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Original Scientific Paper

THE RELATIONSHIP BETWEEN NATIONAL CULTURE AND INNOVATIVE ENTREPRENEURIAL ORIENTATION: AN ANALYSIS FOR THE SOUTHEAST EUROPEAN COUNTRIES

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Abstract. *This paper aims to examine the relationship between entrepreneurial attitudes of national culture and innovative entrepreneurial orientation (IEO). The empirical research employs multiple linear regression models, utilizing data obtained from the Global Entrepreneurship Monitor. For the purpose of empirical research, we selected samples of early-stage entrepreneurs incorporated in Bosnia & Herzegovina, Bulgaria, Croatia, Greece, and Slovenia. The main findings highlight a significant relationship between national cultural dimensions and innovation, while absorbing the knowledge value and information through media resources equally positively related to IEO, as well as the presence of high status disparity negatively related to IEO. The results can be explained by the specific entrepreneurial context of the SEE region. We also point out recommendations for future research.*

Key words: *national culture, innovative entrepreneurial orientation, total early activity-stage, South East Europe region*

JEL Classification: L26, M14, O30

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1. INTRODUCTION

As a rapidly changing global economic system has forced entrepreneurs to increase their survival ability on the open global market, innovation became one of the most powerful tools by which nations and businesses achieve global success. Thanks to the exponential increase in cross cultural management, the main focus of researchers has been placed on approaches at the macro level conducted to investigate the relationship between national culture and innovations (Wu, 2007; Barichello, 2020). Therefore, through numerous studies, researchers have used different methods and data to investigate this connection. These authors used Hofstede's national culture index database as an open publication from the official website of Geert Hofstede, indicators provided by The World Bank, or annual innovation data per country provided by the Global Innovation Index released by Cornell Univercity, INSEAD and The World Intellectual Property Organization (Činjarević & Veselinović, 2017; Espig et al., 2021), while the others used The Global Competitiveness Index report provided by The World Economic Forum for the purpose of measuring national competitive capacity (Handoyo, 2018), data of national culture support and the Innovation Index rate provided by The Global Entrepreneurship Monitor (Wu, 2007; Song et al., 2020), etc.

With regard to the adopted multidimensional models and typology of national culture presented in literature, it is noticeable that Hofstede's is one of the most commonly used and cited (Song, Park & Kim, 2020). Most findings show that national culture positively affects IEO, while the most desirable situation to boost IEO exists when there is low distance power, long-term orientation, femininity culture characteristics, high individualism, and a higher level of indulgence (Espig et al., 2021). Additionally, low power distance and low uncertainty avoidance are in most cases characteristics of European counties. The impact of individualism versus collectivism is more debatable, but generally in Europe, entrepreneurs from more individualistic countries achieve better innovative results (Strychalska-Rudewich, 2016 p. 121). In highly individualistic societies, creativity is related to individual expression, individuals have the freedom to conduct an experiment and it refers to a high probability of success, entrepreneurial growth, as well as a higher level of IEO (Strychalska-Rudewich, 2016). Papula et al. (2018), when referring to Germany, Austria, Switzerland and the Czech Republic, highlight that cultural aspects have a strong positive impact on perceiving business partners as reliable, having trust in the benefits of mutual cooperation, presenting positive role models or encouragement of innovation.

Therefore, it is evident that previous studies conducted to explain how national culture affects innovation show discrepant results among authors (Espig et al., 2021). However, there is no universal IEO model that can be applied to all strategies and policies, without translation across cultures (Smale, 2016). In this study, we aim to fill the gap that exists in literature and which refers to the relationship between national culture and IEO, in the context of the SEE region. The present empirical research was created to extend our knowledge of factors which determine IEO. We examined the relationship between cultural dimensions and IEO, using Global Entrepreneurship Monitor (GEM) data. Therefore, a combination of terminology proposed by Hofstede and GEM innovation index was used. The research questions were: Do entrepreneurial attitudes of national culture contribute to the modelling of IEO? What factors of national culture are best associated with IEO?

The remainder of this paper has been organized as follows. The following section contains an overview of literature according to the set of hypothesis. This is followed by sections on data, methodology and empirical results. This paper ends with a discussion and conclusion, and notes the limitations and recommendations for future research.

2. Literature Review

The majority of individuals from a particular country or group share certain cultural characteristics. National culture, as a value system peculiar to a specific group, society or country, configures individuals' attitudes and behaviour to act in a specific way that may not be applicable in other societies (Hofstede, 2001). In view of this definition, culture has been consider to affect not only social norms but also, in terms of economy, the level of entrepreneurial orientation (innovative orientation, international orientation, marketing orientation, etc.). Innovative entrepreneurial orientation (IEO), as one of the most desirable individual characteristics, is a multifaceted construct which relates to an innovation-based strategic orientation (Neely et al, 2001; Norris & Ciesielska, 2019). The term orientation is used to describe the overall approach that represents the competitive capabilities and strategic focus of entrepreneurs (Human & Naude, 2010). IEO pertains to entrepreneurial attitudes, capabilities and skills (Stock & Zacharias, 2011) such as competition-based understanding, organisational skills (Jalilvand, 2017; Zobel at al., 2017), and knowledge capabilities (Dobni, 2010). IEO deals with exploring new ideas, novelties and other creative processes that may result in a formation of new products, services or processes. In addition, IEO is relevant for managers and executives and those in charge of making decisions and innovation management (Norris & Ciesielska, 2019). Furthermore, a group of scholars states that IEO is a reflection of the uniqueness and a new entrepreneurial solution (Lall & Sahai, 2008).

Hofstede's original work described national culture as a set of four dimensions. They are: power distance, individualism vs. collectivism, masculinity vs. femininity, and uncertainty avoidance, while Hofstede's revised national culture consists of long-term orientation and indulgence (Hofstede, Hofstede & Minkov, 2010).

Power distance affects many organizational processes and outcomes (Keltner, Gruenfield & Andderson, 2003). It refers to the degree in which individuals or societies accept inequalities as legitimate, unavoidable or functional (Daniels & Greguras, 2014). Power distance affects the level of decision-making and formal hierarchy within organizations. Individuals lower on the power distance do not perceive many distinctions based on hierarchical position, social strata or power, they believe that all people should have equal rights and equal opportunities to succeed. Those with less power accept their place in the hierarchy, they trust their leaders, and are loyal to them (Kirkman et al., 2009). As such, cultures or individuals higher on the power distance believe that individuals with authority should be respected and show difference; those with higher power are more likely to value status and prestige (Jaw et al., 2007). At the individual level, power distance positively correlates with job satisfaction, perceptions of directive leadership, openness to experience, while lower power distance negatively correlates with team commitment, employee self-esteem, and perceptions of participative leadership (Taras et al., 2010). Some findings show a strong negative relationship between high power distance citizens and a lower level of IEO (Činjarević & Veselinović, 2017). High power distance societies may find it hard to encourage their people to participate in innovation

process as inequalities among people are expected, and social networking is limited between those from different strata (Hofstede et al., 2010). However, people, in high power distance nations, belonging to the lower strata may feel little motivation to be innovatively oriented (Rinne, Steel & Fairweather, 2011).

Individualism refers to societies where self-responsibility, accomplishment, independence of groups, and personal freedom are common dominant behaviours (Handoyo, 2018). The main indicators for rewarding individuals in individualistic societies are their abilities and achievements such as innovations, important discoveries, and all actions that make an individual stand out. This dimension bears negatively on cooperation, valuing harmony and relations with superiors (Gorodnichenko & Rodnin, 2012). In contrast, a collectivistic society emphasis the individual as part of a group, and therefore collectivist national culture has norms, values and beliefs such as a group membership identity, loyalty to the group, and solidarity (Handoyo, 2018). Thus, according to Hofstede's explanation of collectivistic societies, citizens are encouraged to equally absorb knowledge value and information through media resources. In collectivistic cultures, individuals are more prone to not reveal their opinions, which often results in slowing down of innovation, while to the opposite, in individualistic cultures people tend to express their opinions (Činjarević &Veselinović, 2017). Furthermore, some recent findings show that collectivism leads to higher economic efficiency while individualism results in higher IEO because of the social status of rewarding innovation. In other words, a higher innovation rate leads to a higher level of productivity and output in the long run versus collectivism that affects static economic efficiency (Gorodnichenko & Rodnin, 2012).

Dimensions of uncertainty avoidance express the degree to which individuals avoid uncertainty and ambiguity, and prefer a predictable future. Strong uncertainty avoidance societies prefer to avoid risks associated with uncertainty by emphasizing formal rules, procedures, and other constructs designed to reduce ambiguity. Societies with high uncertainty avoidance have rigid beliefs and behaviour which does not tolerate different ideas (Espig et al., 2021). For example, some findings indicate that people are ambiguous because of an ambivalent perception of technology (Shane, 1993). Research that relates this dimension to IEO mostly found that uncertainty avoidance is common to individuals who are less willing to take a risk and engage in activities that might lead to innovation (Činjarević &Veselinović, 2017). Furthermore, Handoyo (2018) found that uncertainty avoidance indicates a weak association with national innovative capacity, given the explanation that the way that society behaves is rooted in the value of national culture and will determine national innovative capacity (p. 147).

Hofstede's fourth cultural dimension, Masculinity versus Femininity, relates to the division of emotional roles between women and men. The characteristics of feminine societies refer to existing on a minimal emotional and social differentiation between gender roles. While the relationship between men and women should be modest and caring as well as that there should be a balance between family and work. Femininity is a management manner characterized by a low level of conflict and emotional support to employees (Papula, 2018). Masculine values refer to achievement, higher goals and hard work. A positive correlation has also been observed between masculinity and entrepreneurship (Leković & Petrović, 2020). In addition, in masculine societies, entrepreneurs enjoy a higher level of innovative orientation (Papula, 2018).

Long-term Orientation versus Short-team orientation and Indulgence versus Restrained are, recently added, Hofstede's dimensions of national culture. Long-Term Orientation has to

do with the tendency of a society to accept societal changes. Societies that score low see societal change with suspicion, deal with the past and the present, and respect tradition. Societies that score high might also be defined as pragmatic, and societies scoring low (short-term) might be defined as normative (Salis & Flegl, 2021). Indulgent society allows basic human drives related to enjoying life, while a restrained society suppresses their needs and has strict social norms (Salis & Flegl, 2021). Recent findings have shown that long-term orientation and indulgence relates to IEO. These results contribute to innovation and competitiveness perspectives, in which the intrinsic values of a national culture can favour the development of innovation and raise the level of competitiveness of nations as well as organizations (Prim et al., 2017, p. 1).

Based on the previous statements, we have developed our research hypothesis:

H1 – Explanatory variables of national culture predict the outcome of response variable IEO, thus, a significant relationship exists between national culture and IEO.

Furthermore, taking under consideration previous studies which investigated the construct of national culture and innovation, mostly in the context of European countries, we delved deeper and presumed the characteristics of a relationship between some national culture dimensions (refers to participants' attitudes), and IEO. That is:

H1.1 – There is a significant and *positive* relationship between *equally absorbing knowledge value and information through media resources* (referring to collectivistic societies), and IEO (according to the entrepreneurial statement that in their country, most people can see the stories in media about successful business).

H1.2 – There is a significant but *negative* relationship between *entrepreneurial attitudes confirming that successful entrepreneurs receive a high level of status and respect* (refers to power distance), and the IEO.

3. METHODOLOGY

Empirical research was conducted on data derived from the Adult Population Survey (APS), GEM database for the year 2017. The GEM also includes the monitoring of entrepreneurial activities by using the indicator *Total early-stage entrepreneurial activity* (TEA) (GEM, 2018). The TEA implies: 1) entrepreneurs in the stage prior to commencing with work, 2) nascent entrepreneurs who have been settling their obligations and paying wages for at least three months, and 3) owning managers who have been paying wages in continuity for forty-two months (Reynolds et al., 2004; Wagner, 2004; Stephan et al., 2015).

For the purpose of this empirical research, we selected a research sample which involved entrepreneurs incorporated in Bosnia & Herzegovina, Bulgaria, Croatia, Greece and Slovenia. Two criteria were used for selecting these five countries. Firstly, the regional aspect and similar cultural features which were observed, and secondly, we selected GEM participant countries from the SEE region for 2017. The research sample totalled 10,047 participants, with 60.1% belonging to a country marked as an *efficiency driven country* (Bosnia & Herzegovina, Bulgaria, Croatia), and 39.9% belonging to an *innovative driven* country (Greece, Slovenia). Out of the research sample, 537 individuals were involved in the TEA stage and entrepreneurial activities that included a new product market combination.

The research model consisted of one dependent variable *TEAyyNPMC* (TEA New product market combination), which is one of the GEM Innovation Indices; it measured the IEO by indicating the level of introduction of a new (innovative) product on a market by participants between the ages of 18-64. The model also consisted of six predictor

variables conducted to measure the level of the participants' attitudes towards national culture. They were: 1) *Equalinc* Qi5. In my country, most people would prefer that everyone had a similar standard of living (according to GEM methodology it refers to a similar standard of living rate, and shows the percentage of the 18-64 population who agree with the statement that in their country, everyone had a similar standard of living; 2) *Nbgoodc* Qi6. In my country, most people consider starting a new business a desirable career choice (it refers to *Entrepreneurship as a Good Career Choice Rate*, and shows the percentage of the 18-64 population who agree with the statement that in their country, most people consider starting a business as a desirable career choice); 3) *Nbstatus* Qi7. In my country, those successful at starting a new business have a high level of status and respect (it refers to a *High Status to Successful Entrepreneurs Rate*, and shows the percentage of the 18-64 population who agree with the statement that in their country, successful entrepreneurs receive high status); 4) *Nbmedia* Qi8. In my country, you will often see stories in the public media and/or internet about successful new business choices (it refers to a media support rate and shows the percentage of the 18-64 population who agree with the statement that in their country, most people can see stories in media about successful businesses); 5*) Easystart* Qi9. In my country, it is easy to start a business choice (it refers to an entrepreneurial rate which shows the percentage of the 18-64 population who agree with the statement that in their country, most people easily made the choice of starting a new business), and 6*)* Nbsocent Qi10. In my country, you will often see a business that primarily aims to solve social problems (it refers to an entrepreneurial rate which measures the level of businesses that aim to solve social problems).

4. RESULTS

In order to research the set of hypotheses, SPSS software was used for data analyses. A multiple linear regression analysis (MLR) is a statistical technique that uses several explanatory variables to predict the outcome of a response variable. MLR was used to predict the values of innovative entrepreneurial orientation, given a set of explanatory variables such as entrepreneurial attitudes about national culture. In this research, we also used MLR to determinate which variables are better predictors than others.

We forced all variables into a linear regression model (method: enter). First, we tested the assumptions for MLR, and the multicollinearity. The results showed that none of the correlations appear to be large, while none of the correlations were higher than .80. Table1 Correlations Matrix shows that multicollinearity is not presents between variables.

