobrovoljnoj osnovi, i imaju drugačiji operativni model od onih u urbanim područjima (Millard-Ball *et al*., 2005).

Glavni modeli koji se javljaju u Sjevernoj Americi su (Millard-Ball *et al*., 2005):

1. *Profitni*. Većina najvećih operatora u Sjevernoj Americi su u privatnom vlasništvu, odnosno to su profitna društva (Flexcar, Zipcar i Communato).
2. *Neprofitni*. Ovi operatori su inkorporirani u organizacije koje su oslobođene od plaćanja poreza (pr. City CarShare u San Franciscu i PhillyCarShare u Philadelphiji).
3. *Kooperativni*. Upravljani su od strane članova koji se pridružuju kupnjom udjela u organizaciji. U praksi, ovaj udio djeluje na sličan način kao povratni depoziti koje naplaćuju profitni i neprofitni operatori (pr. Cooperative Auto Network u Vancouveru).

Jedna od najvažnijih razlika između ova tri oblika organizacijske strukture odnosi se na izvore kapitala i osnivanja. Ključno pitanje koje treba riješiti bilo koja *carsharing* organizacija koja pokreće inicijativu jest odakle će doći kapital za financiranje. Svaka vrsta poslovanja ima jedinstvene izvore financiranja koje će možda moći iskoristiti, poput izravnih ulaganja, zaklada ili državnih potpora. Profitni pružatelji usluga suprijevoza najčešće imaju pristup rizičnom kapitalu ili drugim izvorima kao što su privatni start-up fondovi. Neprofitni operatori često imaju mogućnost iskorištavanja sredstava iz državnih fondova, a njihov status oslobođenja od poreza znači da mogu dobiti poticaje od države za svoje osnivanje. Kooperativne organizacijske strukture su djelomično ovisne o njihovim članovima koji osiguravaju kapital. Također, predložene su i druge različitosti među ovim organizacijskim modelima. Tako Brook (2004) tvrdi da postoji vjerojatnost da neprofitne i kooperativne organizacijske strukture možda neće imati poticaja za širenje poslovanja koliko i profitna poduzeća. S druge strane, ističe da profitna poduzeća nisu baš najbolji primjer modela kojim bi se postigli usko navedeni ekološki ciljevi poput smanjenja putovanja vozila. Na primjer, nekoliko neprofitnih organizacija tvrdi da su njihove strukture cijena postavljene na način da obeshrabre nepotrebnu uporabu automobila naplaćivanjem svakog prijeđenog kilometra, a ne povezivanjem sati i kilometara u promotivne pakete. Neke partnerske agencije su zbog toga izrazile preferencije za suradnju s neprofitnim organizacijama. Neprofitne organizacije se također mogu lakše podržati jer njihov porezni status može smanjiti ciljeve zajednice u privatizaciji uličnog prostora prilikom odobravanja parkiranja na ulici za potrebe dijeljenja automobila. Međutim, profitne organizacije navode kako one postižu slične ekološke ciljeve – "čineći dobro, radeći dobro" (Millard-Ball *et al*., 2005).

Širom svijeta uvedeni su programi franšize, *outsourcinga* i replikacije u dijeljenju automobila kako bi se dodatno promovirala upotreba *carsharinga* (Erceg, 2014). Flexcar, na primjer, vodi Flexcar Network pod kojim lokalni operatori poput I-GO-a u Chicagu, imaju ugovore s Flexcar-om koji im osigurava opskrbu vozila, tehnologije i back-office funkcija kao što je naplata. Prema Flexcar-u franšize imaju smisla na manjim tržištima gdje tvrtke možda neće htjeti samostalno obavljati određene operacije. U Kanadi, Communato je razvio dvojezični sistem pod nazivom Réservauto koji je dizajniran sa svrhom prilagođavanja različitim potrebama drugih carsharing operatora. Međutim, City CarShare iz San Francisca, ima nacionalni replikacijski program kako bi pružio tehničku pomoć neprofitnim operatorima u drugim regijama. Primjer takvog programa je PhillyCarShare koji je bio osnovan s ovakvom podrškom. 2005. godine City CarShare objavio je priručnik za pomoć novim odnosno start-up carsharing operatorima pokrivajući niz detalja vezanih uz probleme operativnog i poslovnog planiranja. Franšize i slični aranžmani su možda najbolje razvijeni u Europi. Primjerice,

njemački Cambio počeo je poslovati u Aachenu i Bremenu 1990. godine. Od tada je tvrtka Cambio razvila zajedničko ulaganje kako bi pružila svoje usluge u četiri dodatna grada u Njemačkoj i Belgiji te osigurala programsku podršku i pozivni centar u sedam drugih gradova. U Italiji, Iniziativa Car Sharing (ICS) je izravni davatelj usluga podrške i tehnologije uključujući nacionalni pozivni centar. Iniziativa Car Sharing je konzorcij od 18 gradova i provincija osnovan od strane Ministarstva okoliša, ali individualni operatori potječu iz javnog i privatnog sektora (Millard-Ball *et al*., 2005).

Erceg (2014) navodi podjelu *carsharing* na tri modela:

- *neighborhood carsharing* (dijeljenje automobila u susjedstvu),
- *station carsharing programi* odnosno vozila namijenjena osobama koje žive izvan metro zone i putuju svakodnevno na posao i sa posla,
- *multi-nodal carharing programi*.

Neigrborhood carsharing ili dijeljenje automobila u susjedstvu je nastao u Europi i osnovni je model suprijevoza (Erceg, 2014). Uključuje programe koji se fokusiraju na zapošljavanje kao i na stambeno tržište. Pojam "neighborhood" odnosno susjedstvo koristi se kako bi se ovaj program razlikovao od ostalih programa dijeljenja vozila kao što su station cars (Millard-Ball *et al*., 2005). U ovom modelu vozila su često smještena u stambenim objektima susjedstva i rjeđe u poslovnim područjima, a troškovi korištenja i vozila dijele se između skupine pojedinaca. Glavno obilježje ovog modela je da rezultira povećanom tranzitnom spremnošću takve vožnje jer korisnici postaju svjesniji pojedinačnih troškova svakog putovanja (Erceg, 2014).

Za razliku od dijeljenja automobila u susjedstvu koje služi širokom izboru putovanja, *station cars* programi fokusiraju se na vezu između tranzitne stanice i doma i/ili radnog mjesta. Pružaju automobil u "kućnom kraju" omogućujući prijevoznicima da se ujutro odvezu na stanicu, a drugi dio puta se voze tranzitnom linijom na posao. Zatim, isti automobil koristi dolazeći željeznički putnik za putovanje od tranzita do svojeg radnog mjesta koje je izvan pješačke udaljenosti. Na primjer, u CarLinku u San Franciscu, automobil je također dostupan za zaposlenike tijekom radnog dana. Ista putovanja navečer se događaju obrnutim redoslijedom, s automobilom smještenim tijekom noći u rezidenciji korisnika (Millard-Ball *et al*., 2005). Karakteristika ovog modela je nizak omjer broja korisnika prema broju vozila u odnosu na ostale modele carsharinga. 1990.-ih godina ovaj model je bilježio rast na području Azije zbog integracije elektroničkih tehnologija (Erceg, 2014). Glavna razlika između neighborhood carsharinga i station cars-a je u tipovima korisnika i vrstama putovanja. *Station cars* usredotočeni su na tržište svakodnevnih putovanja na posao sa plaćanjem mjesečne pretplate. Nadalje, stacionarni automobili imaju definirane skupine korisnika – *home-based* korisnike (korisnici smješteni kod kuće) i *work-based* korisnike (korisnici smješteni na radnom mjestu) te u nekim novijim modelima i podnevne korisnike. S druge strane, svako *carsharing* vozilo uslužuje puno širu bazu članova i plaćanje je obično po uporabi vozila. Također, ovakav program je pomogao *carsharing* tvrtkama zaraditi dovoljno prihoda kako bi nastavili poslovati sa jako malo ili čak bez subvencija (Millard-Ball et al., 2005).

Treća vrsta modela suprijevoza je *multi-nodal carsharing* koji se odnosi na više-čvorišna vozila za zajedničku uporabu koja se voze između više stanica i obično su povezana s odmarališima,

nacionalnim parkovima i kampusima sveučilišta. Ovaj model može bit povezan s tranzitom, a njegova prednost je ta što se može koristiti za jednosmjerna putovanja umjesto dvosmjernih putovanja, kao i kod *neighborhood carsharing* programa. Ovim modelom uvedena je fleksibilnost za korisnike, ali se povećala složenost upravljanja sustava dijeljenja automobila zbog potrebe premještanja vozila na druge lokacije (Erceg, 2014).

3. ISTRAŽIVANJE STAVOVA KORISNIKA O SUPRIJEVOZU U REPUBLICI HRVATSKOJ

3. 1 Pregled literature

Umjesto da kupuju i posjeduju stvari, potrošači žele pristup robi i radije plaćaju iskustvo privremenog pristupa njima. Vlasništvo više nije krajnji izraz želje potrošača. Potrošnja na temelju pristupa definira se kao transakcije koje mogu biti tržišno posredovane u kojima se ne vrši prijenos vlasništva. Potrošač stječe vrijeme potrošnje s artiklom, a u slučajevima tržišno posredovanih pristupa spreman je platiti određenu cijenu za uporabu tog predmeta. Potrošači mogu pristupiti objektima ili mrežama koje si ne bi mogli priuštiti ili koje nisu odlučili posjedovati zbog zabrinutosti kao što su prostorna ograničenja ili okoliš. U usporedbi sa svojim proizvodima koji posjeduju, potrošači ostvaruju koristi kupujući proizvode ili usluge izravno ili ulaze u mrežu na temelju plaćanja, iznajmljivanja ili pristupa. Primjeri modela pristupa vidljivi su također i u programima dijeljenja automobila (Zipcar). U dijeljenju automobila potrošači pristupaju automobilima u vlasništvu tvrtke, što ga razlikuje od programa za zajedničko korištenje automobilom ili od strane *peer-to-peer* dijeljenja automobila, kao što je RelayRides. Dijeljenje automobila jedan je od najvažnijih konteksta koji se temelje na pristupu današnjem tržištu (Bardhi i Eckhardt, 2012). Omogućujući pristup vozilu za povremena putovanja, dijeljenje automobila omogućava kućanstvima da se odreknu automobila ili drugog vozila. Millard-Ball i suradnici (2005) naglašavaju kako u prosjeku, otprilike 20 % članova carsharinga to čine, uz još više odustajanja od kupnje novog automobila. Dakle, najmanje pet privatnih vozila je zamijenjeno jednim vozilom za dijeljenje, a mnoga istraživanja pokazuju znatno veće koristi (Martin, Shaheen i Lidicker, 2010; Shaefers, 2013; Kopp, Gerike i Axhausen, 2015). Zbog toga, smanjeno vlasništvo nad vozilima može dovesti do veće dostupnosti parkiranja i manje potrebe za novim parkiralištima. Šire prednosti smanjenog parkiranja uključuju uštedu troškova, oslobađanje zemljišta za razvoj i manje otjecanja oborinskih voda (Millard-Ball et al., 2005). Suprijevoz je u posljednjem desetljeću znatno porastao u Sjevernoj Americi i procvjetao u metropolitanskim regijama diljem SAD-a i Kanade. Novi transportni ambijent nudi gradskim stanovnicima alternativu za automobil, onaj bez vlasništva nad automobilom. Dijeljenje automobila eliminira potrebu za fiksnim troškovima vlasništva. Gradski stanovnici koji ovise o automobilima mogu uštedjeti novac i prilagoditi se načinu života manje ovisnom o automobilima (Martin, Shaheen i Lidicker, 2010).

Nijland i van Meerkerk (2017) navode da je 37 % ispitanika koji su već posjedovali automobil izjavilo da bi kupilo još jedan da nije započelo dijeljenje automobila. Oni koriste zajednički automobil kao dodatni automobil. Od onih koji nisu posjedovali automobil, 8 % bi ih kupilo da nisu započeli dijeljenje automobila. Ukoliko se gleda ukupni učinak za obje skupine, vlasništvo

automobila smanjilo se sa 1,12 automobila po domaćinstvu na 0,72. Za 57 % ispitanika, zajednički automobil funkcionirao je kao drugi ili treći automobil. Dijeljenje automobila značajno smanjuje posjed vozila u kućanstvima, usprkos činjenici da je 60 % svih domaćinstava koja se pridružuju dijeljenju automobila bez automobila (Martin, Shaheen i Lidicker, 2010). Važno je istaknuti da *carsharing* služi kao dopuna postojećem javnom gradskom prijevozu, te da on nije nužno zamjena za posjedovanje osobnog automobila. Naravno, sve ovisi o razlozima posjedovanja osobnog automobila. Iako u odnosu na pješačenje i bicikliranje *carsharing* sustav ima negativne utjecaje na okoliš (postoji opasnost od prometnih nesreća, a buka i emisije štetnih plinova, osim u slučaju uporabe električnih vozila, i dalje postoje), navedeni utjecaji daleko su manji jer primjena ovog sustava dovodi do smanjenja prijeđenih kilometara i smanjenja broja vozila na cestama, a samim time i do smanjenja gužvi u prometu. Pritom korisnici i dalje uživaju u svim prednostima koje inače nudi posjedovanje osobnog vozila (komfor vožnje i fleksibilnost kretanja) te se može reći da primjena sustava dijeljenja automobila pridonosi povećanju mobilnosti uz ublažavanje posljedica koje ubrzan razvoj cestovnog prometa sa sobom donosi (Hirnig, Šikić i Gržin, 2017).

Katzev (2003) je proveo istraživanje kako bi ispitao kojim faktorima su osobe bili motivirane za učlanjenje u car sharing organizaciji u Portlandu. U ispitivanju su sudjelovale osobe kojima je to bila prva godina članstva. Većina (59 %) članova carsharing programa izjavila je kako nisu posjedovali osobno vozilo u trenutku kada su se pridružili organizaciji, dok je manje od polovice (41 %) reklo da su vlasnici. Najveći broj članova bio je prvenstveno motiviran za pridruživanje carsharing programima zbog periodične potrebe za dodatnim vozilom. Kao drugi razlog ispitanici navode financijske uštede za koje su očekivali da će nastati izbjegavanjem troškova posjedovanja i upravljanja osobnim vozilom ili nepotrebne kupnje vozila. Raspoloživost vozila rijetko je predstavljala problem tijekom prve godine korištenja carsharing programa, kada se odnos članova prema vozilima održavao na 13:1. Postoji vrlo malo osnove za zabrinutost zbog prekomjernih *last-book* rezerviranja, jer je 60 % rezervacija izvršeno najmanje jedan ili dva dana prije korištenja. Suprotno tome, samo 13 % rezervacija je napravljeno 30 minuta ili manje prije traženog vremena odlaska. Mnogi ispitanici naveli su kako su alternativne načine prijevoza (npr. javni prijevoz, šetnje i biciklizam) često koristili za odlazak na posao i kupovinu. Loose, Mohr i Nobis (2006) proveli su istraživanje u svrhu procjene mogućnosti daljnjeg razvoja dijeljenja automobila u Njemačkoj. Rezultati su ukazali na potencijalni rast korištenja usluga dijeljenja automobila, naročito u poslovne svrhe. U usporedbi s rezultatima istraživanja provedenog u 2002. godini zabilježen je značajan rast u broju korisnika (za 18 %), u broju ljudi s pristupom dijeljenju automobila (za 33 %) te u porastu broja stanica za razmjenu automobila (za 31 %). Takvi rezultati potvrda su da se radi o novom tržišnom trendu i kako je za očekivati da će se tržište dijeljenja automobila nastaviti rapidno razvijati (Loose, Mohr i Nobis, 2006). Motive i motivacijske obrasce na kojima se temelji korištenje dijeljenja automobila istraživao je Shaefers (2013), a koristeći pri tome kvalitativni pristup. Cilj je bio identificirati temeljne hijerarhijske povezanosti atributa dijeljenja automobila i temeljnih vrijednosti kupaca. Temeljem rezultata identificirana su četiri osnovna motivacijska obrasca: traženje vrijednosti, praktičnost, stil života i okoliš. Osim utilitarističkih motiva traženja i praktičnosti, afektivni ili simbolički motiv stila života utječe na prihvaćanje i upotrebu potrošača dijeljenja automobila. Boyaci, Zografos i Geroliminis (2015) predstavili su model za planiranje jednosmjernih sustava dijeljenja vozila uzimajući u obzir potrebe za premještanjem vozila i električnim punjenjem vozila. Predloženi

model istodobno razmatra neto koristi i operatora i korisnika. Model pruža donosiocima odluka mnogo mogućnosti za provođenje analize osjetljivosti za relevantne parametre modela. Ova je značajka posebno korisna za vrijednosti troškova koje je teško empirijski utvrditi (pr. korisni dobitak zadovoljnih kupaca, pokrivenost stanovništva, troškovi pristupačnosti stanica).

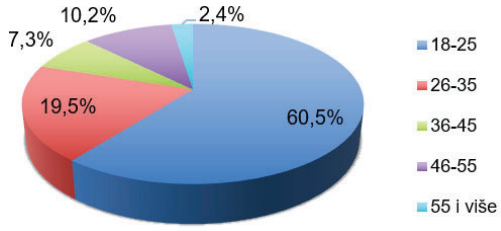
Hirnig, Šikić i Gržin (2017) istraživali su upoznatost ispitanika s pojmovima *carpooling* i *carsharing* na području Republike Hrvatske. Cilj istraživanja bio je i saznati koriste li ispitanici *carpooling* te ukoliko ne koriste bi li postali potencijalni korisnici. Najveći udio ispitanika (39,3 %), iako ima vozačku dozvolu, ne posjeduje automobil te isti imaju samo ponekad na raspolaganju. Većina ispitanika uslugu *carpoolinga* koristi vrlo rijetko, a najviše ispitanika (87 %) *carpooling* koristi povremeno. *Carpooling* se pretežno koristi za neka povremena putovanja, vjerojatno na duže relacije, pri čemu su značajnije financijske uštede. Uvažavajući cilj smanjenja gužvi na cestama, posebice tijekom vršnih sati, neophodno je putnike potaknuti na korištenje *carpoolinga* prilikom svakodnevnih migracija (posao, fakultet i sl.), što za sad nije dovoljno čest slučaj u Republici Hrvatskoj. Ono što dodatno ohrabruje i ukazuje na potencijal razvoja je činjenica da od 129 ispitanika (70,5 %) koji nisu nikada koristili *carpooling*, samo ih je 19 (14,7 %) navelo kako uslugu ne bi koristilo u budućnosti. Očekivano najviše zainteresirane za ovaj oblik prijevoza osobe su koje imaju vozačku dozvolu, ali nemaju automobile na raspolaganju.

3. 2 Metodologija i uzorak istraživanja

U svrhu ostvarivanja cilja rada provedeno je primarno istraživanje, a čija je svrha bila istražiti stavove korisnika o suprijevozu u Republici Hrvatskoj. Kao instrument u primarnom istraživanju korišten je visoko strukturirani anketni upitnik napravljen u Google obrascu. Poziv na sudjelovanje u istraživanju slan je na *email* adrese mladih ispitanika odnosno primarno studenata na Ekonomskom fakultetu u Zagrebu koji su bili zamoljeni da anketni upitnik distribuiraju svojim poznanicima (metoda snježne grude). Istraživanje je provedeno u kolovozu 2020. godine na uzorku od 205 ispitanika na području Republike Hrvatske. Anketni upitnik sastavljen je od 18 pitanja, od čega su 3 pitanja bila usmjerena na sociodemografske karakteristike ispitanika te su kod istih ispitanici mogli odabrati jedan od ponuđenih odgovora. Upoznatost ispitanika s pojmom suprijevoza te navikama vezanim uz putovanje ispitivana je kroz 10 pitanja, a kroz 5 tvrdnji ispitanici su izrazili svoju razinu slaganja vezano uz određene karakteristika suprijevoza.

U istraživanju je sudjelovalo 205 ispitanika, od čega su 60,5 % bile osobe ženskog spola, a ostalih 39,5 % činili su muškarci.

Grafikon 1. Struktura ispitanika prema dobi



Izvor: primarno istraživanje

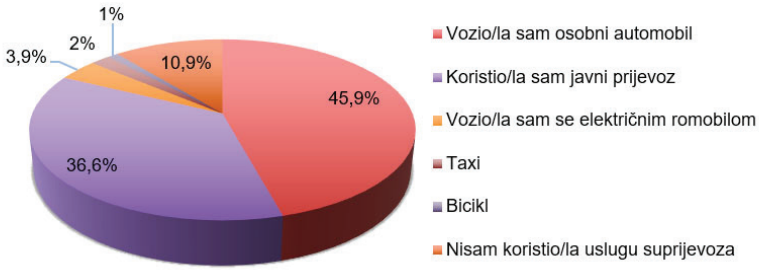
Kao što se može uočiti na grafikonu 1 najveći broj ispitanika (124) bio je starosti od 18 do 25 godina, dok je najmanje ispitanika (2,4 %) bilo starosti 55 godina i više. Najveći udio ispitanika (36,1 %) ima srednjoškolsko obrazovanje, a najmanji broj ispitanika ima završeno osnovnoškolsko obrazovanje (1,5 %). Mjesečna primanja u visini do 2.000 kn ima 28,8 % ispitanika. Nakon toga, slijede ispitanici sa mjesečnim primanjima u rasponu 4.001 - 6.000 kn (21 %). Ispitanici koji imaju mjesečna primanja u iznosu 2.000 - 4.000 kn čine 17,6 %, slijede ispitanici sa mjesečnim primanjima u visini 6.001 - 8.000 kn (12,2 %), te osobe čija primanja iznose više od 10.000 kn (11,7 %), a najmanje je onih koji imaju primanja u rasponu 8.001 - 10.000 kn (8,8 %).

3. 3 Rezultati istraživanja

Od ukupnog broja sudionika, njih 106 (51,7 %) odgovorilo je da nisu upoznati pojmom suprijevoza, dok je njih 99 odnosno 48,3 % odgovorilo potvrdno. Od 205 ispitanika, njih 127 (62 %) izjavilo je da posjeduje osobni automobil, a njih 78 (38 %) izjavilo je kako ne posjeduju osobni automobil. Iako je upoznatost sa pojmom suprijevoza relativno zadovoljavajuća, ipak je 84,4 % ispitanika navelo kako nije koristilo uslugu suprijevoza, dok je samo 15,6 % ispitanika izjavilo da je koristilo uslugu takve vrste prijevoza.

Najčešći razlog korištenja suprijevoza zbog kojeg ispitanici koriste suprijevoz ili bi ga koristili su, kao što je i očekivano, manji troškovi (65,4 %). Kao drugi razlog korištenja slijedi izostanak problema s traženjem parkirnog mjesta (49,8 %). Neki od ostalih razloga koje ispitanici navode su doprinos smanjenju zagušenja u prometu (29,8 %), neučinkovit javni prijevoz (26,8 %) te doprinos zaštiti okoliša (24,4 %). Usluge suprijevoza 26 ispitanika koristi povremeno, a isti broj ispitanika (7) koristi suprijevoz jednom mjesečno i 2 - 3 puta tjedno. Samo jedan ispitanik je naveo kako koristi suprijevoz jednom tjedno.

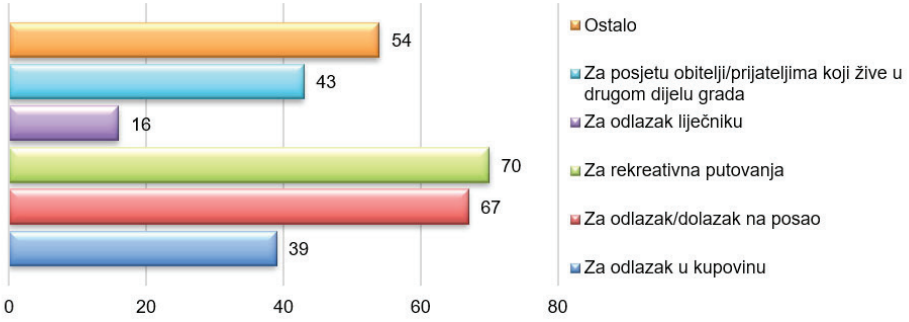
Grafikon 2. Korištenje ostalih oblika prijevoza prije početka korištenja usluge suprijevoza



Izvor: primarno istraživanje

Prije korištenja usluge suprijevoza najviše ispitanika vozilo je osobni automobil (45,9 %), dok ih je 36,6 % koristilo usluge javnog prijevoza (vidi Grafikon 2).

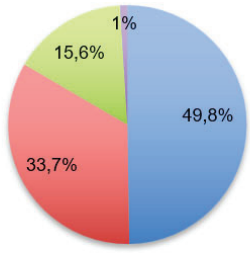
Grafikon 3. Razlozi korištenja suprijevoza



Izvor: primarno istraživanje

Najčešći razlog korištenja suprijevoza jesu rekreativna putovanja, a potom odlazak/dolazak na posao. Za posjetu obitelji ili prijateljima koji žive u drugom dijelu grada 43 ispitanika koristi ili bi koristilo suprijevoz, a njih 39 bi isti koristilo za odlazak u kupovinu. Samo 16 ispitanika koristilo bi suprijevoz za odlazak liječniku (vidi Grafikon 3).

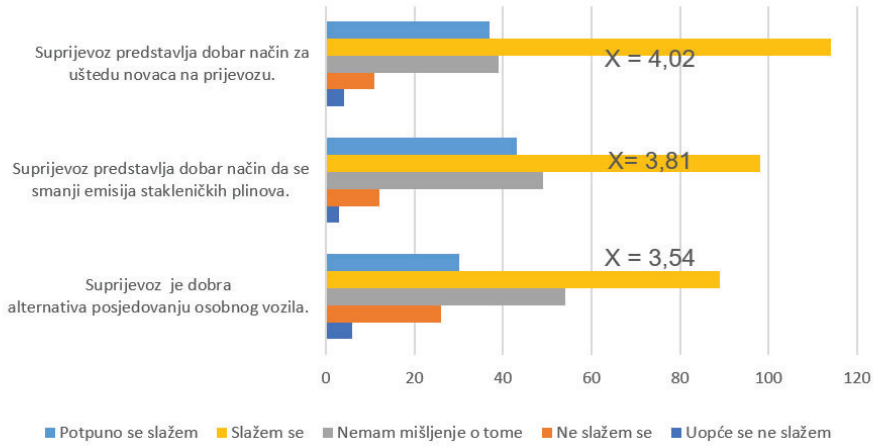
Grafikon 4. Prosječna dnevna udaljenost prijeđena automobilom



Izvor: primarno istraživanje

U prosjeku, najviše ispitanika dnevno prijeđe manje od 20 km (49,8 %), udaljenost od 20 do 50 km prijeđe 33,7 % ispitanika, 15,6 % njih prijeđe od 50 do 100 km automobilom, a samo 1 % ispitanika dnevno prelazi udaljenost veću od 100 km (vidi Grafikon 4).

Grafikon 5. Stavovi ispitanika o suprijevozu

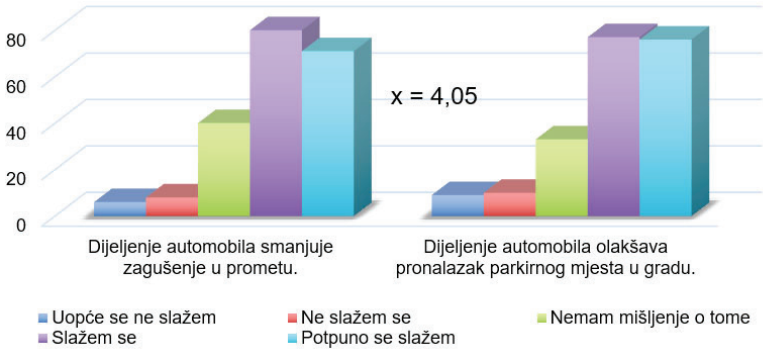


Izvor: primarno istraživanje

Kao što se može uočiti na grafikonu 5 najviše ispitanika (114) smatra kako suprijevoz predstavlja dobar način za uštedu novaca na prijevozu. Upravo su navedenu tvrdnju ispitanici i ocijenili u prosjeku s najvećom ocjenom (x = 4,02). Ispitanici su najmanje suglasni s tvrdnjom kako je suprijevoz dobra alternativa posjedovanju osobnog vozila (x = 3,54). Na pitanje „Koje je najduže vrijeme koje biste bili spremni izdvojiti da bi došli pješice od svog doma do lociranog vozila?" 39 % ispitanika je odgovorilo kako bi bili spremni hodati do vozila 5 - 10 min; 38 % njih izdvojili bi 1 - 5 minuta, 18 % bi izdvojilo 10 - 15 min, a samo 4,9 % njih bi bio spremno izdvojiti 15 - 30 minuta vremena kako bi došli do lociranog vozila.

Pozitivno je što je od 129 ispitanika koji su naveli kako nikada nisu koristili usluge suprijevoza, njih 110 (85,27 %) navelo kako se ima namjeru u budućnosti koristiti uslugama istog.

Grafikon 6. Stavovi ispitanika glede dijeljenja prijevoza



Izvor: primarno istraživanje

34,6 % ispitanika u potpunosti se slaže s tvrdnjom da dijeljenje automobila smanjuje zagušenje u prometu, dok je onih koji se uopće ne slažu 2,9 %. Više od trećine ispitanika (37,1 %) potpuno se slaže s tim da suprijevoz olakšava pronalazak parkirnog mjesta u gradu, a 4,4 % smatra potpuno suprotno i ne slaže se s navedenim. Na grafikonu 6 se može uočiti kako su ispitanici u prosjeku s jednakom ocjenom ocijenili razmatrane benefite korištenja suprijevoza.

3. 4 Ograničenja i preporuke za buduća istraživanja

Ograničenja koja se pojavljuju u provedenom empirijskom istraživanju u sklopu ovog rada odnose se na manji uzorak kojeg je obuhvatilo ovo istraživanje (205 ispitanika) na području Republike Hrvatske te se zbog toga rezultati istraživanja ne mogu generalizirati ili koristiti na europskoj razini ili globalnoj razini. Još jedno ograničenje ovog istraživanja predstavlja manji udio mlađe populacije, odnosno učenika mlađih od 18 godina kao i umirovljenika koji bi također mogli biti potencijalni korisnici suprijevoza. Nedostatak je i to što se anketa provodila online putem društvenih mreža čime je na neki način zapostavljena starija populacija koja Internet i društvene mreže koristi u manjoj mjeri. Zbog istaknutih ograničenja teško je donositi zaključke o svim korisnicima i potencijalnim korisnicima na području Republike Hrvatske.

Znanstveni doprinos ovog istraživanja ogleda se u sistematizaciji postojećih saznanja o suprijevozu, kao iznimno zanimljivom trendu koje posljednjih godina sve više dobiva na značaju. Uzevši u obzir kako se i brojni gradovi na teritoriju Republike Hrvatske susreću s problemom prometnih zagušenja zbog neadekvatne prometne infrastrukture, razmatranje stava korisnika prema suprijevozu svakako je vrlo korisno. Obzirom na nedostatak istraživanja ove teme, a kako je provedeno istraživanje eksplorativne prirode sugerira se da se u budućnosti i dalje istraži ova tema.

Preporuka za buduća istraživanja bila bi provesti istraživanje i na druge načine, ne samo putem Interneta kako bi se obuhvatile i druge dobne skupine. Bilo bi korisno obuhvatiti veći uzorak kako bi rezultati istraživanja bili reprezentativniji i precizniji. Takvi podaci mogli bi se koristiti za usporedbu s inozemnim (europskim i svjetskim) istraživanjima na ovu temu. Također, budući da

je Republika Hrvatska poznata turistička destinacija, u istraživanje bi bilo dobro uključiti i turiste koji dođu na odmor bez svog automobila, kao i segment poslovnih putnika koji su isto potencijalni korisnici suprijevoza.