Table 1 Correlations Matrix

Variable	1	2	3	4	5	6	7
TEAyyNPMC	1						
equalinc	0.069	1					
nbgoodc	-0.07	.125**	1				
nbstatus	-.090*	.108**	.236**	1			
nbmedia	.079*	.099**	.170**	.184**	1		
easystart	.080*	.075**	.105**	.072**	.166**	1	
nbsocent	-0.03	.103**	.129**	.099**	.212**	.163**	1

*Correlation is significant at the 0.05 level
**Correlation is significant at the 0.01 level
Source: Authors based on GEM database

Table 2 shows the MLR model summary and overall fit statistics. The R from our model is .201 with the coefficient of determinations R^2=.040 which is relatively low. This suggests: 1) that there may be subgroups of participants from whom the effect size would be larger, and subgroups of participants for whom the effect size would be smaller; 2) depending on the field, small R^2 can have scientific and theoretical significance too, which may be small, but reliable (Vacha-Haase & Thompson, 2004; Lecuna & Chohen & Chavez, 2016 p. 153). The value of Durbin-Watson statistic was d=1,805 which is between the critical values of 1.5<d<2.5. These results show that there is no first order linear auto-correlation in our data of the model, which is adequate and allows us to proceed with model analysis.

Table 2 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.201	.040	.027	.417	1.805

Source: Authors based on GEM database

Table 3 Anova presents the F-test. The linear regressions F-test has the null hypothesis that the model explains zero variance in the response variable. While the F-test is significant and we can assume that the model explains the variance of innovative entrepreneurial orientation: F (6. 423) =2.958, p<.05. The ANOVA table indicates that the model, as a whole, is a significant fit to the data.

Table 3 ANOVA

	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.090	6	.515	2.958	.008
	Residual	73.654	423	.174		
	Total	76.744	429			

Source: Authors based on GEM database

According to Table 4, we also see that: 1) VIF values for all variables are less than 10, as they do not exceed 1.048 and 2) Tolerance value is higher than .10. In addition to these, there are no multiple relations among the explanatory variables.

Table 4 Coefficients

Model	Non-standard. Coeff.		Stand. Coeff.	t	Sig.	95,0% Confidence Interval for B		Collinearity Statistics	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Toler.	VIF
(Const.) 1	.237	.054	-	4.431	.000	.132	.343	-	-
equalinc	.075	.044	.082	1.719	.086	-.011	.161	.997	1.003
nbgoodc	-.065	.043	-.074	-1.524	.128	-.149	.019	.955	1.048
nbstatus	-.094	.043	-.108	-2.219	.027	-.178	-.011	.962	1.040
nbmedia	.090	.041	.106	2.180	.030	.009	.171	.960	1.042
easystart	.051	.050	.049	1.018	.309	-.047	.149	.982	1.018
nbsocent	-.059	.046	-.062	-1.282	.201	-.149	.031	.967	1.034

Source: Authors based on GEM database

Following the results from the table above it is evident that explanatory variables *Nbstatus*, and *Nbmedia*, are statistically significant at the level, $p<0.05$, as well as being better predictors than others. The variable that represents *High Status to Successful Entrepreneurs Rate*, has a negative beta value coefficient ($b=-0.094$, $p<0.05$), while national media support rate has a positive coefficient ($b=0.090$, $p<0.05$). For explanatory variable *Nbmedia* a greater percentage is associated with a higher level of IEO, while *Nbstatus* is associated with a lower level of IEO. Taking % of *High Status to Successful Entrepreneurs Rate*, we see that if we hold all other explanatory constant, for every 1% increase in the % of this rate, there is a decrease of 9% in the predicted value of IEO. Furthermore, taking % of the national media support rate, we see that if we hold all other explanatory constant, for every 1% increase in the % of this rate there is an increase of 9% in the predicted value. Other predictors of national culture indicate a weak association (Equalinc, $b=0.075$, $p<0.1$), /or not significant, but they also add, to a lower extent, to the prediction model.

The estimated regression equitation can be written as follows:

$$\begin{aligned} TEAyyNPMC = {} & 0.237 + 0.075\,Equalinc - 0.065\,Nbgoodc - 0.094\,Nbstatus \\ & + 0.09\,Nbmedia + 0.051\,Easystart - 0.059\,Nbsocent \end{aligned} \tag{1}$$

5. DISCUSSION

In line with our expectations, the results of the MLR analysis confirm that explanatory variables of national culture predict the outcome of response variable IEO, thus a significant relationship exists between national culture and IEO. Considering the adjusted coefficient of determination we conclude that, altogether, explanatory variables can explain 4% of the innovative entrepreneurial orientation. We have made useful conclusions about the data even when there is a weak relationship, as some data sets have an inherently larger unexpected variation. Moreover, the results of the pronounced model indicate that national culture, as a set of shared attitudes, values and practices that characterize organizations or groups, contributes to the IEO such as when introducing a new product on a markets. This finding is in line with previous studies that indicate the confirmation of this construct (Strychalska-Rudewich, 2016; Papula et al., 2018; Espig et al., 2021). Therefore, our findings suggest a confirmation of H1. Furthermore, in our analysis we went evenfurther and assumed a significant and positive relationship between *equally absorbing knowledge value and information through media resources* and IEO. Our findings suggest confirmation of H1.1. The results are in agreement with Hofstede's explanation of collectivistic societies where citizens are encouraged to equally absorb knowledge value and information through media resources. This means that SEE countries have a mostly collectivistic environment which refers to the scores of individualistic preferences measured by Hofstede's Culture Compass. In addition, SEE countries mostly contribute to collectivistic societies, while, for example, Hungary (80%), Poland (60%) and Slovakia (52%) are among mostly individualistic societies. A positive relationship between national media support and IEO can be explained in the context of early entrepreneurs who aim to achieve business success from the very start. Those proactive and innovative oriented early-stage entrepreneurs receive valuable information through different social media, transforming it into essential knowledge that is valuable for their further development. This finding is in line with the argument that innovation depends on the flow of information sharing (Papula et al., 2018). Furthermore, our third hypothesis H1.2 has also

been confirmed. A significant but negative relationship exists between entrepreneurial attitudes related to the statement that successful entrepreneurs receive a high level of status and respect, and the IEO. The result suggests that a high level of status and respect refers to high power distance societies where a low level of innovation rate exists. This statement is in line with previous research results. In addition, high power distance may prevent the spread of innovative aspirations, while a low power distance society supports knowledge sharing and ideas (Papula et al., 2018). For example, Switzerland or Sweden, as some of the most innovative countries, present one of the lowest levels of power distance according to the beliefs of their citizens that everyone should have equal right, decentralized power, open communication among hierarchical strata and consequently the exchange of innovation (Espig et al., 2021). However, other research confirms that long-run, individualistic cultures with high power distance societies and low uncertainty avoidance have a greater predisposition to translate new ideas into innovations and achieve the benefits of economic prosperity (Gorodnichenko & Rodnin, 2012). Also, the results of our research can be explained within the context of the research (SEE region) where a specific historical and economic influence exists since its citizens have faced periods of transitions and reforms. In addition, the entrepreneurs from the SEE region have been, for decades, operating within a restrictive economic system, so they are quite unprepared and distrustful of new challenges while government policies and institutional arrangements have an assignment to encourage entrepreneurs to act more innovatively. This is a question of time, so we have been witness to the establishment of a number of successful innovation oriented firms which established their business in the SEE region.

4. CONCLUSION

The total early-stage entrepreneurial activity in transitional countries of the SEE is significantly lower compared to highly developed European countries (Ivanović-Đukić et al., 2018). In addition, the levels of entrepreneurial activity differ between countries, even when speaking about countries which enjoy similar levels of economic development. This led us to propose that disparity is not only the output of variables of economic nature, but that other factors might affect it. In this research, we have focused on entrepreneurs' attitudes about national culture and concluded that a significant relationship exists between dimensions of national culture and the level of innovative entrepreneurial orientation.

Our results suggest a series of implications both at the theoretical and the practical level. Apart from the fact that only a limited number of authors have examined the role of national culture in innovation, observing it within the context of the SEE region, we have contributed to filling the gap in literature. Our empirical research conducted on 537 participants from SEE countries provides empirical evidence that a relationship exists between national cultural dimensions and IEO. The results can be useful to practitioners because it provides empirical evidence supporting the following conclusion: firstly, our findings show that collectivistic culture as a dominant characteristic for nations and organizations in the SEE region seems to be positively connected to IEO, while a high power distance dimension seems to be negatively related to IEO. We found an explanation of these results in the specific entrepreneurial context of the SEE region. In addition, such results contribute to early-stage entrepreneurs from SEE countries that have a similar cultural and historical heritage that might not be prevalent in other societies. Meaning that the results of

one study may not strictly apply to other countries or regions. Thus, our findings are in line with some previous studies which explain the role of national culture in innovation (Strychalska-Rudewich, 2016; Papula et al., 2018). Moreover, the results of this research can be useful to entrepreneurs who are planning to start a business, as well as entrepreneurs in the early stages of entrepreneurial activity, i.e., when the company's resources (financial, human, etc.) are limited and when the company is most vulnerable. The entrepreneurial perception that a product can be developed and positioned on markets with greater support programs at the national level can strengthen the entrepreneurial spirit as well as entrepreneurial innovative orientation.

Lastly, it is necessary to consider some of the possible limitations of the study. The limitation lies in the fact that empirical results can be generalized only on early-stage entrepreneurs from Bosnia & Herzegovina, Bulgaria, Croatia, Greece and Slovenia. Serbia, North Macedonia and Montenegro did not participate in the GEM survey for the year 2017. Also, adding more predicted variables of national culture to a regression model tends to increase the variability of IEO. A statistical analysis with time flow i.e., more than a year, would also be desirable.

Further research might examine how the other factors of national culture affect the level of IEO. It would also be interesting to find out if Hofstede's revised dimensions as long-term orientation versus short-term orientation, and indulgence versus restrained could affect the IEO.

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VEZA IZMEĐU NACIONALNE KULTURE I INOVATIVNE PREDUZETNIČKE ORIJENTACIJE: ANALIZA ZA ZEMLJE JUGOISTOČNE EVROPE

Cilj ovog rada je da istraži vezu između preduzetničkih statovova o nacionalnoj kulturi i inovativne preduzetničke orijentacije. Empirijsko istraživanje uključuje višestruku linearnu regresiju, a podaci za istraživanje su selektovani iz baze podataka Global Entrepreneurship Monitora. Za potrebe istraživanja odabrali smo uzorak u kojem su učestvovali preduzetnici u ranoj fazi preduzetničke aktivnosti, iz sledećih zemalja: Bosna i Hercegovina, Bugarska, Hrvatska, Grčka i Slovenija. Rezultati istraživanja potvrđuju vezu između dimenzija nacionalne kulture i inovacija. Naime, podjednaka apsorpcija znanja i informisanje putem različitih medija doprinosi višem stepenu inovativne orijentacije preduzetnika, dok percepcija preduzetnika o prisustvu viših statusnih razlika je u negativnoj vezi sa stepenom inovativne preduzetničke orijentacije. Rezultati istraživanja se mogu objasniti specifičnim preduzetničkim kontekstom regiona jugoistočne Evrope. U radu smo istakli i preporuke za buduća istraživanja.

Ključne reči: *Nacionalna kultura, inovativna preduzetnička orijentacija, rana faza preduzetničke aktivnosti, jugoistočna Evropa.*

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THE IMPACT OF HUMAN CAPITAL VALUE ON HUMAN CAPITAL EFFICIENCY AND BUSINESS PERFORMANCE

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Abstract. *In the knowledge economy era, human capital is a part of intellectual capital and a significant factor in enterprise competitiveness. The importance of human capital is often diminished due to the accounting expression of investments in human resources in the income statement as a cost (expenditure) component. This paper points to the fact that the cost of human resources is an investment that affects the growth of the business performance of an enterprise. Hence, the aim of this paper is to examine the impact of human capital value on human capital efficiency and business performance indicators, such as sales revenue (SR), earnings before interest and taxes (EBIT), and EBIT margin (EBITM). To examine this impact, empirical research is conducted on a sample of 24 companies with the highest brand value for the period 2012-2019. The regression analysis results show that sales revenue and EBIT grow by 0.77% and 1.1% respectively as human capital value grows by 1%. Additionally, findings reveal that the growth of the human capital value negatively affects the values of human capital efficiency indicators and EBIT margin in the sample of examined enterprises.*

Keywords: *human capital value, human capital measurement, efficiency*

JEL Classification: M21

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1. INTRODUCTION

In the knowledge-based economy, contemporary enterprises that possess a high share of intellectual resources in total assets are focused on the efficient management of intangible assets with the aim to improve economic efficiency, effectiveness, and competitive advantage (Debrulle & Maes, 2014). Nowadays, to build sustainable and profitable enterprises, the management of those enterprises should use human competencies, skills, and talents, which are considered valuable intangible assets (Wright et al., 2001). Human capital is a term that refers to human resources and is a part of intellectual capital together with structural and relational capital (Bontis & Fitz-enz, 2002; Vejchayanon, 2005; Phillips, 2005; Jovanović et al., 2021). Intellectual capital is an outstanding source of establishing and maintaining a competitive advantage in the contemporary competitive environment in the information or digital era (Krstić, 2007). Managers decide to invest in intellectual capital components (structural, relational, and human capital) in order to boost the value and performance of the enterprise. Managers have a responsibility to devote more time and effort to measuring and managing human and other intellectual resources in order to improve human capital efficiency, which contributes to the total economic efficiency of an enterprise. The purpose of this paper is reflected in the recommendations to managers to change their attitude toward investing in employees and turn to improving the knowledge, skills, and abilities of employees, due to the significant impact of human capital on the business performance of enterprises.

2. HUMAN CAPITAL: COST VS. INVESTMENT IN HUMAN RESOURCES?

Human capital research has grown in popularity over time. Human capital research has an interdisciplinary trait because the formation of human capital eventuates simultaneously under the influence of external factors, such as investments, information, education, healthcare, and internal factors, such as specific capabilities, creativity, and self-education. People have different levels of education, knowledge, skills, and talents, as well as job expectations. More educated and better-trained employees in any workplace can deliver a higher value for their employers (McConnell et al., 2009, p. 85). Education and training, according to Schultz (1960), represent an investment in human capital. In the knowledge economy era, the importance of human resources has outweighed the importance of physical and financial resources.

Investing in a worker's education and training is analogous to investing in capital goods. Such wise investments increase work productivity and profit and are associated with considerable start-up expenses. Back in 1960, Schultz coined the phrase "human capital". It refers to its economic value further defined by human potentials that may be improved via suitable investments. Becker (1993, p. 412) broadened the definition of efficient human capital by adding a person's health and behavior. Higher wages of more educated employees are viewed as superior in terms of returns on investments in the employees' promotion (Schultz, 1960; Becker, 1962). According to Bowen (1977, p. 507), human capital is comprised of people's accumulated knowledge and skills, utilized for the creation of customer-friendly goods and services. Even then, human capital was recognized in science. However, the measurement of its value is still complex due to the specific intangible nature of human capital.

The intangible aspect of human resources, which contains knowledge, skills, abilities, and other characteristics of employees, is represented by human capital. Human capital focuses on the knowledge, skills, and abilities of employees that create value for the enterprise.

Consequently, employees can successfully perform work tasks and achieve the business goals of the enterprise (Edvinsson & Malone, 1997). Human resources management generally and exclusively deals with work done by all employees and managers, regardless of whether they contribute to value creation or not. Mayo (2000) states that human capital management treats people as an asset (capital), while human resources management treats people as an expense. The necessity to create and implement an integrated and strategic approach to people management is something that both approaches have in common. On the other hand, Meyer et al. (2009) report a large number of differences between human resource and human capital management.

Three approaches to defining human capital were recognized by Chen and Lin (2004). The transaction cost theory is the first method by which enterprises can hire new employees from within or outside the organization. Since both choices involve expenses, businesses will always select the less expensive option, representing the most efficient method. The second approach is the resource-based view of the firm, in which the human competencies that are vital and provide a competitive advantage must be fostered within the organization. The human capital theory is the third approach, in which enterprises decide whether or not to invest in human capital by weighing anticipated future benefits.

Hendricks and Schoellman (2017) developed a process model for human capital cost management that considered the stages of the investment process for human capital formation and renewal. Kassouf (2017) proposes integrating investment and cost techniques to display staff costs by employing the reflection method in human capital cost accounting related to stages of reproduction. Lagakos et al. (2018) established an organizational methodology for human resource accounting as an accounting category for businesses. In actual practice, there are two main methods of human capital accounting and assessment: the Asset Model (Novas et al., 2017) and the Utility Model (Hilorme et al., 2019).

According to Stiles & Kulvisaechana (2003, p. 15), on the onehand, human capital measurement is necessary to quantify the impact of human capital interventions and highlight areas for further upgrading. On the other hand, measurement is a complex topic in this field. In this field, return on investment (ROI), is still seen as a useful metric and its use is increasing worldwide (Phillips, 2005). As stated by Guest (1997), some consulting companies assess human capital investment using financial metrics, production and/or products and service metrics, such as units produced, customer satisfaction, number of mistakes, and time metrics like lateness and absence. According to Mayo (2012), human capital must be quantified by workforce analytics, consisting of labor turnover rate, absenteeism, staff rotation and vacancies, job type, grade, gender, ethnic origin, and views of human capital: temporary, subcontract, and consultant resources.

While enterprises in the industrial economy depended primarily on tangible assets to create value, intangibles have become increasingly essential in the growing knowledge economy. Many conceptual frameworks have been developed to measure intellectual performance in the knowledge economy (Abeysekera & Guthrie, 2004). The discrepancy between the market value and the book value, as defined by Brooking (1997), is typically explored in three components: internal (structural) component, external (relational) component, and human component that facilitates interaction between internal and external components in order to create value. Human capital, as described by Stewart (1998) as the skills, abilities, and competencies of individuals and groups, is not viewed as a legal entity owned by businesses. As a result, it may also refer to the knowledge of employees that they take with them when they depart the enterprise (MERITUM, 2002).

In general, there are two types of human capital measurement: monetary measurement, which expresses the value of human capital (HC) in monetary terms, and non-monetary measurement, which includes the usage of Likert-type scales (Chen & Lin, 2004), as well other non-financial indicators of human performance. According to Guest (1997), to quantify human capital, an enterprise must assess the attitude and behavior of employees, internal and external performance indicators, for example, product and service quality, productivity, sales, and other financial performance.

Additionally, Thomas et al. (2013) presented a technique for measuring human capital – three kinds of measurement, and utilizing human capital dashboards for monitoring. The first kind of measurement includes collecting and measuring all possible data on headcounts, turnover, promotions, and other data from the HR information system. The second one includes the simplification of measurement by emphasizing a few key indicators, substantially enhanced data quality, data from human resource information system (HRIS), and other HR databases (e.g. recruiting, payroll). The third one includes operational data integrations, which include information from non-HR sources like finance, marketing, and quality control, as well as derived metrics like revenue per employee, the value created per employee, etc.

Human capital encompasses the economic worth of human performances such as education level, the training volume, intellect, skills, talents, health, etc. (Jovanović, 2018, Veselinović et al., 2020). Given that all investments and costs for workers (salaries, non-monetary benefits, education, training, etc.) may be represented as total investment in human resources, more precisely, the value of human capital, the human capital (HC) formula is the following (Krstić & Bonić, 2016):

$$Hc = Pe + Si \tag{1}$$

Pe denotes personal expenses, whereas *Si* denotes the total amount of stimulating incentives. Furthermore, *Pe* includes employee or management salaries (net salary + payroll taxes), as well as costs for human resource development, such as education, training, and other costs (Veselinović et al., 2020).

The literature mentions numerous approaches to assessing human capital, such as cost, income, and market approach (Merriman, 2017). The cost approach is founded on the economic concept of substitution, which correlates the worth of human capital to the cost of creating a comparable substitute workforce. The income approach uses the economic principle of anticipating future benefits of employees and considers it as human capital. According to the economic concept of substitution, the market approach calculates the value of human capital based on the selling price of equivalent assets.

Given that there are available and transparent internal data (financial statements) on investment in employees (excluding training costs), the cost approach can be applied in the research model of this study, as total investments in managers and other employees can be estimated. On the other hand, the income approach is difficult to apply due to the lack of other necessary data and the influence of other factors that affect the income of an enterprise, especially other intellectual assets. Since the market approach relies on the economic principles of competition and equilibrium, and since in our sample there are companies from different industries and markets, it was impossible to apply this approach.

3. HUMAN CAPITAL EFFICIENCY MEASUREMENT

Human capital efficiency measurement includes traditional and modern measurement models (Veselinović et al., 2020). The traditional human capital measurement model includes: a) human capital efficiency indicators (i.e. labor productivity indicators) as non-financial and financial measures and b) many non-financial performance indicators of people in a business organization. Labor productivity is an efficiency measure of how well an enterprise uses its human capital or the labor of its workers, measured by the number of provided products (Q) and services by them.

A basic indicator of labor productivity is defined as the ability to accomplish a particular output volume (Q) with the lowest possible labor inputs (L) (Krstić & Sekulić, 2020):

$$P = \frac{Q}{L} \tag{2}$$

This is a non-financial indicator of labor productivity. Multidimensionality and complexity of Q and L, as an element of productivity measure, lead to methodological challenges in measuring the labor productivity indicators. In addition, the production volume (Q) might be expressed in monetary (financial) terms, such as sales revenue, revenue, expenses, accounting profit (earnings), economic value added (EVA), and net cash flow. With this in mind, both non-financial (natural) and financial indicators of labor productivity measurement can be analyzed.

The financial aspect of measuring labor productivity implies that categories defined in monetary terms are used, and data from the balance sheet and income statement are used as a data source (Veselinović et al., 2020). The rationale for this is to overcome the limitations of non-financial indicators of labor productivity measurement. Regarding the financial aspect of labor productivity measurement, there are different financial indicators (Veselinović et al., 2020) or ratios:

- Operating revenue (R_o) per employee;
- Sales revenue (SR) per employee;
- Expenses (E) per employee;
- Earnings before interest and taxes ($EBIT$) per employee;
- Operating profit (P_o) per employee;
- Net profit (P_n) or net profit attributable to shareholders per employee;
- Economic value added (EVA) per employee or Human Economic Value Added ($HEVA$);
- Net cash flow (C_f) per employee.

Efficiency is defined as the ratio of achieved outputs to inputs (Kucharková et al., 2015). Human capital efficiency is evaluated as the quotient of an economic results volume (output) and human capital value (input). Human capital efficiency (HCE) is described by Borowski (2015) as the rate of efficiency in the use of human capital, which indicates human capital relevance in terms of added value to the organization.

The modern human capital efficiency measurement model includes several human capital efficiency indicators. Some of them are human capital market value – $HCMV$ (Drábek et al., 2017; Lindenberg & Ross, 1981), human capital value added – $HCVA$ (Fitz-enz, 2000; Drábek et al., 2017), human capital return on investment – $HCROI$ (Fitz-enz, 2000; Drábek et al., 2017), and efficiency in the use of human capital – EHC (Krstić & Bonić, 2016) (see Table 1).

Within the labor productivity indicators, there are indicators of productivity (efficiency) of human capital that use labor consumption, costs, or the number of employees in their denominator. On the other hand, modern indicators of human capital efficiency include

additional categories of costs that represent investments in human capital: benefits, incentives, training costs, etc. In modern indicators of human capital efficiency, the main focus is on people who represent capital and create value for the enterprise.

Table 1 Human capital efficiency indicators

Indicator	Definition and formula
Human capital market value	Drábek et al. (2017, p. 123) define human capital market value (*HCMV*) as the net market value of an enterprise per employee. The following formula is used to calculate the market value of human capital (Drábek et al., 2017, p. 123; Lindenberg & Ross, 1981): $$HCMV = \frac{Mc : As}{Number\ of\ employees}.$$ Market capitalization is denoted by *Mc*, while total assets are denoted by *As* on the balance sheet.
Human capital value added	Human capital value added (HCVA) is a metric for determining human capital productivity that explains productivity in terms of profitability (Fitz-enz, 2000, p. 50). The full-time equivalent in value added (Drábek et al., 2017, p. 123) represents the economic efficiency of human capital in an enterprise. The human capital value added is computed as follows (Fitz-enz, 2000, p. 50): $$HCVA = \frac{Revenue - (Expenses - Pay\ and\ benefits)}{Full{-}time\ equivalent} \quad \text{or} \quad \text{HCVA} = \frac{\text{EBIT + HC}}{\text{Number of employees}}$$
Human capital return on investment	Drábek et al. (2017, p. 123) define human capital return on investment *(HCROI)* as an indicator illustrating the link between human capital and profitability. This metric shows the profit generated from the money spent on employee salaries and benefits as a return on investment in human capital (Fitz-enz, 2000, p. 50). The return on investment in human capital is computed as follows (Fitz-enz, 2000, p. 50): $$\text{HCROI} = \frac{\text{Revenue – (Expenses – Pay and benefits)}}{\text{Pay and benefits}} \quad \text{or} \quad \text{HCROI} = \frac{\text{EBIT + HC}}{\text{HC}}$$
Efficiency in the use of human capital	Efficiency in the use of human capital (*EHC*) is a measure of productive human capital usage in an enterprise (Krstić & Bonić, 2016). This indicator is calculated in the following way (Krstić & Bonić, 2016): $$EHC = \frac{ICVA}{HC}.$$ This indicator is calculated by adjusting earnings before interest and taxes (*EBIT*). The amount of newly generated value per monetary unit spent on visible intellectual capital is the *intellectual capital value added* (*ICVA*) (Dženopoljac, 2013, p. 134). The following is how ICVA is obtained (Krstić & Bonić, 2016): $$ICVA = EBIT + Dfa + Amia + Iml + Pe \quad \text{or} \quad ICVA = EBITDA + Pe$$ *Dfa* stands for depreciation of fixed or long-term assets, whereas *Amia* stands for amortization of intangible assets having a defined lifespan. A reduction in the value of intangible assets having an indeterminate lifespan is referred to as *Iml* (goodwill). Earnings before interest, taxes, depreciation and amortization are referred to as *EBITDA*.

Source: Authors' presentation

4. Conceptual Framework and Methodology of Empirical Research

Data used in this empirical research are from the financial statements of 24 companies covering the period 2012-2019. Due to the global Coronavirus (COVID-19) pandemic, 2020 is not included in the research. The sample includes the following companies: Accenture, Amazon, American Express, Apple, Cisco, Citi, Coca Cola, Disney, eBay, General Electric,

Honda, HSBC, IBM, Intel, JP Morgan, McDonald's, Microsoft, Nike, Oracle, Philips, Samsung, SAP, Toyota, UPS. The sample includes companies that are on the top 50 Interbrand list of the most valuable brands. One of the essential criteria for the selection of companies is their ranking on the list for the entire analyzed period 2012-2019. By applying this criterion and observing the brand's value at the global level in the analyzed period, the sample is reduced to 36 companies and 36 brands, respectively. Finally, the final sample includes 24 brands because we had to exclude 12 brands from the analysis due to the unavailability of financial data.

The aim of the research is to determine the impact of the human capital value on the human capital efficiency of an enterprise. *Human capital* (*HC*) represents an independent variable in our model and the sum of investments in human resources. Given the unavailability of data on investment in the training and development of employees, the human capital value contains the salaries of employees and managers and the total amount of stimulating incentives. On the otherhand, we have 9 dependent variables, which include various business performance and efficiency (productivity) indicators:

- Sales revenue (*SR*);
- Sales revenue per employee (*P0*);
- Earnings before interest and taxes (*EBIT*);
- Earnings before interest and taxes per employee (*P1*);
- Earnings before interest and taxes margin (*EBITM*);
- Human capital market value (*HCMV*);
- Human capital value added (*HCVA*);
- Human capital return on investment (*HCROI*);
- Efficiency in the use of human capital (*EHC*).

Sales revenue (*SR*) and earnings before interest and taxes (*EBIT*) were chosen as dependent variables because we wanted to see the impact of the value of human capital on the results achieved without the influence of financial and tax factors that can significantly change the research results. In addition, we wanted to observe the impact of the value of human capital on the productivity (*P0, P1*) and profitability (*EBITM*) indicators associated with them. We have included in the study all modern indicators of human capital efficiency that are in the literature, except for the Human capital cost factor (*HCCF*), because its value in our research coincides with the value of human capital.

In order to explore the impact of key variables and verify the defined hypotheses, secondary data were used, collected from the websites and annual financial statements (the balance sheet, income statement, cash flow statement, statement of changes in equity, notes to the financial statements) of selected companies for the period 2012-2019. Based on one independent and 9 dependent variables, the following hypotheses were formulated:

H1: The increase of human capital (HC) has an impact on the decrease of sales revenue per employee indicator (P0).

H2: The increase of human capital (HC) has an impact on the decrease of earnings before interest and tax per employee indicator (P1).

H3: The increase of human capital (HC) has an impact on the decrease of human capital market value (HCMV).

H4: The increase of human capital (HC) has an impact on the decrease of human capital value added (HCVA).

H5: The increase of human capital (HC) has an impact on the decrease of human capital return on investment (HCROI).

H6: The increase of human capital (HC) has an impact on the decrease of the efficiency in the use of human capital (EHC).

H7: The increase of human capital (HC) has an impact on the increase of sales revenue (SR).

H8: The increase of human capital (HC) has an impact on the increase of earnings before interest and tax (EBIT).

H9: The increase of human capital (HC) has an impact on the decrease of EBIT margin.[2]

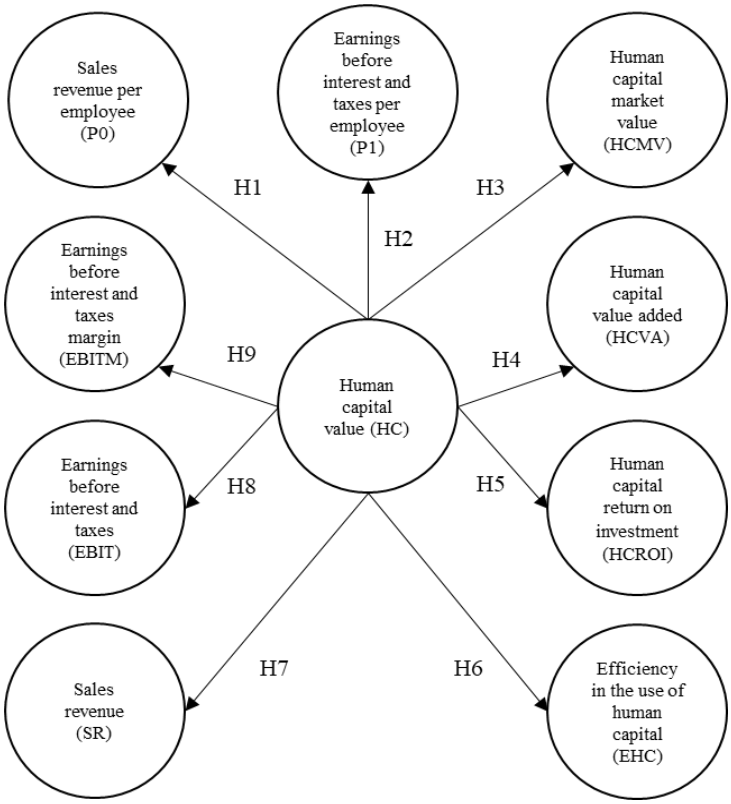

Fig. 1 The conceptual framework
Source: Authors' presentation

With the purpose to test the validity of hypotheses, correlation and regression analysis methods were used in this empirical research. We have in total 192 observations in the sample.