4. ZAKLJUČAK

Danas je mobilnost od velikog značaja u urbanim područjima. Sve veći broj stanovnika i njihova potreba za putovanjima te porast broja automobila postaju opterećenje za gradove koji prvotno nisu bili dizajnirani kako bi mogli zadovoljiti te rastuće potrebe za mobilnošću. Posljedice toga su problemi zagušenja u prometu, zagađenje okoliša, prevelika potrošnja neobnovljivih izvora energije te buka koja stvaraju vozila čime se smanjuje kvaliteta života u urbanim područjima. Također, kao još neki problemi javljaju se rastući troškovi goriva, problem pronalaska parkirnog mjesta u gradu te troškovi posjedovanja osobnog automobila. Suprijevoz ili sustav dijeljenja automobila javlja se kao moguće rješenje navedenih problema jer dovodi do reduciranja broja osobnih automobila kao i do povećane mobilnosti, smanjenja emisije štetnih plinova te snižavanja troškova za korisnike.

U vrijeme provođenja istraživanja *carsharing* organizacije su prisutne u Zagrebu (Spin city) i u Dubrovniku (Avant2Go). Rezultati istraživanja stavova korisnika na području Republike Hrvatske pokazuju kako je upoznatost ispitanika s pojmom suprijevoza zadovoljavajuća (48,3 %), ali još uvijek je visok udio (51,7 %) onih koji nisu upoznati s tim pojmom. Navedeno upućuje kako bi trebalo educirati korisnike o takvom alternativnom obliku prijevoza.

Prije korištenja usluge suprijevoza najviše ispitanika vozilo je osobni automobil (45,9 %), a 36,6 % je koristilo javni prijevoz. Uslugu dijeljenja automobila trenutno koristi 15,6 % korisnika, što je relativno malo, a najviše ju koriste povremeno (80 %) te zbog manjih troškova i za rekreativna putovanja. Ipak, ohrabruje činjenica da suprijevoz ima potencijal daljnjeg razvoja jer od 84,4 % ispitanika koji nikad nisu koristili uslugu suprijevoza, njih 140 (78,2 %) razmislilo bi o korištenju takve usluge. Isto tako, ispitanici se u velikoj mjeri slažu s tvrdnjama da je suprijevoz dobra alternativa osobnom vozilu, da smanjuje emisiju štetnih plinova, olakšava pronalazak parkirnog mjesta, smanjuje zagušenje u prometu te da dovodi do uštede novca u prijevozu. Navedeno upućuje na svjesnost ispitanika o pozitivnim stranama suprijevoza što bi trebalo iskoristiti kroz bolje promotivne i edukacijske mjere kako bi se potaknuo razvoj i popularizirao ovakav oblik prijevoza u Republici Hrvatskoj.

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Review Article
https://doi.org/10.31784/zvr.9.1.21
Received: 1. 12. 2020.
Accepted: 2. 2. 2021.

EMPIRICAL RESEARCH ON USERS' ATTITUDES ABOUT CARSHARING IN THE REPUBLIC OF CROATIA

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ABSTRACT

The urban population has been growing and this is the current issue many cities are facing, especially those not planned in the way as to provide for the commuting of continuously growing number of people. This leads to traffic congestions in urban areas, pollution, over-use of non-renewable energy resources and noise pollution vehicles create. The possible solution to this problem of mass transportation may be found in the form of carpooling i.e. the system of car-sharing based on the principle of sustainable development. In the last decades, buying and owning a car has become more affordable, this resulting in the development of road networks that have been overloading urban areas. However, due to the facts that parking has become an issue in these areas, and that costs of owning a personal car have been increasing, carpooling has been gaining on popularity throughout the world. In line with that, the purpose of this paper is to investigate users' attitudes on carpooling in the Republic of Croatia. The findings have shown that, although they are present on the Croatian market, a smaller number of the participants in the research use the services carpooling. The respondents who do use carpooling services state that the reasons for doing so are lower costs, avoiding the search for a parking spot and contributing to protecting the environment. The positive side to is that many respondents that have not yet used this service state they will be doing so in the future.

Key words: *carsharing, mobility, urban transport*

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Pregledni rad
https://doi.org/10.31784/zvr.9.1.22
Datum primitka rada: 5. 11. 2020.
Datum prihvaćanja rada: 7. 12. 2020.

ANALIZA PRIMJENE METODE ANALITIČKOG MREŽNOG PROCESA ANP U SUSTAVIMA ZA E-UČENJE

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SAŽETAK

Cilj je ovim radom istražiti pojavnost korištenja metode analitičkog mrežnog procesa u sustavima za e-učenje kao metode za donošenje odluke temeljem više kriterija. Pretražene su znanstvene baze Scopus i WOS (Web of Science) prema odabranim ključnim riječima: „analytic network process" i „e-learning system", radovi koji su u otvorenom pristupu i u cijelosti na engleskom jeziku. Pronađena su 23 članka, od čega su dva članka bila indeksirana u obje baze pa se analiza temelji na 21 članku. Radovi su analizirani prema godini objave, državi prebivališta autora, broju izvora korištenih u pisanju radova, prosječnom broju autora koji su sudjelovali u izradi rada, publikaciji objave članaka te je izvršena kvalitativna analiza sadržaja radova o primjeni metode analitičkog mrežnog procesa ANP (engl. Analytic Network Process*) u sustavima za e-učenje. Najviše je objavljenih radova u 2018. i 2020. godini, najčešća je država prebivališta autora Tajvan, a prosječan je broj autora po jednom radu 4. Kvalitativnom analizom sadržaja izdvojenih radova utvrđeno je da ni u jednom sustavu metoda ANP nije ugrađena u sam sustav već se navedena metoda koristi u istraživanjima vezanim uz evaluaciju sustava ili identifikaciju parametara potrebnih za njihovu izgradnju ili u nekom dijelu istraživanja koje uključuje sustav za e-učenje.*

Ključne riječi*: analitički mrežni proces, ANP, sustavi za e-učenje, e-učenje, metode višekriterijskog odlučivanja*

1. UVOD

Danas je, više nego ikad, u fokusu globalne pandemije virusom COVID-19, osim zdravstvene djelatnosti, sektor obrazovanja od iznimne važnosti. Obrazovanje u digitalnom dobu na daljinu podrazumijeva korištenje sustava za e-učenje. „Sustavi za e-učenje su sustavi koji studentima omogućavaju pristup izvorima za učenje u elektroničkom obliku, a da pri tom nema prostornih i vremenskih ograničenja." (Gligora Marković, 2020. prema Albert, 2001).

S obzirom na razvoj digitalne tehnologije danas imamo sustave za e-učenje koji se svojim funkcionalnostima prilagođavaju korisnicima prema nekim kriterijima prilagodbe. U procesu prilagođavanja u sustavima za e-učenje potrebno je donijeti odluku o prilagodbi prema nekim kriterijima. Najčešći je kriterij prilagodbe znanje (Gligora Marković, Kadoić, Kovačić, 2018) i koriste se jednostavna pravila prilagodbe u sustavima za e-učenje. Međutim ukoliko želimo kvalitetnije i učinkovitije sustave, potrebno je uključiti više kriterija i donijeti odluku na temelju više njih, dakle primijeniti neku od metoda višekriterijskog odlučivanja. Najpoznatije metode višekriterijskog odlučivanja jesu: ELECTRE, TOPSIS, PROMETHEE, AHP, ANP, LINANP itd. (Sikavica *et al.*, 2014; Đurek, Sedda, 2020. prema Kadoić *et al.*, 2016).

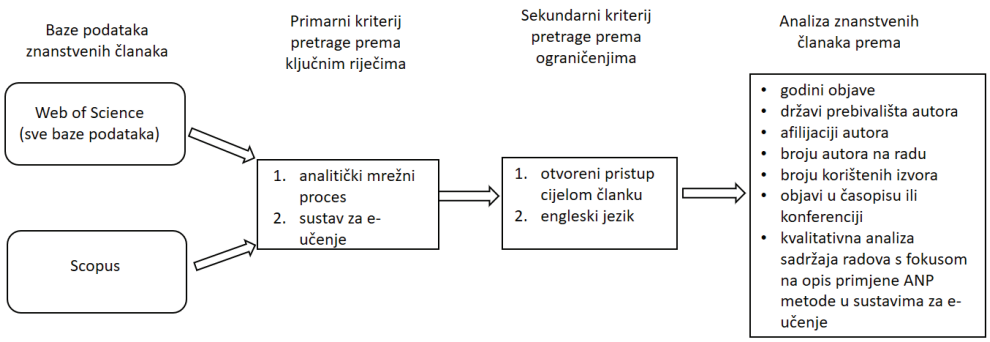
Cilj je ovim istraživanjem bilo utvrditi pojavnost korištenja metode ANP u sustavima za e-učenje s obzirom na to da je u procesu prilagodljivosti sustava za e-učenje korisniku potrebno donijeti odluku o načinu i kriterijima prilagodbe sustava.

„Metoda analitički mrežni proces (ANP) predstavlja metodu višekriterijskog odlučivanja kod koje osim informacija o kriterijima za donošenje odluke su nam potrebne i informacije o alternativama" (Gligora Marković, 2020). U sustavima za e-učenje kriteriji su vezani uz prilagodbu korisniku i nekim njegovim preferencijama dok alternative najčešće predstavljaju aktivnosti koje korisnik može provoditi u sustavu i/ili objekte učenja (resursi za učenje) koji predstavljaju najmanju jedinicu sadržaja učenja. Metoda ANP jedna je od rijetkih metoda koja u obzir uzima zavisnost među kriterijima i povratnu vezu između alternativa i kriterija te je zbog toga veći izazov primijeniti je.

2. METODOLOGIJA ISTRAŽIVANJA

Provedeno je istraživanje tijekom studenog 2020. koje je uključivalo pretraživanje baza podataka *Web of Science (all databases)* i *Scopus* prema sljedećim kriterijima pretrage: ključne riječi u pretrazi bile su „*analytic network process*" i „*e-learning system*" kao pojmovi koji obuhvaćaju potpuno ime metode ANP i sustavi za e-učenje kao krovni pojam za sve specifične podvrste sustava čija je namjena podrška poučavanju i učenju te kriterij otvorena pristupa izvoru (članku). Baze korištene u istraživanju odabrane su iz razloga jer su to baze relevantne za izbor u znanstvena zvanja Republike Hrvatske (Pravilnik o izboru u znanstvena zvanja, 2017), ali i inače baze priznate u znanstveno-istraživačkom svijetu. Pristup bazama podataka osiguran je preko nadležnog Ministarstva znanosti i obrazovanja putem portala Nacionalne i sveučilišne knjižnice u Zagrebu (http://baze.nsk.hr/o-portalu/). Osim ključnih riječi i otvorenog pristupa primijenjen je i kriterij engleskog jezika kao jezika na kojem je rad napisan te period objave otkad baze postoje do danas. Tako definiranom pretragom pronađena su 23 članka. Uspoređeni su naslovi članaka gdje je utvrđeno da su dva članka indeksirana u obje baze te je time sužen rezultat na 21 rad, na čijem se broju temelji daljnja analiza. Radovi su analizirani prema godini objave, državi prebivališta autora, afilijaciji autora, broju autora rada, broju korištenih izvora, objavi u časopisu ili konferenciji te je provedena kvalitativna analiza sadržaja radova s fokusom na opis primjene metode ANP u sustavima za e-učenje. Prikupljeni podatci pohranjeni su i obrađeni pomoću alata Excel 2016. Na slici 1. prikazana je metodika istraživanja.

Slika 1. Metodika istraživanja



Izvor: autor

3. REZULTATI ISTRAŽIVANJA S DISKUSIJOM

Pretraga je rezultirala s ukupno 23 članka, i to 7 članaka pronađeno je u bazi WOS (*all databases*) i 16 članaka u bazi Scopus. Dva su članka indeksirana u obje baze pa se analiza temelji na 21 članku. U tablici 1 prikazana je pojavnost radova prema godini objave za 21 članak.

Tablica 1. Pojavnost broja radova prema godini objave

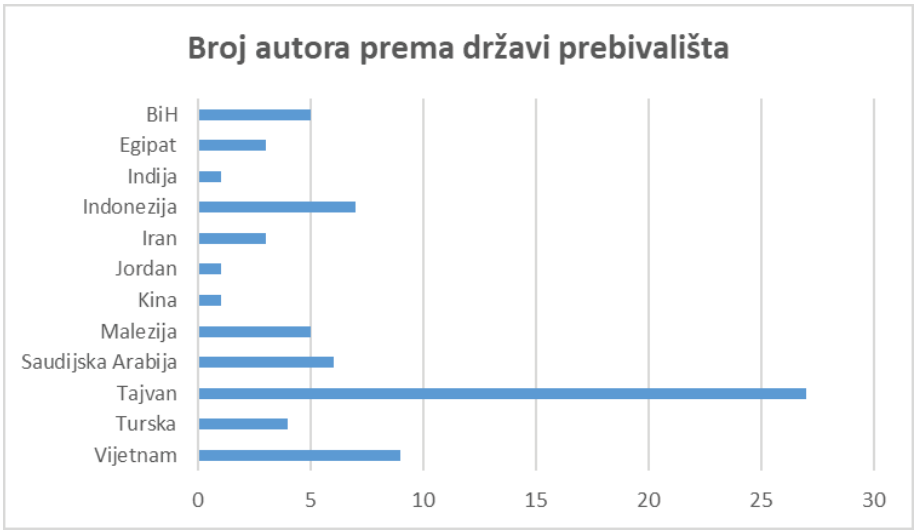
godina objave	pojavnost
2011.	1
2012.	3
2013.	0
2014.	0
2015.	2
2016.	2
2017.	2
2018.	5
2019.	2
2020.	4

Izvor: autor

Možemo uočiti da je najviše radova objavljeno u 2018. i 2020. godini iako još 2020. u trenutku analize nije završila pa se može očekivati da će biti još radova iz teme pretrage jer znamo da bazama treba određeno vrijeme za indeksiranje publikacija.

Analizom država prebivališta autora uočeno je da su u svim člancima u kojima je više autora, osim u jednom, autori iz iste zemlje. Na slici 2. prikazana je pojavnost država prebivališta autora.

Slika 2. Pojavnost broja autora prema državi prebivališta



Izvor: autor

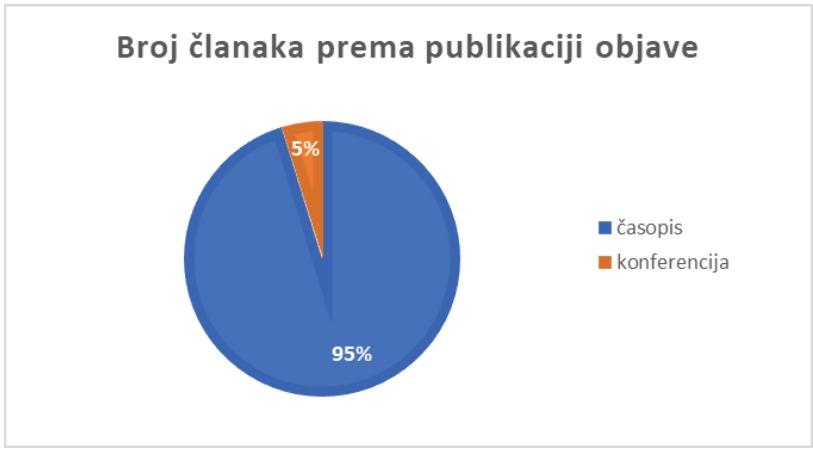
Analiziramo li pojavnost pojedine države, možemo uočiti dominaciju Tajvana, nakon čega slijede Vijetnam i Indonezija. I u rijetkim prethodnim istraživanjima (Gligora Marković, Jakupović, Kovačić, 2014) može se uočiti dominacija zemalja iz Azije. Jedan je od mogućih razloga razvijena industrija digitalne tehnologije u odnosu na zemlje zapadnog svijeta.

U izradi ovog 21 rada sudjelovalo je ukupno 77 autora, odnosno 3,666 autora po radu, što govori u prilog složenosti teme (pretrage) i potrebe angažmana većeg broja znanstvenika u njihovoj izradi. Svi autori kao afilijaciju navode sveučilište ili visoke škole.

Ukupno je korišteno 952 izvora u izradi 21 članka, što je u prosjeku 47,6 izvora po radu, a medijan broja izvora po članku iznosi 39.

Na slici 3. prikazana je relativnim brojem zastupljenost publikacije objave članka. U časopisima je objavljeno 20 radova, a u zborniku konferencije 1 rad. S obzirom na to koje su baze bile uključene u istraživanje, rezultat je očekivan jer te baze indeksiraju više časopisa nego zbornika konferencija.

Slika 3. Broj članaka prema publikaciji objave



Izvor: autor

U nastavku slijedi kvalitativna analiza korištenja metode ANP opisane u radovima, a dobivena pretragom baza SCOPUS i WOS. U 2 rada (Yu *et al.*, 2020.; Yen *et al.*, 2015) metoda ANP uopće se ne spominje, što daje razlog za razmišljanje na koji način baze izvršavaju pretragu radova koje indeksiraju te koliko ključne riječi stvarno odražavaju sadržaj radova. U radovima ključne riječi definiraju autori, ali i baze same imaju dodatne ključne riječi kojima se opisuju radovi.

U preostalih 19 radova metoda ANP korištena je u istraživačkom procesu, međutim ni u jednom od radova navedena metoda nije ugrađena u sam sustav kao mehanizam za donošenje nekih odluka već je na različite načine upotrijebljena tijekom opisanih istraživanja.

Gotovo polovica autora u svojim radovima spominju metodu ANP u kontekstu metoda višekriterijskog odlučivanja posebno u usporedbi s metodom AHP (engl. *Analytic Hierarcy Process*), kojoj je metoda ANP nadogradnja na način da se u odlučivanju umjesto hijerarhijske strukture klastera i pripadajućih čvorova karakterističnih za metodu AHP koristi mrežna struktura karakteristična za ANP (Hsieh *et al.*, 2012; Hu, 2016; Naveed *et al.*, 2019; Alzubi *et al.*, 2018; Kustiyahningsih *et al.*, 2020; Kustiyahningsih *et al.*, 2018; Stević *et al.*, 2018; Idrees *et al.*, 2019).

Tako autori Rahmanita *et al.* (2018), Yang *et al.* (2012), Etaati *et al.* (2011) i Abdullateef *et al.* (2016) metodu ANP koriste u svrhu procjene kvalitete sustava ili nekih njegovih dijelova kako bi identificirali ili odredili težinske faktore parametara koji opisuju kvalitetu sustava te na temelju toga donijeli odluku o daljnjem upravljanju sustavom.

Neki od autora u svojim radovima koriste metodu ANP u svrhu identifikacije parametara potrebnih za izgradnju sustava za e-učenje (Yang *et al.*, 2018; Huynh, 2020; Nguyen, 2020) dok rijetki koriste za evaluaciju edukativnih mrežnih sjedišta (Kabak, 2017). Ostali autori, npr. Chuang (2015), koriste metodu ANP u istraživanju parametara vezanih uz bihevioralnu znanost, čiji se rezultati mogu koristiti u različitim sustavima koji uključuju ljude kao korisnike, odnosno kod procjena sljedivosti informacija u sustavima na primjeru ponašanja potrošača u sustavu (Chen, 2012).

4. ZAKLJUČAK

Provedeno istraživanje obuhvatilo je najrelevantnije znanstvene baze podataka – WOS i SCOPUS. Pretraga je izvršena s pojmovima koji obuhvaćaju puni naziv metode ANP (engl. *Analytic Network Process*) i pojmom sustavi za e-učenje (engl. *E-learning system*) kao pojmom koji obuhvaća različite vrste sustava za učenje poput hipermedijskih, prilagodljivih, inteligentnih itd. Rezultati su pokazali da je najviše radova objavljeno zadnjih godina (2018. i 2020.), što je s obzirom na razvoj tehnologije i očekivano. Najveći je broj autora radova iz država Azije (Tajvan), što je u skladu s prethodnim istraživanjima. Neočekivan je dio što metoda ANP nije ugrađena ni u jedan sustav za e-učenje. Mogući nastavak budućeg istraživanja jest da se proširi broj baza za pretragu i na baze koje su, prema Pravilniku za izbor u znanstvena zvanja (2017), u rangu A2 radova, odnosno da se pretražuju i radovi koji nisu dostupni u otvorenom pristupu s obzirom na to da smo upoznati s činjenicom da je trošak objave rada u časopisima koji su indeksirani u relevantnim bazama najčešće izuzetno visok. Osim povećanja broja baza u planu je uključiti i veći broj ključnih riječi za pretragu s obzirom na to da ovako dva opća pojma korištena u istraživanju nisu baš polučila očekivani rezultat.

Ovaj rad je sufinancirala Hrvatska zaklada za znanost projektom UIP-2020-02-6312.

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Review Article
https://doi.org/10.31784/zvr.9.1.22
Received: 5. 11. 2020.
Accepted: 7. 12. 2020.

ANALYSIS OF THE APPLICATION OF THE ANALYTICAL NETWORK PROCESS (ANP) METHOD IN E-LEARNING SYSTEMS

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ABSTRACT

The Scopus and Web of Science scientific databases were searched according to the selected keywords: "analytical network process" and "e-learning system", papers that are in open access and entirely in English. 23 articles were found, of which two articles were indexed in both databases, so the analysis is based on 21 articles. The papers were analyzed according to the year of publication, country of residence of the author, number of sources used in writing the paper, average number of authors who participated in the preparation of the paper, publication of articles and qualitative analysis of the content of papers on the application of Analytical Network Process) methods in e-learning systems. The most published papers are in 2018 and 2020, the most common country of residence of the authors is Taiwan, and the average number of authors per paper is 4. Qualitative analysis of the content of selected papers found that in no system ANP method is built into the system itself. in research related to system evaluation or identification of parameters required for their construction or in some part of research involving an e-learning system.

Key words: *analytical network process, ANP, e-learning systems, e-learning, multicriteria decision-making methods*

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Pregledni rad
https://doi.org/10.31784/zvr.9.1.23
Datum primitka rada: 17. 11. 2020.
Datum prihvaćanja rada: 20. 1. 2021.

PREGLED METODA OBRADE PRIRODNIH JEZIKA I STROJNOG PREVOĐENJA

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SAŽETAK

U radu je dan pregled područja povezanog s procesiranjem prirodnih jezika i njihova međusobnog odnosa, počevši od šire domene kao što je umjetna inteligencija, putem strojnog učenja, računalne lingvistike, metoda strojnog prevođenja te posebice onih zasnovanim na dubokom učenju. Opisane su karakteristike, primjene, faze i glavni problemi obrade prirodnih jezika s leksičke, sintaktičke, semantičke, govorne i pragmatičke perspektive. Opisane su faze prepoznavanja i analize prirodnog jezika kao i faza generiranja prirodnih jezika. Postupci pre-editinga i post-editinga uz korištenje kontroliranih prirodnih jezika dani su kao primjeri prakse kojom se povećava točnost i kvaliteta automatskog prevođenja i općenito procesiranja teksta. Poseban je fokus stavljen na strojno prevođenje te metode strojnog prevođenja. Pristupi strojnom prevođenju kao statistički, temeljen na pravilima, hibridni i pristup temeljen na dubokom učenju opisani su i predstavljeni s obzirom na njihove prednosti i nedostatke i prikladnu primjenu u praksi. Na kraju su dani još uvijek neriješeni izazovi kao smjer daljnjih istraživanja vezanih uz obradu prirodnih jezika te značaj razvoja pristupa temeljenog na dubokom učenju.

Ključne riječi: *obrada prirodnog jezika, strojno prevođenje, računalna lingvistika, duboko učenje, umjetna inteligencija*

1. UVOD

Umjetna inteligencija (engl. *Artificial intelligence* – AI u daljnjem tekstu) može se definirati kao znanstveno područje koje istražuje načine kako postići da se računalo inteligentno ponaša. AI istražuje računalno modeliranje ljudske inteligencije koja obuhvaća mnoge sposobnosti među kojima se ističe sposobnost opažanja i sposobnost razumijevanja i generiranja jezika (Silva, Fonseca, 2019). Inteligentno ponašanje uvjetovano je znanjem koje se može opisati kao ljudsko djelovanje temeljeno na onome što se zna (ili vjeruje) o svijetu (Jordan, Russell, 2001; Brachman, Levesque, 2004). Ljudsko je znanje raspoređeno i pohranjeno na različite načine – tekst, zvuk, slike ili bilo što čime se može pohraniti znanje (Gottschalk-Mazouz, 2007), a tijekom procesa učenja ono postaje osobno, ugrađeno i pohranjeno u ljudski um. Različitim kognitivnim potrebama i funkcijama (npr.

razmišljanje, učenje, motivacija, emocije) pokreću se određena pohranjena znanja kojima se tada nadograđuju prošla ili kreiraju nova znanja koja se koriste za procese zaključivanja i donošenja odluka. Cilj je i težnja da i neki AI sustav ima slične karakteristike i način funkcioniranja – da bude sposoban naučiti znanje pohranjeno u različitim nositeljima znanja. Tako *naučeno* znanje postaje personalizirano, pohranjeno i dostupno umjetnom kognitivnom procesu.

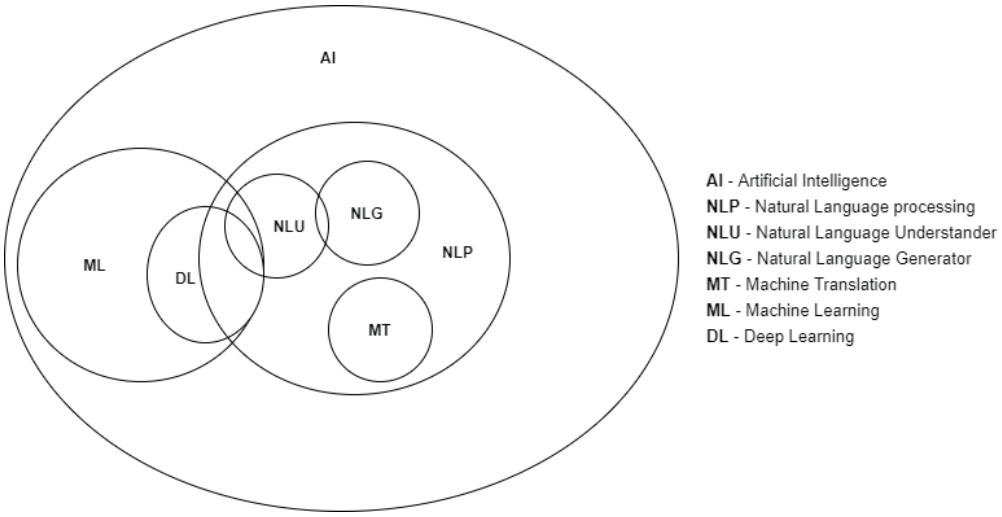
Procesiranje ili obrada prirodnih jezika (engl. *Natural language processing*, NLP u daljnjem tekstu) dio je umjetne inteligencije te predstavlja fokus ovog rada.

Cilj ovoga rada je dati pregled područja povezanih sa NLP-om te njihovih međusobnih odnosa. Svrha rada je predstavljanje metoda koje se koriste u obradi prirodnih jezika kroz specifikaciju njihovih prednosti i nedostataka kao i opisa mogućih primjena. Posebno je dan naglasak na faze i metode strojnog prevođenja (engl. *Machine translation*, MT u daljnjem tekstu).

Motivacija za ovo istraživanje proizašla je iz težnje da se sintetski i sistematski predstave temeljna povezana područja NLP-a budući da postoji veliki broj radova u kojem se detaljno opisuju pojedine AI metode i algoritmi a nema puno recentnih istraživanja koja obuhvaćaju pregled povezanih područja. Predstavljene su glavne značajke i razine obrade prirodnih jezika – od leksičke do pragmatičke razine, kao i temeljna problematika ovog područja.

U nastavku je dan pregled problematike kod različitih faza procesiranja prirodnih jezika kao i pregled metoda i tehnika koje se koriste u području strojnog prevođenja. Kako će se obuhvatiti različiti pojmovi tijekom ovog pregleda, radi boljeg razumijevanja, na slici 1 dan je kontekst i odnos različitih sastavnica NLP područja.

Slika 1. Prikaz odnosa pojmova povezanih s NLP-om



Izvor: autorica

2. OBRADA PRIRODNOG JEZIKA – NLP

NLP dio je područja umjetne inteligencije koje je povezano s lingvistikom. Budući da računalo „ne razumije" prirodne jezike, postoji potreba za obradom prirodnog jezika (Manning, Schutze, 1999). NLP istražuje načine uporabe računala za obradu ili razumijevanje ljudskih – prirodnih jezika. Upotrebljava se za pretvaranje ili prevođenje podataka s prirodnog jezika na računalu razumljiv jezik – strojno razumljiv format. Nakon što procesiraju prirodni jezik, računala mogu komunicirati jezikom koji upotrebljavaju ljudi.

Gledano sa znanstvene perspektive, cilj NLP-a jest modeliranje kognitivnih mehanizama na kojima se temelji razumijevanje i produkcija ljudskih jezika. Iz inženjerske perspektive, NLP obuhvaća razvoj različitih praktičnih aplikacija za olakšavanje interakcije između računala i ljudskih jezika. Uobičajene aplikacije u NLP-u uključuju raspoznavanje govora (engl. *Speech recognition*), leksičku i semantičku analizu jezika, strojno prevođenje (engl. *Machine translation*, MT), automatsku sumarizaciju (engl. *Automatic summarization*), analizu mišljenja (engl. *Sentiment analysis*), dohvaćanje informacija (engl. *Information retrieval*), odgovaranje na pitanja i dr. (Deng, Liu, 2018).

Pojam računalna lingvistika (engl. *Computational linguistics*, CL u daljnjem tekstu) često se smatra sinonim za NLP iako se razlikuju po predmetu istraživanja. CL je znanstvena disciplina koja proučava lingvističke procese iz računalne perspektive dok NLP koristi računala za stvaranje korisnih aplikacija s jezikom (Johnson, 2012).

Istraživački su napori kod CL-a usmjereni na otkrivanje kako su nizovi riječi povezani s njihovim značenjima te na razvoj formalizama pomoću kojih su opisane te povezanosti. Fokus je kod CL-a na jeziku, a računalni su algoritmi u funkciji potpore.

Kod NLP-a fokusira se na analizu, dizajn i primjenu računalnih algoritama i načina reprezentiranja za obradu prirodnih jezika (Eisenstein, 2019). Ciljevi su u NLP-u realizacija efikasnih algoritama, analiziranje rečenične strukture i/ili značenja zadane rečenice (Tsujii, 2011). NLP istražuje mogućnost primjene računalnih algoritama na zadaće kao što su ekstrakcija informacija iz teksta (*Information extraction*), prevođenje jednog jezika na drugi, mogućnost automatizirana odgovora na pitanja, razumijevanja govornih ili tekstualnih naredbi, vođenja razgovora na prirodnom jeziku i sl (Šuman, 2019).

Današnji pristupi NLP-u često koriste strojno učenje (engl. *Machine learning*, u daljnjem tekstu ML), kojim se omogućava stvaranje složenih programa na temelju ulazno-izlaznih parova primjera. U slučaju NLP-a strojno učenje, pojednostavljeno rečeno, različitim tehnikama, niz riječi-tokena iz jednog rječnika pretvara u niz riječi-tokena iz drugog rječnika, što se tada naziva prevođenjem jednog jezika na drugi (engl. *Translation*) (Eisenstein, 2019).