[2] *Earnings before interest and taxes margin* (EBITM) measures the earning potential from the operating activities of an enterprise (Krstić & Sekulić, 2020). The operating activities are the primary source of cash flow for the enterprise, and a rise in *EBITM* from one quarter to the next is considered an indication of a strong, expanding business. The *EBIT margin* is a measure of the managerial ability and operational efficiency of the enterprise. It assesses the capacity of the enterprise to convert revenues into profit before interest and taxes. It is a metric for comparing a competitive position of the enterprise to that of others in the same industry. The following formula is used to calculate the *EBIT margin* (Krstić & Sekulić, 2020*): EBITM = EBIT : SR*.

5. Results of Empirical Research

5.1. Results of descriptive statistics

The descriptive statistics are presented in Table 2. The average human capital (HC) in the analysed companies is 15,400 million $. The minimum value of 1,716 million $ is recorded in eBay in 2013, while the maximum value of 109,111 million $ is recorded in Amazon in 2019. The average sales revenue (SR) in the analyzed companies is 79,709 million $, while the minimum value of 8,257 million $ is recorded in eBay in 2013 and the maximum value of 280,522 million $ is recorded in Amazon in 2019. The average value of human capital return on investment (HCROI) in the analyzed companies is 2.4469, while the minimum value of 0.74 is recorded in General Electric in 2018 and the maximum value of 10.94 is recorded in Apple in 2012. The average value of efficiency in the use of human capital (EHC) in the analyzed companies is 2.9159, while the minimum value of 0.87 is recorded in General Electric in 2018 and the maximum value of 11.53 in Apple in 2012.

Table 2 Descriptive Statistics

Variable	Mean	Std. Dev.	Minimum	Maximum
HC	15,400.45	14,641.91	1,716.16	109,111.60
P0	0.4822	0.3760	0.06	2.12
P1	0.1014	0.1160	-0.05	0.73
HCMV	0.0000162	0.0000231	0.0000002	0.001589
HCVA	0.1859	0.1301	0.03	0.8
HCROI	2.4469	1.5593	0.74	10.94
EHC	2.9159	2.0260	0.87	11.53
SR	79,709.89	64,417.66	8,257	280,522
EBIT	14,698.78	13,967.04	-12,999	71,230
EBITM	0.2076	0.1127	-0.11	0.51

Source: Authors' calculations

5.2. Results of correlation analysis

Correlation analysis is performed to investigate the relationship between variables and the results are presented in Table 3. According to the results, there is a positive correlation between HC and SR, HC and HCVA, and HC and EBIT. Results show that the positive correlation between HC and EBIT is moderate and statistically significant (0.2605), while the correlation between HC and HCVA is low and insignificant (0.1106). The strongest positive correlation is between HC and SR (0.5304). The correlation between HC and other variables is negative and statistically significant. A strong negative correlation exists between HC and HCROI (-0.5258), HCMV (-0.5238), and EHC (-0.5165). A moderate negative correlation is present between HC and P1 indicator (-0.2201), while a low negative correlation exists between HC and P0 indicator (-0.1768), and EBITM (-0.1513).

Table 3 Correlations

	HC	P0	P1	HCMV	HCVA	HCROI	EHC	SR	EBIT	EBITM
HC	1									
P0	-0.1768*	1								
P1	-0.2201*	0.6882*	1							
HCMV	-0.5238*	0.2532*	0.3251*	1						
HCVA	0.1106	0.6820*	0.8232*	0.3634*						
HCROI	-0.5258*	0.4569*	0.6915*	0.1972*	0.2789*	1				
EHC	-0.5165*	0.4977*	0.6558*	0.1687**	0.2400*	0.9788*	1			
SR	0.5304*	0.4853*	0.1544**	-0.4924*	0.2039*	0.1477**	0.1983*	1		
EBIT	0.2605*	0.3355*	0.6068*	-0.3182*	0.3937*	0.6401*	0.6157*	0.6193*	1	
EBITM	-0.1513**	-0.0457	0.5991*	0.1699**	0.3725*	0.6206*	0.5464*	-0.2105*	0.5522*	1

Note: * Correlation is significant at the 0.01 level (2-tailed),
** Correlation is significant at the 0.05 level (2-tailed)
Source: Authors' calculations

5.3. Results of regression analysis

The results of diagnostic tests (Table 4) reveal that the random effect model (REM) is appropriate for fitting data in eight models, while the fixed effect model (FEM) is appropriate for model 8, and regression results are presented in Table 5.

Table 4 Diagnostic tests

Model	F-test	*Breusch-Pagan LM*	Hausman
	H_0: Pooled, H_1: FEM	*H_0: Pooled, H_1: REM*	*H_0: REM, H_1: FEM*
Model 1 (ln HC → P0)	213.67 (0.0000)	622.14 (0.0000)	0.10 (0.7531)
Model 2 (ln HC → P1)	115.67 (0.0000)	583.84 (0.0000)	0.15 (0.6962)
Model 3 (ln HC → HCMV)	28.02 (0.0000)	392.76 (0.0000)	0.09 (0.7587)
Model 4 (ln HC → HCVA)	97.89 (0.0000)	562.09 (0.0000)	2.66 (0.1027)
Model 5 (ln HC → HCROI)	53.23 (0.0000)	496.63 (0.0000)	1.15 (0.2843)
Model 6 (ln HC → EHC)	82.79 (0.0000)	553.25 (0.0000)	0.19 (0.6648)
Model 7 (ln HC → ln SR)	250.32 (0.0000)	622.26 (0.0000)	2.52 (0.1123)
Model 8 (ln HC → ln EBIT)	42.48 (0.0000)	439.20 (0.0000)	10.00 (0.0016)
Model 9 (ln HC → EBITM)	31.16 (0.0000)	412.55 (0.0000)	0.17 (0.6818)

Note: p values are given in ( )
Source: Authors' calculations

All models presented in Table 5 analyze the impact of human capital (HC) on the human capital efficiency indicators and business performance (sales revenue, EBIT, and EBIT margin). The models revealed a statistically significant impact of HC on the human capital efficiency indicators and business performance (sales revenue, EBIT, and EBIT margin).

The impact on the human capital efficiency indicators and EBIT margin is negative, while the impact on sales revenue and EBIT is positive.

Table 5 Regression results

	P0	P1	HCMV	HCVA	HCROI	EHC	ln SR	ln EBIT	EBITM
Constant	1.4331 [5.10] (0.000)	0.4144 [3.75] (0.000)	0.0002 [6.10] (0.000)	0.6224 [4.64] (0.000)	11.8642 [6.46] (0.000)	13.2838 [6.47] (0.000)	3.7939 [7.98] (0.000)	-1.0055 [-0.66] (0.510)	0.5712 [3.61] (0.000)
ln HC	-0.1021 [-3.52] (0.000)	-0.0336 [-2.90] (0.004)	-0.00002 [-5.58] (0.000)	-0.0468 [-3.32] (0.001)	-1.0108 [-5.20] (0.000)	-1.1128 [-5.14] (0.000)	0.7720 [15.82] (0.000)	1.0965 [6.71] (0.000)	-0.0390 [-2.32] (0.020)
θ	0.9331	0.9090	0.8152	0.9008	0.8657	0.8925	0.9380		0.8247
ρ	0.9653	0.9374	0.7795	0.9264	0.8719	0.9144	0.9701		0.7978
R^2	0.0667	0.0457	0.1064	0.0756	0.1300	0.1214	0.5959	0.8618	0.0250
$\bar{R}^2$								0.8418	
F (FEM); Wald (REM)	12.40 (0.0004)	8.43 (0.0037)	31.11 (0.0004)	11.02 (0.0009)	27.00 (0.0000)	26.45 (0.0000)	250.38 (0.0000)	44.99 (0.0000)	5.39 (0.0203)

Note: p values in ( ), z values in [ ] for REM models, and t values in [ ] for FEM model
Source: Authors' calculations

Model 1 analyses the impact of HC on sales revenues per employee (P0) and obtained results show a negative and statistically significant impact. If HC increases by 1%, the sales revenue per employee decreases by $1,021. The estimated model is statistically significant, as confirmed by the Wald statistics. The individual specific error can explain 96.53% of the entire composite error variance.

Model 2 analyses the impact of HC on earnings before interest and taxes per employee (P1) and obtained results show a negative and statistically significant impact. If HC increases by 1%, the earnings before interest and tax per employee indicator decreases by $336. The estimated model is statistically significant, as confirmed by the Wald statistics. The individual specific error can explain 93.74% of the entire composite error variance.

Model 3 analyses the impact of HC on human capital market value (HCMV) and obtained results show a negative and statistically significant impact. If HC increases by 1%, the human capital market value decreases by 0.0000002. The estimated model is statistically significant, as confirmed by the Wald statistics. The individual specific error can explain 77.95% of the entire composite error variance.

Model 4 analyses the impact of HC on human capital value added (HCVA) and obtained results show a negative and statistically significant impact. If HC increases by 1%, the human capital value added decreases by 0.000468. The estimated model is statistically significant, as confirmed by the Wald statistics. The individual specific error can explain 92.64% of the entire composite error variance.

Model 5 analyses the impact of HC on human capital return on investment (HCROI) and obtained results show a negative and statistically significant impact. If HC increases by 1%, the human capital return on investment decreases by 0.0101. The estimated model is statistically significant as confirmed, by the Wald statistics. The individual specific error can explain 87.19% of the entire composite error variance.

Model 6 analyses the impact of HC on the efficiency of the use of human capital (EHC), and obtained results show a negative and statistically significant impact. If HC increases by 1%, the efficiency of the use of human capital decreases by 0.0111. The estimated model is statistically significant, as confirmed by the Wald statistics. The individual specific error can explain 91.44% of the entire composite error variance.

Model 7 analyses the impact of HC on the sales revenues (SR) and obtained results show a positive and statistically significant impact. If HC increases by 1%, the sales revenue increases by 0.77%. The estimated model is statistically significant, as confirmed by the Wald statistics. The individual specific error can explain 97.01% of the entire composite error variance.

Model 8 analyses the impact of HC on earnings before interest and taxes (EBIT), and obtained results show a positive and statistically significant impact. If HC increases by 1%, the earnings before interest and taxes increase by 1.1%. The estimated model explains 86.18% change in EBIT and is statistically significant, as confirmed by the F test.

Model 9, finally, analyses the impact of HC on the EBIT margin (EBITM) and obtained results show a negative and statistically significant impact. If HC increases by 1%, the EBIT margin decreases by 0.0004. The estimated model is statistically significant, as confirmed by the Wald statistics. The individual specific error can explain 79.78% of the entire composite error variance.

6. Discussion and Conclusion

Based on the results of the empirical research in this paper, it can be concluded that human capital has a significant statistically positive impact on sales revenues and EBIT and a significant statistically negative impact on other efficiency and productivity indicators. Hence, this implies that all the hypotheses are confirmed. The value of human capital in the era of the knowledge economy has an impact on the business results of enterprises in terms of increasing sales revenue and earnings before interest and taxes. This indicates that additional investment in human resources would lead to higher revenue.

Since investments in human resources are treated as costs in the income statement, managers often refuse to increase salaries and incentives for employees because they are afraid of increased costs and reduced profits (earnings). On the other hand, they often reduce business costs at the expense of employees, in terms of reducing salaries and benefits. Financial reporting standards should find an adequate solution for recording intangible assets, especially human capital. Human resources entail costs that represent investments with a specific rate of return, which is reflected in the increase in revenue.

By looking at the impact of the human capital value on the human capital efficiency indicators and EBIT margin, the logical conclusion can be driven, verified through conducted empirical research, that such an impact is caused by the structure of formulas that have in their denominator either the number of employees or human capital value. Since the human capital value includes the costs of salaries, benefits, incentives, employee training, etc., it will have a negative impact on the human capital efficiency indicators and EBIT margin with the growth of the human capital value.

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UTICAJ VREDNOSTI LJUDSKOG KAPITALA NA EFIKASNOST LJUDSKOG KAPITALA I POSLOVNE PERFORMANSE

U eri ekonomije znanja ljudski kapital je deo intelektualnog kapitala i glavni faktor razvoja preduzeća. Značaj ljudskog kapitala se često umanjuje zbog računovodstvenog izražavanja ulaganja u ljudske resurse u bilansu uspeha kao troškovne komponente. Ovaj rad ukazuje na činjenicu da troškovi za ljudske resurse predstavljaju investicije koje utiču na rast poslovnih perfomansi preduzeća. Otuda, cilj ovog rada je da se istraži uticaj vrednosti ljudskog kapitala na efikasnost ljudskog kapitala i neke poslovne performanse, kao što je prihod od prodaje, dobit pre odbitka kamata i poreza, i marža dobiti pre odbitka kamata i poreza. Da bi se ispitao ovaj uticaj, sprovedeno je empirijsko istraživanje na uzorku od 24 preduzeća s najvećom vrednošću brenda za period 2012 - 2019. Rezultati regresione analize pokazuju da prihod od prodaje i EBIT rastu za 0,77%, odnosno 1,1% s rastom vrednosti ljudskog kapitala za 1%. Takođe, rezultati pokazuju da rast vrednosti ljudskog kapitala negativno utiče na vrednosti pokazatelja efikasnosti ljudskog kapitala i marže dobitka pre odbitka kamata i poreza u istraživačkom uzorku preduzeća.

Ključne reči: *vrednost ljudskog kapitala, merenje ljudskog kapitala, efikasnost*

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HETEROGENEOUS DEPENDENCE OF OIL-FOOD PRICE DYNAMICS IN AFRICA'S NET OIL-EXPORTING COUNTRIES

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Abstract. *The determinants of food prices have attracted sizeable debates among scholars over the last three decades. However, many of these studies ignore the possibility that the impact of oil prices on food prices could vary across the food price distribution. The paper employs a quantile regression technique to ascertain whether food prices respond to the potential heterogeneous impact of crude oil price changes in the six selected African net oil-exporting countries. The coefficient of negative oil price shocks in the panel OLS model is insignificant and positive at the 5% significance level. In contrast, the coefficient of positive oil price shocks significantly affects food prices for the chosen African countries. The quantile regression analysis's empirical findings highlight the diverse dependence effects of various ranges on food prices. All coefficients are non-significant across all quantiles for negative oil price shocks, a conclusion consistent with panel least squares estimate results. Besides, the findings prove that positive changes in oil prices significantly affect the magnitude of food prices in selected African countries. The article concludes that the influence of crude oil price variations on food prices is diverse and positive across quantiles for a subset of Africa's net oil-exporting countries. The findings of this study could have a crucial policy and economic implications for economic agents and stakeholders in diverse fiscal environments. As a result, economic agents must make timely decisions to respond to the effects of oil price uncertainty on Africa's food market.*

Key words: *Oil prices, Food prices, Heterogeneity effects, Quantile regression, Africa*

JEL Classification: Q17, Q41, O55, C33

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1. INTRODUCTION

Global household food prices have generated headlines and raised public anxiety in the aftermath of the COVID-19 pandemic. Africa is particularly vulnerable to the COVID-19 pandemic consequences on four fronts: rising food costs, increasing gasoline prices, decreased tourism earnings, and possibly increased barriers to accessing foreign capital inflows. Recent data indicates that COVID-19 pandemic has resulted in skyrocketing domestic gasoline prices and a significant increase in consumer food prices, albeit perceptions differ across Africa. Indeed, rising food and oil prices have begun to trickle down to domestic consumer prices, as retailers, unable to absorb the additional costs, have passed them on to customers. Energy costs are increasing, putting a strain on the entire food chain. Food prices may rise as demand for oil increases, as it is required to operate agricultural equipment, transport agricultural inputs and produce, and meet end-user demand. Similarly, expenditures associated with food imports would result in outflows during periods of rising oil prices, exerting upward pressure on domestic food prices. Several oil-producing countries have adversely affected agriculture, notably Nigeria, due to increased food costs, severe weather, and reduced farming operations. As a result, crude oil prices are a substantial source of volatility in food prices, and there are serious worries about the domestic policy space available to sustainably solve these problems. As a result, it is necessary to assess the impact of the diverse reliance on oil and food price dynamics in selected African nations.

Nevertheless, a slew of research has concluded that the price of crude oil has a considerable effect on food prices (see Alghalith, 2010; Ciaian & Kances, 2011; Kyung & Jeong, 2011; Peri & Baldi, 2012; Nazlioglu & Soytas, 2012; Baumeister & Kilian, 2013; Pal & Mitra, 2018; Koirala et al., 2015; Nicola et al., 2016; Jadidzadeh & Serletis, 2018; Taghizadeh-Hesary, Rasoulinezhad & Yoshino, 2018). Baumeister and Kilian (2013) argue that oil price changes drive food prices. In contrast, studies such as Reboredo (2012), Gardebroek and Hernandez (2013), Zhang and Chen ((2014), and Fowowe (2016), amongst others, confirm neutrality between oil prices and food prices. Another viewpoint focuses on the transmission mechanism between crude oil and food prices, which operates continuously in diverse phases. Also, recent studies like Ibrahim (2015), George and Ogede (2020), and Adeosun, Olayeni, and Ayodele (2021) employ NARDL methodology to gauge the asymmetries effect of changes in oil prices on explanatory variables. These studies provide conflicting outcomes. Thus, an unexpected surge in the actual cost of oil was mirrored by deliberate increases in agricultural output prices in the United States (Baumeister & Kilian, 2013). Also, Adeosun et al. (2021) establish a significant oil-food relationship that changes across frequencies. The authors also contend that oil price behaviour may have exhibited structural breaks, suggesting reasons for gauging the distributional effect of oil price shocks. The inconsistent outcomes regarding the oil price and food price debates raise questions about how much intensifying oil prices can explain the increase in food prices.

While empirical evidence suggests that asymmetric reactions exist in oil prices and inflation (George & Ogede, 2020), the empirical evidence for the link between oil prices and food prices appears to be mixed. Methodologically, the literature reveals numerous explanations for various outcomes, ranging from estimation techniques, sample scope, campaigns for substitute energy sources, and monetary policies. Besides, the current study contends that these empirical outcomes may be biased, assuming that the distributional heterogeneity of food price returns is ignored. In theory, oil-food price shocks significantly impact society since food accounts for a more significant proportion of poorer customers'

demand; a global increase in food prices substantially influences inflation in poorer countries. The same can be said for energy prices, which have skyrocketed. Rising food and oil prices on trade terms vary by nation. However, it has been positive in nearly half of the oil-producing countries, particularly those exporting commodities. The impact varies by the economic group; for example, farmers who grow and export commodities may benefit, but urban consumers who use imported food and oil may suffer. Hence, given the significance of oil-food debates and the current happenings amid COVID-19, it is expedient to examine whether crude oil price changes drive food price changes in Africa and whether the effects vary across time and the distribution of food prices in Africa.

Given the preceding, the policy thrust of this study is to gauge the heterogeneous dependence of oil-food price dynamics in the net oil-exporting countries. These countries include Algeria, Angola, Gabon, South Africa, Egypt, Morocco, and Nigeria. These countries also import refined products made from crude oil (Ogede, George andAdekunle, 2020), and their primary source of revenue is crude oil exports. In combination with the COVID-19 pandemic, the fluctuating oil prices are a danger to these countries' consumer pricing (Ogede, 2020a). Besides, the current events have crippled economies and shattered livelihoods, rendering food and health services exorbitant or inaccessible. Thus, to our knowledge, the quantile regression model has been validated in studies such as Mehnatfar, Khanian, and Azari (2018), Lahiani (2018), Nusair and Olson (2019), Ogede (2020a), and Ogede and Adegboyega (2021) that examine inflation and exchange rate behaviour in response to changes in oil prices. For example, Ogede (2020a) established a significant disparity in the magnitude and sign of the inflation returns. Nevertheless, there is a dearth of empirical literature demonstrating a link between oil price changes and food prices in Africa using a quantile regression model approach.

This study contributes to the body of knowledge in two ways. To begin with, it studies the influence of oil price variations on food prices in a grouping of Africa's net oil exporters: Morocco, Angola, South Africa, Egypt, Algeria, and Gabon, as well as Nigeria. Second, the study uses the quantile regression (QR) model to examine the effects of oil price fluctuations on the median and conditional dispersion of food prices using the quantile regression (QR) model. The essay examines how food prices fluctuate in response to variations in oil prices. The justification for using quantile regression on the equation of oil price changes is that QR can uncover the entire conditional dispersion of consumer price returns. As a result, the study assesses how oil price fluctuations affect food prices based on their location on the dispersion of food price returns. Finally, the study contributes to a deeper understanding of the discussion and serves as a policy document discussing well-being assessment and appropriate policy proposals for overcoming emerging oil-food price crises in the selected nations. The outcomes emphasize the varied dependence impacts of multiple quantiles of food prices. All coefficients are insignificant across all quantiles for negative oil price shocks, confirming the panel OLS results. Furthermore, it is established that increases in oil prices have a considerable impact on the scale of food prices in some African countries. The remainder of the study is structured as a review of pertinent literature. Section 3 presents a discussion of methodology and an examination of data sources. The findings are discussed in Section 4. Section 5 concludes the study and highlights the report's policy recommendations.

2. Review of the Related Literature

A plethora of literature has been documented regarding the oil price and food price debates. The review of the related empirical studies shows that the outcomes are diverse and renews the discourse on how much intensifying oil prices can explain changes in food prices. The first standpoint argues for the existence of linkages between oil prices and food prices (see Alghalith, 2010; Ciaian & Kances, 2011; Kyung & Jeong, 2011; Peri & Baldi, 2012; Nazlioglu & Soytas, 2012; Pal & Mitra, 2018; Jadidzadeh & Serletis, 2018; Taghizadeh-Hesary, Rasoulinezhad & Yoshino, 2018). For example, Taghizadeh-Hesary et al. (2018) employ a Panel-VAR model to investigate the interaction between food and energy prices in eight Asian economies. According to the authors, oil prices significantly impact food costs. Jadidzadeh and Serletis (2018) explore whether the market-driven shocks of global oil prices have affected global and US corn prices and whether the underlying market-driven volatilities in the global oil market account for changes in the overall US corn prices. In divergence to the empirical literature that confirms the existence of linkage, studies such as Reboredo (2012), Gardebroek and Hernandez (2013), Baumeister and Kilian (2013), Zhang and Chen (2014), Fowowe (2016), amongst others, confirm the neutrality concerning food-energy price dynamics. For instance, Zhang and Chen (2014) show that the grains index exhibits a substantial response to anticipated volatility in oil prices. Additionally, Fowowe (2016) reported a comparable outcome for the South Africa study. Additionally, numerous studies have found possible asymmetries involving oil and food prices by exploring NARDL, Markov switching, and VAR methodologies. Ibrahim (2015), Meyer, Sanusi, and Hassan (2018), and Adeosun et al. (2021) all indicate mixed results regarding food prices' relation to oil prices.

Meanwhile, there is no long-term relationship between decreased oil costs and lower food prices. Additionally, the model demonstrates no short-term asymmetry in food price behaviour, as the association between the waxing and waning in fuel-food prices is minimal. Using a panel vector autoregressive (PVAR) model, Taghizadeh-Hesary et al. (2018) examine the relationship between fuel and food prices rigorously and conclude that oil prices have a considerable impact on food rates in designated Asian economies. Recently, Adeosun et al. (2021) employed wavelet and Markov-switching techniques to investigate the oil-food price dynamics in Nigeria. Thus, to eliminate contradicting behaviour and adjust for disturbances near the edge of the wavelet impulses, the author used monthly data from 1995: M1 to 2019: M5. The data demonstrate that the direct response of oil price shocks to food prices shifted across frequencies, indicating that the immediate impact of oil price shocks on food prices predominated, with evidence of a slight spillover effect in the short term.

While there is substantial literature on the linear and non-linear effects of oil price variations on food prices, limited studies have been conducted to assess the nexus using the quantile regression technique. As a result of this lacuna, it is conceivable to estimate the heterogeneous dependency of oil price changes on food prices based on the location of food prices within the respective distribution following Lahiani (2018). The quantile regression model's advantages over many other techniques include highlighting discoveries that look minor throughout the whole sample year but are highly noteworthy when assessed partially with some sample space. It provides a temporary difference in the elasticity of the food price. Additionally, it is reasonable to anticipate that the food price index will be distorted (Lahiani, 2018).

3. Methodology and Sources of Data

This study employs a quantile regression (QR) model to investigate the heterogeneous dependence on oil-food price dynamics in Africa's net oil-exporting countries following the work of Lahiani (2018), Nusair and Olson (2019), and Ogede (2020a). The net oil-exporting countries include Algeria, Angola, Egypt, Gabon, Morocco, and Nigeria. The study spans 19 years, from 2001 to 2019. The oil price is obtained from the OPEC Bulletin, while the food price index is calculated and sourced by the Food and Agriculture Organization (FAO). The food price index is also used to evaluate the monthly change in worldwide food costs for a basket of goods. These studies contend that the impacts of changes in oil prices differ across the distribution of inflation. Consequently, the paper structured the QR model as:

$$Z_r(Z_t|K_t) = K_t\beta_q \tag{1}$$

Equation (1) is modified to reflect oil-food prices interaction as:

$$z_r(FP_t|\Delta OP_t) = \alpha.(k) + \beta(k)\Delta OP_t + \varepsilon_t(k) \tag{2}$$

FP_t and ΔOP_t are the food price and oil price changes, respectively, at the time represented by *t*, and ε_t is the error term.

Thus, following Ogede (2020a), oil prices are segmented into negative and positive variations to analyze the asymmetric effect of oil-food prices on Africa's net oil-exporting countries. Besides, the monthly crude oil price sourced from OPEC statistical bulletins was transformed by modelling realized volatility. The realized volatility model is piloted by Andersen & Bollerslev (1998) and modified by Ogede (2020b) in gauging the monthly oil price volatility as specified in equation (3). These are in divergence to studies such as Baumeister & Kilian (2013); Avalos (2014); Fowowe (2016); Reboredo (2012); Ibrahim (2015); Taghizadeh-Hesary, Rasoulinezhad & Yoshino (2018), amongst others, that investigate the impact of oil price shocks on food prices. The monthly realized volatility (MRV) model uses squared intra-month returns to generate more true volatility measures, and it is structured as:

$$OP_t = MRV_t = \sum_{t=1}^{D} r_t^2 \tag{3}$$

where OP_t represents the oil prices at time *t*, MRV_t and r_t^2 depicts the monthly realized volatility and intra-month returns at time *t*, respectively.

The equation is then integrated into to become equation (4),

$$q_r(FP_t|\Delta OP_t) = \alpha.(k) + \beta(k)\Delta MRV_t + \beta(\tau)\Delta Pos_t^{+} + \beta(\tau)\Delta Pos_t^{-} + \varepsilon_t(k) \tag{4}$$

4. Results and Discussion

This section explores and explains the empirical evidence about the diverse dependence of oil-food price dynamics in Africa's net oil-exporting countries. The analyses included a variety of econometric approaches, including panel unit root, ordinary least squares (OLS), and quantile regression (QR). Table 1 summarizes the results of descriptive statistics on changes in oil prices and the returns on food price indexes. As the standard deviations suggest, food and oil prices have been highly variable during the study period. According to skewness data, food prices and positive oil price changes are positively skewed, whereas

negative crude oil price changes are negatively skewed. At the 5% significance level, all variables have Jarque-Beta (J-B) probability values less than the 0.05 critical value. Table 2 summarizes the results of the stationary tests and demonstrates the confirmation of stationary for the series.

Table 1 Descriptive Statistics

	lnFP_Ind	Neg_Shock	MRV	Pos_Shock
Mean	4.3411	-0.0319	0.6395	0.0362
Median	4.3355	0.0000	0.5744	0.0191
Maximum	4.7629	0.0000	2.9170	0.1959
Minimum	3.9466	-0.3109	0.0112	0.0000
Std. Dev.	0.2649	0.0605	0.5368	0.0441
Skewness	0.0337	-2.4547	1.5999	1.2112
Kurtosis	1.4952	9.1505	6.2476	3.9477
J-B (Prob.)	21.463 (0.000)	585.77 (0.000)	196.61 (0.000)	63.991 (0.000)

Source: Authors' Computation, 2021

Table 2 Panel Unit Root Test

Method	Statistic	Prob.**	Cross-sections	Obs.
Levin, Lin & Chu test	-2.31121	0.0104	4	901
Im, Pesaran and Shin W-stat +	-16.8519	0.0000	4	901
ADF - Fisher Chi-square+	260.422	0.0000	4	901
PP - Fisher Chi-square+	260.635	0.0000	4	905

Source: Authors' Computation, 2021

The nexus between food prices and changes in oil prices, negative oil shocks, and positive oil shocks in selected African net oil-exporting countries is presented in Table 3. The findings of the OLS are presented to illustrate the average influence of changes in oil price shocks on food prices and to compare them to the quantile regression (QR) of the selected nations, namely Algeria, Angola, Gabon, South Africa, Egypt, Morocco, and Nigeria. The coefficient of negative oil price shocks in the panel OLS model (0.198) is insignificant and positive at the 5% significance level. Additionally, the table illustrates that the coefficient of positive oil price shocks (-0.859) has a considerable negative effect on food prices in selected African countries. For the selected African countries, a negative oil price shock often forces these countries to offer incentives to purchasers to take the product off their hands due to concerns about storage capacity running out. The negative oil price shock may also necessitate a drop in crude oil export profits, further undermining the government's commitment to diversification through agricultural production growth and provision of agricultural subsidies. Additionally, the empirical data indicate that the overall direction of the coefficients change with quantile and are only minimally different from the OLS coefficients. The results of the regressive quantile model are depicted visually in Fig. 1a-c.