2. 1 Faze i razine obrade

Problem i najveći izazov kod NLP-a jest dvosmislenost na više razina: značenju riječi, morfologiji, sintaktičkim svojstvima i ulogama i vezama između dijelova teksta. Moguće se dvosmislenosti događaju kod pojedinih riječi, dijelova rečenica i cijelih rečenica, a pogotovo kada se trebaju obraditi duže, gramatički složene rečenice (Poibeau, 2017). Ljudi rješavaju problem dvosmislenosti

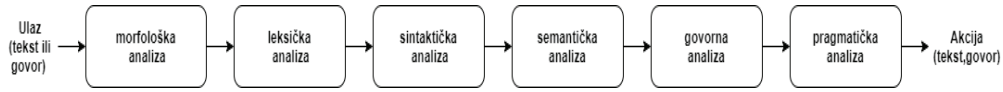
uzimajući u obzir širi kontekst, iskustvo i prethodno znanje, ali ni tada ne mogu izbjeći probleme u komunikaciji. Računala problem dvosmislenih značenja također rješavaju slično kao ljudi: uzimajući širi kontekst oko riječi i zaključivanje na temelju prošlih slučajeva (Šuman, 2019).

Stoga se prevođenje i/ili interpretiranje temelje na vjerojatnosnu zaključivanju o pravom značenju koje nije direktno sadržano u izvornom tekstu, a uključuje znanje iz konteksta i domene. Kako bi uspješno izveo svoje zadaće, NLP proces izvodi se u nekoliko koraka/faza u procesu obrade u ovisnosti o razinama jezika (Liddy, 2003) – od morfologije riječi do leksičkih, sintaktičkih i semantičkih aspekata teksta i pragmatičnih svojstava teksta prirodnog jezika. Neki su sustavi fokusiraniji na niže razine obrade, a drugi na više ili sve razine. Što više razina postoji, sustav je složeniji, ali i podložniji pogreškama. Opći model razumijevanja prirodnih jezika prikazan je na slici 2.

Sljedeće razine NLP područja izdvajaju se te međusobno isprepliću, a prikazane su i na slici 2:

- *morfološka razina* – ako se radi o pisanom jeziku-tekstu, u općem, tradicionalnom modelu razumijevanja prirodnog jezika (Dovedan, 1993), prva faza analize jest morfološka analiza. Morfem je najmanja jedinica riječi koja nosi neko značenje. Prema Jurafsky, Martin, 2008, pojmovi i afiksi tipovi su morfema. *Stem* je primarni dio riječi te daje neko značenje (npr. igra). Dio riječi koje joj daje dodatno značenje jest afiks. Afiksi su najčešće sufiksi (npr. *-nje* u riječi igranje) ili prefiksi (na primjer, *do-* u riječi doigravanje);
- *leksička razina* **–** na ovoj se razini provodi analiza u kojoj se riječ svrstava u leksičke kategorije (na primjer imenica, glagol, pridjev i sl.) i određuju obilježja kao što je, na primjer, jednina ili množina.
- *sintaktička razina* – sintaksa je znanost o rečenicama, a sintaktička analiza dijeli rečenice na sastavne dijelove. Sintaksa je primarno usredotočena na pravila i uvjete koji se definiraju gramatikom te oblikuju rečenicu;
- *semantička razina* – sintaktička je analiza povezana sa strukturom rečenica, dok semantička razina otkriva značenje u tim rečenicama (Feldman, 1999; Rajesh, Reddy Lokanatha 2009). Sa semantičkog gledišta većina riječi ima različita značenja i određivanje točnog značenja za neku riječ ovisi o kontekstu, odnosno poziciji riječi u rečenici. Semantičkom se analizom rečenica prevodi u oblik pogodan za donošenje zaključaka. Sintaktička i semantička razina nedjeljive su, međusobno djeluju jedna na drugu te su u obradi prirodnog jezika te dvije razine duboko isprepletene, u identifikaciji i upotrebi (Rajesh, Reddy i Lokanatha, 2009);
- *govorna razina* – govorna razina upotrijebljena je u NLP-u za određivanje značenja rečenica, u ovisnosti o ostalim rečenicama iz određenog teksta ili odlomka nekog dokumenta (Feldman, 1999; Rajesh, Reddy i Lokanatha, 2009);
- *pragmatička razina* – ova razina istražuje rečeničnu analizu i mogućnosti različitog iskorištavanja u različitim situacijama – jasno određuje kontekst rečenice, kao što je odnos između vremena kada je rečenica izgovorena i vremena na koje se odnosi (Rajesh, Reddy i Lokanatha, 2009).

Slika 2. Opći model razumijevanja prirodnih jezika



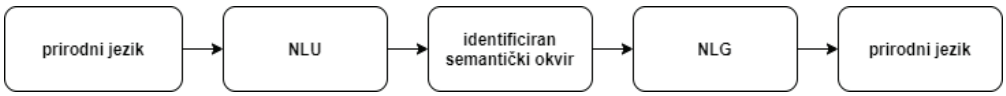
Izvor: autorica

2. 2 Prepoznavači i generatori prirodnih jezika

NLU (engl. Natural Language Understander), odnosno prepoznavač prirodnih jezika i NLG (engl. Natural Language Generator) ili generator prirodnih jezika dijelovi su domene i istraživačke tematike NLP-a. Predstavljaju različite dijelove procesa kojim se nastoji reproducirati ljudska komunikacija i ponašanje putem računala. NLU, kao dio NLP-a, rastavlja jezik (tekst ili govor) na manje dijelove, tzv. part of speech, ili još manje, morpheme, te nastoji "razumjeti" pravo značenje teksta/govora analizirajući ga sintaktički i semantički na temelju gramatike, leksika te različitih algoritama i mehanizama za izvođenje tih analiza. Nakon što je računalo/uređaj „razumjelo" tekst ili govor (što predstavlja neki ulaz), potrebno je da ono stvori ljudima „razumljiv" odgovor. NLG proces je kreiranja smislenih fraza i rečenica na prirodnom jeziku. Može se reći da NLU nastoji „pročitati" tekst ili „čuti" govor s razumijevanjem dok NLG nastoji ispisati govor, odgovoriti na njega ili ga reproducirati na ljudski razumljivu jeziku. NLU pretvara tekst ili govor (koji pripadaju nestrukturiranim tipovima podataka) u strukturirane podatke (semantički okvir) dok NLG kreira tekst ili govor na temelju strukturiranih podataka (slika 3). NLU nastoji pronaći semantičko značenje u danom tekstu, a NLG ima za cilj stvoriti odgovarajuće rečenice na temelju dane semantike (Su i sur., 2018; Su i sur., 2019).

NLG primjenu ostvaruje u različitim područjima kao što su sumarizacija i personaliziranje izvještaja, *chatbotovi*, personalizirana komunikacija s klijentima, ispis statusa uređaja u IoT okruženju (engl. *Internet of things*) (Sciforce, 2019).

Slika 3. Ciklus razumijevanja i generiranja prirodnog jezika



Izvor: obrada autorice na temelju Su i sur., 2019.

3. STROJNO PREVOĐENJE – MT

Strojno prevođenje (engl. *Machine translation*, MT u daljnjem tekstu) istraživačko je područje koje obuhvaća računalnu lingvistiku (CL) i procesiranje prirodnih jezika (NLP). Strojno je prevođenje vrlo slično procesu razgovora-dijaloga čovjeka i stroja na nekom prirodnom jeziku budući da generiranje odgovora nekog stroja na prirodnom jeziku uključuje također neku vrstu prevođenja. Strojno prevođenje kao i strojno generiran dijalog mapiraju jedan niz znakova u drugi: kod

prevođenja to je npr. niz riječi/znakova iz engleskog jezika u npr. niz riječi na hrvatskom jeziku, a kod strojnog dijaloga niz riječi znakova prirodnog jezika u očekivani niz znakova strojno generiranog odgovora (Lane i sur., 2019).

Glavna je zadaća strojnog prevođenja (MT) prevođenje s izvornog jezika na ciljani jezik uz očuvanje originalnog značenja bez „tragova". Izazov kvalitetnog prijevoda ogleda se u zadržavanju značenja originalnog teksta u ciljnom jeziku, kao i činjenice da taj novi tekst treba biti pravilno napisan („u duhu jezika") u ciljnom jeziku, a ne doslovno preveden riječ po riječ (Skadiņa i sur., 2019)

Kako problem prevođenja zahtijeva više razina apstrakcije (riječi, klauze, složene klauze, POS, morfologija riječi, sintaksa, semantika, diskurs, veza između klauza) nad prirodnim jezikom, ali i puno stručnog znanja i zaključivanja, to MT čini jednim od težih problema kod umjetne inteligencije (Koehn, 2020). Također, budući da se jedna rečenica može prevesti na više način i procjena kvalitete prevođenja predstavlja dodatni izazov (Majcunić, Matetić, Brkić Bakarić,2019).

3. 1 Prededitiranje, posteditiranje i kontrolirani jezik

Kako bi se smanjile pogreške automatskog prevođenja i olakšalo kreiranje algoritma za strojno prevođenje, često se koriste prilagodba i uređivanje ulaznih tekstova, naknadno uređivanje rezultata strojnog prijevoda te korištenje reduciranog, kontroliranog prirodnog jezika. Prededitiranje ili uređivanje postupak je pripreme i transformacije ulaznih tekstova (ili govora) koja uključuje izmjenu tekstova prije prevođenja – najčešće se odnosi na ispravljanje uglavnom gramatičkih pogrešaka u tekstu uz uklanjanje nejasnoća i suvišnih dijelova te zadržavanje semantike (Gerlach i sur., 2013). Cilj je prethodnom detekcijom i prilagodbom/modifikacijom problematičnih elemenata stvoriti izvorni tekst koji stroj lakše može prevesti. Pravila za *pre-editing* može čovjek primijeniti ručno ili automatski (Nitzke, 2019).

Post-editing ili postuređivanje proces je kojim stručnjaci dodatno pregledavaju i ispravljaju izlaz procesa strojnog prevođenja - ispravljanje sintaktičkih, semantičkih pogrešaka prijevoda, uklanjanje redundancije i izmjenu rečenične strukture (*Pre-editing and post-editing*).

Kontrolirani prirodni jezik (engl. *Controlled natural language*, CNL u daljnjem tekstu) definira se kao umjetno stvoren jezik koji se temelji na nekom prirodnom jeziku, zadržava većinu njegovih svojstava, ali je ograničen u leksičkom, sintaktičkom i semantičkom smislu (Kuhn, 2014). CNL moguće je definirati odabirom i/ili pojednostavljenjem leksičkih elemenata i kategorija i/ili lingvističkih pravila ili dodajući neke sintaktičke ili semantičke bilješke na originalan tekst u prirodnom jeziku. Korisnik CNL-a može biti čovjek ili stroj: pisac, urednik, prevoditelj, znanstvenik, student, softver za obradu teksta, softver za razumijevanje teksta, za rudarenje teksta i sl. (Choi, Isahara, 2014).

Formulacija kontroliranog jezika (Arendse, Gdaniec, 2001; Miyata i sur., 2015) olakšava postupak *pre-editinga* ili ga u potpunosti eliminira, a također olakšava *post-editing* (O'Brien, Roturier, 2007; Aikawa i sur., 2007; *The Machine translation Odyssey*, 2018; Miyata, Fujita, 2017).

Budući da postoje različite metodologije i pristupi za automatiziranje postupka strojnog prevođenja, automatizirani MT sustav može biti klasificiran s obzirom na primjenu metode: MT

temeljen na pravilima (engl. *Rule-based* ili RBMT), statistički MT ili SMT, temeljen na primjerima MT-a (engl. *Example based* ili EBMT), hibridni ili HMT te MT temeljen na dubokom učenju (engl. *Deep learning*), i to najčešće metodama neuralnih mreža (engl. *Neural networks* ili NMT) (Poibeau, 2017). U nastavku slijedi opis metoda.

3. 2 Strojno prevođenje temeljeno na pravilima

Strojno prevođenje temeljeno na pravilima (engl. *Rule based machine translation*, RBMT) poznato je i kao strojno prevođenje temeljeno na znanju ili klasični pristup MT-a. Općenito označava sustave strojnog prevođenja koji se temelje na lingvističkim informacijama o izvornim i ciljnim jezicima u osnovi preuzetim iz (dvojezičnih) rječnika i gramatika koji pokrivaju glavne semantičke, morfološke i sintaktičke pravilnosti svakog jezika. RBMT sustav na temelju ulaznih rečenica (na nekom izvornom jeziku) generira izlazne rečenice (na nekom ciljnom jeziku) na temelju morfološke, sintaktičke i semantičke analize obje vrste izvornog i ciljnog jezika uključenih u dani prevoditeljski proces.

RBMT pristup primjenjuje skup jezičnih pravila u fazama analize, prijenosa i generiranja. Sustav temeljen na pravilima zahtijeva sintaktičku i semantičku analizu te sintaktičko i semantičko generiranje.

Nedostatci povezani s pristupom RBMT jesu nedovoljna količina dobrih rječnika (dok je izgradnja novih skupa), činjenica da se neke jezične informacije moraju postaviti ručno, složenost s interakcijama pravila u velikim sustavima, dvosmislenosti i idiomatskim izrazima te neuspješna prilagodba na nove domene (Okpor, 2014).

3. 3 Statistički pristup kod strojnog prevođenja

Statistički pristup temeljen je na podatcima i oslanja se na kvantitativne metode za otkrivanje odnosa. Ovakvi pristupi zahtijevaju tekstualne korpuse kako bi osigurali pouzdanost i razvili modele za automatizaciju različitih jezičnih konteksta i modele koji opisuju jezične pojave računanjem različitih parametara. Općenito, NLP temeljen na statistici ne ograničava se na osnovne statističke konstrukte iz teorije vjerojatnosti već obuhvaća više kvantitativnih pristupa za automatsku obradu jezika kao što su modeliranje vjerojatnosti, teorija informacija i linearna algebra (Hogenboom, 2010).

Različitosti sustava SMT uglavnom proizlaze iz definiranja minimalne jedinice za prijevod (riječ, fraza ili konstituent – sastavni dio). Prijevod koji se temelji na frazama – PBSMT (Koehn i sur., 2003) predstavlja evoluciju prijevoda od riječi do riječi. Ako se u obzir uzima fraza umjesto riječi, uzima se u obzir kontekst i lokalni razmještaj svake riječi (Koehn, 2010). Fraza ne predstavlja nužno jezični element izvornog jezika (engl. *Source language*, SL) koji mora imati odgovarajuću vrijednost u jeziku na koji se prevodi (engl. *Target language*, TL). Kako je broj fraza koje se mogu izvući iz korpusa veći od broja sintaktičkih elemenata, omogućena je veća sloboda u prijevodu, ali također i veći broj gramatički neispravnih prijevoda (España-Bonet, Costa-jussà, 2016).

Sustavi temeljeni na sintaksi (SSMT) primjenjuju suprotan pristup i prevode pojedine sintaktičke elemente (Wu, 1997; Quirk i sur., 2005). Osnovna je ideja pristupa upotreba sinkronih gramatika koje mogu stvoriti vrijednost iz izvora i cilja prevođenja istovremeno. Sinkrone gramatike kreirane su iz paralelnog korpusa što ovaj pristup čini vrlo sporim u odnosu na sustave PBSMT.

Hijerarhijski sustavi temeljeni na frazama (HPBSMT) svojevrsna su ravnoteža između pristupa PBSMT i SSMT (Chiang, 2005). Hijerarhijska se fraza sastoji od hijerarhije riječi i podfraza koja je namijenjena uspostavljanju pravilna redoslijeda među frazama (España-Bonet, Costa-jussà, 2016).

Statistički pristup omogućava precizno modeliranje različitih značenja riječi u skladu s kontekstom, a statistički su podatci efikasni za pronalaženje ekvivalenta prijevoda na razini riječi ili fraze. Statističkim pristupom danas je relativno dobro formalizirana leksička semantika dok su razumijevanje semantike rečenica i odnosa među njima još uvijek izazov koji se danas pokušava rješavati pristupom poznatim kao dubinsko učenje (engl. *Deep learning*) (Poibeau, 2017).

3. 4 Strojno prevođenje temeljeno na primjerima

Prevođenje temeljeno na primjerima ili analogiji (engl. *Example based machine translation*, EBMT) uvedeno je s ciljem prevladavanja problema prevođenja temeljenog na pravilima. EBMT obično djeluje u tri faze kako bi se prevela rečenica. U prvoj fazi sustav pokušava pronaći fragmente rečenice koja će se prevesti u korpusima izvornog jezika. U drugoj fazi, nakon što su svi relevantni fragmenti prikupljeni i pohranjeni, sustav traži translacijske ekvivalente na ciljnom jeziku, zahvaljujući tekstovima iz dvojezičnog korpusa koji se koriste za prijevod. Treća i zadnja faza kombinira fragmente prijevoda kako bi se dobila točna rečenica na ciljnom jeziku (Poibeau, 2017).

3. 5 Hibridni pristup kod strojnog prevođenja

Hibridni je pristup razvijen kombinacijom SMT-a i RBMT-a te je kompenzirao slabe točke oba pristupa s njihovim prednostima (Hogenboom, 2010). Postoje hibridni sustavi kojima je osnovni mehanizam statistički i oni kojima je osnovni mehanizam temeljen na pravilima. *Hibridni sustavi kojima je osnovni mehanizam zasnovan na SMT-u*: statistički se sustavi mogu graditi kad god postoje paralelni korpusi, a na kvalitetu prijevoda utječe i količina podataka. Dobar leksički izbor predstavlja prednost sustava SMT kada su dostupni podatci o određenoj domeni, budući da se leksički odabir modelira iz tih podataka (Costa-jussà i sur., 2012). Statistički sustavi pokušavaju poboljšati gramatičku točnost integrirajući značajke iz sustava RBMT, na primjer u fazama prededitiranja i posteditiranja.

Hibridnim sustavima strojnog prevođenja pristupa se iz perspektive temeljene na pravilima ili korpusu, dakle statistici.

Hibridni sustavi kojima je glavni mehanizam zasnovan na pravilima: sustavi RBMT inače zahtijevaju puno vremena i napora budući da su rječnici i pravila ručno kreirani i definirani. No uz ispravnu analizu izvornog teksta i dobro definiranih pravila, a kako bi poboljšali točnost, čisti RBMT sustavi upotrebljavaju sve više komponenata temeljenih na korpusima i statistici i time se automatiziraju neki dijelovi procesa prevođenja, koji su se provodili ručno.

Kad su hibridni sustavi vođeni SMT sustavima, integracija pravila izvršena je od faze prededitiranja/posteditiranja do središnjega dijela sustava. Kad su hibridni sustavi vođeni RBMT sustavima, integracija statistike upotrebljava se kako bi se obogatili resursi, moduli temeljeni na podatcima ili okosnica sustava temeljenog na pravilima (España-Bonet, Costa-jussà, 2016).

4. METODE DUBOKOG UČENJA

Razvojem procesorske moći računala otvaraju se nove mogućnosti u obradi ogromnog broja različitih podataka, prvenstveno nestrukturirana tipa, kao što je tekst, govor, slika ili video. Tijekom posljednjih se godina razvojem neuronskih mreža pojavila nova vrsta statističkog učenja nazvana „duboko učenje" (engl. *Deep learning*, DL u daljnjem tekstu) ili „hijerarhijsko učenje". Prema autorima Goodfellow i sur. (2016), „suvremeni pojam" DL-a nadilazi neuroznanstvenu perspektivu trenutne generacije modela strojnog učenja te obuhvaća općenitiji princip učenja više razina kompozicije, koji se može primijeniti u okvirima strojnog učenja koji nisu nužno neuronske mreže. Umjesto da koristi skupinu unaprijed definiranih karakteristika, DL djeluje iz jako velikog niza primjera. Ovo je učenje hijerarhijsko jer započinje osnovnim elementima (znakovima ili riječima u slučaju jezika), nastavlja identifikacijom složenijih struktura (nizovi riječi ili izraza u slučaju jezika) dok ne dobije cjelovitu analizu predmeta koji se analizira (rečenica) (Poibeau, 2017; Deng, Liu, 2018). Metode DL-a utemeljene na neuronskim mrežama pokazuju obećavajući trend u obradi prirodnog jezika, posebno u području strojnog prevođenja (Zheng i sur., 2019).

Primjena DL-a kod strojnog prevođenja omogućava stvaranje sustava koji sam izvodi najbolju reprezentaciju iz podataka uz vrlo malo ručnog podešavanja. Sustav za prevođenje koji je temeljen isključivo na dubokom učenju (engl. *Deep learning machine translation* ili *Neural machine translation*) sastoji se od *encodera* i *decodera*, koji se temelje na neuronskoj mreži. *Encoder* je dio sustava koji analizira trening-podatke, odnosno podatke za učenje, a *decoder* dio sustava koji automatski generira prijevod iz određene rečenice, na temelju podataka koje je analizirao *encoder*.

Pristupom dubokog učenja kod strojnog prijevoda odjednom se razmatra cijela rečenica bez njezine dekompozicije na manje segmente, istovremeno razmatrajući sve vrste odnosa u kontekstu. DL pristup može otkriti strukturu rečenica (odnose riječi ili skupina riječi) na temelju pravilnosti koje su identificirane u velikom broju primjera danih sustavu tijekom treninga. Spomenuti odnosi u rečenici mogu biti vertikalni (skupine sličnih riječi koje mogu popuniti poziciju u rečenici) ili horizontalni (sintaktički povezane skupine riječi u rečenici), što čini ovakav pristup fleksibilnim i kognitivno zanimljivim, kao i računalno vrlo zahtjevnim.

DL je značajan korak naprijed i omogućio je velika poboljšanja u području obrade prirodnih jezika, strojnog prevođenja, prepoznavanja slika i obrade govora (Poibeau, 2017).

Iako je tehnologija automatskog prevođenja već dugo predmetom istraživanja, izvorni cilj strojnog prevođenja (MT) – zamijeniti ljudske prevoditelje – još nije postignut (Skadiņa i sur., 2019).

Iako je primjena metoda DL-a u kratkom roku doprinijela povećanoj kvaliteti prevođenja, sustavi za strojno prevođenje još uvijek nisu u mogućnosti proizvesti izlaz iste kvalitete kao ljudski prevoditelj.

Prostora za napredak ima pogotovo na gramatičkim razinama složenih klauza (Wu i sur., 2018; Ge i sur., 2019).

5. ZAKLJUČAK

Obrada prirodnih jezika kao i konkretnije, strojno prevođenje, jako su napredovali u zadnja dva desetljeća, pogotovo primjenom dubokog učenja zasnovanog na neuronskim mrežama. Izvođenje zadataka kao što su razumijevanje teksta (uz mogućnost odgovaranja na pitanja), razumijevanje govora, vođenje dijaloga između računala i čovjeka već se naveliko koriste u praksi s različitim stupnjem kvalitete. Upravo sve šira uporaba metoda obrade prirodnih jezika pretpostavlja i dobro temeljno znanje o ovom području što je i predstavljalo motivaciju pisanja ovog rada.

Kako bi se koncizno i sistematski dao pregled i povezanost područja, u radu su prikazani odnosi između niza povezanih područja i njihovih sastavnica: umjetna inteligencija, obrada prirodnih jezika, prepoznavač i generator prirodnog jezika, strojno prevođenje, strojno učenje i duboko učenje. Osim osnovnih značajki opisana je temeljna problematika područja obrade prirodnih jezika i konkretnije metoda strojnog prevođenja. Za opisane metode diskutirala se i praktičnost i smjernice za primjenu pa je tako klasični pristup, temeljen na pravilima, prikladan za uže i specijalizirane domene NLP-a budući da pravilima može formalizirati ekspertno znanje dok je statistički pristup prikladniji kada postoje veliki paralelni jezični korpusi. Hibridnim se pristupom obuhvaćaju prednosti oba pristupa. U radu je opisan i najnoviji pristup dubokog učenja zasnovan na neuronskim mrežama kojem se povećala kvaliteta prevođenja prvenstveno za široko korištene jezike za koje postoje veliki paralelni korpusi. Iako još ne može generirati prevođenje kvalitete ljudskog prevoditelja, strojno je prevođenje, kao i ostala potpodručja NLP-a, već naširoko korišteno u praksi: sumarizacije dokumenata, prilagođeni rezultati analitika, ekstrakcija informacija i znanja, jeftino ili besplatno prevođenje i sl. Svaka od navedenih metoda strojnog prevođenja prikladna je za određene domene primjene te se očekuje i njihov daljnji razvoj, pogotovo hibridnih i metoda dubokog učenja. Također, kako bi se smanjila potreba za prededitiranjem i posteditiranjem te pogreške strojnog prevođenja prvenstveno na semantičkoj, govornoj i pragmatičkoj razini, bitno je uključiti i velik broj ljudskih eksperata koji procjenjuju i ispravljaju rezultate strojnog prevođenja.

U ovom je području još mnogo postojećih izazova, prostora za napredak i poboljšanje kvalitete automatskih obrada/prijevoda/generiranja jezika kako bi one bile na razini ljudske komunikacije ili prevođenja koje izvode ljudski eksperti. Daljnji smjer istraživanja je usmjeren na konkretne primjere obrade prirodnih jezika, izradu specijaliziranih korpusa za primjenu različitih algoritama strojnog prevođenja te istraživanje mogućnosti i primjene prevođenja prirodnog jezika u formalni i obrnuto.

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Review article
https://doi.org/10.31784/zvr.9.1.23
Received: 17. 11. 2020.
Accepted: 20. 1. 2021.

OVERVIEW OF NATURAL LANGUAGE PROCESSING AND MACHINE TRANSLATION METHODS

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ABSTRACT

The paper provides an overview of areas related to the processing of natural languages and their interrelationships, starting from a broader domain such as artificial intelligence, through machine learning, computational linguistics, machine translation methods and especially those based on deep learning. The characteristics, applications, phases and main problems of natural language processing from the lexical, syntactic, semantic, speech and pragmatic perspective are described. The phases of natural language recognition and analysis as well as the natural language generation phase are described. Pre-editing and post-editing procedures using controlled natural languages are given as examples of practices that increase the accuracy and quality of automatic translation and text processing in general. Special focus is given to machine translation and machine translation methods. Approaches to machine translation as statistical, rule-based, example-based, hybrid and deep learning-based approach are described and discussed with regard to their advantages and disadvantages including appropriate application in practice. In the end, still unresolved challenges are given as a direction of future research related to natural language processing and the importance of further development of a deep learning-based approach.

Key words: *natural language processing, machine translation, computational linguistics, deep learning, artificial intelligence*

TEHNIČKE ZNANOSTI

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Original scientific paper
https://doi.org/10.31784/zvr.9.1.24
Received: 3. 7. 2020.
Accepted: 2. 10. 2020.

MECHANICAL LOAD CAUSED BY PHYSICAL ACTIVITY BY WEARING MILITARY EQUIPMENT

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ABSTRACT

In this paper fatigue for professional soldier caused by active physical activity and endurance limits is investigated. The resulting workload is one of indicators of how training, preparedness and other acquired work skills can contribute to the human body being a large working "machine". Ergometry test was conducted and field test for soldier fitness condition and energy expenditure was measured regarding the level of body's metabolism. Field test consisted of three runs on a polygon of 10 km and different workloads, the energy consumption was monitored. Work load was compared with Occupational Safety and Health law acts. The results showed difference in workload conditions and hart rate which allowed to determine rest spots and safety in training conditions.

Key words: *fatigue, metabolism, energy expenditure, occupational safety, soldier*

1. INTRODUCTION

Fitness for duty is something that is important in occupational safety, as it influences alertness that individuals need while preforming safety sensitive work. Alertness is influenced by what one does as current operation, by sleep quality, by management of fatigue, by medical issues from work related sources or by personal health issues. Potential consequences of low alertness are injuries at work therefore safety risk must be managed, between 1996 and 2016, 434 121 occupational injuries were reported in the Republic of Croatia (Pupovac et al., 2018). For professional soldiers one of issues to consider are work shifts that can be fulltime on evening, night, or rotating shifts, or other employer-arranged irregular schedules. If it relates to performing an action on a training ground or during other military exercises, then these are jobs with special working conditions from the Ordinance (Official Gazette 5/84). According to the Occupational Safety and Health Act (Official Gazette 71/14, 118/14 and 154/14), which means safety, access to safety and wearing protective

clothing and footwear. Also, from the Ordinance on Occupational Safety at Manual Handling of Loads (OG No. 42/05) restrictions on the workload of workers. And from the Law on Service in the Armed Forces of the Republic of Croatia (Official Gazette 73/15, 75/15, 50/16 and 30/18), which must be fulfilled in order to become an active military person. And it depends on the specialization that the tests must pass in order to be able to perform a military job and advance in a military career. Dangers like bad lighting, sound, vibration or extreme temperature changes are present in the field of work of soldiers and can influence overall fitness status. However physical dangers are more often categorized as work diseases that affect hands, hearing problems, cardiovascular problems, eyes problems, skin problems, (Regent, 2015). Repetitive high load work can be subjected to cause heat stress if working conditions aren't meet according legal recommendations (Bognolo et al., 2015).

The hypothesis is that a professional soldier can withstand proper exercise and preparation to withstand the stress of the body, that is, to achieve maximum load under difficult conditions on the training ground, which he would not be able to do without preparation.

The subject of the final work is based on the fact that hard work and easier work with different combat equipment was performed, when collecting data in the field. The requirement is that a professional soldier, in addition to his job, must satisfy the criteria of psycho-physical education, in addition to his military duty. Measurements were made visually and using devices for analyzing the fitness of soldiers.

Physical exercise induces adaptations in metabolism that improve overall cardiac metabolism and capacity of people to perform more demanding tasks. However, in order to achieve significant therapeutic relevance that boosts energetic aspect of a person it is required to maintain proper training, and correct nutrition in individuals. There is a risk when modulating cardiac metabolism in heart failure. In this paper such investigation is conducted for workload of soldiers that are subjected with intense workload and continuous exercise, training, and competitions. It is necessary to monitor type of work being done and in what conditions such work is performed in order to secure occupational safety.

Aim of this paper is to investigate loading dose of physical activities of professional soldier, with correlation to endurance limits. There is a need to find relation between load and metabolism on practical example and to offer recommendation for purposes of increasing knowledge for this type of work. It is important to explain what metabolism is. Point out the dangers of mechanical loading. Explain legislation for special work conditions. Demonstrate required energy intake. Demonstrate work skills on a training ground. Suggest safeguards if dangerous situations occur.

2. POWER CONSUMPTION AT WORK

All activity that is performed at work uses energy, this energy can be used to compare different physical stresses, but it cannot be used for measuring mental activity and skill level. Attitudes of the body at work can also have a significant impact on energy consumption. Such as sitting (3 – 5 %), sitting (8 – 10 %), bending (50 – 60 %), kneeling (30 – 40 %). Total energy consumed in a day is as follows: 1. basal metabolism 2. energy for work 3. energy for other activities.

For soldiers' active culture of health is a must, therefore supportive work environment must be obtained for managing alertness and one of main things to monitor is metabolism. Metabolism is conversion of chemical energy to body energy by transforming nutrients into warmth, mechanical work, assimilated organic matter (fat reserves) and wasted energy in urine + feces. Therefore, basal metabolism covers basic life functions at rest where average person needs about 70 - 80 W of heat (1 kcal / kg h = 1 BMR). With this energy a person is enabled to perform work tasks that require different workloads. 1 MET (Metabolic Equivalent of Task) is defined by ANSI / ASHRAE Standard 55 as 58.2 W/m^2, which is the amount of heat a person produces when sitting still. In relation to metabolism we can assume that for light work the metabolic effect is up to M = 2 = 116 W/m^2; while for medium heavy duty, M = 2.6 = 150 W/m^2; and for heavy work like soldiers M = 4.7 = 275 W/m^2.