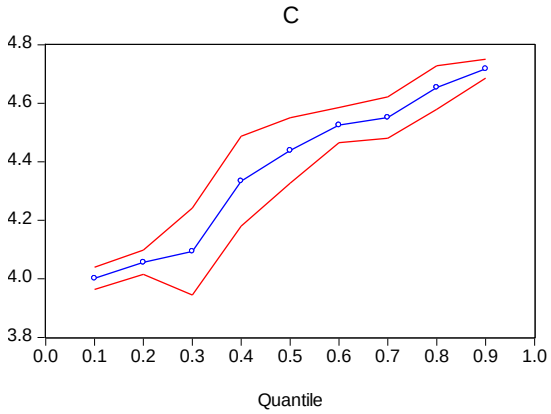

Fig. 1a Quantile Process Estimate of C

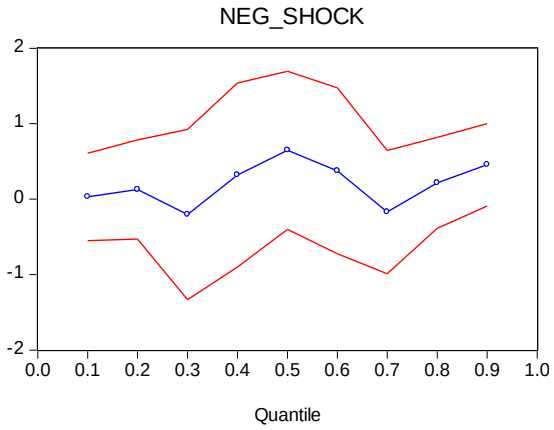

Fig. 1b Quantile Process Estimate of Negative Shock

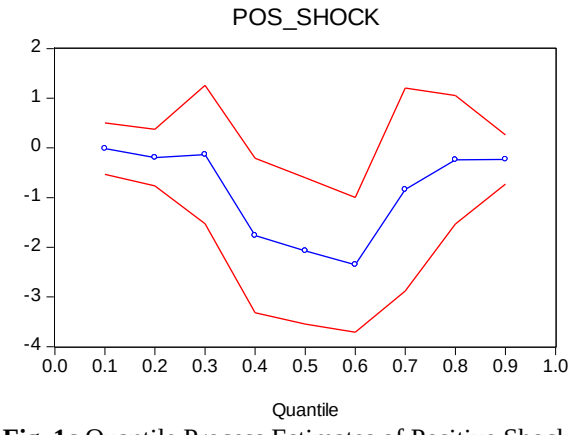

Fig. 1c Quantile Process Estimates of Positive Shocks

The indicator of positive oil prices (-2.0734) produces a negative and significant effect on food prices at the 10 per cent significance level. The coefficient of adverse oil prices (0.646) exhibits a positive and insignificant impact on food prices, revealing the asymmetric nexus in the selected African countries. The results further explain that a 1 per cent improvement in the median value of negative oil prices will translate into a 0.64 per cent increase in food price median value. A 1 per cent increase in the median value of a positive oil price shock will translate into a 2.07 per cent decrease in the median value of food prices.

Table 3 Ordinary Least Square and Quantile Regression Results

Variable	OLS		QR (Median)	
	Coefficient	Prob.	Coefficient	Prob.
Neg_Shock	0.198404	0.5392	0.646549	0.2255
Pos_Shock	-0.859670*	0.0533	-2.073452	0.0060*
C	4.378592***	0.0000	4.438553	0.0000***

Note: *Significant at 10%, **Significant at 5%, ***Significant at 1%.
Source: Authors' Computation, 2021

Table 4 establishes an essential distinction through the conditional distribution of food prices. It provides the results for the 10^{th} to 90^{th} conditional quantiles. The empirical findings of the quantile regression analysis point out the heterogeneous dependence impacts of various distributions on food prices. As shown in Table 4, all variables are insignificant throughout all distributions for negative oil prices, similar to the panel OLS results. The findings indicate a positive association between food prices and negative oil prices in the lower to higher quantiles of 0.10 to 0.90. Furthermore, the result shows that positive changes in oil prices positively impact the food price distributions in the selected African countries. The coefficients are insignificant across the quantiles except in the 0.40, 0.50, and 0.60 quantiles at the 1% and 5% significance levels, respectively. The outcome is in tandem with the empirical investigations of Adeosun et al. (2021), Lahiani (2018), Taghizadeh-Hesary et al. (2018), and Ogede and Adegboyega (2021). For instance, Adeosun et al. (2021) demonstrate that the immediate response of oil price changes to food prices shifted across frequencies. However, a fascinating question arising from our findings is whether the results are robust or varied. The paper compared OLS results, which gauge the overall impact, with conclusions from QR at each quantile. It is noted that the results diverge. The paper contends that the impact of crude oil price changes on food prices is heterogeneous and positive across quantiles for the selected net oil-exporting countries in Africa. Thus, the findings support the erstwhile extant studies that expose that oil price changes as crucial potential causes of soaring food prices (Baumeister & Kilian, 2013; Ciaian & Kances, 2011; Nazlioglu & Soytas, 2012; Jadidzadeh & Serletis, 2018; Taghizadeh-Hesary, Rasoulinezhad & Yoshino, 2018). Moreover, the quantile process estimates of positive and negative oil price shocks provide lower (0.10) and upper (0.90) quantiles, substantially different from zero. The results indicate that a considerable increase in food prices in response to oil price changes could help investors and policymakers plan ahead of shocks. The findings may require a domestic policy framework to strengthen the economic agents in different economic and financial circumstances. Specifically, the conclusion that positive and negative oil price changes positively affect food prices requires particular attention.

Table 4 Quantile Process Estimates

Quantile/	C			Neg_Shock			Pos_Shock		
Variable	Coef.	t-Stat	Prob.	Coef.	t-Stat	Prob.	Coef.	t-Stat	Prob.
0.10	4.001	206.9	0.000***	0.295	0.101	0.919	0.265	-0.056	0.955
0.20	4.056	191.9	0.000***	0.335	0.383	0.703	0.291	-0.671	0.503
0.30	4.093	54.1	0.000***	0.575	-0.35	0.724	0.711	-0.190	0.849
0.40	4.333	55.4	0.000***	0.622	0.514	0.608	0.793	-2.224	0.027**
0.50	4.438	77.7	0.000***	0.535	1.209	0.228	0.752	-2.759	0.006*
0.60	4.525	148.4	0.000***	0.561	0.668	0.505	0.692	-3.398	0.001***
0.70	4.551	126.6	0.000***	0.416	-0.409	0.682	1.042	-0.805	0.422
0.80	4.653	122.5	0.000***	0.307	0.699	0.485	0.659	-0.365	0.716
0.90	4.717	287.5	0.000***	0.279	1.633	0.104	0.253	-0.923	0.357

Note: *Significant at 10%, **Significant at 5%, ***Significant at 1%.
Source: Authors' Computation, 2021

5. Conclusion and Policy Recommendations

This paper investigates the potential heterogeneous impact of oil price changes on food prices in six (6) net oil-exporting African countries, namely: Algeria, Angola, Egypt, Gabon, Morocco, and Nigeria spanning from 2001 to 2019. The study employs the food price index as a proxy for food and monthly oil prices to gauge the negative and positive oil price changes. The paper uses a quantile regression approach to address the potential heterogeneous impact of the oil price changes on food prices in six (6) African countries. The investigation yielded the following findings and conclusions. Firstly, the ordinary least squares and quantile regression (median) results on the connection between food prices and variations in oil prices shocks in selected African net oil-exporting countries. The coefficient of negative oil price shocks in the panel OLS model is insignificant and positive at the 5% significance level. In contrast, the coefficient of positive oil price shocks has a significant negative effect on food prices in several African countries. Additionally, the quantile regression analysis's empirical findings highlight the diverse dependence effects of various ranges on food prices. All coefficients are non-significant across all quantiles for negative oil price shocks, a conclusion consistent with panel least squares estimate results. Additionally, the result of the quantile regression establishes that positive changes in oil prices have a significant effect on the extent of food prices in selected African countries. The article argues that the influence of crude oil price variations on food prices is diverse and positive across quantiles for a subset of Africa's net oil-exporting countries.

The findings may have significant policy and economic consequences for economic actors and stakeholders operating in various socio-economic situations. For example, the reflection of the quantile process's lower (0.10) and upper (0.90) quantile estimates of positive and negative oil price shocks is significantly different from zero. The above provides helpful information to investors and policymakers about the possibility of a significant increase in food prices in response to oil price changes. The policy makers should also motivate the development of a domestic policy framework to strengthen economic agents in various socio-economic settings. Specifically, the findings that positive and negative oil price changes positively affect food prices require attention. Also, given the anti-inflationary characteristics of food, a portion of food or agricultural input subsidies should be provided to increase food

production. Furthermore, fiscal and monetary authorities in these countries should change public policy measures to accommodate oil price reductions and reduce food prices. In addition, these nations have to develop a long-standing agricultural framework to protect the individual domestic economies against food crises induced by increased oil prices.

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HETEROGENA ZAVISNOST DINAMIKE CENA NAFTE I HRANE U AFRIČKIM ZEMLJAMA IZVOZNICAMA NAFTE

Determinante cena hrane su predmet rasprave među naučnicima u poslednje tri decenije. Međutim, mnoge studije zanemaruju mogućnost da uticaj cena nafte na cene hrane može da varira u zavisnosti od distribucije cena hrane. Ovaj rad koristi kvantil regresivnu tehniku da odredi da li cene hrane odgovaraju potencijalnom heterogenom uticaju promena cene sirove nafte u šest odabranih afričkih zemalja izvoznica nafte. Koeficijent negativnih šokova cene nafte u panel OSL modelu nije značajan i pozitivan je na nivou od 5%. Nasuprot tome, koeficijent pozitivnih šokova cena nafte značajno utiče na cenu hrane u odabranim afričkim zemljama. Empirijski rezultati kvantil regresivne analize naglašavaju efekte zavisnosti različitih rangova na cene hrane. Svi koeficijenti su ne-značajni preko svih kvantila za negativne šokove cena nafte, što je u skladu sa rezultatima panel procene najmanjih kvadrata. Osim toga, rezultati dokazuju da pozitivne promene u ceni nafte značajno utiču na veličinu cena hrane u odabranim afričkim zemljama. Rad zaključuje da je uticaj varijacija cene sirove nafte na cene hrane raznovrstan i pozitivan za odabrane afričke zemlje izvoznice nafte. Rezultati ove studije mogli bi imati važne političke i ekonomske implikacije za ekonomske činioce i donosioce odluka u različitim fiskalnim okruženjima. Kao rezultat, ekonomski činioci moraju da donose pravovremene odluke kako bi odgovorili na efekte neizvesnosti cene nafte na afričko tržište hrane.

Ključne reči: *cene nafte, cene hrane, efekti heterogenosti, kvantil regresija, Afrika*

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COVID-19 PANDEMIC AND NIGERIA'S INTERNATIONAL LIQUIDITY: IMPACT ANALYSIS

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Abstract. *Covid-19 pandemic woes have caught across almost every international activity in the world today, which makes many economies to be in a cross-road whether the COVID-19 pandemic is the cause of these woes or not. In this regard, this study investigated the effect of the COVID-19 pandemic on international liquidity in Nigeria. COVID-19 pandemic was proxied by COVID-19 new cases and new deaths of the pandemic in Nigeria and a dummy which represented the period of the pandemic, and as such, stood in as the explanatory variables in the study, while international liquidity was put as the dependent variable. Daily data sets were sourced from National Centre for Disease Control in Nigeria and the Central Bank of Nigeria statistical bulletin between February and October 2020, employing Auto-Regressive Distributed Lag (ARDL) technique. Findings of the study revealed that, in the short run, the COVID-19 pandemic period had a significant impact on Nigeria's international liquidity. However, the COVID-19 new cases and new deaths could not have any significant impact on the international liquidity. Moreover, none of the COVID-19 pandemic variables could have any long-run impact on the international liquidity in Nigeria. The study, therefore, suggests that Nigerians should know that the depletion of its foreign reserve is not due to policy deficiency but to the COVID-19 pandemic. Also, the government should try to improve quality exports that will be demanded by foreign countries irrespective of any pandemic.*

Keywords: *COVID-19 Pandemic, Dummy variable, International liquidity, Time series*

JEL Classification: F38, F42, I11, I15, I18

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1. INTRODUCTION

The woes that have befallen the world as a result of the Corona Virus are an unanticipated and unprojected challenge, and this health challenge has spread to almost all sectors of the world economy. With the declaration of the World Health Organisation (WHO) on March 11th, 2020, that COVID-19 has become a global pandemic, the issue has shaken the world economy as a whole.

To curb the spread of this pandemic, most governments have put in place policies to reduce or regulate the spread. Apart from the use of sanitary materials, which to some extent, has encouraged a quantum level of productive capacity in the pandemic-demanded goods such as face-masks, hand sanitizers, COVID-19 test kits among others, it has, however, drastically paralyzed the demand for a major international product, crude oil, due to the total lockdown experienced in most nations of the world, in which Nigeria is not left out.

The advanced economies were hit by the effect of the pandemic which resulted in the total and partial closure of many sectors that fed their external reserves with the appreciable quantity of foreign currencies. Even though they remain the main producers and providers of these COVID-19 test kits, which brought lots of foreign patronages and hence were expected to boost their economy to some extent, they still cry out as the pandemic bit hard on their economy. The question now is that what will be the fate of the developing economies like Nigeria, in which this challenge has depleted her major source of foreign reserve? Moreover, the developing country has not developed to the extent of exporting COVID-19 test materials to the international market.

Nigeria's economy at the start of the pandemic has been very fragile as it depends solely on the demand and price of oil in the international market and the nation's budget is based. Oil is the main source of improvement in its international liquidity popularly known as external reserve. The price of Brent crude oil was $26 per barrel at the beginning of April 2020, whereas, the budget is based on $57 a barrel, showing a negative gap of $31. This has an adverse consequence on the reserve (Onyekwena & Ekeruche, 2020).

Quoting from a report by the International Monetary Fund (IMF), "Nigeria has been severely hit by the spread of COVID-19 and the associated sharp decline in oil prices. Government policy is responding to both these developments. A range of measures has been implemented to contain the spread of the virus, including the closure of international airports, public and private schools, universities, stores, and markets, and the suspension of public gatherings. A "lockdown" was declared in Lagos, Abuja, and Ogun states. Work at home is also encouraged in several states and government institutions while isolation centres are being expanded in Lagos state. Testing capacity is increasing as National Center for Disease Control (NCDC) now deploys digital platforms for people to get results sooner.

The President ordered the release of inmates in correctional facilities to decongest prisons. On May 4th, phase 1 of the three-phase economic re-opening commenced following a full lockdown that had been placed since March 30th. Phase 1 moved to phase 2 on June 2nd - allowing most offices and schools to reopen. However, a comprehensive list of restrictions remains in place, including a nighttime curfew, a ban on non-essential inter-state passenger travel, the partial and controlled interstate movement of goods and services, and mandatory use of face masks or coverings in public. On September 4th, Nigeria transitioned into phase 3. Night curfew has been reduced to 12am – 4am. Groups of up to 50 people are allowed to attend parties and gatherings. More opening hours were allowed for parks and gardens but clubs and bars remained shut. Schools around the country reopened around October 12th, 2020" (IMF, 2020).

Based on the background of the COVID-19 pandemic in the world and Nigeria specifically concerning the economic sector, the broad objective of this study is to investigate the impact of the COVID-19 pandemic on Nigeria's international liquidity. Specifically, the objectives are:

i. To examine the impact of COVID-19 cases on international liquidity in Nigeria.
ii. To determine the effect of the period of COVID-19 on Nigeria's international liquidity.
iii. To examine the impact of new deaths as a result of COVID-19 on Nigeria's international liquidity.

The rest of the study is organized in sections: Section two presents the relevant literature underpin; Section three showcases the methodology; Section four presents the research findings, and section five concludes and proffers recommendations.

2. Review of Relevant Literature

Cevik and Mutlu (2022) examined the actions taken by different central banks to support various businesses in their respective economies. Their findings indicated that these banks made liquidity to be abundant by keeping a very low-interest rate. Also, quantitative easing was applied during the period of the COVID-19 pandemic. A swap agreement was also implemented to facilitate the access of economies to dollars and euros. The resultant response was the flow of credit into the real economy which boosted the employment rate, reduced the market volatility, and reduced the supply of dollars pressure.

Papyrakis (2022) also studied the impact, drivers and responses of COVID-19 on international development. According to him, the pandemic has reshaped the debates and processes in international development. The crisis has generated a quantum of challenges for developing nations, many of which could not conveniently cope with the situation of high demand for health care which calls for an immediate decision and made a prompt relief to affected economic development outcomes such as climate change, water, education, poverty and migration, among others.

Nikolova (2021) reviewed the role of foreign reserves in the COVID-19 pandemic period in central banks of governments. Simple bar chart methods were employed to compare pre-COVID with the present situation, sourcing data from the Bank for International Settlements and the International Monetary Fund databases. The finding revealed that the foreign exchange reserves are necessary for the central banks and governments, especially in times of crisis and in pandemics, since the reserves are used as a source of last resort for intervention and rescue of the domestic economy.

Marques et al. (2021) studied the foreign intervention and capital flow management measures from a multilateral view. They realized that more caution is warranted in the use of this policy when there are spillovers in a multilateral review from an individual country's view. Also, multilateral cooperation could be more helpful when considering foreign intervention which will also affect the international liquidity of a country.

Dong and Xia (2020) examined the impact of COVID-19 on the balance of payments and foreign reserves in China. The emergence of the pandemic resulted in an expansion in the nation's balance of payment. Moreover, capital inflows and the international liquidity of the country increased appreciably.

Adenomon and Maijamaa (2020) studied the impact of COVID-19 on the Nigerian stock exchange from January to April 2020 employing quadratic and exponential autoregressive

conditional heteroskedasticity. The findings indicated a loss in stock returns and high volatility in stock returns during the COVID-19 period in Nigeria.

Jacob et al. (2020) presented in their study that the COVID-19 pandemic affected higher institutions in Nigeria through the lockdown of schools, reduction of international education, disruption of the academic calendar of higher institutions, cancellation of local and international conferences, creation of teaching and learning gap, loss of human resources in the educational institutions, and cut in the budget of higher education.

The submission of Ozili (2020) was that Nigeria had the highest number of COVID-19 cases in West Africa and the third highest cases in Africa between March and April 2020. Fernandes (2020) studied the impact of the COVID-19 pandemic on industry and countries and stated that in the case of this crisis, the economic impact of the crisis varied between 3.5% and 6% and that this impact would depend on the weight of tourism and dependence of countries on foreign trade. Odhiambo et al. (2020) used a Discrete Markov chain analysis to determine that COVID-19 affects all sectors of the Kenyan economy.

Ohia et al. (2020) foresaw that the consequence of COVID-19 would be severe in Africa since the health systems in countries in Africa are quite fragile. They claimed that the current national health systems of Nigeria could not be able to manage the growing number of infected patients who require admission into intensive care units.

Other studies on empirical literature are the work of Olapegba et al. (2020); Chinazzi et al., 2020; Haleem et al., 2020; Chen et al., 2020; Fornaro and Wolf, (2020) and most recently van der Hoeven and Vos (2022) who examined the various methods carried out in some developing countries using the international financial and fiscal system reforms. They have all contributed to the literature as a whole but could not empirically investigate the impact of COVID-19 on international liquidity, let alone on the Nigerian economy. This is the contribution to knowledge that the paper intends.

3. METHODOLOGY

3.1. Model Specification

To achieve the set broad objective of this study, the impact of Covid-19 was disaggregated into Covid-19 new cases, new deaths as a result of Covid-19, and the period of Covid-19. This study adapted the model of Dineri and Cutcu (2020) which specified that Covid-19 new cases, new death cases, and the period of the Covid-19 pandemic stood as the explanatory variables while international liquidity was put as the dependent variable, thus specified as:

$$I_l = f(C_{nc}, C_{nd}, C_p) \tag{1}$$

where,

I_l is the international liquidity of the Nigerian economy, C_{nc} stands for Covid-19 new cases, C_{nd} is Covid-19 new deaths and C_p is Covid-19 period of attaching.

In this regard, the econometric model becomes

$$I_l = \alpha_0 + \alpha_1 C_{nc} + \alpha_2 C_{nd} + \alpha_3 C_p + \varepsilon_t \tag{2}$$

Where $\varepsilon_t$represents the disturbance error term at present time, which represents all other factors that affect international liquidity outside the model. Since variables have different measurements, it becomes imperative to take the log of international liquidity to make equation 2 a semi-log model, thus,

$$lI_l = \alpha_0 + \alpha_1 C_{nc} + \alpha_2 C_{nd} + \alpha_3 C_p + \varepsilon_t \quad (3)$$

Hence, equation 3 was employed in the analysis.

In measuring the effect of this pandemic, three variables were used. They are the daily data of the total number of Covid-19 new cases (C_{nc}) and Covid-19 new deaths (C_{nd}) which were gotten from the National Centre for Disease Control (NCDC). A dummy variable (C_p) was put up for the period of this attack. As usual, the period of the Covid-19 attaches represented 1 while a period of no pandemic represented 0. These were the main variables that represented the pandemic period.

The external reserve measured in United States dollars was employed to cater for international liquidity and it was sourced from the Central Bank of Nigeria (2020) online database assessed in November 2020.

3.2. Estimation Procedure

After taking the natural log of the dependent variable, *Il*, a trend analysis was taken, and then the descriptive and correlation statistics. A pre-estimation technique using unit-roots of Augmented Dicky Fuller, Phillip Peron and KPSS was employed which informed the study of the autoregressive Distributive Lag (ARDL) model**.** Finally, a post-estimation test was carried out.

4. Research Findings

4.1. Trend Analysis

The graph of the trend of international liquidity and Covid-19 cases in Nigeria is shown in Figure 1 below; the Y-axis shows the number of cases while the X-axis shows the month and year. From the graph, the first Covid-19 case was recorded in March while the first death was recorded in April. The highest daily case number was recorded in July before we start experiencing a fall in the number of daily reported cases.

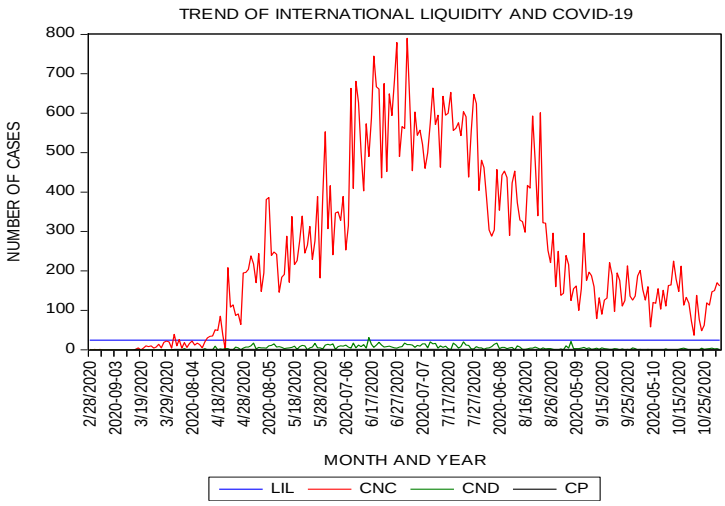

Fig. 1 Trend of International Liquidity and Covid-19 cases in Nigeria
Source: Author's extraction from E-view 9

4.2. Result of Descriptive Statistics

Table 1 showcases the descriptive statistics of the dataset with 247 observations. The table shows that International liquidity (*Lil*) was logged in other to reduce its volatility while Covid-19 cases (C_{nc}), have the highest mean followed by International liquidity (*Lil*), Covid-19 deaths (C_{nd}), and Covid-19 period (C_p) respectively. Skewness is the measure of the asymmetry of the data around its mean, C_{nc} and C_{nd} are positively skewed while *Lil* and C_p are negatively skewed. The standard deviation shows the rate of the volatility of the dataset, the high figures of Covid-19 cases (C_{nc}), is as a result of the fact that the logarithm is not taken while *Lil* has a low figure because its log was taken.

The Kurtosis shows that only C_{nc} is less than 3 i.e. Platykurtic distribution meaning the distribution is flat relative to normal. The implication of this is that it has a lower likelihood of extreme events compared to a normal distribution (Greene, 2002). While the other three variables are peaked i.e. Leptokurtic distribution because they are more than 3. The Jarque-Bera shows the normality distribution of data. The small Jacque-Bera probability as shown in the table means rejection of the null hypothesis.

Table 1 Descriptive Statistics

	Lil	CNC	CND	CP
Mean	24.29632	254.4696	4.631579	0.874494
Median	24.30400	196.0000	3.000000	1.000000
Maximum	24.32331	790.0000	31.00000	1.000000
Minimum	24.23481	0.000000	0.000000	0.000000
Std. Dev.	0.025422	211.4025	5.290532	0.331965
Skewness	-1.523617	0.602856	1.458866	-2.260810
Kurtosis	4.405047	2.237743	5.403502	6.111260
Jarque-Bera	115.8820	20.94126	147.0677	310.0363
Probability	0.000000	0.000028	0.000000	0.000000
Sum	6001.190	62854.00	1144.000	216.0000
Sum Sq. Dev.	0.158987	10993992	6885.474	27.10931
Observations	247	247	247	247

Source: Authors extract gotten from E-view 9

4.3. Result of Pairwise Correlation Matrix

Table 2 shows the correlation matrix and the probability of the relationship between the variables. C_{nc}, C_{nd} and C_p all show a positive relationship with *Lil* and they are all significant at a 1% level of significance.

Table 2 Correlation Matrix

Correlation Probability	LIL	CNC	CND	CP
LIL	1.000			

CNC	0.4462	1.000		
	0.000	-----		
CND	0.3260	0.5926	1.000	
	0.000	0.000	-----	
CP	0.1496	0.4494	0.3277	
	0.018	0.000	0.000	1.000 -----

Source: Author's extraction from E-view 9

Being more particular about the explanatory variables, their coefficients (0.59, 0.45 and 0.33) are far from the 0.8 benchmarks of high correlation (Asteriou & Hall, 2011; Gujarati & Porter, 2009). This indicates that the model is not having any issue with multicollinearity.

Table 2(b) Variance Inflation Factor (VIF)

Variable	Coefficient Variance	Uncentered VIF	Centred VIF
C	1.38E-05	6.763498	NA
CC	8.21E-11	4.237576	1.802569
CD	1.18E-07	2.750085	1.588567
CP	2.11E-05	8.832204	1.305929

Source: Author's extraction from E-views 9

Table 2(b) further explains the status of the explanatory variables to ascertain the presence of multicollinearity. From the table, the centred VIF values for the three explanatory variables show that there is an absence of multicollinearity in the variables as the values are less than the usual threshold of 10 (Asteriou & Hall, 2011; Greene, 2002).

4.4. Result of Unit root tests

The Augmented Dickey-Fuller (ADF), Phillip Peron (PP) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) are the three unit-root tests used in the study (Phillips & Perron, 1988) (Gujarati & Porter, 2009). The ADF and KPSS tests show that *LIL* and C_{nc}, are stationary at 1st difference while the others are stationary at level. The PP test, however, shows a little difference that all the variables are stationary at level except *LIL* which is stationary at 1st difference.

Table 3(a) ADF

Variables	At level	Probability	At 1st difference	Probability	Remark
LIL	-2.155552	0.2234	-15.58850	0.0000***	1(1)
CNC	-1.816755	0.3718	-17.64468	0.0000***	1(1)
CND	-3.274341	0.0172	-	-	1(0)
CP	-2.924887	0.0440	-	-	1(0)

Source: Author's extraction from E-view 9

Table 3(b) PP

Variables	At level	Probability	At 1st difference	Probability	Remark
LIL	-2.211812	0.2027	-15.58850	0.0000***	1(1)
CNC	-2.702500	0.0750			1(0)
CND	-10.41699	0.0000***			1(0)
CP	-2.998643	0.0364			1(0)

Source: Author's extraction from E-view 9

Since two of the tests have supported the stationarity of the variables at level and 1st difference, we conclude that the order of integration is mixed and this is the justification for employing the ARDL analysis (Alogoskoufis & Smith, 1991; Asteriou & Hall, 2011)

Table 3(c) KPSS

Variables	At level	Probability (5%) Critical Value	At 1st difference	Probability	Remark
LIL	0.7165	0.4630	0.4465	0.4630	1(1)
CNC	0.5957	0.4630	0.2003	0.4630	1(1)
CND	0.0729	0.4630	-	-	1(0)
CP	0.2273	0.4630	-	-	1(0)

Source: *Authors extraction from E-view 9*

4.5. Result of Model Selection Criteria

Figure 2 shows the result of the model selection criteria using the Akaike information criteria top 20 of the model. It is clear from the figure that ARDL (1,0,0,1) is the best model and was chosen because it has the lowest AIC of 41.2998.

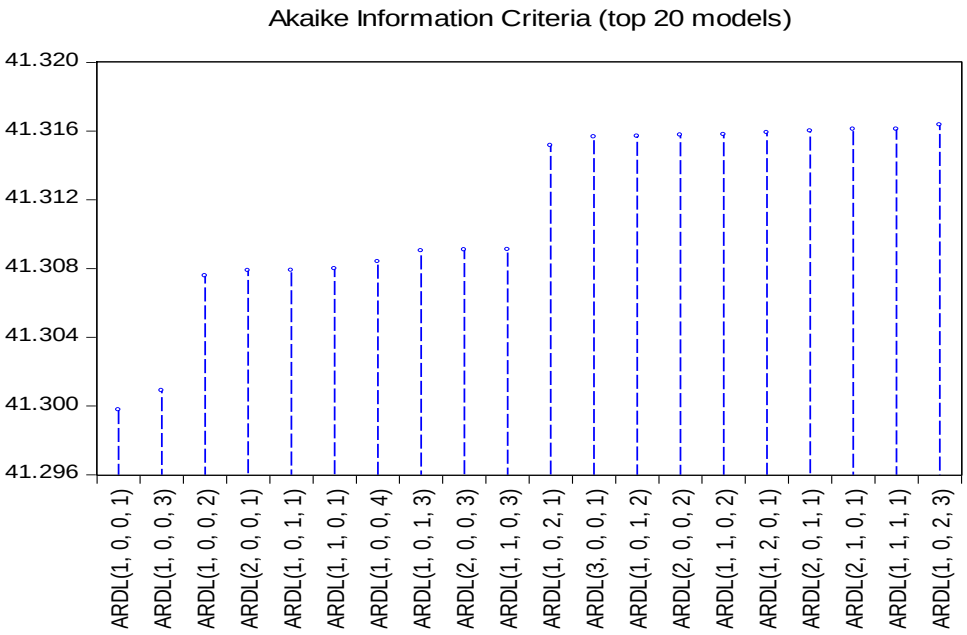

Fig. 2 Graph of selected model criteria
Source: Author's extraction from E-view 9

4.6. Result of ARDL Coefficients

In Table 4, the result of impact analysis in the short run using the ARDL model is showcased. The coefficient of C_{nc} (4666.010) and C_{nd} (4020291.) show that Covid-19 cases and Covid -19 deaths have a positive impact on international liquidity. The impacts are

insignificant at 1%, 5%, or 10% levels. Although international liquidity (*Lil*) shows a positive and significant relationship with itself in the previous period. The coefficient of C_p (-5.27E+08) shows that the Covid-19 period has a negative impact on international liquidity and its impact is significant at a 1% level of significance. It is also shown that the $C_p$coefficient in the previous period positively impacted international liquidity and its impact is significant at a 1% level of significance.