Nutrition consists of the necessary intake of food and drink for the functioning of the body and restore spent energy or metabolism. Only a small amount of food is used for the repair of body tissues or stored as fat reserves. It is assumed that average person moderately active needs around 2,000 calories a day for women and 2,500 for men every day to maintain energy and weight. It is related to age, gender and physical activity level, (Bender 2007.). The main nutrients are eaten in large quantities and are protein, carbohydrates, and fat while small dosage nutrients are vitamins, minerals and very important water. The metabolism of these fuels results in the production of carbon dioxide and water. The same energy can be gained by burning in air and fundamental law of chemistry states that if the starting material and end products are the same, the energy yield is the same. Therefore, energy consumption is measured by body heat output with calorie (Cal) signifying required heat to raise temperature of 1g of water by 1 °C. For energy purposes conversion of calories and joules is used as 1 kcal = 4.186 kJ, 1 kJ = 0.239 kcal. Approximatively for women 2000 calories = 8.372 MJ and 2500 for men 10.465 MJ. In table 1 some energy values for food is shown table 1 (Bender, 2007).

Table 1. Energy values of metabolic food conversion

	Kcal/g	KJ/g	KJ/g
Carbohydrate	4	16744	17
Protein	4	16744	16
Fat	9	37674	37

Source: Bender (2007)

For example, if a soldier is extra active (exercises & physical job or 2x training) then he could spend 2.8 MET and if his weight is 70 kg and body surface of 1.847 m^2 then he spends 300.97 W. It can be calculated from knowing that $Q_{baz} \approx m \cdot q \cdot 24$ [kJ/day], where q = 4,19 kJ/(kg·h), and basic metabolism Q_{M1}=1 *MET* · A = 58.2 · 1.847 = 107.49 W, then the energy expenditure results as Q_M = 2.8 MET·107.49 W = 300.97 W = 300.97 Js^{-1}.

If he works 7.5 hours 1 h = 3600 s, during work time (7.5 h·3600 s = 27000 s) then spent energy results in Q= 27000 s·300.97 Js^{-1}= 8126190 J = 8126.19 kJ.

The soldier needs to recuperate lost energy by eating, the average diet should provide about 55 % of energy from carbohydrates, 30 % from fat, and 15 % from protein, the ratio can be for athletes also 70 % carbohydrates, fat /12 % fat /18 % protein or 60% carbohydrates /25 12 % fat /15% protein, (Manoroe 2009.).

$C_{carbohydrates}$ = 0,55·8126.19 kJ = 4469.40 kJ that is equivalent to 4469.40 kJ/(16744 kJ/kg) = 266.9 g. $C_{protein}$ = 0,15·8126.19 kJ = 1218.92 kJ that is equivalent to 1218.92 kJ/(16744 kJ/kg) = 72.7 g. C_{fat} = 0,3·8126.19 kJ = 2437.8 kJ that is equivalent to 2437.8 kJ/(37674 kJ/kg) = 64.7 g.

For maintaining energy used for extra active job he needs to eat 266.9 grams of carbohydrates, 72.7 grams of protein and 64.7 grams of fat.

3. CONDITIONAL PREPARATION OF SOLDIERS

The importance and purpose of each soldier's fitness is fitness training and achieving optimal alertness that he can use in real combat action. One of these conditions is health status and another is ergonomics the repeatability and training of interaction with things and procedures.

Health status of soldiers is a basic prerequisite for any type of training and general exercise. Members of the Armed Forces, unlike individual athletes or the sports team, must maintain fitness throughout their military careers. And they do this through the various activities they are assigned to in order to achieve preparedness and manage fatigue related to a selected task. The importance of maintaining optimum health status is largely aided by preventive and rehabilitation fitness programs aimed at reducing the number and severity of injuries. There are different needs in the Air Force, the Army, Navy, Special Forces or Military Police. Soldiers members must show their "excellent form" throughout the year in various tests and that can be done by detecting health risks. Just as their passing on fitness tests should not be questioned, in order to increase the health status of soldiers, anthropometric measurements are performed in the thickness assessment.

Special attention in training should be done to ergonomically interaction when doing physical work with a thing of interest, with proper body motion a certain task can be done with less energy and less fatigue. With repeated actions such as working with certain equipment, using repetitive procedures there comes an adaptation to that work. The degree of strain depends not only on the number of kJ consumed, but also on the number of muscles involved in the work, and the magnitude of the static load to which they are exposed. Care should be taken and muscle contractions that provide energy form mechanical work monitored. After contractions, while the muscle is relaxed and rested, energy reserves are restored. Both processes release energy and renewal occur in the muscle while working. If the energy requirement exceeds the possibility of regeneration, the metabolic balance is disturbed, resulting in a loss of muscle capacity.

Ergonomics also take in consideration temperature, humidity and other factors that influence people while doing work. The energy consumed is not sensitive to these factors, but heart rate is, and therefore the Ordinance on Occupational Safety at Work (Official Gazette 29/13), Article 24 sets out the obligations of employers to achieve a microclimate with regard to the severity of work. So, it is designed for work without physical stress of 20 - 25 °C, for light physical work of 16 - 22 °C, heavy

physical work of 10 - 19 °C. Also, the ideal humidity is from 40 % to 60 % while 50 % would be ideal. Below 40 % dry air and above because of body sweating requires more liquids to be consumed.

Therefore, if we monitor work conditions and use fewer muscles, use more static work and optimal temperature and humidity we can decrease stress and detect safety risks.

4. METODOLOGY

In order to determine workload of a soldier during a regular extra active fitness run. Before run a classic an ergonomic test was preformed and after the soldier run a track long around 9.6 km. The run was done three times on separate days without load, with 10 kg load and with 20 kg load in backpack. Standard equipment that was not taken in consideration and calculation was around 7.5 kg from helmet 4 kg, boots 2.5 kg, belt 0.5 kg, military clothes 0.5 -1 kg.

The ergonomic load test is continuous and progressive usually it is used for athletes or persons with hart conditions. Test monitors values of blood pressure and pulse, changes in the ECG and subjective problems of the subjects (chest pain, shortness of breath, leg pain, dizziness, etc.) are recorded. It consists of several stages of work loading with duration of 3 minutes or less for a stage. Ergometry can determine maximum heart rate and maximum blood pressure where test can be maximum or submaximal. The maximum load test is one in which the maximum heart rate determined for the age and gender of the subjects is reached. Whereas the submaximal loading test is one in which the submaximal heart rate is reached, which is 85 - 90 % of the maximum heart rate.

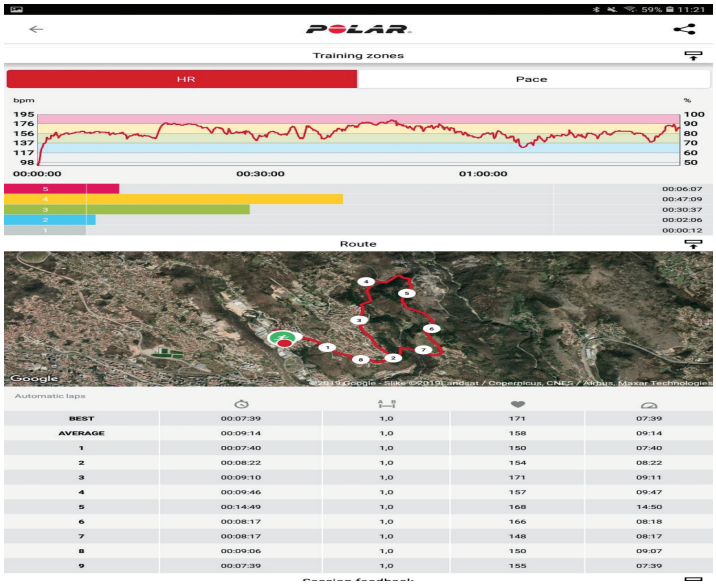
The ergonomic test was done in medical clinic Medico special hospital in the city of Rijeka. The subject was a man 25 years old height 172 cm and weight 72 kg. During the performance of the ergometric test according to the Bruc Protocol, the following were obtained:

- load 1, 2.4 / 25 MET/ W 97 beats / min, blood pressure 139/62 mm / Hg.
- load 5, 7.1 / 125 MET/ W 133 beats / min, blood pressure 157/63 mm / Hg.
- load 10, 13.1 / 250 MET/ W 182 beats / min, blood pressure 194/83 mm / Hg.

Total time of test lasted 27.54 minutes, time of workload was 18.36 minutes, time of resting lasted 4.55 minutes and preparation time was 4.23 minutes.

Polygon test was done on path shown in figure 1, specific location consisting of road, forest and gravel road. The run was executed three times, once without load, once with 10 kg load and once with 20 kg load. The objective was to measure workload and results were obtained using the Polar digital watch and polar web application. The runs were conducted 3 days in a row from 15 to 18 of November, from 10 am to 12 am, temperature was 20 °C and four soldiers were running together.

Figure 1. Polygon track of 10 km where test was conducted



Source: Babić (2020)

5. RESULTS AND DISCUSSION

5. 1 Ergometric test

Results of ergonomic test are shown in table 2, 3 and graph 1.

Table 2. Maximal workload achieved on ergonomic test

Max. workload	13.1/250 (214) Met/W (117,0) %
Max. HR	184 (195) /min (94 %)
Max. BP	194/83 mmHg
Max. BP x HR	353 mmHg/min
Min. BP x HR	150 mmHg/min
DP- factor	2.4
Body surface	1.847 m
PWC 150/170	159/216 W
PWC rel	2.21 / 3.00 W/kg

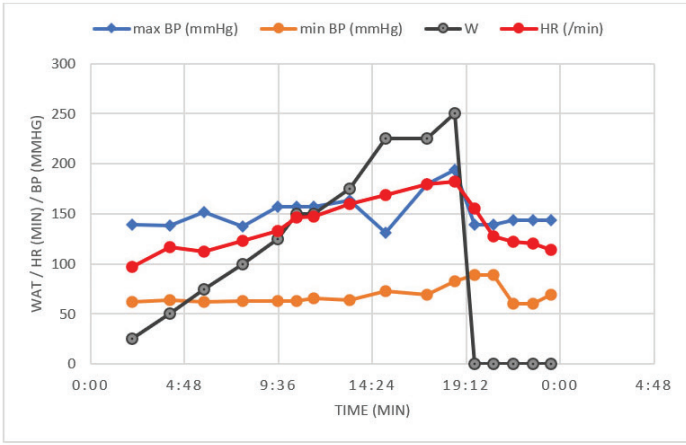
Source: Babić (2020)

Table 3. Incremental increase of workload results of ergonomic test

Protocol ST@J + 40 ms					
	Time mm:ss	Workload Met/W	HR (/min)	BP (mmHg)	ST V5 (mm)
Before	4:23	1.2/0	106	142/79	1.3
Load 1	2:08	2.4/25	97	139/62	1.4
Load 2	4:03	3.6/50	117	138/64	1.2
Load 3	5:46	4.8/75	112	152/62	1.1
Load 4	7:46	6.0/100	123	137/63	1.2
Load 5	9:33	7.1/125	133	157/63	1.1
ST max	10:31	8.3/150	146	-	1.1
Load 6	11:24	8.3/150	147	157/66	1.5
Load 7	13:15	9.5/175	160	163/64	1.7
Load 8	15:04	10.7/225	169	161/73	2.3
Load 9	17:12	11.9/225	180	180/69	2.5
Load 10	18:36	13.1/250	182	194/83	3.2
Rest	1:00	1.2/0	155	-	4.1
Rest	2:00	1.2/0	128	139/89	2.8
Rest	3:00	1.2/0	122	144/60	1.8
Rest	4:00	1.2/0	120	-	1.3
EOT	4:55	1.2/0	114	144/69	1.2

Source: Babić (2020)

Graph 1. Comparison of workload Mets and blood pressure mmHg



Source: Babić (2020)

ECG before loading: SR freq. 90 / min, medium el. os, Neat. RR before loading 139/62 mmHg. ECG during load: SR. Max. Freq. 184 / min. No major changes in T wave and ST coupling, no rhythm disturbance. ECG after loading at 5 minutes recovery: SR freq. 115 rpm medium e. RR at 5 minutes recovery 144/69 mmHg. A load of 250 W - 13.1 MET (117 % of theoretical maximum load) with a maximum pulse of 184 / min (94 % of theoretical maximum pulse) was achieved. At maximum load, RR 194/83 mmHg is registered. During load as well as after load, without significant changes in T wave and ST coupling, without rhythm disturbance. Test terminated due to high load achieved.

Conclusion: functional capacity 117 %, very high KR ability. The coronary reserve test is electrocardiographically and clinically negative at a load of W250 (13.1 MET) at 94 % of maximum pulse. Proper pressure movement, no arrhythmia.

5. 2 Polygon test

The soldier demonstrated his readiness for the task he was tested through 3 load levels. At 1st level, the soldier was without additional equipment, and the course on which the test was conducted was crossed without significant difficulty. During the next 2, the load level was more difficult because it was loaded with 10 kg of equipment, it took longer to reach the specified path. Increased energy consumption and heart rate were also present. The last 3rd, the level was the most difficult because the body of the soldier was loaded with 20 kg of equipment. He had to cross a 10 km long section, which required excellent physical fitness, good health ultimately for the whole body. The soldier has traveled the given path, but only for the reason that he was prepared for such a level of physical exertion, which is the soldier's daily routine. Soldier's workload expressed in (W) or MET. The workload was carried out in accordance with the Occupational Safety and Health Act (Official Gazette 71/74, 118/14 and 154/14), the Ordinance on Special Conditions of Work (Official Gazette 5/84) and the Law on Service in the Armed Forces of the Republic of Croatia. Results of level 1, 2 and 3 runs are shown in tables 4 and 5 while cardio BPM rate is shown in graph 2.

Table 4. Results while performing the test on a polygon for level of run 1, 2 and 3.

Level	1	2	3
Load of equipment	0 kg	10 kg	20 kg
Consumed	941 kcal/3,952 kJ	1177 kcal/4943 kJ	1404 kcal/6739 kJ
Beats	177 bpm	178 bpm	184 bpm
Time	01:08 h	01:22	01:26 h
Cardio load on training	114	151	180
Subjective training load	274	413	605
Subject estimation	4/10	5/10	7/10
Running index	43	37	37

Source: Babić (2020)

Table 5. Results of BPM rate for top to bottom work load 0 kg, 10 kg and 20 kg

Level	1	2	3
Load of equipment	0 kg	10 kg	20 kg
Duration	01:08:35 h	01:22:37 h	01:26:25 h
Distance	9,62 km	9,67 km	9,62 km
HR avg	151 bpm	155 bpm	159 bpm
Calories	941 kcal	1177 kcal	1404 kcal
HR min	78 bpm	81 bpm	92 bpm
HR max	177 bpm	178 bpm	184 bpm
Fat burn % of Cal	26 %	26 %	24 %
Pace avg	07:08 min/km	08:33 min/km	08:59 min/km
Pace max	03:17 min/km	04:39 min/km	03:47 min/km
Ascent	295 m	295 m	290 m
Descent	300 m	290 m	290 m
Cadence avg	79 steps/min	77 steps/min	76 steps/min
Cadence max	104 steps/min	88 steps/min	100 steps/min

Source: Babić (2020)

Graph 2. Results of BPM rate for top to bottom work load 0 kg, 10 kg and 20 kg



Source: Babić (2020)

Results for different levels:

- Level 1, consumed 941 kcal or 3,952 kJ and 177 bpm beats in 01:08 h. Cardio Load based on training impulse was calculated as 114, perceived subjective training load as 274, and subject estimation 4/10. Running index was 43.
- Level 2, with 10 kg of combat equipment 178 bpm and a power consumption of 1177 kcal or 4943 kJ in a time of 01:22 h. Cardio Load based on training impulse was calculated as 151, perceived subjective training load as 413, and subject estimation 5/10. Running index was 37.
- Level 3, with 20 kg of combat equipment 184 bpm and a power consumption of 1404 kcal or 6739 kJ, and it took 01:26 h for this final phase. Cardio Load based on training impulse was calculated as 180, perceived subjective training load as 605, and subject estimation 7/10. Running index was 37.

It took the soldier *without equipment* for 10-kilometer course only just over an hour. The energy consumed for this work is 3952 kJ. More significant is the maximum frequency achieved (177 bpm). The terrain was demanding even during sudden climbs or falls, but there was no rest. There was a change in heart rate. Depending on the configuration of the terrain, the number of steps the soldier made on the polygon was adjusted.

In the middle diagram we see that the highest number is 178 (bpm), while the average heart rate is 81 (bpm). The ascent is 295 meters, the descent or "fall" is 290 meters, the altitude is 426 meters. Energy consumption is 4943 kJ. The difference between load 1 and load 2 in terms of energy consumption is not a significant deviation. Because of this, there was a slightly slower movement on the 2nd level, due to the additional weight, that is, the combat equipment of the soldiers. The difference in heart rate is due to the *extra combat equipment of 10 kg.*

In the diagram above, the soldier had 184 bpm, which is 94 % of the maximum aerobic load for him. An energy consumption of 6739 kJ represents a significantly higher energy consumption when compared to the same set time with less energy consumed. The difference in heart rate is due to the *extra combat equipment of 20 kg,* then there was also a big climb. There was no rest during the exercise.

6. CONCLUSION

The research was undertaken in order to determine energy expenditure when doing work load related activity. Measuring mechanisms used in detecting fatigue were ergonomic test and measuring hart rate, calorie consumption, cardio load base with Polar digital watch and Polar website application. Fatigue risk management for a soldier fitness conditioning was examined with the intention to improve outcome energy expenditure by forecasting risk management. The soldier had 184 bpm, which is 94 % of the maximum aerobic load for him. An energy consumption of 6739 kJ represents a significantly higher energy consumption when compared to the same set time with less energy consumed.

First step was ergonomic test that determinates endurance limit and test was done in medical clinic Medico special hospital in the city of Rijeka. During ergonomic test maximum load 10 was measured, 13.1 / 250 MET/ W 182 beats / min, blood pressure 194/83 mm / Hg. The test subject endured 117 % of overload and is conclude that he is prepared for excessive exercises.

Second step included monitoring spent energy while running at a predetermined course for a distance of around 9.6 km without load first run, with 10 kg of load second run and 20 kg third run. Data collected showed as expected increase of energy consumption form 3,952 kJ for 0 kg, 4943 kJ for 10 kg and 6739 kJ for 20 kg. According the results more load results with increased fatigue and decreases efficiency in work therefore safety risk management can be forecast. In attempt to determine preformed work characteristic the tiredness of employee was determined as:

1. Run, no load, subjective cardio training load as 274, and subject estimation 4/10.
2. Run, 10 kg, subjective cardio training load as 413, and subject estimation 5/10.
3. Run, 20 kg, subjective cardio training load as 605, and subject estimation 7/10.

When performing work, a healthy body metabolism is essential, especially when it comes to such levels of workload. With the proper intake of protein, fat, carbohydrates, minerals and other nutrients, the soldier's body was able to achieve maximum load. The results of the load test survey show that work requiring heavy workload can be performed if a person is admitted for the stated physical exertion. This involves the interaction of the soldier's metabolism, fitness, and protective equipment that protects or helps him with such a load. For this reason, it is important to achieve it with a healthy lifestyle, proper nutrition and sports activity.

It can be concluded that soldier fitness requires safety management policy by knowing risks of fitness preparation, energy expenditure with and without load, proper food supplement for increase of energy consumption. Therefore, fatigue monitoring and alertness for duty depend on reporting of fatigue during work, incident investigation for unusual circumstances and proper education about training is needed for energy losses detection of a soldier.

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Izvorni znanstveni rad
https://doi.org/10.31784/zvr.9.1.24
Datum primitka rada: 3. 7. 2020.
Datum prihvaćanja rada: 2. 10. 2020.

MEHANIČKO OPTEREĆENJE UZROKOVANO TJELESNOM AKTIVNOŠĆU NOŠENJA VOJNE OPREME

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SAŽETAK

U ovom radu istražuje se umor profesionalnog vojnika uzrokovan aktivnom fizičkom aktivnošću i ograničenjima izdržljivosti. Rezultat radnog opterećenja jedan je od pokazatelja kako obuka, pripremljenost i druge stečene radne vještine mogu pridonijeti ljudskom tijelu kao velikom radnom „stroju". Provedeno je ergometrijsko ispitivanje i terenski test za kondicijsko stanje vojnika i potrošnja energije mjereno je s obzirom na razinu metabolizma u tijelu. Terensko ispitivanje sastojalo se od staza na poligonu od 10 km i različitih opterećenja, a praćena je i potrošnja energije. Radno opterećenje uspoređeno je sa zakonima o zaštiti na radu. Rezultati su pokazali razliku u uvjetima radnog opterećenja i brzini vrtnje, što je omogućilo određivanje mjesta odmora i sigurnosti u uvjetima treninga.

Ključne riječi: *umor, metabolizam, potrošnja energije, zaštita na radu, vojnik*

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Stručni rad
https://doi.org/10.31784/zvr.9.1.25
Datum primitka rada: 14. 7. 2020.
Datum prihvaćanja rada: 2. 10. 2020.

KARAKTERISTIKE PROBLEMA PARKIRANJA U GRADOVIMA – STUDIJA SLUČAJA GRADA ŠIBENIKA S PRIJEDLOZIMA ZA RJEŠENJE PROBLEMA

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SAŽETAK

Porast stupnja motorizacije stanovništva kako Republike Hrvatske tako i grada Šibenika doveo je do problema stacionarnog prometa i potrebnog broja parkirališnih mjesta za automobile. Zbog nedostatka slobodnih parkirališnih mjesta u središtu grada ili blizini središta, mnogi vozači parkiraju svoje automobile u okolne stambene gradske četvrti čime uzrokuju negodovanje domicilnog stanovništva i dodatno opterećenje na ulice. Gradske četvrti često karakterizira ilegalno parkiranje u obliku zauzimanja dijela prolaznih ulica, zauzimanje i pretvaranje otvorenih javnih površina u parkirališna mjesta. Gradska četvrt Baldekin III grada Šibenika predstavlja jednu od najmnogoljudnijih gradskih četvrti u Šibeniku gdje osim velikog broja automobila domicilnog stanovništva, nedomicilno stanovništvo parkira svoje automobile i odlaze prema središtu grada zbog obavljanja privatnih i poslovnih aktivnosti. Prevladavajući način parkiranja je izvan-ulični način parkiranja na parkiralištima uz stambene zgrade, i ulični način parkiranja gdje vlasnici svoja vozila ostavljaju uz rub gradskih ulica čime su izvorno projektirane dvosmjerne ulice pretvorene u jednosmjerne. Cilj ovog rada je da je prijedlog rješenja za ublažavanje i rješavanje problema parkiranja u gradskoj četvrti Baldekin III. Problem se može riješiti uvođenjem naplate parkiranja na uličnim površinama, pretvaranja nekih ulica u jednosmjerne, izgradnjom garažno-parkirnih objekata, upotrebom pametnih parkirnih rješenja, tj. općenito povećanjem parkirališnog kapaciteta. Navedene mjere i kružna, protočnija regulacija prometa rasteretila bi ulice i zadovoljile potrebe domicilnog stanovništva gradske četvrti za slobodnim parkirališnim mjestima. Svrha rada je prikazati problematiku parkiranja u gradskoj četvrti koja je osim parkiranja automobila domicilnog opterećena i parkiranim automobilima nedomicilnog

stanovništva, te rješenja kojima bi se ovim problemi mogli dosta ublažiti i riješiti na zadovoljstvo prvenstveno domicilnog stanovništva četvrti.

***Ključne riječi**: gradska četvrt, problemi parkiranja, prijedlozi rješenja, regulacija prometa*

1. UVOD

Rastuća stopa korištenja privatnih automobila u gradskim područjima nastala su kao rezultat rastućeg gospodarstva države. Zbog pristupačnih uvjeta kreditiranja i cijene automobila, besplatnih ili nominalnih naknada za parkiranje, neučinkovitog i sporog javnog gradskog prijevoza većina ljudi radije putuju privatnim automobilom nego javnim prijevozom (Parmar *et al.*, 2020). Ljudi radije posjeduju automobile jer automobili nude neusporedivu kombinaciju brzine, autonomije i privatnosti. Veći broj osobnih automobila na gradskim ulicama podrazumijeva i veću potražnju za parkirališnim prostorom. Činjenica je da ne postoji automobil koji je neprestano u pokretu, većina automobila provodi vrijeme u mirovanju bilo tijekom radnog vremena, bilo preko noći. Pod pojmom "parkiranje" smatra se prekid kretanja, smještaj i ostavljanje vozila u trajanju dužem od tri minute na površini predviđenom za tu radnju, tj. na parkirnom mjestu (Brčić *et al.* 2012). Problem s parkiranjem automobila u gradskim sredinama zapravo znači da postoji jaz između broja automobila kojima trebaju parkirna mjesta i broja parkirnih mjesta dovoljnih za automobile kojima je potrebno parkiranje (Ibrahim, 2017). Nedostatkom slobodnih parkirališnih mjesta u središtu grada ili blizini središta, vozači zbog toga što žele parkirati najbliže svom odredištu i kako bi izbjegli plaćanje naknade za parkiranje, parkiraju svoje automobile u okolnim stambenim gradskim četvrtima (Parmar *et al.*, 2020). Takav način parkiranja povećava pritisak na tim područjima što uzrokuje prosvjed domicilnog stanovništva gradske četvrti koja tada ima poteškoća u pronalaženju parkirnog mjesta za svoje automobile (Mingardo *et al.*, 2015). Zbog nedostatka dovoljnih površina za parkiranje u gradskim četvrtima dolazi do ilegalnog načina parkiranja odnosno parkiranja na površinama koja za to nisu predviđena (Brčić *et al.*, 2012), a koje se prikazuje u dva oblika. Prvi oblik obuhvaća parkiranje uz rub prolazne ceste i ulice gdje se tako zauzima jedna prometna traka, povećava opterećenje ostalih prometnih traka i uzrokuje zastoj u prometu. Drugi oblik obuhvaća zauzimanje i postepeno pretvaranje otvorenih javnih površina u parkirališne prostore. Vozila parkirana ilegalno na cesti ugrožavaju sigurnost pješaka, smanjuju raspoloživi prostor za hodanje, povećavaju opterećenje slobodnih prometnih traka, povećavanju propadanja cesta i zemljišta uz stambene objekte, uzrokuju zastoje u prometu, ometaju promet vozila i uzrokuju sukobe među domicilnim stanovnicima (Parmar *et al.*, 2020).

2. PREGLED LITERATURE

Gospodarski razvoj koji se dogodio u zapadnim državama tijekom posljednjih desetljeća prošlog stoljeća doveo je do povećanog porasta broja automobila. Povećana prodaja automobila dovela je do velikog broja domaćinstava s dva ili više privatnih automobila u kućanstvu, s druge strane to je rezultiralo većom potražnjom za parkirališnim mjestima (mjestima za parkiranje automobila) posebno u gradskim područjima (Tsakalidis, Tsoleridis, 2015). Mnogi gradovi pate od nedostatka parkirališnih površina što se može smatrati početnim razlogom problema s

parkiranjem u gradovima. U svjetskim gradovima kao što su Peking na 5 milijuna vozila dolazi 2 milijuna parkirališnih mjesta (Yan-ling *et al.*, 2016), i Hangzhou na 2,38 milijuna automobila dolazi 1,2 milijuna parkirališnih mjesta (Yang i Huang, 2017). Većina automobila svoje vrijeme provodi u stanju mirovanju, bilo tijekom radnog vremena ili preko noći. To znači da bi trebalo biti po dva mjesta za parkiranje svakog automobila, jedno na početku drugo na kraju putovanja. Zbog nedostatka dovoljnih površina za parkiranje, otvoreni prostori poput javnih trgova i prostora, mjesta društvenih okupljanja, zelenih površina, s vremenom i pod pritiskom problema parkiranja pretvaraju se u parkirališta. Automobili zbog parkiranja često zauzimaju prometne trakove kod dvosmjernih ulica, na taj način povećava se opterećenje na preostaloj prometnoj traci koja zbog ovog načina parkiranja često postaje jedina prolazna traka. Također, ovaj način parkiranja dovodi do zastoja u prometu, te uzrokuje nervozu i stres kod vozača.

U mnogim gradovima kada vozači ne mogu pronaći mjesto za parkiranje automobila na određenom području, u tom slučaju kruže obližnjim gradskim četvrtima tražeći mjesto za parkiranje. Taj fenomen se naziva kruženje (engl. *Cruising)* (Ibrahim, 2017). Kruženje je rezultat neocijenjenog (ili precijenjenog) vanjskog troška: vremenski trošak koji vozač koji zauzima parkirno mjesto nameće onima koji traže slobodno mjesto u toj blizini. Ovaj vanjski trošak varira od prostora do prostora i njegova veličina raste s atraktivnošću mjesta na kojem se nalazi parkirališno mjesto (Russo *et al.*, 2019). Kombinacija čimbenika, uključujući neprivlačan javni prijevoz koji nudi nisku razinu usluge, nedostatak uličnih i izvan-uličnih parkirališnih mjesta, neadekvatna edukacija vozača, te loša kontrola od strane policije ili prometnih redara, može dovesti do ilegalnih ili nezakonitih načina parkiranja. Ilegalni ili nezakoniti način parkiranja poput parkiranja na privatnim prostorima, prostorima za posebnu uporabu (npr. mjestu rezerviranom za osobe s invaliditetom ili trudnice s djetetom), dvostruko parkiranje (parkiranje pored već parkiranih vozila), parkiranje na autobusnim trakama ili autobusnim stajalištima, parkiranje na pješačkim prijelazima, parkiranje u neposrednoj blizini raskrižja, i parkiranje na uglovima čest su problem. U Grčkoj je proučeno ilegalno parkiranje u šest različitih gradova, u gradu Kosu 67 % svi parkiranih automobila bilo je ilegalno parkirano, u Solunu ilegalno parkiranje varira od 30 % do 75 % ovisno o mjestu parkiranja područjima (Tsakalidis, Tsoleridis, 2015). U Mexico Cityju automobili dominiraju na gotovo svakom kvadratnom centimetru javne površine, vlasnici vozila parkiraju se na ulicama, ivičnjacima, pločnicima, vrtovima, uličicama, bulevarima i biciklističkim stazama (Shoup *et al.*, 2017).

3. POLITIKA PARKIRANJA U GRADOVIMA S PRIMJERIMA RJEŠENJA

Planiranje izgradnje i upravljanje parkirališnim mjestima uključuje dovoljan broj parkirališnih mjesta, cijene parkiranja, lokaciju parkirališta u odnosu na krajnje odredište, kontrolu pristupa, kontrolu trajanja parkiranja ili kombinaciju navedenog (Snell *et al.*, 2017). Parkirališna mjesta su važan element i za mobilnost i za kvalitetu života u urbanim sredinama (Mingardo, 2016). U većini europskih država planiranje broja i upravljanje parkirališnim mjestima je u domeni lokalnih vlasti grada, kao što su određivanje koncesionara za upravljane parkirališnim mjestima, cijene parkiranja, područja koje će se naplaćivati, lokacije za izgradnju novih parkirališta, zona parkiranja, i vremenskog ograničenja parkiranja. Nacionalne vlade obično daju smjernice i standarde, ali se rijetko miješaju u kreiranje politike parkiranja. Na primjer, u Nizozemskoj zahtjevi za parkirališnim

mjestima koje koriste gradovi i manje općine obično se temelje na službenim standardima koje je objavila "Platforma za promet, infrastrukturu i javni prostor". U Velikoj Britaniji standarde za parkirališna mjesta postavljaju lokalne vlasti. Propisi o parkiranju definirani su kao "propisi koji kontroliraju tko, kada i koliko dugo vozilo može parkirati na određenom mjestu kako bi se dalo prioritet korištenju parkirališta" (Mingardo *et al*., 2015).

Mnoge gradske četvrti i stambene zgrade izgrađene su prije masovnog posjedovanja automobila, gdje je ispred zgrada s 10 do 20 kućanstava bilo na raspolaganju 4 do 6 parkirališnih mjesta, a parkirališnih mjesta na ulicama gotovo i nije bilo. Ovakav slučaj čest je u državama s bivšim socijalističkim uređenjem gdje masovno posjedovanje automobila nije bilo predviđeno u vrijeme projektiranja i izgradnje zgrada. S obzirom na povećani broj automobila, postojeće dvosmjerne ulice (jedna prolazni trak) počele su služiti kao parkirališna mjesta. Zbog malog broja parkirališnih mjesta ispred stambenih zgrada nova izvan-ulična parkirališna mjesta su se pojavila kao rješenje za problem, a posebno garaže za parkiranje (Rye, Koglin, 2014). Program za izgradnju garaža za parkiranje grada Beča od 2003 godine, stvorio je 160 garaža s oko 50000 parkirališnih mjesta (Jittrapirom i Emberger, 2011). U gradu Hangzhou, u 21 lokalnoj zajednici nakon ankete između domicilnog stanovništva o problemu nedostatka parkirališnih mjesta, odlučilo se ovaj problem riješiti izgradnjom garaža za parkiranje i naplatom uličnih površina (Yang, Huang, 2017). U gradskim četvrtima, čest je slučaj da se parkirališne površine ne naplaćuju jer je logika da stanovnici plaćaju porez i različite pristojbe lokalnim vlastima, i u skladu s tim imaju pravo besplatno parkirati svoj automobil ili uz nisku cijenu naplate (Mingardo, 2016). Autori (Ibrahim, 2017) smatraju da parkirališno mjesto treba promatrati kao nekretninu gdje njegov položaj određuje vrijednost i cijenu parkiranja koja se može mijenjati ovisno o potražnji. Autori (Shoup *et al*., 2017) smatraju da naknada za parkiranje povećava fleksibilnost vozača automobila jer omogućava kasniji dolazak i mogućnost pronalaženja slobodnog parkirališnog mjesta.

Gradovi kao što su Pasadena, Houston, Mexico City, San Diego, Kairo, Lagos, Mumbai i São Paulo prihode od naplate parkirališnih površina u gradskim četvrtima koriste za financiranje javnih usluga. Gradovi kao što su Lyon, Edinburgh, Haag, Rotterdam, Amsterdam, Utrecht, Leiden, Dordrecht, i Groningen za domicilno stanovništvo gradske četvrti imaju povlaštenu ili jeftiniju cijenu parkiranja automobila na uličnim površinama. Oni na mjesečnoj ili godišnjoj bazi plaćaju dozvolu za korištenje ulične parkirališne površine. Također domicilno stanovništvo može kupiti određeni broj besplatnih ili vrlo jeftinih sati parkiranja kako bi ih iskoristili za svoje posjetitelje na način da oni ne moraju plaćati parkiranje (Mingardo, 2016). U gradskoj četvrti Nangok-dong grada Seula problem parkiranja automobila domicilnog stanovništva, gradska uprava riješila je izgradnjom javnih parkirališta, na uličnim površinama označili su parkirališna mjesta rezervirana isključivo za domicilno stanovništvo (Seo, Kim, 2018). Mnogi gradovi kao što su Nice, Belin, London, Ghent, Los Angeles, San Francisco, Beijing, Tokyo, Stockholm, Bordeaux, Boston, Melbourne, Koln, Geneve od 2010. godine primjenjuju tehnologiju pametnog parkiranja. Ta tehnologija uključuje bežične senzorske mreže, mobilne aplikacije, digitalne parkirne automate s mogućnošću plaćanje preko registracijskih oznaka automobile, parkirališne senzore na kolniku, radarske senzori na uličnoj rasvjeti, kamere za prepoznavanje registarskih oznaka automobila (Lin, Rivano, Le Mouël, 2017). Tehnologija pametnog parkiranja može poboljšati učinkovitost parkirališne infrastrukture

pružanjem informacija korisnicima prije i tijekom putovanja, kao što su dostupnost parkirališnog mjesta, put do dostupnog parkirališnog mjesta, rezervaciju, trenutnu i očekivanu popunjenost u blizini odredišta putovanja (Snell *et al.*, 2017; Rye, Koglin, 2014).

4. PARKIRANJE U GRADU ŠIBENIKU

Grad Šibenik najveći je grad, ekonomsko i političko sjedište Šibensko-kninske županije. Promatrajući Jadransku obalu Republike Hrvatske nalazi se otprilike na sredini obalnog dijela. U administrativnom dijelu, Grad Šibenik podijeljen je na gradske četvrti koje čine urbani dio grada i mjesne odbore koji čine naselja izvan grada (do kojih ima 10 do 20 minuta vožnje automobilom). Urbani dio grada u kojem postoji ulični i zvan-ulični način parkiranja čine gradske četvrti Baldekin I, Baldekin II - Škopinac, Baldekin III, Crnica, Građa, Mandalina, Meterize, Plišac, Ražine, Stari grad, Šubićevac, Varoš, i Vidici (https://www.sibenik.hr/).U naseljima izvan grada u potpunosti prevladavaju obiteljske kuće gdje vlasnici imaj svoj dvorišta za parkiranje automobila, stoga ova naselja neće biti spominjana u radu. Prema popisu stanovništva iz 2011. godine grad Šibenik ima 46 332 stanovnika (urbano područje i naselja izvan grada), dok samo urbano područje ima 34 302 stanovnika. Prema istom popisu prosječan broj članova kućanstva u Republici Hrvatskoj je 2,8 (https://www.dzs.hr/). Uspoređujući broj stanovnika urbanog dijela grada Šibenika s prosječnim brojem članova kućanstva u Republici Hrvatskoj, urbani dio grada ima 12 250 stambenih jedinica. Prema svjetskim standardima a i u gradovima kao što su London, Beč, Singapur, Bangkok, broj parkirališnih mjesta po stambenoj jedinici je jedno parkirno mjesto po stambenoj jedinici (Jittrapirom, Emberger, 2011). Prema navedenom podatku grad Šibenik trebao bi imati 12 250 parkirališnih mjesta. Prema podacima iz Policijske uprave Šibensko-kninske županije koja ima sjedište u gradu Šibeniku, u urbanom dijelu grada Šibenika registrirano je 19 990 automobila (https://sibensko-kninska-policija.gov.hr/). Uspoređujući broj potrebnih parkirališnih mjesta s brojem registriranih automobila, omjer iznosi 1,63 automobila na jedno parkirališno mjesto.

U sjevernom dijelu grada koji obuhvaća gradske četvrti Šubićevac i Meterize uglavnom je zastupljen izvan-ulični način parkiranja zbog velikog broja stambenih zgrada s pripadajućim parkiralištima, dok na područjima četvrti gdje ima obiteljskih kuća parkirališna mjesta se nalaze u dvorištima kuća. U ovim četvrtima parkirališna mjesta se ne naplaćuju. U zapadnom dijelu grada koji obuhvaća gradske četvrti Crnica i Njivice uglavnom prevladavaju obiteljske kuće gdje se parkirališna mjesta nalaze u dvorištima kuća. Parkirališna mjesta srednjeg i većeg kapaciteta nalaze ispred trgovačkih centara PLODINE i SUPERNOVA koji su namijenjeni za kupce i ne naplaćuju se. Parkirališta koje se zbog blizine staroj gradskoj jezgri tijekom ljetne sezone (Lipanj – Rujan) naplaćuju a ostali dio godine su besplatni nalaze se kod bazena i na prostoru bivše tvornice TEF. Navedenim parkiralištima upravlja gradska tvrtka Gradski parking d.o.o. Šibenik (http://www.gradski-parking.hr/). U središnjem dijelu grada koji obuhvaća gradske četvrti Dolac, Gorica, Građa, Stari grad, Varoš, Plišac, Baldekin I, Badekin II – Škopinac podjednako su zastupljeni ulični i izvan-ulični način parkiranja s cijelo-godišnjom naplatom parkirališnih površina. Parkirališnim površinama upravlja gradska tvrtka Gradski parking d.o.o. Šibenik koje je parkirališne površine podijelila prema određenim zonama s pripadajućom cijenom parkiranja. Gradski parking d.o.o. Šibenik upravlja s 520 uličnih i 2372 izvan-uličnih parkirališnih mjesta. U istočnom dijelu grada

koji obuhvaća gradske četvrti Baldekin III, Vidici i Mandalina podjednako su zastupljen ulični i izvan-ulični način parkiranja zbog velikog broja stambenih zgrada s pripadajućim parkiralištima, i obiteljskih kuća. U ovim četvrtima ulični način parkiranja karakterizira zauzimanje jedne prometne trake od strane automobila a druga prometna traka je prolazna. Na području četvrti Baldekin III gradska tvrtka Gradski parking d.o.o. na jednom uličnom i dva izvan-ulična parkirališta u ulici Stjepana Radića (kod s košarkaške dvorane Baldekin) naplaćuje parkiranje, dok je u ostalom dijelu četvrti i četvrtima Vidici i Mandalina parkiranje besplatno.Također u ovim četvrtima uočen je veliki broj ilegalnog parkiranja automobila prvenstveno na zelenim površinama i pločniku.

5. GRADSKA ČETVRT BALDEKIN III GRADA ŠIBENIKA

Gradska četvrt Baldekin III (slika 1) nalazi se u središnjem dijelu grada Šibenika (promatrajući grad u smjeru istok-zapad) (http://www.sibenik.hr) izgrađena je između 60-ih i 80-ih godina prošlog stoljeća, tlocrtna površina gradske četvrti iznosi 766 290,42 m² (https://geoportal.dgu.hr/). Prema podacima iz Ureda za opću upravu Šibensko-kninske županije gradska četvrt Baldekin III u prosincu 2019. godine imala je 6480 birača (broj birača nije relevantan podatak za popis stanovnika, ali u ovom slučaju je poslužio za procjenu broja stanovnika s obzirom da je posljednji popis stanovnika bio 2011. godine). Uspoređujući broj birača gradske četvrti s prosječnim brojem članova kućanstva Republike Hrvatske iz 2011. godine, broj kućanstava na području gradske četvrti iznosi 2314 kućanstava. Broj parkirališnih mjesta s obzirom na broj kućanstava trebao bi biti isti. Na području ove četvrti nalaze se zgrada Veleučilišta u Šibeniku, studentska menza, dvije osnovne škole, pet vrtića za djecu, sportska dvorana, sportska teretana, nekoliko trgovinskih i mnoštvo ugostiteljskih objekata koji privlače promet i ljude. Svi ti objekti nemaju osigurana parkirališna mjesta, već se za parkiranje automobila koriste parkirališne površine uz stambene zgrade i gradske ulice. Također u gradskoj četvrti nalazi se pomorska teretna luka Šibenik, trgovački centar KAUFLAND, dok se u neposrednoj blizini nalazi gradska bolnica, srednja škola i robna kuća. Glavni cestovni prometni ulazi i izlazi automobila u ovu gradsku četvrt su s ulice Stjepana Radića, Put 1. Šibenskog partizanskog odreda, ulice Petra Preradovića, ulice Frana Supila i Marka Marulića (Kundid *et al.*, 2014) (slika 1, strelice narančaste boje). S obzirom na konfiguraciju terena, gornji dio gradske četvrti, iznad ulice 3. studenog 1944., Mariborske ulice i ulice Ivana Gundulića topografija terena je viša a prevladavaju obiteljske kuće. Srednji dio četvrti, između ulice 3. studenog 1944. i ulice Stjepana Radića je ravni dio gdje prevladavaju stambene zgrade. Južni dio četvrti, ispod ulice Stjepana Radića do željezničke pruge i trgovačkog centra KAUFLAND (ispod je smještena Luka Šibenik) topografija terena je niža a prevladavaju stambene zgrade.

Slika 1. Područje gradske četvrti Baldekin III u okviru Grada Šibenika (označeno linijama plave boje).



Izvor: obrada autora rada na podlozi karte Državnog geodetskog portala Republike Hrvatske (https://geoportal.dgu.hr/)

6. NAČINI PARKIRANJA U GRADSKOJ ČETVRTI BALDEKIN III

Prevladavajući postojeći način parkiranja u gradskoj četvrti Baldekin III, s obzirom na broj parkirališnih mjesta, je izvan-ulični način parkiranja (parkirališna mjesta uz stambene zgrade kapaciteta do najviše 50 mjesta npr. kod OŠ Tin Ujević u ulici Trg Andrije Hebranga, i ljekarne u ulici Stjepana Radića, garaže za parkiranje privatnih stambenih objekata, i nadzemne garaže za parkiranje uz neke stambene zgrade). Ulični način parkiranja, vlasnici automobila svoja vozila ostavljaju uz rub gradskih ulica (slike 2, 3, 4 i 5). Broj parkirališnih mjesta u gradskoj četvrti Baldekin III prikazan je u tablici 1. Također, pregledom stanja na području gradske četvrti, autori ovog rada utvrdili su između 100 i 110 ilegalno parkiranih automobila izvan obilježenog i uređenog parkirališnog mjesta, tj, na pločniku, kolniku i zelenim površinama, što predstavlja oko 15 % od ukupnog broja parkiranih vozila.

Tablica 1. Broj parkirališnih mjesta u gradskoj četvrti Baldekin III grada Šibenika.

Ulična parkirališna mjesta	252
Izvanulična parkirališna mjesta	770
UKUPNO	1022

Izvor: autori

Slika 2. Postojeći načini parkiranja u gradskoj četvrti Baldekin III.



Izvor: autori

Slika 3. Postojeći načini parkiranja u gradskoj četvrti Baldekin III.



Izvor: autori

Slika 4. Postojeći načini parkiranja u gradskoj četvrti Baldekin III.



Izvor: autori

Slika 5. Postojeći načini parkiranja u gradskoj četvrti Baldekin III.



Izvor: autori

Ulični način parkiranja predstavlja problem jer su ulice izvorno projektirane kao dvosmjerne, a ovakvim načinom parkiranja su postale jednosmjerne (kao na primjer: ulica Mandalinskih žrtava, Trg Andrije Hebranga, ulica 3. studenog 1944., dio Varaždinske ulice, dio Ulice Stjepana Radića). Također, problem u nekim ulicama je to što vlasnici kuća imaju svoje garaže, a automobile parkiraju ispred kuće čime ometaju dvosmjerno odvijanje prometa (kao na primjer dio Karlovačke ulice, dio Bosanske ulice, Mariborska, Mostarska, ulica, Ulica Josipa Jurja Strossmayera). S obzirom na besplatno parkiranje te položaj ove gradske četvrti i objekata koji se u njoj nalaze, dosta ljudi koji dolaze iz drugih dijelova grada a imaju poslovne ili privatne obveze u ovoj gradskoj četvrti ili središtu grada, svoje automobile parkiraju na ulicama i parkiralištima gradske četvrti Baldekin III od 2 sata do 10 sati. Ovo vrijeme se poklapa s radnim vremenom javnih institucija, obavljanjem poslova, odlaskom na radno mjesto, slobodnim aktivnostima, obrazovanjem, ugostiteljskim aktivnostima.

Domicilnom stanovništvu stvara se problem traženja slobodnog parkirališnog mjesta ispred svojih stambenih objekata. Također za vrijeme špice turističke sezone, vlasnici automobila stranih registarskih oznaka koji borave u iznajmljenim stanovima, zbog odlaska na otoke ili više-dnevne izlete parkiraju i ostavljaju automobile po nekoliko dana na istom mjestu. Ovo vrijeme parkiranja prema autorima (Brčić *et al.*, 2012) podijeljeno je srednje dugo parkiranje (od 2 do 6 sati), dugo parkiranje (od 6 do 10 sati) i dugotrajno parkiranje (više od 10 sati).

Provedena je analiza vremena zauzeća parkirališnih mjesta na području gradske četvrti gdje prevladavaju stambene zgrade. Područje karakterizira veća koncentracija automobila, ulični i izvan-ulični način parkiranja. Analiza je provedena od listopada 2019. do travnja 2020. godine, od 08:00 do 20:00 sati. Utvrđeno je da su parkirališna mjesta najviše zauzeta u vremenskim terminima od 08:00 do 16:00 sati, što je povezano s radnim vremenom, te od 18:00 sati do 20:00 sati. Parkirališna mjesta su najmanje zauzeta u vremenskim terminima od 15:00 do 18:00 sati. Na područjima gdje prevladavaju obiteljske kuće, a karakterizira ih manja koncentracija automobila i ulični način parkiranja, parkirališna mjesta su najviše zauzeta u vremenskim terminima od 08:00 sati do 16:00 sati. Vrijeme najveće koncentracije automobila također je povezano s radnim vremenom. Dok su parkirališna mjesta najmanje zauzeta u vremenskim terminima od 16:00 sati do 20:00 sati. Slobodnih površina za izgradnju i uređivanje izvan-uličnih parkirališnih površina ispred i pokraj stambenih zgrada je vrlo malo, to su najčešće male i zapuštene zelene površine uz stambene zgrade. Površine se mogu pretvoriti u parkirališta kapaciteta od 5 do 10 parkirališnih mjesta ako nemaju utvrđenu javnu namjenu.

7. PRIJEDLOZI ZA RJEŠAVANJE PROBLEMA PARKIRANJA

Problemi nedostatka parkirališnih mjesta nastoje se riješiti na više načina. Gradnjom podzemnih i nadzemnih javnih garaža, uz istodobno širenje područja u kojima parkiranje nije dopušteno. Uvođenjem i proširenjem pješačkih zona, širenjem prostora naplatnoga parkiranja, smanjenjem dopuštenoga trajanja parkiranja, povećanjem cijene parkiranja i poboljšanjem javnoga gradskog prometa (https://www.enciklopedija.hr/). Prijedlozi rješenja za ublažavanje i rješavanje problema parkiranja u gradskoj četvrti Baldekin III grada Šibenika uključuju izgradnju tri garaže za parkiranje, uvođenje naplate parkiranja na uličnim površinama, pretvaranje nekih ulica iz dvosmjernih u jednosmjerne. Uz navedeno predlaže se i korištenje pametnih parkirnih sustava. Pod pojmom "garaža" smatra se objekt kojem je primarna namjena parkiranje jednog ili više vozila (Brčić *et al.*, 2012). Budući da garaže mogu biti izgrađene u više etaža, omogućavaju višestruku iskoristivost površina za parkiranje stoga se smatraju najboljim načinom za parkiranje vozila na malom prostoru. Garaže osiguravaju znatno bolje iskorištenje prostora za parkiranje u odnosu na klasična parkirališta ali je izgradnja, ali održavanje takvih objekata višestruko skuplje nego ulične ili izvan-ulične parkirališne površine. Radi ekonomske racionalnosti, u garažama je potrebno osigurati dobru popunjenost u svim vremenskim intervalima tijekom dana i tjedna (Brčić *et al.*, 2012). Prema istraživanju iz grada Koprivnice o rješavanju problema nedostatka parkirališnih mjesta 41 % svih ispitanika smatra da bi se taj problem mogao riješiti izgradnjom garaža za parkiranje, što predstavlja najveći udio sudionika (Štajdohar, 2019).

Analizirajući potencijalni veliki slobodni prostor za izgradnju garaža za parkiranje na području gradske četvrti Baldekin III, najpovoljniji dio je srednji dio četvrti između ulice 3. studenog 1944. i ulice Stjepana Radića. Na tom području topografija terena je ravna. Dio južnog dijela gradske četvrti ispod križanja ulica Stjepana Radića i Mandalinskih žrtava također je povoljan. Gornji dio gradske četvrti koji je dosta izgrađen obiteljskim kućama, a topografija terena je viša, nema mjesta ni potrebe za izgradnju garaže za parkiranje. Područje šume na granici četvrti namijenjeno je za izgradnju novog raskrižja Rokići (http://www.sibenik.hr/). Područje ispod Vukovarske ulice od trgovačkog centra KAUFLAND do željezničkog kolodvora u korištenju je pomorske teretne luke Šibenik, te na tom prostoru trenutno nema mogućnosti za izgradnju garažno-parkirnih objekata. Na srednjem dijelu četvrti između ulice 3. studenog i ulice Stjepana Radića postoje tri potencijalne lokacije za izgradnju garaža zbog raspoloživog mjesta (slika 6, pravokutnici crne boje). Na ulici Trg Andrije Hebranga moguća je izgradnja dvije garaže, obje s dvije etaže. Na ulici Mandalinskih žrtva moguća je izgradnja jedne garaža s nadzemnom etažom. Garaže na ulici Trg Andrije Hebranga nalazile bi se ispod parka i dječjeg igrališta (slika 7), a nadzemna garaža u ulici Mandalinskih žrtava ispod dvije okolne zgrade (slika 8). Pristup garažama bio bi iz navedenih ulica. Garaže za parkiranje bile bi namijenjene prvenstveno za automobile domicilnog stanovništva koje žive u stambenim zgradama u blizini garaža. Za kupovinu ili iznajmljivanje prvog parkirališnog mjesta oni bi oni plaćali povlaštenu mjesečnu cijenu parkiranja, dok za eventualno drugo parkirališno mjesto plaćali bi veću cijenu. Na ulazu, garaže bi imale rampe čime bi se onemogućilo da se nedomicilno stanovništvo tamo parkira. Financiranje izgradnje garaža na navedenim lokacijama odvijala bi se po principu javno-privatnog partnerstva gdje bi u podjednakim udjelima sudjelovali grad Šibenik, gradska tvrtka koja upravlja parkirališnim mjestima i stanari ulica koji bi koristili garaže. Nakon izgradnje, prostori iznad garaža u ulici Trg Andrije Hebranga ponovno bi se uredio za prostor javne namjene kao što su dječje igralište ili park.

Tlocrtne površine navedenih raspoloživih prostora za izgradnju garaža iznose (https://geoportal.dgu.hr/): garaža ispod parka na ulici Trg Andrije Hebranga 2594,41 m²; garaža ispod dječjeg igrališta na ulici Trg Andrije Hebranga 1676,18 m²; te nadzemna garaža u ulici Mandalinskih žrtava 2858,45 m². Budući da se predložene garaže planiraju izgraditi na ograničenim površinama, tj. površinama koje imaju čvrste granice prostora koji se mogu iskoristiti za parkiranje, a koji je manji od stvarnih potreba za parkiranje te je potrebno utvrditi optimalan položaj i raspored mjesta za parkiranje s obzirom na veličinu i oblik raspoložive površine. Prema (Brčić *et al.*, 2012) za parkiranje jednog vozila u prosjeku je potrebna bruto površina od 25 m². Navedena bruto površina uključuje površinu za smještaj jednog vozila i zajedničku površinu za kretanje vozila. Dakle, okvirni broj mogućih parkirališnih mjesta s obzirom na dostupnu površinu može se izračunati prema izrazu:

$$N_{PM} \approx \frac{P}{25\ m^2} \quad (1)$$

gdje je N_{PM} – broj mjesta za parkiranje, P – površina dostupna za izgradnju parkirališta.

U tablici 2. prikazan je okvirni broj mogućih parkirališnih mjesta za svaku od predloženih lokacija garaža za parkiranje, prema formuli (1).

Tablica 2. Okvirni broj mogućih parkirališnih mjesta za svaku od predloženih lokacija garaža za parkiranje.

Lokacija garaže za parkiranje	Tlocrtna površina (m^2)	Okvirni broj mogućih parkirališnih mjesta
park u ulici Trg Andrije Hebranga	2594,41	206
dječje igralište u ulici Trg Andrije Hebranga	1676,18	134
Ulica Mandalinskih žrtava	2858,45	114
Ukupan broj parkirališnih mjesta		454

Izvor: autori

Prema navedenoj formuli kapacitet garaže ispod parka u ulici Trg Andrije Hebranga bio bi 206 parkirališna mjesta, u garaži ispod dječjeg igrališta u ulici Trg Andrije Hebranga 134 parkirališnih mjesta (obje garaža s dvije etaže), a u nadzemnoj garaži u ulici Mandalinskih žrtava 114 parkirališnih mjesta (garaža s jenom etažom), što ukupno iznosi 454 parkirališna mjesta. Zbog izgradnje ulaza i izlaza u garažu ispod parka u ulici Trg Andrije Hebranga izgubilo bi se otprilike 15 uličnih parkirališnih mjesta. Izgradnjom garaža za parkiranje, domicilni stanovnici dobili bi veliki broj mjesta za parkiranje svoih automobila, što bi i doprinijelo poboljšanoj kvaliteti života u četvrti. Parkiranjem u garaži, slobodna ulična parkirališna mjesta iskoristila bi se za parkiranje drugog ili trećeg automobila domicilnog stanovništva koje bi po povlaštenoj cijeni iznajmilo parkirališno mjesto. Također, umanjio bi se broj ilegalno parkiranih vozila na javnim površinama jer bi vlasnici automobila dobili mogućnost pravilnog parkiranja. U suprotnosti bilo bi omogućeno kažnjavanje nastavka ilegalnog parkiranja.

Prijedlog uvođenja naplate parkiranja na uličnim površinama podrazumijeva naplatu uličnih parkirališnih površina za domicilno stanovništvo gradske četvrti na načelu mjesečne karte po određenoj povlaštenoj cijeni (primjer ulica Vatroslava Lisinskog iza sportske dvorane Baldekin (http://www.gradski-parking.hr/), dok se za nedomicilno stanovništvo koje zbog poslovnih ili privatnih potreba svoje automobile parkira u ovom dijelu grada treba odrediti satna cijena parkiranja. Gradovi kao što su Brno (https://www.brnoexpatcentre.eu) i Firenza (https://www.visitflorence.com/) parkirališna mjesta na uličnim površinama označili su bojama (posebna boja za domicilne stanovnike, i posebna boja za nedomicilne stanovnike. Prijedlog pretvaranja nekih ulica iz dvosmjernih u jednosmjerne čime bi se omogućila kružna regulacija prometa uključuje pretvaranje Bosanske ulice, Karlovačku, i ulicu Mandalinskih žrtava u jednosmjerne ulice (slika 6). Ulica 3. studenog 1944. kao jedna od glavnih ulica četvrti ostaje dvosmjerna, postojeća ulična parkirališna mjesta trebaju se izmjestiti izvan prolazne prometne trake, a jedno od rješenja je uređenje već uništene zelene površine u parkirališna mjesta između drvoreda. Otkupom privatne nekretnine i građevinskim zahvatom u Varaždinskoj ulici, omogućio bi se jednosmjerni kružni tok prometa između Karlovačke i Varaždinske ulice. U ovim ulicama s jedne strane bio bi prolazni prometni trak a s druge strane postojeća besplatna ulična parkirališna mjesta bila bi pod naplatom. Također procjene autora su da bi se na uličnim površinama navedenih ulica označilo i dobilo još novih između 80 i 90 novih parkirališnih mjesta. Uvođenjem naplate i obilježavanjem novih

parkirališnih mjesta u navedenim ulicama, domicilne stanovnike potaklo bi se da za parkiranje automobila koriste svoje garaže. Mariborska ulica ostala bi jednosmjerna u smjeru kretanja zapad-istok koji je povoljniji zbog kvalitetnog ulaza s državne ceste D8. Na području ove ulice označilo bi se otprilike 30 parkirališnih mjesta.

Na istočnom kraju ulice izgradilo bi se malo okretište za automobile. Mostarska ulica ostala bi dvosmjerna zbog mogućnosti manjeg vremena kruženja automobila po tom dijelu četvrti (slika 6). Na kraju ulice 3. studenog 1944. i Mostarske ulice za stanare moglo bi se izgraditi malo kružno okretište (slika 6, krug crvene boje). U budućnosti zapadni kraj Mostarske ulice mogao bi se spojiti s Jadranskom magistralnom (državna cesta D8) gdje bi stanovnici četvrti imali mogućnost izlaza na cestu u zapadnom smjeru (prema izlazu na autocestu A1, Brodarici, Vrpolju). Na području ulice Mandalinskih žrtava, na 2 mjesta građevinskim radovima spojila bi se navedena ulica s Vukovarskom ulicom (slika 6, strelice plave boje). Također na kraju Gospićke ulice i ulice Josipa Jurja Strossmayera građevinskim radovima ove ulice bi se spojile s početkom Karlovačke i Varaždinske ulice (slika 6, strelice plave boje). Ovim građevinskim radovima omogućilo bi se spajanje navedenih ulica čime bi se ulazak/izlazak u taj dio gradske četvrti odvijao kružnim načinom.

Slika 6. Lokacije potencijalnih garaža za parkiranje (pravokutnik crna boja) i nove jednosmjerne ulice (žuta boja)



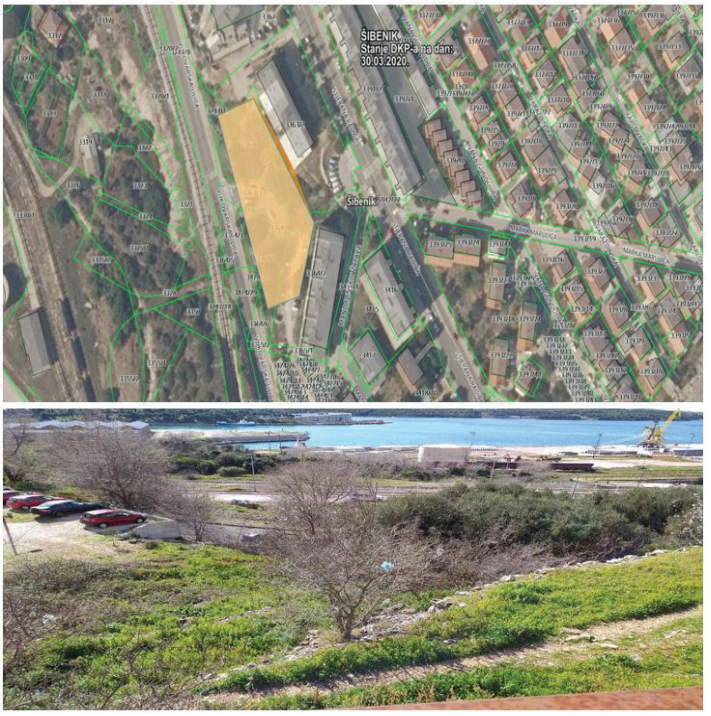
Izvor: obrada autora rada na podlozi karte Google Earth

Slika 7. Lokacije garaža za parkiranje na ulici Trg Andrije Hebranga



Izvor: Karte Državnog geodetskog portala Republike Hrvatske (https://geoportal.dgu.hr/), autori

Slika 8. Lokacije garaže za parkiranje u ulici Mandalinskih žrtava



Izvor: Karte Državnog geodetskog portala Republike Hrvatske (https://geoportal.dgu.hr/), autori

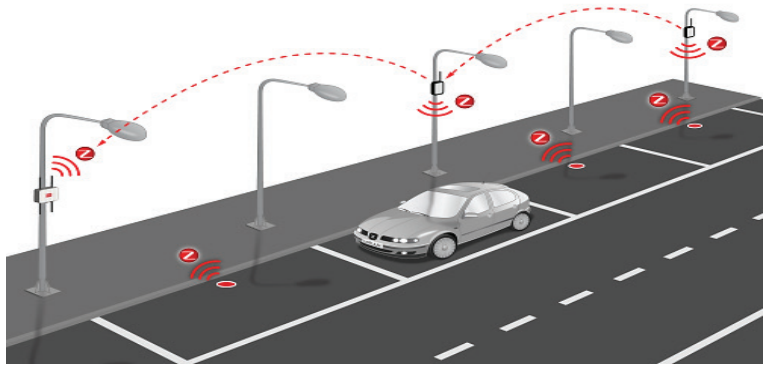
Jedan od načina rješavanja ili ublažavanja problema parkiranja u gradskoj četvrti Baldekin III, posebno uličnog načina parkiranja bilo bi uvođenje i primjena tehnologije pametnog parkiranja. Ovaj tehnologija sadrži pametna rješenja kao što su upotreba bežične senzorske mreže (Fernandes *et al.*), parkirališnih senzora na kolniku (slika 9), radarskih senzori na uličnoj rasvjeti (slika 10), digitalnih parkirnih automata s mogućnošću plaćanje preko registracijskih oznaka automobile, mobilnih aplikacija i dr. (Hanzl, 2020). Parkirališne senzore na kolniku od susjednih gradova Republike Hrvatske počeo je koristiti grad Split (https://www.nedapidentification.com/), dok se prema literaturi od 2017. godine parkirališni senzori koriste u gradu Cardiffu (https://www.smartparking.com/) i od 2019. godine u gradu Portsmouthu, u Velikoj Britaniji (https://www.expressfm.com/). Pilot-projekt upotrebe radarski senzora postavljenih na fasade zgrada ili ulične rasvjete pokrenut je u rujnu 2015. u Berlinu, gdje senzori smješteni na javnoj rasvjeti pokrivaju 250 metara dugački dio ulice (Hanzl, 2020).

Slika 9. Pametni parkirni senzori



Izvor: https://www.smartcitiesworld.net/connectivity/connectivity/smart-parking-gets-smarter

Slika 10. Djelovanje opreme za upravljanje parkirališnim mjestima



Izvor: https://www.engineeringexchange.com/profiles/blogs/smart-parking-systems-market-key-factor-responsible-for-the

8. ZAKLJUČAK

Danas je osobni automobil u doslovnom smislu postao "osobni" tj. pojedinac. Gotovo svaka obitelj ima minimalno jedan osobni automobil za razne namjene. Veći broj automobila znači i potrebu za većim brojem parkirališnih mjesta. Ulice i površine gradskih četvrti zbog parkiranja automobila domicilnog stanovništva i nedomicilnog stanovništva sve su više opterećene. Gradska četvrt Baldekin III grada Šibenik predstavlja jednu od najmnogoljudnijih četvrti u gradu Šibeniku. Zbog svoj položaja i objekata privlači veliki broj nedomicilnog stanovništva koji tamo parkiraju svoje automobile. Sve veći broj parkiranih automobila nedomicilnog stanovništva uzrokuje nezadovoljstvo domicilnog stanovništva koje sve više vremena troši na kruženje po četvrti i traženje slobodnog parkirališnog mjesta. Izgradnjom triju garaža za parkiranje gdje bi se dobilo oko 450 parkirališnih mjesta, pretvaranjem nekih ulica u jednosmjerne s obilježavanjem parkirališnih mjesta gdje bi se dobilo novih 110 do 120 parkirališnih mjesta domicilni stanovnici ove četvrti dobili bi veliki broj novih parkirališnih mjesta za svoje automobile. Obilježavanjem i uvođenjem naplate na uličnim parkirališnim površinama po principu jeftinije ili povlaštenije mjesečne cijene parkiranja za domicilno stanovništvo, a za nedomicilno stanovništvo višim satnim cijenama parkiranja, postiglo bi se da domicilno stanovništvo ima rezervirano svoje parkirno mjesto te bi se smanjile gužve po gradskoj četvrti. Pretvaranjem nekih ulica u jednosmjerne, te građevinskim zahvatima omogućila bi se kružna regulacija prometa po četvrti. Korištenjem pametnih parkirnih rješenja domicilni ili nedomicilni stanovnici prilikom dolaska u četvrt na svojim mobilnim telefonima dobili bi podatak o trenutno slobodnima mjestima, čime bi se smanjilo kruženje automobila po četvrti i vrijeme traženja parkirališnog mjesta. Svim predloženim rješenjima ublažili ili riješili bi se problemi parkiranja u gradskoj četvrti Baldekin III grada Šibenika na zadovoljstvo domicilnog stanovništva.

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Professional paper
https://doi.org/10.31784/zvr.9.1.25
Received: 14. 7. 2020.
Accepted: 2. 10. 2020.

CHARACTERISTICS OF PARKING PROBLEMS IN URBAN CITIES - CASE STUDY OF THE CITY OF ŠIBENIK WITH PROPOSALS FOR SOLVING THE PROBLEM

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ABSTRACT

The increase in the level of population`s motorization of both the Republic of Croatia and the city of Šibenik has led to the problem of stationary traffic and the required number of parking spaces for cars. Due to the lack of free parking spaces in the city center or near the center, many drivers park their cars in the surrounding residential areas of the city, causing discontent among the domicile population and an additional congestion on the streets. City districts are often characterized by illegal parking in the form of occupying driving part of the streets, occupying and turning open public areas into parking spaces. The district Baldekin III in the city of Šibenik is one of the most populous city districts in Šibenik where, in addition to a large number of cars of the domicile population, non-domicile residents park their cars and go to the city center for private and business activities. The predominant mode of parking is the off-street mode of parking in car parks next to residential buildings, and the street mode of parking where owners leave their vehicles along the edge of city streets thus turning originally designed two-way streets into one-way streets. The goal of this paper is to propose a solution to mitigate and solve the problem of parking in the city district Baldekin III by introducing parking fees on street areas, converting some streets into one-way streets, building garages, using smart parking solutions, in order to increase parking capacity, introduce roundabouts and more fluid traffic regulation, relieve the streets, and meet the needs of the domicile population of the city district for free parking spaces. The purpose of this paper is to present the issue of parking in the city district, which in addition to parked domicile cars is congested with parked cars of non-domicile population, and solutions that could alleviate these problems in order to primarily satisfy domicile population.

Key words: *city district, parking problems, proposed solutions, traffic regulation*

BIOTEHNIČKE ZNANOSTI

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Original scientific paper
https://doi.org/10.31784/zvr.9.1.26
Received: 21. 10. 2020.
Accepted: 10. 2. 2021.

PATTERNS OF SOIL PROCESSES ON DARK CHESTNUT SOIL UNDER CONDITIONS OF ITS USE IN THE CONDITIONS OF THE STEPPE OF UKRAINE

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ABSTRACT

As a result of four-year research, the patterns of soil processes development depending on the parameters of reclamation load were established. It was established that at the end of vegetation season irrigation of crops with water with high mineralization leads to deterioration of soil structure, where the largest amount of aggregates >10 mm (42.67%) was observed during disk tillage (a similar trend was observed for aggregates <0.25 mm). On average, during 2016-2019, under the influence of irrigation, the transformation of the ionic composition of the aqueous extract led to a change in the chemistry of salinity from sodium chloride-sulfate to calcium-sodium sulfate in all variants, regardless of the studied factors. The most favorable conditions for the formation of the yield in the experiment were created under a differentiated system of tillage with one split for crop rotation and with the

introduction of increased doses of fertilizers, which per 1 ha of crop rotation area provided the highest productivity, which was for corn 15.49 t/ha, sorghum - 8.72 t/ha, wheat winter - 7.07 t/ha, and only for soybeans the best conditions this year were created for 1 option - 4.27 t/ha. The highest level of profitability from 1 ha of crop rotation area was obtained for the average fertilization background 2 ($N_{120}P_{52,5}$) for differentiated tillage - 199%, while for other tillage systems and fertilizer doses it decreased to 33-189%.

Key words: *soil processes, Ionic-salt composition, methods of tillage, qualitative composition of soil structure, exchange cations*

1. INTRODUCTION - THE STATE OF STUDY OF THE PROBLEM

The development of irrigated agriculture is necessary for fulfilling the requirements of the increasing global population. However, the intensification of irrigated agriculture causes the twin menace of waterlogging and soil salinization in arid and semiarid regions of the world. Waterlogging and salinization have direct and indirect effects on crops growth and yield (Singh, 2015).

Agriculture in the Steppe of Ukraine occurs with a deficit of moisture and high air temperature, hydrothermal coefficient is 0.6-0.7, the coefficient of natural moisture is only 0.4, so in this region irrigation is one of the important factors of intensification of agricultural production. At the same time, it is one of the most powerful anthropogenic factors by influencing the soil and removing it from the systemic balance (Ромащенко et al., 2017).

Additional moisture supply under irrigation conditions leads to a change in the nature and direction of soil processes. The definition of these processes, their patterns is an urgent problem for the development of modern irrigated agriculture (Балюк et al., 2018).

The results of studies on the evolution of dark chestnut steppe solonetzic soil under conditions of different uses and climate aridization have shown that under the influence of agricultural use, in the arable and long-term irrigated soils, the direction of soil formation processes changes. This process affects the properties of soils leading to changes in agrophysical indicators (compaction, structural state deterioration, decrease in the strength of the microstructure and the water resistance of aggregates of dark chestnut steppe soil) (Baliuk et al., 2018).

Agro ameliorative monitoring revealed that reversible and irreversible processes take place in irrigated soils (secondary salinization, salinization, flooding, destruction of macro- and microstructure, removal of organic and nutrients, etc.) (Медведев, 2012).

2. TASKS AND METHODS OF RESEARCH

The aim of the research was to determine the nature and direction of changes in the properties of dark chestnut soil, the patterns of these changes under the influence of long-term irrigation and fertilizer application. The research was carried out in the area of the Ingulets irrigation system on the lands of the experimental field of the Institute of Irrigated Agriculture of NAAS in a stationary experiment, which was laid in 1971 on dark chestnut medium loamy soil. Agrotechnics of

cultivation of the studied crops (corn, winter wheat, soybeans, sorghum) was generally accepted for the conditions of irrigation of the Southern Steppe of Ukraine. Establishment of field research and their implementation were carried out in accordance with generally accepted methods. Analysis of the ionic-salt composition of aqueous soil extract was determined by the Giedroyc method, humus content - by Tyurin, exchangeable sodium - in the extract of 1% acetic acid ammonium, flame-photometrically, exchangeable calcium and magnesium - by DSTU 26487-85 [6-8].

The Coefficient of structure is calculated by the Fageler method:

$$Ks = \frac{b - a}{b} * 100$$

a - sludge content in% at microaggregate analysis;

b - sludge content in% with granulometric analysis

The Coefficient of water resistance is calculated by the the Nikolsky method:

$$Kv = \frac{(a * k_1) + (b * k_2) + \cdots + (n * k_n)}{A}$$

a, b, n - the number of aggregates disintegrated per minute; k_1, k_2 ... k_n - correction factor; A is the total number of aggregates taken for analysis.

3. RESEARCH RESULTS

The research fields of the Institute of Irrigated Agriculture of NAAS are located in the area of the Ingulets irrigation system, the main problem of which is the low quality of irrigation water, namely - increased mineralization and unfavorable chemical composition. Observations of the chemical composition of water were conducted from 2016 to 2019 during the growing season of plants. Water sampling was performed during irrigation. On average for 2016-2019, the mineralization of irrigation water ranged from 1.538-1.697 g/dm^3 (Table 1).

Table 1. Mineralization and ionic-salt composition of irrigation water on average for 2016-2019

Date of selection*	pH	The content of ions, mEq/dm^3 / %							Mineralization, g/dm^3
		CO_3^{2-}	HCO_3^-	Cl^-	SO_4^{2-}	Ca^{2+}	Mg^{2+}	Na^+	
April	8.3	-	3.12 0.190	12.80 0.454	11.20 0.538	4.8 0.096	8.6 0.103	13.72 0.316	1,697
May	8.1	-	3.08 0.188	12.32 0.437	10.20 0.490	4.6 0.092	8.0 0.096	13.00 0.299	1,602
June	8.0	-	2.48 0.151	10.80 0.383	11.20 0.538	4.0 0.080	7.80 0.094	12.68 0.292	1,538

July	7.7	–	2.72 0.166	10.80 0.383	11.00 0.528	4.2 0.084	8.2 0.098	12.12 0.279	1,538
August	8.2	–	1.96 0.120	12.00 0.426	11.30 0.542	3.8 0.076	8.6 0.103	12.86 0.296	1,563

Note: * - specified average data by month

The ionic-salt composition of irrigation water during the irrigation period was stable. The chemical composition of the water was anionic to sulfate-chloride, and the cationic composition to magnesium-sodium, according to DSTU 2730: 2015 Environmental protection. The quality of natural water for irrigation. Agronomic criteria.

In the chemical composition of irrigated water on average in 2016-2019, chlorides (46.34%) and sulfates (43.29%) of the total amount of anions predominated among the anions. Among the cations - sodium (50.98%) and magnesium (32.16%) of the sum of cations (Table 2).

Table 2. Irrigation assessment of irrigation water on average for 2016-2019

Date of selection	Mineralization, g/dm^3	pH	Concentration of toxic ions in equivalents Cl^-, mEq/dm^3	$\frac{100\ Na^+}{Ca^{2+} + Mg^{2+} + Na^+}$	$\frac{Mg^{2+}}{Ca^{2+}}$	$\frac{Ca^{2+}}{Na^+}$	The content of ions, mEq/dm^3		
							CO_3^-	HCO_3^-	Cl^-
April	1,697	8.3	15.21	50.6	1.8	0.35	–	3.12	12.80
May	1,602	8.1	14.55	50.8	1.7	0.35	–	3.08	12.32
June	1,538	8.0	13.11	51.8	2.0	0.32	–	2.48	10.80
July	1,530	7.7	13.09	49.2	2.0	0.35	–	2.62	10.80
August	1,563	8.2	14.16	50.9	2.3	0.30	–	1.96	12.00
Average	1,581	8.1	13.99	51.0	1.9	0.33	–	2.62	11.72

On average for the studied years, the content of non-toxic salts in irrigation water was 0.298 g/dm^3, and the content of toxic - 1.283 g/dm^3.

The content of toxic salts in chlorine equivalents, which characterizes the water quality at the risk of secondary salinization of the soil, averages 13.99 mEq/dm^3 for the studied year and belongs to class II (limited suitable for irrigation). In terms of the danger of soil alkalinization, salinization and toxic effects on plants, irrigation water also belongs to the same quality class. The pH of the water varied from 7.7 to 8.3.

Studies have shown that the irrigation of water of high mineralization changes the ratio of mesoaggregates of different sizes and their water resistance, but the structural and aggregate composition of the soil was also influenced by the system of tillage.

It is established that on average for 2016-2019 for systems of long-term application of shallow tillage in crop rotation in the phase of full maturity of soybeans in the control version (option 1), a maximum content of air-dry units of 0.25-10 mm was in arable land layers - 61.58%. The most agronomically valuable aggregates (size 1-5 mm) - 32.64%, which on the scale of assessment of the structural and aggregate composition of soils is characterized as satisfactory. The number of block aggregates with a size of >10 mm was 35.56%, and soil spraying (sum of aggregates <0.25 mm) was 2.86% and reached the best value in the experiment (Table 3). Under the influence of irrigation, the coefficient of soil structure ranged from 1.2 to 1.6. The highest rate was for shelf processing (option 1) and was 1.6, which exceed s the values obtained for other options.

Also, one of the important indicators of the properties of structural units is their water resistance, and its criterion is the coefficient of water resistance. The definition of water-resistant agronomically valuable aggregates (wet sieving) shows that the amount for shelf cultivation is 27.92%, ie according to the evaluation scale of DSTU 7872: 2015 Soil protection. Soil degradation. Assessment of chemical and physical soil degradation, the soil is characterized as unsatisfactory. The coefficient of water resistance was equal to 0.29 (Table 3).

Table 3. Changes in the qualitative composition of the structure of dark chestnut soil in different ways and the depth of its main cultivation (layer 0-40 cm) on average for 2016-2019

Unit size, mm (content,%)									Coefficient of structure (Ks)	Coefficient of water resistance (Kv)
>10	10-7	7-5	5-3	3-2	2-1	1-0.5	0.5-0.25	<0.25		
Shelf processing										
35.56	10.61 0.47	7.17 0.59	10.88 0.92	10.21 0.92	11.55 1.95	5.26 7.63	5.9 15.44	2.86 72.08	1.6	0.29
Shelfless cultivation - 1										
40.97	8.96 0.53	8.74 0.65	9.36 0.71	9.58 0.95	10.66 1.55	4.35 6.88	4.01 16.22	3.37 72.51	1.3	0.28
Shelfless cultivation - 2										
42.67	9.45 0.55	8.56 0.66	8.61 0.8	8.29 0.81	9.46 1.76	4.88 5.52	4.62 15.91	3.46 73.99	1.2	0.27
Differentiated - 1										
35.46	9.81 0.49	7.51 0.47	11.18 0.85	10.50 0.97	11.96 1.89	4.87 8.24	5.34 15.83	3.37 71.26	1.6	0.30
Differentiated - 2										
40.72	8.54 0.58	7.85 0.68	7.97 0.69	9.06 0.73	11.92 1.46	5.01 6.53	5.40 16.86	3.53 72.47	1.3	0.29

In the system of long-term use of multi-depth tillage in crop rotation after chisel tillage (option 2) there is a deterioration of the structural and aggregate composition of the soil relative to the control multi-depth shelf tillage in crop rotation (option 1), it was noted the decrease in the number of

agronomically-valuable sizes of mesoaggregates of 0.25-10 mm by 5.92%, most valuable aggregates 1-5 mm in size - by 3.4 %, waterproof aggregates - by 0.43 % and an increase in aggregates >10 mm - by 5.41%. The coefficients of structure and water resistance decreased to 1.3 and 0.28, respectively.

The most significant deteriorations of structural and aggregate composition in the experiment were observed for the implementation of disk shallow tillage (option 3) and for the system of long-term use of single-depth shallow tillage in crop rotation. There is a destruction and reduction of the number of agronomically-valuable mesoaggregates of 0.25-10 mm by 7.71%, the most valuable-aggregates of 1-5 mm - by 6.28%. The sum of aggregates >10 mm in this option was the largest in the experiment and reached 60.68% and there is a significant increase in soil dispersion (sum of aggregates <0.25 mm) by 0.6%, which is 3.46% compared with the data obtained from the control (option 1). Under such conditions, the structural factor decreases to 1.2. Water-resistant structure, which determines the structure of soils and its stability over time and resists the destructive action of water, decreased (the number of water-resistant units) - by 1.91%, which reduced the coefficient of water resistance - to 0.27, which is the lowest value of this indicator in the experiment. According to the scale of assessment of structural and aggregate composition, the soil in this variant (option 3) is characterized as unsatisfactory.

According to the results of research, there is a deterioration in the structural composition of irrigated soils, which occurs due to the destruction and reduction of agronomically valuable mesoaggregates of 0.25-10 mm and a sharp increase in aggregates over 10 mm. Partial replacement of absorbing calcium in the colloidal soil complex by absorbing magnesium and sodium causes the transition of a significant part of colloids to the state of reverse coagulation, which in turn leads to the destruction of the structure.

With long-term use of differentiated tillage with one split for crop rotation (option 4), the number of agronomically valuable mesoaggregates is observed at the control level, size 0.25-10 mm - 61.17%, which is less than only 0.41%; and the most valuable units with a size of 1-5 mm - 1% more. Soil brittleness (sum of units >10 mm) is also at the level of option 1 - 35.46%. The obtained data show that the scale of assessment of the structural and aggregate condition of the soil is characterized as satisfactory. Determination of water resistance of units (wet sieving) shows that the sum of units larger than 0.25 mm for systems of differentiated tillage (option 4) increased relative to control by 0.82%, which increased the coefficient of water resistance to 0.30, with the coefficient of structure at the level of shelf processing (option 1) – being 1.6.

After differentiated tillage in the system with one plow per rotation (option 5) there is a deterioration of the structural and aggregate composition of the soil relative to the control of different depth tillage in crop rotation. Namely there was a decrease in agronomically-valuable mesoaggregates of 0.25-10 mm by 5.83%; the most valuable units with a size of 1-5 mm - by 3.69%. Determination of water resistance of aggregates (wet sieving) shows that the sum of units larger than 0.25 mm for differentiated-2 systems (option 5) decreased by 0.39%. Under such conditions, the coefficients of structure and water resistance are 1.3 and 0.29, respectively, which is better than options 2 and 3.

The density of the soil structure characterizes the porosity and structure, water permeability, aeration and directly affects the water, air, thermal regimes and biological activity of the soil. The

density of the structure is characterized by greater dynamism, which is due to the duration of irrigation, humidity and fertilizer system.

For corn, the optimal density of the arable soil layer is 1.1-1.3 g/cm^3. The most optimal level of this indicator is provided by carrying out various depth system of the main tillage. Thus, the density of the soil layer at 0-40 during the period of seedlings in the variants of the experiment ranged from 1.24 to 1.31 g/cm^3 (Table 4).

Table 4. Density of formation and water permeability of the soil layer 0-40 cm depending on the method and depth of the main tillage at the beginning and end of the corn growing season on average for 2016-2019

№ (option)	Basic tillage system	The beginning of the growing season		The end of the growing season	
		Density, g/cm^3	Water permeability, mm/min	Denseness, g/cm^3	Water permeability, mm/min
1	Shelf processing	1.24	4.8	1.26	4.2
2	Shelfless - 1	1.27	4.1	1.29	3.6
3	Shelfless - 2	1.31	3.5	1.33	3.0
4	Differentiated-1	1.26	4.3	1.28	3.5
5	Differentiated-2	1.27	4.6	1.29	3.8

The top layer of soil 0-10 cm was the most loose. Intensive compaction process takes place in the variants of cultivation without rotation of the slice (options 2 and 3), reaching the maximum values in the variant of disk cultivation by 12-14 cm in the system of shelfless shallow single-depth main tillage in crop rotation.

Before harvesting, the density of addition increased to 1.26-1.33 g/cm^3. Characteristic of all variants is that the increased density of the soil layer 0-40 cm was formed mainly due to the compaction of the layers 10-20 and 20-30 cm, especially at the end of the growing season - the soil layer 30-40 cm.

In direct dependence on the density of the arable layer is its porosity. Thus, when determining at the beginning of the growing season the porosity of the soil layer 0-40 cm ranged from 49.8 to 52.4%. There was no significant difference between the options of basic tillage in the determination, both at the beginning of the growing season and before harvest. The lowest indicators of total porosity corresponded to the variant of disk tillage by 12–14 cm carried out against the background of long-term use of the system of shallow single-depth shelfless loosening in crop rotation during rotation and amounted to 49.8 and 49.0%.

Soil porosity during the corn harvest period decreased in all variants. The influence of experimental variants on this indicator had a similar tendency as in the germination period. The highest rate of porosity before harvest was observed for shelf different depth of main tillage and amounted to 51.72%.

One of the most important water-physical properties of the soil, associated with the density of composition and porosity, is the ability of the soil to absorb and filter through itself the water that is supplied during vegetation irrigation and comes with precipitation. In our experiments during the period of maize germination there is a decrease in water permeability by 1.3 mm/min in the variant of differentiated-1 and 2 shelfless single-depth main tillage in crop rotation (option 3). Close to the control were the indicators for the differentiated-2 system and were 4.6 mm/min, ie were within error.

The decrease in pre-harvest density led to a decrease in water permeability by shallow disk tillage by 28.6% compared to the control. Water permeability in the variant of disk tillage to a depth of 8-10 cm in the system of differentiated-2 main tillage (option 5) was 3.8 mm/min.

Correlation-regression analysis of the obtained indicators allowed to obtain the equation of the dependence of water permeability on the density of soil composition: $y=56{,}025x^2-161{,}09x+118{,}16$, ($R^2=0{,}8481$), which confirms the close relationship between these indicators and indicate that the regulation of the density of composition can significantly affect the water permeability of the soil.

That is, the reduction of soil composition density due to chisel tillage to a depth of 12-14 cm with one slit per rotation by 38-40 cm in the system of differentiated tillage (option 4) contributes to a stable increase in soil permeability.

Experimental data for 2016-2019 show that at the beginning of the winter wheat vegetation the content of exchange cations of 0-40 cm of the soil layer did not differ significantly in all the studied variants. In the plowing variants in the system of long-term application of different depth tillage and in the system of differentiated crop rotation (variants 1 and 4) against the background of fertilizer application, the content of absorbed calcium was insignificantly higher compared to other studied variants and averaged 12.5 meq/100 g (68% of the amount of absorbed cations) at 11.6 - 12.0 mEq/100 g in other variants (65-66% of the amount of absorbed cations). Differentiation of the absorbed sodium content was observed in the range of 0.59 - 0.71 mEq/100 g of soil (3.4-4.0% of the amount of absorbed cations), which indicates a weak degree of irrigation salinity according to this indicator. The content of absorbed sodium at the level of 0.71 mEq/100 g of soil (4.0%) of the amount of absorbed cations was observed for disk tillage to a depth of 12-14 cm in the system of shallow single-depth tillage in crop rotation (option 3) without fertilizers. The content of absorbed magnesium averaged 5.2-5.5 mEq/100 g of soil (29-31%).

Analysis of the data on the content of exchangeable cations in the 0-40 cm layer of soil at the end of the growing season shows that in all studied variants there is a slight increase in absorbed sodium (up to 1%), but this does not affect the degree of irrigation salinity and corresponds to a weak level.

Thus, the studied types of tillage do not show a significant impact on the physico-chemical process of desalination of the soil during the study period. Some decrease in the content of absorbed sodium in the composition of the soil absorption complex at the beginning of the growing season is probably due to the difference in agrophysical properties (Table 5).

Table 5. Dynamics of exchange cations in dark chestnut soil by different methods of basic cultivation on average for 2016-2019 of the winter wheat growing season

№ (option)	Basic tillage system (Factor A)	Beginning of growing season				End of the growing season			
		Content of exchangeable cations, mEq/100 g of soil			The amount of exchangeable cations, mEq/100 g of soil	Content of exchangeable cations, mEq/100 g of soil			The amount of exchangeable cations, mEq/100 g of soil
		Ca^{2+}	Mg^{2+}	Na^{+}		Ca^{2+}	Mg^{2+}	Na^{+}	
Power supply background (Factor B)									
No fertilizers									
1	Shelf processing	12	5.4	0.63	18.0	12	5.6	0.79	18.4
2	Shelfless - 1	12	5.4	0.68	18.1	11.8	5.6	0.83	18.2
3	Shelfless - 2	11.6	5.5	0.71	17.8	11.6	5.6	0.85	18.1
4	Differentiated-1	12	5.4	0.63	18.0	12	5.6	0.78	18.4
5	Differentiated-2	12	5.4	0.67	18.1	11.9	5.6	0.81	18.3
$N_{82,5}P_{45}$*									
1	Shelf processing	12.2	5.3	0.62	18.1	12.2	5.5	0.75	18.5
2	Shelfless - 1	12.1	5.4	0.66	18.2	12.1	5.6	0.79	18.5
3	Shelfless - 2	11.8	5.4	0.69	17.9	11.8	5.6	0.84	18.2
4	Differentiated-1	12.3	5.3	0.61	18.2	12.3	5.5	0.75	18.6
5	Differentiated-2	12.2	5.4	0.65	18.3	12.2	5.6	0.77	18.6
$N_{120}P_{52,5}$*									
1	Shelf processing	12.5	5.2	0.6	18.3	12.4	5.5	0.73	18.6
2	Shelfless - 1	12.2	5.3	0.65	18.2	12.2	5.6	0.77	18.6
3	Shelfless - 2	12	5.4	0.67	18.1	11.9	5.6	0.82	18.3
4	Differentiated-1	12.5	5.2	0.59	18.3	12.5	5.5	0.72	18.7
5	Differentiated-2	12.3	5.2	0.64	18.1	12.3	5.5	0.76	18.6
LSD_{05}, mEq/100 g of soil:		A = 0.03, A = 0.02, A = 0.005 B = 0.02, B = 0.02, B = 0.005				A = 0.03, A = 0.02, A = 0.005 B = 0.03, B = 0.02, B = 0.006			

Note: * - the average doses of fertilizers according to the studied agricultural products are indicated.

Analysis of the aqueous extract of dark chestnut soil on the studied variants showed that at the beginning of the soybean vegetation on average in 2016-2019, the content of water-soluble salts in the 0-40 cm layer was in the range of 0.74-0.86% (Table 6). The amount of toxic salts (0.046-0.057%) is not saline soil. The largest amount of toxic salts was observed in the variants without fertilizers 0.048-0.057%, the application of fertilizers slightly reduced their content to 0.046-0.056%. The ratio of calcium cations to sodium in the soil solution varies in the layer of 0-40 cm in the range from 0.73 to 1.03 units.

Table 6. Ion-salt composition of water extract in dark chestnut soil with different methods of basic cultivation and doses of fertilizers at the beginning of the growing season on average for 2016-2019

№ (option)	Soil layer	Ion content, mEq/100 g of soil							The amount of salts,%		Ca^{2+}/Na^{+}	pH
		CO_3^-	HCO_3^-	Cl^-	SO_4^{2-}	Ca^{2+}	Mg^{2+}	Na^+	general	toxic		
No fertilizers												
1	0-40	0.00	0.36	0.26	0.53	0.40	0.30	0.45	0.079	0.050	0.89	7.4
2	0-40	0.00	0.38	0.26	0.59	0.40	0.30	0.53	0.085	0.055	0.75	7.5
3	0-40	0.00	0.38	0.25	0.62	0.40	0.30	0.55	0.086	0.057	0.73	7.6
4	0-40	0.00	0.35	0.25	0.52	0.40	0.30	0.42	0.076	0.048	0.95	7.4
5	0-40	0.00	0.36	0.25	0.62	0.40	0.20	0.63	0.085	0.055	0.63	7.5
Power supply background 1 - $N_{82,5}P_{45}$*												
1	0-40	0.00	0.35	0.25	0.54	0.40	0.30	0.44	0.078	0.049	0.91	7.3
2	0-40	0.00	0.35	0.26	0.60	0.40	0.30	0.51	0.083	0.054	0.78	7.5
3	0-40	0.00	0.36	0.26	0.62	0.40	0.30	0.54	0.085	0.056	0.74	7.5
4	0-40	0.00	0.33	0.24	0.52	0.40	0.30	0.39	0.074	0.046	1.03	7.3
5	0-40	0.00	0.38	0.26	0.52	0.40	0.20	0.56	0.081	0.051	0.71	7.5
Power supply background 2 - $N_{120}P_{52,5}$*												
1	0-40	0.00	0.34	0.25	0.53	0.40	0.30	0.42	0.076	0.048	0.95	7.3
2	0-40	0.00	0.35	0.26	0.57	0.40	0.30	0.48	0.081	0.052	0.83	7.4
3	0-40	0.00	0.36	0.25	0.61	0.40	0.30	0.52	0.084	0.055	0.77	7.5
4	0-40	0.00	0.34	0.25	0.50	0.40	0.30	0.39	0.074	0.046	1.03	7.3
5	0-40	0.00	0.38	0.25	0.52	0.40	0.20	0.55	0.080	0.050	0.73	7.5

Note: * - the average doses of fertilizers according to the studied agricultural products are indicated.

Type of salinization of soil solution by ionic composition chloride-sulphate calcium-sodium. However, in the system of differentiated tillage with one slit for crop rotation on the background of fertilizer application, the type of salinization of the soil solution of sodium chloride chloride-sulphate is noted (NI Bazylevych, EI Pankova). Studies have shown that irrigation of the Ingulets irrigation system with an unfavorable ratio of monovalent and divalent cations leads to changes in the ionic-salt composition of the aqueous extract of the soil.

After harvesting, the content of water-soluble salts in the layer of 0-40 cm of soil increased in all variants of the experiment to 0.075-0.085%. The increase in salts was mainly due to the increase in SO_4^{2-} and Cl^- ions among the anions and Na^+ among the cations (Table 7). The content of toxic salts in the 0-40 cm layer in the soil of all variants of the experiment also increased by 12-15 relative percent. However, their lowest content is observed in the system of differentiated cultivation of crop rotation (option 4) on the background of making N_{180} 0.051% in the layer 0-40 cm. The ratio of calcium cations to sodium in the soil solution ranges from 0.44 to 0.85 units, which indicates the

development of the process of secondary salinization. Transformation of the ionic composition of the aqueous extract led to a change in the chemistry of salinity, it became the ionic composition of calcium chloride-sulfate in all variants, regardless of the factors studied. Metabolic processes in the soil-absorbing complex caused an increase in the number of sodium cations in the soil solution. Their highest content of 0.65-0.68 mEq/100 g of soil was observed in the variants of disk cultivation to a depth of 12-14 cm in the system of shallow single-depth tillage in crop rotation (option 3). Also during this treatment, in the variant without mineral fertilizers, the highest amount of sodium was observed in the experiment of 0.68 mEq/100 g in a layer of 0-40 cm. It should be noted that the highest ratio of water-soluble calcium to sodium in the ratio - 0.85 is observed in the variants with fertilizers on the background of the system of long-term use of different depth shelf and differentiated tillage in crop rotation (option 4).

Table 7. Ion-salt composition of water extract in dark chestnut soil with different methods of basic cultivation and doses of fertilizers at the end of the growing season on average for 2016-2019

№	Layer soil, cm	Ion content, mEq/100 g of soil							The amount of salts,%		Ca^{2+}/Na^{+}	pH
		CO_3^-	HCO_3^-	Cl^-	SO_4^{2-}	Ca^{2+}	Mg^{2+}	Na^+	general	toxic		
No fertilizers												
1	0-40	0.00	0.24	0.36	0.61	0.40	0.30	0.51	0.080	0.054	0.78	7.5
2	0-40	0.00	0.25	0.38	0.61	0.30	0.30	0.64	0.082	0.063	0.47	7.7
3	0-40	0.00	0.25	0.38	0.65	0.30	0.30	0.68	0.085	0.065	0.44	7.7
4	0-40	0.00	0.24	0.35	0.62	0.40	0.30	0.51	0.080	0.054	0.78	7.5
5	0-40	0.00	0.28	0.39	0.50	0.30	0.30	0.57	0.078	0.058	0.53	7.6
Power supply background 1 - $N_{82,5}P_{45}$*												
1	0-40	0.00	0.24	0.36	0.60	0.40	0.30	0.50	0.079	0.053	0.80	7.5
2	0-40	0.00	0.26	0.37	0.58	0.30	0.30	0.61	0.080	0.061	0.49	7.6
3	0-40	0.00	0.26	0.37	0.62	0.30	0.30	0.65	0.083	0.063	0.46	7.7
4	0-40	0.00	0.24	0.35	0.60	0.40	0.30	0.49	0.079	0.053	0.82	7.4
5	0-40	0.00	0.28	0.39	0.51	0.30	0.30	0.58	0.078	0.059	0.52	7.6
Power supply background 2 - $N_{120}P_{52,5}$*												
1	0-40	0.00	0.24	0.36	0.60	0.40	0.30	0.50	0.079	0.053	0.80	7.4
2	0-40	0.00	0.25	0.37	0.57	0.30	0.30	0.59	0.079	0.059	0.51	7.6
3	0-40	0.00	0.25	0.37	0.63	0.30	0.30	0.65	0.083	0.063	0.46	7.7
4	0-40	0.00	0.24	0.35	0.58	0.40	0.30	0.47	0.077	0.051	0.85	7.4
5	0-40	0.00	0.26	0.38	0.50	0.30	0.30	0.54	0.075	0.056	0.56	7.5

Note: * - the average doses of fertilizers according to the studied agricultural products are indicated.

Analysis of crop yield data on average for 2016-2019 shows that compared to plowing to a depth of 20-22 cm in the system of long-term use of shallow tillage in crop rotation (option 1), the increase in corn yield was only for disk tillage to depth 8- 10 cm in a system of differentiated cultivation

(option 4) and amounted to an average of factor a («way of cultivation») 3.0%, the level of yield depending on the dose of fertilizers 12,31-15,49 t/ha.

Disc tillage to a depth of 12-14 cm in the system of shallow single-depth tillage in crop rotation (option 3) led to a decrease in yield by 33.7%, and without applying fertilizer to the lowest yield in the experiment 3.11 t/ha. Fertilization with doses of N_{120} and N_{180} increased the yield on average by factor B ("dose of fertilizer") by 166.4 and 233.3%. When applying N_{90} sorghum, the yield was increased by 146.5%, the increase in the dose of mineral fertilizers contributed to a lower yield germination compared to other crops in the experiment, which on the background of N_{120} was 175.9%, respectively (Table 8).

The influence of the method of tillage on the yield of sorghum is a similar trend with other crops. Carrying out chisel tillage to a depth of 12-14 cm with a gap of 38-40 cm in the system of differentiated tillage (option 4) compared with plowing to a depth of 23-25 cm in the system of long-term application of shallow shelf tillage in crop rotation (option 1) increased yield on average by factor A («method of tillage») 2.9%. Replacement of deep tillage with disc tillage to a depth of 12-14 cm in the system of long-term use of single-depth shallow tillage in crop rotation (option 3) led to a decrease in yield by 32.1%, in other options - by 5.6-10.9%. The highest sorghum yield in the experiment was obtained in option 4 with the application of mineral fertilizers at a dose of N_{120}, which amounted to 8.72 t/ha.

Table 8. Crop yields on average in 2016-2019 under the influence of various elements of agricultural cultivation technology

№ (option)	Basic tillage system (Factor A)	Yield, t/ha			
		corn	soy	winter wheat	sorghum
Power background (Factor B)					
No fertilizers					
1	Shelf processing	3.63	2.81	3.11	2.82
2	Shelfless-1	3.96	2.46	3.00	2.50
3	Shelfless-2	3.11	2.07	2.81	2.14
4	Differentiated-1	4.77	2.77	3.17	3.35
5	Differentiated-2	4.32	2.27	2.89	2.32
Power background 1					
		N_{120}	$N_{30}P_{60}$	$N_{90}P_{60}$	$N_{90}P_{60}$
1	Shelf processing	11.98	3.59	5.97	7.54
2	Shelfless-1	11.05	3.41	5.91	7.15
3	Shelfless-2	7.97	2.83	5.89	4.96
4	Differentiated-1	12.31	3.64	6.05	6 , 51
5	Differentiated-2	11.91	3.22	5.92	6.83
Power background 2					
		N_{180}	$N_{60}P_{60}$	$N_{120}P_{60}$	$N_{120}P_{60}$
1	Shelf processing	15.06	4.27	6.89	7.70

2	Shelfless-1	14.43	3.92	6.82	7.40
3	Shelfless-2	9.87	3.15	6.74	5.17
4	Differentiated-1	15.49	4.01	7.07	8.72
5	Differentiated-2	14.24	3.49	6.77	6.94

In the experiment with winter wheat, fertilizer application increased crop yields on average by factor B («fertilizer dose») by 96.5 and 128.9%, respectively. The influence of tillage methods on the yield of winter wheat was less effective. When carrying out disk tillage to a depth of 8-10 cm in the system of differentiated tillage with one slit for crop rotation (option 4) there was an increase in winter wheat yield on average by factor A («tillage method») by 2%, while for others options (2, 3, 5), the shortage of harvest compared to plowing to a depth of 14-16 cm in the system of long-term use of different depth tillage in crop rotation (option 1) ranged from 1.5 to 5.2%.

Yields of soybeans for plowing to a depth of 25-27 cm (option 1) and tillage to a depth of 14-16 cm (option 4) on fertilized backgrounds was the highest and ranged depending on the doses of fertilizers in the range of 3.59-4.27 t/ha and 3.64-4.01 t/ha, respectively. With the reduction of tillage depth (option 3), the yield decreased on average by factor A («tillage method») by 24.6%. compared to control. When fertilizers were applied at doses of $N_{30}P_{60}$ and $N_{60}P_{60,}$ the yield increased on average by factor B ("fertilizer dose") by 34.8 and 52.2%, respectively.

Thus, the best conditions for crop yields in the experiment were created with a differentiated tillage system with one slot for crop rotation (option 4), and with the introduction of increased doses of fertilizers, which per 1 ha of crop rotation area provided the highest productivity for corn 15.49 t/ha, sorghum – 8.72, winter wheat – 7.07, and only for soybeans the best conditions this year were created by the option 1 – 4.27 t/ha.

To assess the economic and energy efficiency of agricultural cultivation techniques, production costs were calculated according to the norms and prices in force within the production boundaries of the Steppe zone of Ukraine (Table 9).

Table 9. Assessment of energy and economic efficiency of growing crops under the influence of various elements of technology on average for 2016-2019, t/ha

№	Profitability level,%			Gross energy output, GJ			Energy efficiency ratio		
	without fertilizers	$N_{82.5}P_{45*}$	$N_{120}P_{52.5}$ *	without fertilizers	$N_{82.5}P_{45*}$	$N_{120}P_{52.5}$ *	without fertilizers	$N_{82.5}P_{45*}$	$N_{120}P_{52.5}$ *
1	59	160	182	64.4	140.0	163.4	1.7	3.6	4.1
2	44	147	171	57.7	132.4	156.3	1.6	3.5	4.1
3	3 3	89	103	48.8	102.6	119.7	1.4	2.8	3.2
4	73	189	199	68.0	152.6	157.2	1.9	4.1	4.1
5	41	152	167	56.5	134.3	151.6	1.5	3.6	4.0

Note: * - the average doses of fertilizers according to the studied agricultural products are indicated.

The highest level of profitability from 1 ha of crop rotation area was obtained for the average feeding background 2 ($N_{120}P_{52.5}$) for differentiated tillage (option 4) - 199%, while for other tillage systems and fertilizer doses it decreased to 33-189%.

The lowest level of profitability was observed for disk tillage in the system of shallow single-depth tillage in crop rotation (option 3) on an unfertilized background - 33%. Analyzing long-term data, it was found that per 1 ha of crop rotation area chisel tillage to a depth of 12-14 cm with one slit per rotation of 38-40 cm in the system of differentiated tillage (option 4) is the most cost-effective.

It was determined that the yield of gross energy of crops per 1 ha of crop rotation area, depending on the methods of basic tillage in the unfertilized version and against the background of $N_{82,5}P_{45}$ was the highest at chisel tillage to a depth of 12-14 cm system of differentiated tillage (option 4) and amounted to 68.0 and 152.6 GJ/ha, and for $N_{120}P_{52.5}$ was the highest for long-term application of shallow tillage (option 1) - 163.4 GJ/ha, where the gross energy in the system of differentiated tillage (option 4) were slightly lower - 157.2 GJ/ha (Table 10). In the variants using different depth troughless (option 2) and differentiated-2 (option 5) main tillage, it ranged from 132.4-156.3 and 134.3-151.6 GJ/ha, depending on the feeding background. In the variant of shelf-free shallow tillage, the gross energy yield for fertilizer-free fertilizer variants, $N_{82,5}P_{45}$ and $N_{120}P_{52,5}$ - decreased to 48.8, 102.6 and 119.7 GJ, respectively.

It was determined that the lowest payback costs for growing crops was created by shallow single-depth shelfless main tillage (option 3), the energy factor according to the feeding backgrounds was: without fertilizers – 1.4; $N_{82.5}P_{45}$ – 2.8 and $N_{120}P_{52.5}$ – 3.2, respectively. While for chisel tillage to a depth of 12-14 cm with one slit per rotation of 38-40 cm in the system of differentiated tillage (option 4) it acquires the maximum value and reaches 1.9, 4.1 and 4.1, respectively to power backgrounds. Thus, the cultivation of crops under these options is economically and energetically justified.

4. CONCLUSIONS

As a result of research, the patterns of soil processes development depending on the parameters of reclamation load were established. It is established that at the end of vegetation of crops irrigation with increased mineralization leads to deterioration of soil structure.Their content decreased the most in the system of differentiated tillage. A similar trend was observed for soil dispersion.

The most favorable conditions for the formation of yields in the experiment were created under a differentiated system of tillage with one split for crop rotation and with the introduction of increasing doses of fertilizers, which per 1 ha of crop rotation area provided the highest productivity, for corn 15.49 t/ha, followed by sorghum - 8.72, wheat winter - 7.07, and only for soybeans the best conditions this year were created for 1 option - 4.27 t/ha.

The yield of gross energy of crops per 1 ha of crop rotation area depending on the methods of basic tillage and fertilizer doses in the unfertilized version and on the background of nutrition $N_{82,5}P_{45}$ on the yield of gross energy was the highest in the system of differentiated tillage. The energy

coefficient in the system of differentiated tillage was the maximum and reached 1.9, 4.1 and 4.1, respectively, according to the studied feeding backgrounds.

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Izvorni znanstveni rad
https://doi.org/10.31784/zvr.9.1.26
Datum primitka rada: 21. 10. 2020.
Datum prihvaćanja rada: 10. 2. 2021.

OBRASCI PROCESA TLA U TAMNO SMEĐEM TLU U UVJETIMA KORIŠTENJA U UKRAJINSKOJ STEPI

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SAŽETAK

Kao rezultat četverogodišnjeg istraživanja, utvrđeni su obrasci razvoja procesa tla ovisno o parametrima meliorativnih zahvata. Određeno je da na kraju razdoblja vegetacije navodnjavanje usjeva visoko mineraliziranom vodom vodi k propadanju strukture tla gdje je najveća količina agregata >10 mm (42.67%) zapažena tijekom tanjuranja (sličan je trend primijećen za agregate <0.25mm). U prosjeku, od 2016. do 2019. godine, pod utjecajem navodnjavanja, ionska izmjena vodenih ekstrakata vodi k promjeni sastava saliniteta od natrij klorida - sulfata do kalcij - natrij sulfata u svim varijantama, bez obzira na promatrane čimbenike. Najpovoljniji uvjeti za stvaranje uroda u eksperimentu ostvareni su diferenciranom metodom obrade tla u jednom polju u plodoredu i uvođenjem povišenih doza gnojiva, koje je za područje plodoreda veličine 1 ha najproduktivnije, koje je za kukuruz bilo 15 t/ha, sirak - 8.72 t/ha, ozima pšenicu - 7.07 t/ha, i samo su za soju najbolji uvjeti ove godine bili dobiveni u

jednom slučaju - 4.27 t/ha. Najviša razina profitabilnosti za područje plodoreda veličine 1 ha dobivena je za prosječnu drugu varijantu norme gnojidbe ($N_{120}P_{52,5}$) za diferenciranu metodu obrade tla - 199%, dok su se drugi sustavi obrade tla i doze gnojenja smanjile za 33 - 189%.

***Ključne riječi**: procesi tla, ionski sastav soli, metode obrade tla, kvalitativna struktura tla, izmjenični kationi*

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Izvorni znanstveni rad
https://doi.org/10.31784/zvr.9.1.27
Datum primitka rada: 11. 12. 2020.
Datum prihvaćanja rada: 18. 2. 2021.

INVAZIVNA VASKULARNA FLORA POŽEŠKE KOTLINE, REPUBLIKA HRVATSKA: RAZNOLIKOST I PROCJENA RIZIKA

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SAŽETAK

Strane, a posebno invazivne vrste često imaju negativan učinak na biološku raznolikost, ekonomiju, pa i ljudsko zdravlje. One su sposobne proizvoditi produktivno potomstvo i posjeduju potencijal širenja na značajnim površinama. Stoga je širenje invazivnih vrsta jedno od najvećih problema u zaštiti prirode. Praćenje rasprostranjenosti i procjena rizika invazivne vaskularne flore Požeške kotline vršeno je tijekom ljetnih mjeseci od 2017. do 2019. godine putem kombinirane procjene brojnosti i pokrovnosti. Istraživanjima je utvrđeno ukupno 34 invazivne svojte vaskularne flore kojima je pridružena porodica, životni oblik, geografsko porijeklo te je procjenjena faza procesa invazije. Za analizu povezanosti između nadmorske visine i pokrovnih vrijednosti invazivne flore Požeške kotline, primjenjena je multivarijantna statistička tehnika - CCA analiza. Najbrojnije vrstama su porodice Asteraceae i Poaceae. Analiza životnih oblika izdvojila je dominaciju terofita, ali i prisutnost hemikriptofita, fanerofita, geofita i hidrofita. Po porijeklu invazivne biljke pronađene u Požeškoj kotlini dolaze prvenstveno sa američkog područja, posebice Sjeverne Amerike, a zatim slijede one iz Azije i Afrike. Većina zabilježene invazivne flore nalazi se u stadiju ekspanzije tj. kolonizacije. Dobar dio je već naturaliziran, a dio je u fazi introdukcije. Nizinska područja do 200 m nadmorske visine pogoduju najvećem broju invazivnih biljaka. Samo manji broj biljnih vrsta je pozitivno koreliran s brežuljkastim područjima gdje se ističu vrste Phytolacca americana L. i Ailanthus altissima (Mill.) Swingle. Najviše zahvaćeni invazijom su ruderalna i poljoprivredna staništa.

Ključne riječi: *vaskularna flora, invazivne biljke (IAS), Požeška kotlina, stanišna raznolikost*

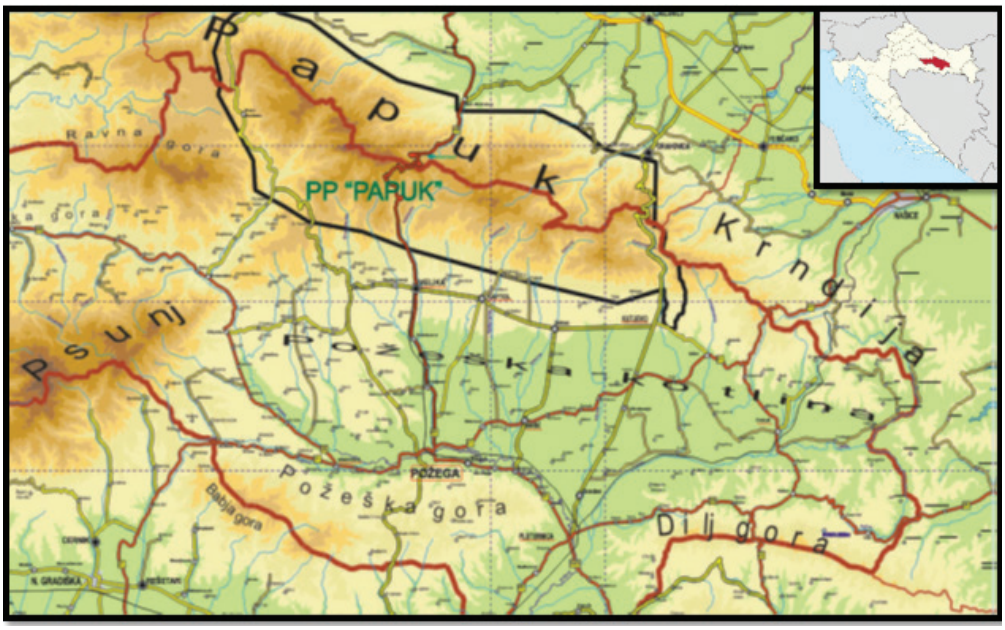
1. UVOD

Pod invazivnim biljkama podrazumijevaju se one vrste koje dolaze iz drugih biogeografskih područja, a u procesu kompeticije potiskuju autohtonu floru, prodirući u raspoložive ekološke niše (Richardson, Pyšek, 2006). Najčešće se šire kao slučajan pratilac raznih ljudskih aktivnosti, zauzimajući urbana i ruralna staništa, a potom se nesmetano rasprostiru i u slobodnoj prirodi. Zbog svoje izrazite sposobnosti uspješnog razmnožavanja, rasprostiranja i osvajanja novih prostora, ozbiljno ugrožavaju različite ekosustave, te se stoga smatraju drugom najznačajnijom prijetnjom biološkoj raznolikosti i po važnosti dolaze odmah nakon direktnog uništavanja staništa (Randall, 1996). Invazivne biljne vrste nerijetko imaju negativan učinak ne samo na biološku raznolikost narušavajući prirodnu ravnotežu u okolišu, već štete i ekonomiji i/ili ljudskom zdravlju (Kowarik, 2003).

Požeška kotlina odlikuje se velikim bogatstvom flore i vegetacije. To je, kako navodi Ilijanić (1977), odraz njenog specifičnog biljnogeografskog položaja gdje su jasno izraženi utjecaji nekoliko različitih flornih i vegetacijskih područja i to Panonske nizine, mediterana i submediterana, kao i Srednje Europe. Obilje podataka o flori ovoga područja nalazi se u radovima Tomaševića (1998, 2016), Rauša (1977), Pandže (2010) i dr. Premda se unutar njihovih istraživanja navode i vrste koje su danas poznate kao invazivne, njihova nalazišta im, međutim, nisu bila zabilježena.

Danas postoji mnogo literaturnih navoda vezanih za praćenje, procjenu rizika i kontrolu invazivnih biljaka (Betheny i sur., 2010, Jordan i sur., 2003, Vila i sur., 2010). Također su i zakonodavstva mnogih zemalja (uključujući i hrvatsko) donijela Uredbe vezane uz aktivan pristup rješavanju ovog problema s ciljem donošenja mjera za očuvanje biološke raznolikosti. Na europskoj razini je to Uredba o sprječavanju i upravljanju unošenja i širenja invazivnih stranih vrsta (Anonymous, 2014), a hrvatski Zakon o zaštiti prirode (NN 80/13, Članak 68), regulira njihov uvoz, uvođenje u ekosustave u kojima prirodno ne obitavaju i stavljanje na tržište Republike Hrvatske. Zbog navedenih razloga sustavno istraživanje invazivne flore predstavlja vrlo važan segment biološke znanosti, jer predstavlja direktnu primjenu u borbi za očuvanjem biološke i krajobrazne raznolikosti. Stoga je i cilj ovog istraživanja sustavno praćenje invazivne flore radi očuvanja biološke i krajobrazne raznolikosti na području Požeške kotline.

Slika 1. Požeška kotlina



Izvor: Zavod za prostorno planiranje Požeško – slavonske županije

Klima istraživanog područja je umjereno topla i kišna. Prema Riđanoviću (1977) klimatska obilježja ovog područja označavaju relativno visoke vrijednosti srednjih mjesečnih temperatura zraka i stabilan položaj ekstrema, maksimuma u srpnju i minimuma u siječnju. Oborine su jednoliko razdijeljene kroz godinu, a najsuši dio pada u hladno godišnje doba (Seletković, Katušin,1992). U Požeškoj kotlini je uz poljoprivredno zemljište (49,30%) u najvećoj mjeri zastupljen šumski pokrov (45,26%). Od poljoprivrednog zemljišta važno mjesto zauzimaju oranične površine, a sve više su zastupljeni i vinogradi i voćnjaci. U Požeškoj kotlini susreću se i tri tipa travnjaka: brdski, nizinski i močvarni. Tomašević (2016) navodi da brdski travnjaci ovog područja pripadaju razredu *Festuco-Brometea*, a da se na nizinskim razvijaju zajednice *Ononido-Arrhenatheretum elatioris*, *Bromo-Cynosuretum cristati.*

2. MATERIJAL I METODE

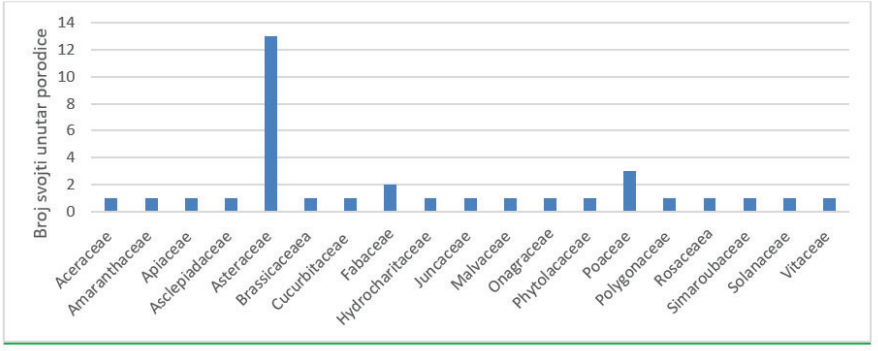
Floristička istraživanja su izvršena tijekom ljetnih mjeseci 2017. - 2019. godine. Područje istraživanja (Požeška kotlina s obroncima gora koje ju okružuju) je podijeljena na 60 kvadrata, te je u svakom kvadratu evidentirano prisustvo invazivne flore i procjenjena je njihova abundacija i pokrovnost. Svi lokaliteti su geopozicionirani i razdijeljeni u tri kategorije: nizinski (područja nadmorske visine do 200 m), brežuljkasti (između 200 i 350 m nadmorske visine) i brdski dio (područja viša od 350 m nadmorske visine). Determinacija biljnih vrsta obavljena je pomoću sljedećih floristićkih „ključeva": Domac (1994), Javorka i Csapody (1975), Tutin i sur. (1968 - 1980) i Tutin i sur. (1993) a nomenklatura je usklađena prema Nikolić i sur., (1994, 1997, 2000). Analiza životnih oblika određena je prema Pignatti (2002), a pet osnovnih oblika prikazano je kraticama: P – fanerofiti

(phanerophyta), H – hemikriptofiti (hemicryptophyta), G – geofiti (geophyta), T – terofiti (therophyta), Hy – hidrofiti (hydrophyta). Geografsko porijeklo invazivne flore navedeno je prema Boršić i sur. (2008) i pri tome su korištene sljedeće kratice: Am – Amerika (Sjeverna i Južna), As – Azija, Af – Afrika i Ea – Eurazija. Faze procesa invazije svake od utvrđenih biljnih vrsta razvrstane su unutar tri stadija prema Radosevich (http://www.weedcenter.org/textbook/) i Hobbs, Humpshires (1995). Prvi stadij jest introdukcija kada je broj invazivnih biljaka na novom području malen, a njihova abundacija se ne povećava duži niz godina. Drugi stadij jest ekspanzija tj. kolonizacija novog područja, a predstavlja razdoblje eksplozivnog širenja invazivne vrste. Treći, posljednji stadij jest faza naturalizacije gdje se invazivna vrsta integrirala u postojeću zajednicu, a ekspanzija se usporava. Pokrovnost invazivnih biljaka na istraživanom području utvrđena je putem Braun-Blanquet-ove skale (Braun- Blanquet, 1964) gdje vrijednost + ima raspon pokrovnosti ≤ 1%, vrijednost 1 ima raspon pokrovnosti od 1 – 5%, 2 odgovara rasponu pokrovnosti 5 – 25%, 3 ima raspon pokrovnosti 25 -50%, 4 je s rasponom pokrovnosti od 50 -75%, a vrijednost 5 ima raspon pokrovnosti od 75 – 100%. Statistička analiza izvršena je pomoću programa CANOCO 4,5 (Lepš, Šmilauer, 2003.) kojim se obrađuju multivarijantne analize podataka. U radu je korištena kanonička korelacijska analiza (CCA = engl. *Canonical Correspondence Analysis*) kojom se izračunavaju parovi linearnih funkcija varijabli uz uvjet da njihova povezanost bude maksimalna. CCA je odabrana nakon što su zavisne varijable testirane indirektnom analizom dužine gradijenta pomoću DCA analize (DCA = *detrendec correspondence analysis*). Međutim, zbog dugog gradijenta (4.112 SD jedinica) za multivarijantnu analizu primjenjena je prikladnija CCA metoda.

3. REZULTATI I RASPRAVA

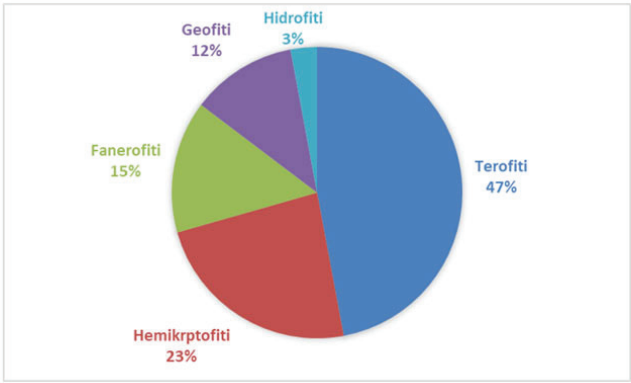
Na istraživanom području je utvrđeno ukupno 34 invazivne svojte vaskularne flore (Tablica 1.), pripadnika 18 porodica. Najbrojnija vrstama jest porodica Asteraceae (13), zatim slijede Poaceae (3) i Fabaceae (2), dok su ostale porodice samo s jednom zabilježenom invazivnom vrstom (Grafikon 1.). Porodica Asteraceae jest, kako navode Boršić i sur. (2008), porodica kojoj pripada više od jedne trećine ukupne invazivne vaskularne flore u Republici Hrvatskoj. Porodica Poaceae također je zabilježena u navedenom radu sa većim brojem svojti. Burda, 2018 navodi da su te dvije porodice najbrojnije i u Ukraini.

Grafikon 1. Zastupljenost porodica među invazivnim vaskularnim biljkama Požeške kotline



Od životnih oblika dominiraju terofiti (47 %), a zatim slijede hemikriptofiti (24 %). Fanerofitima pripada 15 %, a geofitima 12 %. Hidrofiti su zastupljeni samo sa jednom vrstom: *Elodea canadensis* Michx., odnosno s učešćem od 0,03 % u spektru životnih oblika (grafikon 2). Predominacija terofita podudara se i s analizom hrvatske invazivne flore (Boršić i sur. 2008), a također sa mnogim drugim istraživanjima (Pyšek i sur. 2002, Marini i sur. 2012). Kratkoća životnog ciklusa terofita (jednogodišnje biljke) daje im prednost, jer omogućava proizvodnju veće količine sjemena u jedinici vremena.

Grafikon 2. Spektar životnih oblika invazivne vaskularne flore u Požeškoj kotlini



Po porijeklu invazivne biljke pronađene u Požeškoj kotlini dolaze prvenstveno sa američkog područja, posebice Sjeverne Amerike (67,6 %). Porijeklom iz Azije jest 6 svojti (17,7 %), a ostala izvorišna mjesta su znatno slabije zastupljena (Tablica 1). Boršić i sur., 2008 navode da je postotak invazivnih biljaka unesenih sa američkog područja 71,9 %. To je očekivano zbog sličnosti u općim klimatskim prilikama između Europe i Sjeverne Amerike te zbog intenzivnih trgovačkih i prometnih veza.

Procjenom invazivnosti zabilježene alohtone vaskularne flore u Požeškoj kotlini utvrđeno je da se 21 % invazivnih vrsta nalazi u fazi introdukcije, 47 % u fazi ekspanzije, a za 32 % biljaka je utvrđeno da je nastupila naturalizacija. Među naturaliziranom florom svakako treba istaknuti alergenu korovnu i ruderalnu biljku *Ambrosia artemisiifolia* s rasponom pokrovnosti na istraživanom području od 50 do 75 %. Javlja se kao korov, posebice u okopavinama, a isto tako je zabilježena uz okućnice, ceste i puteve, uz željezničke pruge i na raznim ruderalnim staništima (Radojčić i sur. 2018). Istaknuti treba i ekspanziju vrste *Conyza canadensis* sa zabilježenim rasponom pokrovnosti od 25 do 50 %. Među onima u stadiju invazije ističu se *Rudbeckia laciniata* i *Bidens frondosa* sa rasponom pokrovnosti na teritoriju Požeške kotline od 1 – 5 %.

Tablica 1. Invazivna flora Požeške kotline i procjena stupnja njihove invazivnosti

Životni oblik	Svojta	Geografsko porijeklo	Procjena invazivnosti svojte u Požeškoj kotlini	
			Faza procesa invazije	Raspon pokrovnosti svojte
T	*Abutilon theophrasti* Medik.	EA, Af	ekspanzija	1-5%
P	*Acer negundo* L.	Am	naturalizacija	< 1%
P	*Ailanthus altissima* (Mill.) Swingle	As	ekspanzija	5 – 25%
T	*Amaranthus retroflexus* L.	Am	naturalizacija	5 – 25%
T	*Ambrosia artemisiifolia* L.	Am	naturalizacija	50 – 75%
P	*Amorpha fruticosa* L.	Am	ekspanzija	< 1%
H	*Angelica arhangelica* L.	EA	naturalizacija	1-5%
T	*Artemisia annua* L.	EA	naturalizacija	1-5%
G	*Asclepias syriaca* L.	Am	ekspanzija	1-5%
T	*Bidens frondosa* L.	Am	introdukcija	1-5%
T	*Chamomilla suaveolens* (Pursh.) Rydb.	As, Am	ekspanzija	5 – 25%
T	*Conyza canadensis* (L.) Cronquist	Am	ekspanzija	25 / 50%
T	*Datura stramonium* L.	Am	ekspanzija	1-5%
H	*Duchesnea indica* (Andrews) Focke	As	introdukcija	< 1%
T	*Echynocystis lobata* (Michx.)Torr.et Gray	Am	ekspanzija	1-5%
T	*Eleusine indica* (L.) Gaertn	As	ekspanzija	1-5%
Hy	*Elodea canadensis* Michx.	Am	ekspanzija	< 1%
T	*Erigeron annuus* (L.) Pers.	Am	naturalizacija	5 – 25%
T	*Erigeron annuus* (L.) Pers.ssp. *strigosus* (Muhlenb. Ex Willd.) Wagenitz	Am	ekspanzija	1-5%
T	*Galinsoga parviflora* Cav.	Am	ekspanzija	1-5%
G	*Helianthus tuberosus* L.	Am	introdukcija	< 1%
H	*Juncus tenuis* Wild.	Am	introdukcija	< 1%
T	*Lepidium virginicum* L.	Am	introdukcija	< 1%
H	*Oenothera biennis* L.	Am	introdukcija	< 1%
T	*Panicum capillare* L.	Am	ekspanzija	< 1%
P	*Parthenocissus quinquefolia* L.	Am	naturalizacija	1-5%
H	*Phytolacca americana* L.	Am	ekspanzija	1-5%
G	*Reynoutria japonica* Houtt.	As	ekspanzija	5 – 25%
P	*Robinia pseudoaccacia* L.	Am	naturalizacija	25 - 50%

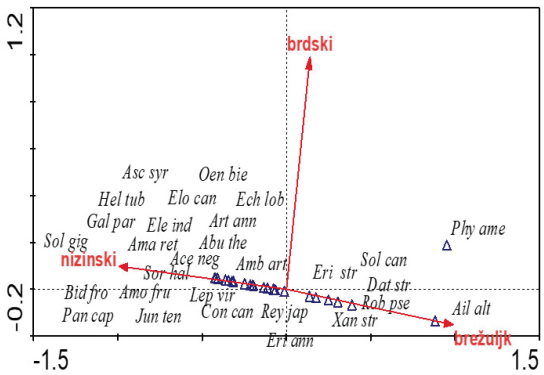
G	*Rudbeckia laciniata* L.	Am	introdukcija	1-5%
H	*Solidago canadensis* L.	Am	naturalizacija	5 – 25%
H	*Solidago gigantea* Aiton	Am	naturalizacija	5 – 25%
H	*Sorghum halepense* (L.) Pers.	Af, As	ekspanzija	5 – 25%
T	*Xanthium strumarium* L. ssp. *Italicum* (Moretti) D. Löve.	Am	naturalizacija	< 1%

Kanonička korelacijska analiza, kao mjerilo jačine povezanosti između dva seta varijabli, prikazana je Tablicom 2 i Grafikonom 3. Prve dvije ordinacijske osi CCA analize objašnjavaju ukupno 100 % varijabilnosti među vrstama. Prva ordinacijska os objašnjava 97,4 % varijabilnosti i izdvaja nizinska područja do 200 m nadmorske visine koja pogoduju najvećem broju invazivnih biljaka. Samo manji broj biljnih vrsta je pozitivno koreliran s brežuljkastim područjima (druga ordinacijska os, sa svega 2,6 % varijabilnosti). Tu se ističu vrste Phytolacca americana i Ailanthus altissima. Brojnost invazivnih biljnih vrsta redovito je, kako navodi Vuković (2015) negativno korelirana s nadmorskom visinom, odnosno, veće nadmorske visine sadrže značajno manji broj invazivnih biljaka.

Tablica 2. Sažetak CCA analize za pokrovne vrijednosti invazivnih biljaka unutar 60 kvadrata i prosječne nadmorske visine fitocenoloških snimaka

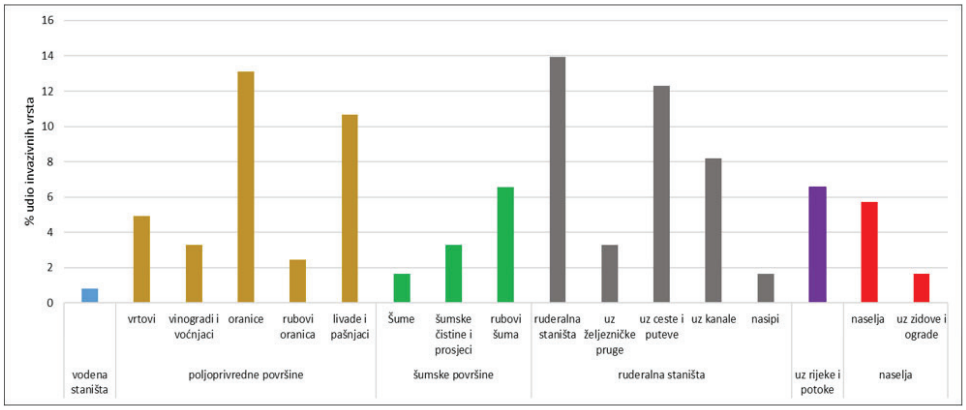
Osi	1	2	Ukupna varijanca
Svojstvena vrijednost (*eigenvalue*)	0,781	0,320	1,42
Postotak kumulativne varijance	97,4	100,00	
Suma svih kanoničkih svojstvenih vrijednosti (*eigenvalues*)			0,19

Grafikon 3. Ordinacijski graf invazivne vaskularne flore Požeške kotline i prosječne nadmorske visine na prvoj (X) i drugoj (Y) ordinacijskoj osi (nizinski: područja nadmorske visine do 200 m, brežuljkasti: između 200 i 350 m nadmorske visine i brdski dio: područja viša od 350 m nadmorske visine).



Analizu tipova staništa prikazuje Grafikon 4. Najviše zahvaćeni invazijom su ruderalna i poljoprivredna staništa. Od ruderalnih staništa posebno se ističu rubovi cesta i puteva i rubovi kanala, a od poljoprivrednih valja istaći oranice te livade i pašnjake. Chytrý i sur. (2005, 2009), Lambdon i sur. (2008), također ukazuju na to da su antropogena staništa puno podložnija invazijama od prirodnih.

Grafikon 4. Postotni udio staništa sa zabilježenim invazivnim biljkama Požeške kotline



4. ZAKLJUČAK

Prema izvršenim istraživanjima utvrđeno je na području Požeške kotline 34 invazivne biljne svojte, unutar kojih je značajno zastupljena porodica *Asteraceae*. Među invazivnom vaskularnom florom dominiraju terofiti, a po porijeklu najčešće dolaze sa sjevernoameričkog kontinenta. Većina zabilježene invazivne flore (47 %) nalazi se u stadiju ekspanzije tj. kolonizacije, naturalizirano je već 32 %, a u fazi introdukcije nalazi se 7 svojti odnosno 21 %. Među naturaliziranom florom izdvaja se alergena korovna i ruderalna biljka *Ambrosia artemisiifolia* s rasponom pokrovnosti na istraživanom području od 50 do 75 %. Vrste *Conyza canadensis* sa zabilježenim rasponom pokrovnosti od 25 do 50 % nalazi se u stadiju značajne ekspanzije, a u stadiju invazije ističu se *Rudbeckia laciniata* i *Bidens frondosa* sa rasponom pokrovnosti na teritoriju Požeške kotline od 1 – 5 %. Nizinska područja do 200 m nadmorske visine pogoduju najvećem broju invazivnih biljaka. Samo manji broj biljnih vrsta je pozitivno koreliran s brežuljkastim područjima. Tu se ističu vrste *Phytolacca americana* i *Ailanthus altissima*. Najviše zahvaćeni invazijom su ruderalna i poljoprivredna staništa.

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Original scientific paper
https://doi.org/10.31784/zvr.9.1.27
Received: 11. 12. 2020.
Accepted: 18. 2. 2021.

INVASIVE VASCULAR FLORA OF POŽEGA VALLEY, REPUBLIC OF CROATIA: DIVERSITY AND RISK ASSESSMENT

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ABSTRACT

Non native, and especially invasive plants, often have a negative impact on biodiversity, economy, and even on human health. They have rapid reproduction potential and are capable for dispersal over significat areal. They have a negative impact on biological diversity, economy and even on human health. Therefore, the spread of invasive plant species is consider as one of the biggest problems in nature protection. Research on prevalence and risk assesment of invasive vascular flora in Požega valley were conducted during the summer months from 2017 to 2019 using the Br. –Bl. (1964.) cover/abundance method. A thirty four invasive species were detected during the study period. Analysis according to family affiliation, life form, geographic origin and invasion stage were made. Multivariate statistical technique –CCA were use to analyse relation between elevation and cover values of invasive flora of Požega valley. The most numerous families are Asteraceae and Poaceae. Life-form analysis showed the predominance of therophytes, but also presence of hemicryptophytes, phanaerophytes, geophites and hydrophyte. Regaridng origin, majority of invasive alien species come from American continent, particularly from North America, followed by those from Asia and Africa. Most of them (47%) are in the stage of invasion i.e. colonisation. Many of them are already naturalised, and in invasion phase. Lowlands (elevation up to 200 m) are favorable sites for most of the invasive plants, and just small amount of them, like Phytolacca americana L. and Ailanthus altissima (Mill.) Swingle are positively correlated with the hilly areas. The most affected by the invasion are ruderal and agricultural habitats.

Key words: *vascular flora, invasive alien species (IAS), Požega valey, habitat heterogenity*

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Tablice, grafikoni i sheme moraju imati broj i naziv (piše se iznad tablice, grafikona, sheme) te izvor podataka (navodi se u podnožju u skraćenom obliku; ako je preuzeto iz određenog izvora – Prezime autora (godina); npr. Izvor: Driankov *et al.* (1996)). Numeriraju se u kontinuitetu arapskim brojevima (posebno grafikoni, posebno sheme).

Važna napomena: Ako tablica, grafikon ili slika sadržavaju posebne znakove te su rađeni u posebnom programu, dostavljaju se u posebnoj datoteci s točno navedenim i označenim položajem na kojem dolaze u tekstu.

Članak mora zadovoljavati sve tehničke propozicije navedene u ovim uputama.

Stil i organizacija teksta

Autori se obvezno moraju pridržavati znanstvene metodologije prezentacije građe u pisanju tekstova koja je uobičajena u znanstvenim publikacijama (*Harvard style*).

To zahtijeva sljedeći pristup:

(1) Naslov i organizacija prezentacije građe:

Naslov je najvažniji sažetak rada koji mora odražavati sadržaj i svrhu rada. Mora biti jasan, koncizan i informativan (veličina fonta 14).

Građu se raspoređuje u dijelove kao što su:

- Sažetak (*Abstract*) – ispod naslova
- Ključne riječi
- Uvod
- Metodologija/metoda/model/koncepcija analize – u drugom poglavlju
- Empirijski podaci (dokumentacijska podloga) i analiza – slijede u trećem poglavlju.
- Rezultate i diskusiju – prezentira se u četvrtom poglavlju
- Zaključci – (naravno) slijede na kraju.

(2) Sadržaj pojedinih dijelova prezentirane građe:

a. *Sažetak* – na skraćeni način opisuje sadržaj članka, sadrži opći prikaz teme i ispisuje se u 150 - 250 riječi *single spaced*, veličina fonta 10, *italic*, obvezno treba sadržavati:

- utvrđeni cilj istraživanja
- metodu/model/koncepciju analize
- glavni rezultat istraživanja (analize)
- temeljni zaključak istraživanja

Sažetak se ne smije pisati u odlomcima.

b. *Ključne riječi* – moraju odražavati suštinu sadržaja rada, a navodi se tri do pet takvih riječi (veličina fonta 10, *italic*).

c. *Uvod* – sadrži definiranje problema i predmeta istraživanja s pozivom na recentnu literaturu, odnosno rezultate istraživanja (taj se dio može istaknuti i u posebnom, tj. 2. poglavlju kao *Literature review*); pri kraju uvodnog dijela utvrditi radnu/e pretpostavku/e (hipotezu/e) istraživanja – o kojoj/kojima se treba očitovati (kasnije) na početku zaključaka; taj dio završiti s naznakom organizacije teksta.

d. *Metodologija/Metoda/Model/Koncepcija* – obično se prezentira u drugom poglavlju; metoda/model/koncepcija analize mora biti transparentno istaknuta radi eventualnog (ponavljanja) testiranja rezultata od zainteresiranih istraživača (to je jedno od temeljnih pravila znanstvene metodologije).

e. *Empirijski podaci i analiza* – sadržavaju dokumentacijsku podlogu i rezultate analize.

f. *Rezultati i rasprava* – objasniti rezultate, osobito njihovo ekonomsko značenje i poruke.

g. *Zaključak* – treba imati u vidu da taj dio teksta nije i ne smije biti rezime! Zaključci su autorovo originalno mišljenje (ocjena) o dobivenim rezultatima te sadrže očitovanje o

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(3) *Literatura* – navesti samo one naslove (izvore) koji su korišteni u tekstu! Koristi se veličina fonta 9; viseći prvi redak.

Iza teksta članka na hrvatskom jeziku i popisa literature treba priložiti sažetak članka na engleskom jeziku (do 250 riječi). Uz sažetak na engleskom jeziku navodi se i naslov članka te ključne riječi (u konačnom prihvaćenom radu za objavu navode se i podaci o autorima na engleskom jeziku).

TABLICE dolaze unutar teksta. Svi podaci u tablici stavljaju se u redove i stupce odvojene jednostrukim tankim linijama. Svaki stupac sadrži naziv i uključuje numeričku jedinicu koja se odnosi na cijeli stupac. Tako se za višeznamenkaste brojeve rabe jedan ili dva broja, a u nazivu za određeni stupac označuju se numeričke jedinice u tisućama, milijunima i sl. Tablice se numeriraju u kontinuitetu arapskim brojevima (tablica 1, tablica 2 itd.), a pored broja i naziva, moraju imati i izvor podataka.

GRAFIKONI I SHEME dolaze unutar samog teksta. Moraju imati broj, naziv i izvor podataka. Numerira ih se u kontinuitetu arapskim brojevima (posebno grafikoni, posebno slike). Izvori podataka, navode se ispod grafikona, odnosno slika.

Napomena. U tekstu se ne prepričavaju i ne ponavljaju rezultati koji su navedeni u tablicama i grafikonima, već se rabe referentne oznake koje upućuju na podatke u tablicama ili grafikonima.

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- *Knjige*: prezime, inicijali (godina) Naslov, mjesto izdavanja: ime izdavača

Mohr, L. B. (1996) *Impact analysis for program evaluation*, 2nd. ed. London: Sage

Ako su dva ili tri autora, redom navesti njihova prezimena i inicijale (godinu) *Naslov*, mjesto izdavanja: ime izdavača

Ridderstråle, J., Nordström, K. (2004) *Karaoke Capitalism Management for Mankind*, Harlow: Pearson Education Ltd.

Perišin, I., Šokman. A., Lovrinović, I. (2001) *Monetarna politika*, Pula: Sveučilište u Rijeci, Fakultet ekonomije i turizma "Dr. Mijo Mirković"

Ako je više autora (četiri ili više), navodi se prezime prvog autora nakon čega slijedi *et al.*

Norton, M. B. et al. (1981) *A People and a Nation – A History of the United States*, Boston: Houghton Mifflin Company.

- *Časopisi:* prezime, inicijali (godina) "Naslov članka", *naziv časopisa u kojem je objavljen*, volumen(broj), stranice

Fox, S. (1994) "Empowerment as a Catalyst for Change: An Example from the Food Industry", *Supply Chain Management*, 2(3), p. 29-33

Ako je više autora (četiri ili više), navodi se prezime prvog autora nakon čega slijedi *et al.*

Di Noia, C. et al. (1999) "Should Banking Supervision and Monetary Policy Tasks be Given to Different Agencies?", *International Finance*, 2(3), p. 361-378

Ako je više radova istog autora objavljenih iste godine, uz godinu se rabe oznake "a, b, c":

Quah, Danny Tyson. (1993 a) "Empirical Cross-section Dynamics in Economic Growth", *European Economic Review*, 37(2-3), p. 426-434

Quah, Danny Tyson. (1993 b) "Galton's Fallacy and Tests of the Convergence Hypothesis", *Scandinavian Journal of Economics*, 95(4), p. 427-443

- *Izvori preuzeti s interneta*: prezime autora/urednika, inicijali imena, (godina), "Naslov članka", *Naslov časopisa*, datum publikacije, godište, broj, stranice, adresa na internetu (datum pregleda adrese na internetu)

Ako kod izvora preuzetih s interneta nema autora: adresa na internetu (datum pregleda adrese na internetu).

Martin, C. L. (1998) "Relationship Marketing: a High-Involvement Product Attribute Approach, *Journal of Product and Brand management*, 7(1), p. 6-26, http://www.apmforum.com/emerald/marketing-research-asia.htm (3. 10. 2002.)

- *Knjige sabranih djela*: autor poglavlja/odjeljka (godina) "Naslov poglavlja/odjeljka". U: ime izdavača ili autora sabranih djela, *Naslov sabranih djela*, mjesto izdavanja: izdavač.

Silobrčić, V. (2000) "Znanstvena proizvodnost i kriteriji vrednovanja znanstvenika u Hrvatskoj". U: Sunko, U. D. (ur.) *Znanost u Hrvatskoj na pragu trećeg tisućljeća*, Zagreb: HAZU.

- *Radovi u Zborniku skupa*: autor (godina izdanja) "Naslov članka". U: *Naslov zbornika*. Mjesto izdanja: izdavač, stranice

Fedchak, E., Duvall, L. (1996) "An engineering approach to electronic publishing" In: *Proceedings of the International Workshop on Multimedia Software Development*, 25-26 March. Berlin, Los Alimos, Ca: IEEE Comput. Soc. Press, p. 80-88.

- *Teze i disertacije*: navodi se ime autora (godina) naslov, te institucija gdje su teze obranjene

Whitehead, S. M. (1996) *Public and private men: masculinities at work in education management*, doktorska disertacija, Leeds Metropolitain University

- *Službene publikacije*: naziv publikacije/organizacije/ustanove, (godina) *Naslov*, mjesto izdavanja: izdavač

Department of the Environment (1986) *Landfilling wastes*. London: HMSO (*Waste management paper*, 26)

Autori bi trebali u popis referenci uključiti i DOI brojeve (kao poveznicu). DOI broj je moguće pronaći putem obrasca *Simple Text Query form* (Crossref; poveznica: https://apps.crossref.org/SimpleTextQuery). DOI broj autor upisuje na kraju pojedine reference u sljedećem obliku: https://doi.org/10.31784/zvr.7.1.3

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Contributions should be written in standard language free of spelling and grammar mistakes. The authors are responsible for language editing. Before the final publication of accepted articles, a test print will be sent to authors to proofread, and at this stage, only misprints will be corrected.

Editorial Board disclaims responsibility for language and printing errors.

If none of the authors speak Croatian, the Editorial Board will provide translation of the article summary (including the title and key words) into Croatian.

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Review Process

All articles submitted for publication are reviewed by two anonymous and independent reviewers. The names of the authors will also be unknown to the reviewers. Reviewers evaluate the article following some already given criteria by filling in a reviewer evaluation form. If the reviewers find that the article does not meet international standards and the Journal criteria, the Editorial Board does not accept the article. If the reviewer gives a positive review the article can be categorized into one of the following categories:

- *Original scientific paper* – an original scientific work which presents new results of some fundamental or applied research. The article is written in a way that using the information given the following can be done:
    - reproduce methodological procedures and mathematical calculations obtaining equally accurate results or within the permitted deviation as indicated by the author himself; or
    - repeat the author's observations and judge his analyses; or
    - check the accuracy of the analyses' results and deductions on which the author bases his findings.
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- *Conference paper* – can be published only as a full text previously presented at a scientific conference, but not published as a complete article in conference proceedings.

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After the reviews have been completed the Editorial Board analyzes them. Reviewer's comments are sent to the author after both reviews are received. If necessary, the author needs to adjust his/her paper to the reviewer's demands. In cases where the quality and originality of the text in not in question the Editorial Board is empowered to intervene. In case it is necessary, the Editorial Board may ask the third reviewer for an opinion.

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Only categorized papers given two positive reviews are published. After the review process has been completed and the articles changed and revised by the authors and the Editorial Board, the Editor-in-Chief proposes the sequence of the accepted articles in the table of contents.

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(2) If the reviewers have categorized the article in different categories, the Editor-in-Chief proposes to the Editorial Board the categorization in favour of the author, i.e. to a higher category;

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GUIDELINES FOR AUTHORS ON FORMATTING TEXT AND SUBMITTING A PAPER

Content of the Article

The paper must be relevant for international scientific and professional public with clearly defined objectives and results of the research, conclusion, references in the text and bibliography at the end

of the paper. The ideas presented in the paper must be original, considerably contributing to the development of the topic researched with clearly described methodology.

When writing articles authors must pay special attention to the appropriate structuring of the text and its length which should be in line with the accepted standards of scientific methodology.

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- in Croatian
- in English.

The first page of the article should contain: the title of the article, abstract and key words in the language of the article (on the first page of the article submitted the authors are not mentioned). At the end of the article the same information is given:

- in Croatian (if the article is in English) and
- in English, if the original language of the article is other than English.

The main body of the text should begin with an introduction and contain sections, footnotes, tables, graphs, diagrams, references in the text, conclusion and bibliography.

Text Editing

The text of the article should be written in *Microsoft Word Windows* program (95 or later versions). The manuscript should not exceed 7000 words in length (including abstracts, keywords, footnotes, tables, references, captions and appendices), and the font used should be Arial, font size 11 single-spaced, justified, written from the begining to the end of the line (without indenting the first line of a paragraph), all margins at 2.5 cm. The length of the paper can exceed the above mentioned limit only if the Editor-in-Chief consents. If it is necessary to highlight a specific word or a sentence italics should be used, never bold. Paragraphs should be double-spaced.

Footnotes should be used only for additional explanations of the text. They are not used to refer to literature used. They are put at the bottom of the page and numbered consecutively in Arabic numerals starting with number 1.

Section headings (from Introduction to Conclusion) should be short and clear and numbered using single Arabic numerals. Section headings can have subsection headings which must be marked with double or maximum triple-digit numbers (e.g. 1; 1.1; 2.; 2.1; 2.1.1 etc.), but not more than that.

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Important note: If a table, graph or diagram contains some specific signs and is written in a special program, it should be submitted as a separate file with precise indications and marked insertion point in the text.

The article should comply with all the editing requirements listed in these guidelines.

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Authors should apply scientific methodology in presenting the contents of their papers complying with the standards of scientific publications ("Harvard Style")

This implies the following:

(1) *Title and organization of the content of the paper*:

The title is the most important abstract of the work which must contain the content and the objective of the paper. It should be clear, concise and informative (font size 14).

The content is divided into sections as follows:

- Abstract – below the title
- Key words
- Introduction
- Methodology /method / model / conception of the analysis – in the second section
- Empirical data (documented background) and analysis – in the third section
- Results and discussion – are presented in the fourth section
- Conclusion – at the end

(2) *The content of particular sections of the material presented*:

a. *Abstract* – it describes in short the content of the article, it contains a general overview of the topic in 150-250 words single spaced, font size 10, italic, and should include:

- Established objective of the research
- Method / model / conception of the analysis
- Main results of the research (or the analysis)
- Basic conclusion of the research

The abstract should not be written in paragraphs.

b. *Key words* – should reflect the essence of the article's content, usually there are three to five words (font size 10, italic).

c. *Introduction* – is focused on defining the problem and subject matter of the research with reference to the latest literature, i.e. research results (this part can also be indicated in a separate section i.e. in the second section as *Literature review*; towards the end of introduction working hypotheses should be formulated which will be discussed later on at the beginning of the conclusion; this part should end indicating the organization of the text.

d. *Methodology /method / model / conception* - is usually presented in the second section; the method /model / *conception* of the analysis should clearly be stated because of possible re-testing of the research results by interested researchers (this is one of the fundamental principles of scientific methodology).

e. *Empirical data and analysis* – contain documentation background and the results of the analysis.

f. *Results and discussion* – explain results, particularly their economic significance and messages.

g. *Conclusion* – it should be kept in mind that this part does not represent a summary! Conclusions are the author's original opinion on or evaluation of results obtained and they contain information on the starting hypothesis (which can be contradicted or confirmed), main results of the research/analysis, referring to limitations and problems of the research as well as guidelines for future research.

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TABLES should be included in the text. All the information given in tables are put in rows and columns separated by single thin lines. Each column heading for numerical data should include the unit of measurement applied to all data under the heading. Large numbers can be expressed in smaller units with appropriate column headings (in thousands, millions, etc.). Tables are numbered consecutively in Arabic numerals (e.g. Table 1, Table 2, etc.), and next to the number the source of data should also be stated.

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REFERENCES IN THE TEXT. Cited parts of the text are included in the text of the article, not in the footnotes. They are put in brackets with the name of the author and the year of publication e.g. (Horvat, 2003), and in the case of a citation, the page is also indicated (Horvat, 2003:150). *Ibid*. and similar words should not be used. Each note is indicated in the same way it has been indicated the first time. If there are two authors e.g.: (Horvat, Courty, 2004). If there are more than two authors, the first one should be indicated followed by ''et al", e.g. (Horvat et al., 2003). For Internet sources in the references included in the text only the basic domain is indicated *(http://www.veleri.hr)*. Each refernece should be listed in bibliography.

Bibliography comprises all sources used as well as complete information on works mentioned in references. Bibliography does not include the number of headings and is put at the end of the paper (after Conclusion). Bibliography is not numbered and it is listed in alphabetical order by first author's last name and in chronological order when there are more works by the same author.

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Mohr, L. B. (1996) *Impact analysis for program evaluation*, 2nd. ed. London: Sage

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If there are more authors (four or more), the surname of the first author is put followed by et al.

Norton, M. B. et al. (1981) *A People and a Nation – A History of the United States,* Boston: Houghton Mifflin Company.

- *Journals:* surname, initials (year) "Title of the article", *title of the journal in which it was published,* volume (number), pages

Fox, S. (1994) "Empowerment as a Catalyst for Change: An Example from the Food Industry", *Supply Chain Management*, 2(3), p. 29-33

If there are more authors (four or more), the surname of the first author is put followed by et al.

Di Noia, C. et al. (1999) "Should Banking Supervision and Monetary Policy Tasks be Given to Different Agencies?", *International Finance,* 2(3), p. 361-378

Multiple works by the same author published in the same year, besides the year the "a, b, c" letters are used after the year:

Quah, Danny Tyson. (1993 a) "Empirical Cross-section Dynamics in Economic Growth", *European Economic Review*, 37(2-3), p. 426-434

Quah, Danny Tyson. (1993 b) "Galton's Fallacy and Tests of the Convergence Hypothesis", *Scandinavian Journal of Economics*, 95(4), p. 427-443

- *Sources from the Internet:* surname of the author/editor, name initials, (year), "Title of the article", *Title of the journal,* date of publication, year, volume, number, pages or online equivalent, Internet address (date of accession)

If Internet sources do not give the name of the author: Internet address (date of accession).

Martin, C. L. (1998) "Relationship Marketing: a High-Involvement Product Attribute Approach, *Journal of Product and* B*rand management*, 7(1), p. 6-26, http://www.apmforum.com/emerald/marketing-research-asia.htm (3. 10. 2002.)

- *Books of collected writings:* author of the chapter (year of publication) "Title of the chapter". In: name of the publisher or author of collected writings, *Title of collected writings*, place of publication: publisher.

Silobrčić, V. (2000) "Znanstvena proizvodnost i kriteriji vrednovanja znanstvenika u Hrvatskoj". U: Sunko, U. D. (ur.) *Znanost u Hrvatskoj na pragu trećeg tisućljeća*, Zagreb: HAZU.

- *Papers in Conference Proceedings:* author (year of publication) "Title of the article". In: *Title of the Conference Proceedings*. Place of publication: publisher, pages of the section referred to:

Fedchak, E., Duvall, L. (1996) "An engineering approach to electronic publishing" In: *Proceedings of the* I*nternational* W*orkshop on Multimedia Software Development*, 25-26 March. Berlin, Los Alimos, Ca: IEEE Comput. Soc. Press, p. 80-88.

- *Theses and dissertations*: name of the author is stated (year) *title*, and the name of the awarding institution

Whitehead, S. M. (1996) *Public and private men: masculinities at work in education management*, doctoral dissertation, Leeds Metropolitain University

- *Official publications:* title of the publication/organization/institution, (year) *Title,* place of publication: publisher

Department of the Environment (1986) *Landfilling wastes.* London: HMSO (*Waste management paper, 26)*

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Other Journal Contributions

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the book in question), followed by his academic title, institution affiliation, the title and subtitle (if there is one) of the work, year of publication, publisher, number of pages, type of edition, language, ISBN and email address for contact. The author of the review signs the text at the end. Together with the name of the reviewer, the institution affilitaion is given and a copy of the cover page is enclosed.

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Reviews on conferences and other scientific gatherings. They are written as critical reviews. In the title of the review the following is included: title of the conference, organizers, date and venue of the conference/meeting, official language of the conference, the name of the person for contact, followed by email, webpage and information on conference materials. The review provides a clear and concise survey of the main objectives of the conference, names of keynote speakers and discussions of the participants on scientific achievements, research results and suggestions for further researches on key issues. The author of the review signs the text at the end. Together with the name of the reviewer, the institution affilitaion is given.

Letters to the Editor. Special section is available for comments, opinions and suggestions by readers, authors and other contributor.

Other Important Information

It is necessary to ensure the application of the standards of ethical practice by all parties that participate in the publication procedure. Author(s) should read Publication Ethics Statement (*Code of Ethics*) published on the website of the Journal and act according to it.

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