The R^2 shows that about 93% of the variation in international liquidity is explained by the explanatory variables. This means that 7% of the variation responsible for international liquidity is outside the model. The R^2 adjusted shows about 93% variations which are very close to the R^2 indicating that there is no redundant variable in the model.

The F-statistics (683.1887) and Prob. (F-statistic) (0.000000) show that the goodness of fit is significant at a 1% level of significance. The Durbin-Watson stat (2.000879) is approximately 2 which shows the goodness of fit.

Table 4 ARDL Coefficient

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LIL(-1)	0.950031	0.018552	51.21009	0.0000
CNC	4666.010	97639.94	0.047788	0.9619
CND	4020291.	3468199.	1.159187	0.2475
CP	-5.27E+08	1.36E+08	-3.869932	0.0001
CP(-1)	5.92E+08	1.35E+08	4.389676	0.0000
C	1.71E+09	6.56E+08	2.601883	0.0098
R-squared	0.934353			
Adjusted R-squared	0.932986			
F-statistic	683.1887			
Prob(F-statistic)	0.000000			
Durbin-Watson stat	2.000879			

Source: Authors extract gotten from E-view 9

4.7. Result of ARDL Bound Test

Table 5 showcases the bound test which is required to ascertain if the explanatory variables (COVID-19: *Cnc*, *Cnd*, and *Cp*) can affect the dependent variable (international liquidity) in the long run. From the table, the F-statistic value (2.383703) is lower than the I0 bound, so the null hypothesis of no co-integration could not be rejected.

Table 5 ARDL Bound test

Test Statistic	Value	K
F-statistic	2.383703	3
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.72	3.77
5%	3.23	4.35
2.5%	3.69	4.89
1%	4.29	5.61

Source: Authors extract gotten from E-view 9

This is an indication that the model does not have any long-run relationship. Hence, we only estimated the short-run model which is the ARDL coefficients as presented and interpreted in Table 4.

4.8. Result of Diagnostic Tests

Table 6 presents the result of residual diagnostic tests of serial correlation using the Brusch-Godfrey LM test, the heteroskedasticity using the ARCH test, and Linearity using the Ramsey RESET test.

Table 6 Diagnostic test

Tests	Statistics	Probability values
Breusch-Godfrey Serial Correlation LM Test	0.0077	0.9923
Heteroskedasticity Test: ARCH	0.0091	0.9240
Linearity Test- Ramsey RESET Test	0.1181	0.7312

Source: Authors extract gotten from E-view 9

Their respective probability results are all more than 5% meaning that we accept the null hypotheses that, there are no issues of serial correlation, heteroskedasticity, and specification error.

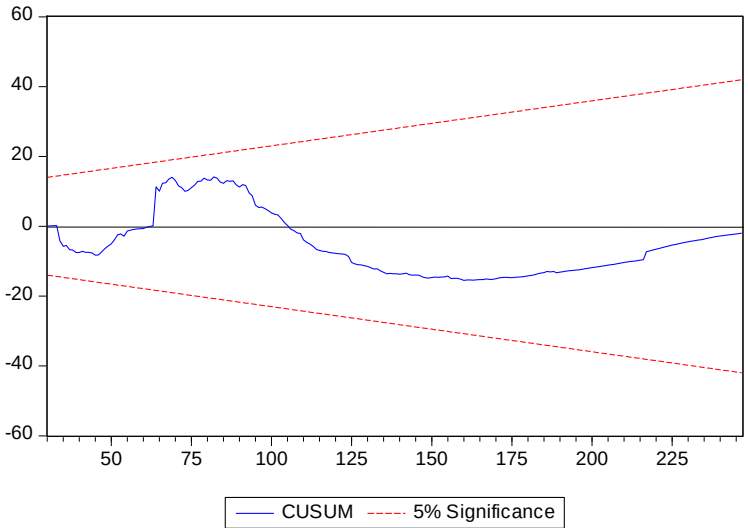

Fig. 3 Graph of Recursive Estimate test- CUSUM
Source: Authors extract gotten from E-view 9

Figure 3 showcases the stability test result using the Cumulative Sum test. From the result, the blue line is within the red lines, and so, we accept the null hypothesis (which is desirable) that the coefficients of the regression are changing systematically and therefore, stable.

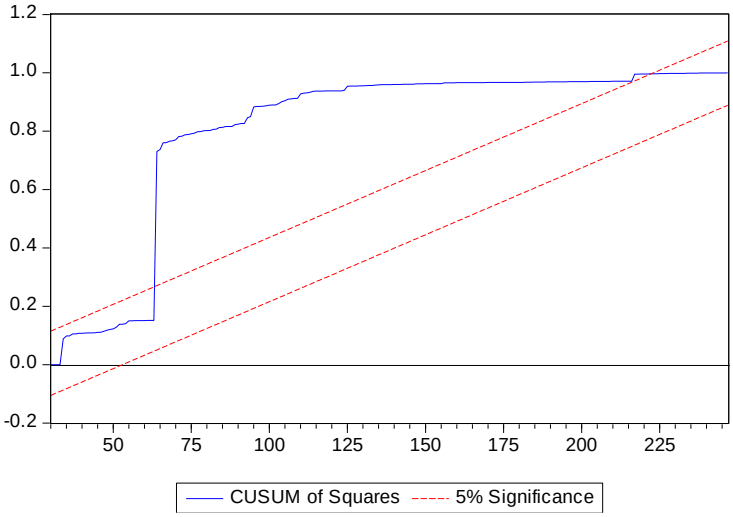

Fig. 4 Graph of Recursive Estimate test- CUSUM Square
Source: Authors extract gotten from E-view 9

Figure 4 presents the stability test result using the Cumulative Sum of Square test. From the result, the blue line is crossing the red line, and so, we reject the null hypothesis (which is not desirable) that the coefficients of the regression are not changing suddenly and therefore, based on this test, are not stable.

Going by the words of Turner (2010), "if the break is in the intercept of the regression equation then the CUSUM test has higher power. However, if the structural change involves a slope coefficient or the variance of the error term, then the CUSUMSQ test has higher power. This may help to explain why the two tests often produce contradictory findings", our regression (ARDL) has an intercept and so the CUSUM is higher and better preferred to CUSUM Squares, thus, we conclude that the coefficients of the regression are stable.

4.9. Discussion of Results and Implications of Findings

This empirical article employed ARDL techniques which were based on the information given by the ADF and PP unit root tests to investigate the impact of the COVID-19 pandemic on international liquidity in Nigeria.

The first objective was to examine the impact of COVID-19 new cases on international liquidity in Nigeria. Though there was an average positive correlation between the new cases and international liquidity, the result of the ARDL cointegration test revealed that, in the short run, COVID-19 new cases did not have a significant impact on international liquidity in Nigeria. There was no long-run relationship as revealed by the bound test result. Hence, the null hypothesis of no significance could not be rejected. Other factors like oil prices would have been responsible for the effect aside from new cases during this period.

The second specific objective was to evaluate the effect of new deaths as a result of COVID-19 on international liquidity in Nigeria. Also, the results of ARDL analysis indicated that new deaths as a result of the COVID-19 pandemic did not have a significant effect on Nigeria's international liquidity within the period under consideration. Thus, the null hypothesis could not be rejected in this regard. This finding is in contrast with the

findings of Dineri and Cutcu (2020), and Odhiambo, Weke, and Ngare (2020), though Fernande's (2020) finding could still be referred to, that, the impact of the COVID-19 pandemic on industry and economies would depend on the weight of tourism and dependence of countries on foreign trade.

The third objective was to examine the impact of the period of the COVID-19 pandemic on international liquidity in Nigeria. Findings of the study discovered that, in both the short run and long run, the period of the COVID-19 pandemic has a very significant impact on international liquidity. This result is in line with our a priori expectation and not different from the study of Dineri and Cutcu (2020) on the exchange rate in the Turkish economy, though they did not use the period as one of their predictors. Hence, we reject the null hypothesis and accept that period of the COVID-19 pandemic has a significant impact on Nigeria's international liquidity.

Moreover, from the results, the predictors in the model were able to explain about 93% of the variation in international liquidity in Nigeria within this period of interest. This applies to real Nigeria's situation since there are still many major contributors to international liquidity like the export of crude oil and other goods that generally have a direct positive impact. Import of goods like used cars, mostly COVID-19 test kits and health care facilities deplete negatively and worsen the international liquidity status of the country. In essence, the high rate of import stretches the Naira exchange rate, in which, for the country to remain within the ambit of the desired exchange rate, the external reserve will have to suffer, mainly due to the COVID-19 pandemic which energized other variables in the negative. Expectedly, as the pandemic rounds off, the international liquidity will keep increasing and moving back to its original point.

6. Conclusion and Recommendations

This study investigated the impact of the COVID-19 pandemic on international liquidity in Nigeria. COVID-19 pandemic was proxied by COVID-19 new cases and new death of the pandemic in Nigeria and a dummy that represented the period of the pandemic, and as such, stood as the explanatory variable while international liquidity was put as the dependent variable in the study. Daily data sets were sourced between February and October 2020, employing Auto-Regressive Distributed Lag (ARDL) technique. The findings of the study revealed that there was an average correlation between the variables of the pandemic and international liquidity. In the short run, the COVID-19 pandemic period had a significant impact on Nigeria's international liquidity. However, the COVID-19 new cases and new deaths could not have any significant impact on the international liquidity. Moreover, none of the COVID-19 pandemic variables could have any long-run impact on the international liquidity in Nigeria. Diagnostic tests revealed that there were no issues of serial correlation, heteroskedasticity, or specification error. Also, the result divulged that the coefficients of the regression were stable.

It is upon the findings of this study that the following recommendations are made:

- Nigerians should know that the depletion of their foreign reserve is not due to policy deficiency but due to the COVID-19 pandemic.
- Also, the government should try to improve quality exports that will be demanded by foreign countries irrespective of the pandemic.

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PANDEMIJA COVID-19 I MEĐUNARODNA LIKVIDNOST NIGERIJE: ANALIZA UTICAJA

Problemi povezani sa pandemijom Kovida 19 su zahvatili skoro svaku međunarodnu aktivnost u svetu danas, što mnoge ekonomije tera da se zapitaju da li je uzrok tih problema sama pandemija ili ne. U tom smislu, ovaj rad istražuje uticaj pandemije Kovid 19 na međunarodnu likvidnost u Nigeriji. Pandemija Kovid 19 se merila brojem novih slučajeva i novih smrti i veštačkom varijablom koja je predstavljala period trajanja pandemije, i kao takva stajala kao objašnjavajuća varijabla u studiji, dok je međunarodna likvidnost bila zavisna varijabla. Dnevni skup podataka dobijen je od statističkih biltena Nacionalnog centra za kontrolu bolesti i Centralne banke Nigerije od februara do oktobra 2020, uz korišćenje ADRL tehnike. Rezultati studije ukazuju da je, kratkoročno, period Kovid-19 pandemije imao značajnog uticaja na međunarodnu likvidnost Nigerije. Međutim, novi slučajevi Kovida 19 i nove smrti nisu imale značajnog uticaja na međunarodnu likvidnost. Štaviše, nijedna od varijabli pandemije Kovida 19 nije mogla da ima značajnijeg uticaja na međunarodnu likvidnost Nigerije. Studija, dakle, ukacije da Nigerijci treba da znaju da smanjenje njihovih deviznih rezervi nije nastalo usled loše politike nego pandemije Kovida 19. Takođe, vlada bi trebalo da pokuša da poveća izvoz kvalitetnih proizvoda koje će strane zemlje zahtevati bez obzira na pandemije.

Ključne reči: *Pandemija Kovid-19, veštačka varijabla, međunarodna likvidnost, vremenska serija*

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THE CHALLENGES IN AUDITING FINANCIAL STATEMENTS AT FAIR VALUE CONCEPT (FVC) IN DEVELOPING ECONOMIES: THE CASE OF REPUBLIC OF SERBIA

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Abstract. *Some balance sheet items are the result of judgments, including fair value estimates, so the relevant evidence is very complicated to collect by auditors, thus the risk of misstatements in financial statements is inevitably greater. The research objective of this paper is to: a) highlight the problems encountered by auditors from developing countries when auditing FV accounting estimates; b) identify the challenges that auditors from Serbia face in auditing FV accounting estimates; c) consider the possibility of adequately responding to these audit challenges in Serbia. The research confirmed that the problems of auditors in Serbia in the audit of FV estimates are generated by inefficient capital markets, and that they are primarily in the field of FV assessment which are connected to the impossibility of applying the market model and higher volatility of FV financial statements, as well as those in the field of auditing techniques used in providing assurance on the objectivity of FV assessments in various business activities, which requires additional training of auditors. Thus, the research confirmed the similarity of the problems in Serbia with the problems in the auditing FV estimates in developing countries.*

Key words: *fair value concept, IFRS 13, financial statement audit, ISA 540*

JEL Classification: M41, M42, C10, C34

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1. INTRODUCTION

The primary reason for introducing the FVC in accounting theory and practice was to bring financial statements close to the facts, although experience has shown that the application of FV and "creative accounting" opens room for manipulation of financial statements. The need to disclose assets at fair value arises as a result of the shortcomings of traditional accounting based on historical cost concept, which most often results in an underestimation of assets and financial results in the current period, but also due to the fact that the disclosure at FV allows for the recognition of unrealized income and gains, which enhances the picture of the company's financial position and disclosed performance. This brings an additional dose of subjectivity to financial statements and the risk of material misstatements in financial statements becomes greater.

Numerous researches related to the specifics of auditing FV assessment in developing countries have stimulated research in this paper on the case of Serbia, with the aim of identifying important challenges that auditors in Serbia face in auditing FV assessments and consider the possibilities to respond to them.

2. LITERATURE REVIEW

FVC in accounting is based on abandoning a centuries-old accounting model based on historical costs, conservatism, and the principle of income and expense causation. Nevertheless, FV-based accounting came to light without actual evidence that its estimates are better than traditional practice. This was observed even before the great economic crisis of 2008, when some practical cases suggested that the application of FV accounting has the potential to lead to misleading results (Stojilkovic, 2011, pp. 92-97). The Enron case showed that FV estimates used were largely based on inputs known today as Level 3 inputs. Enron used the FV model based on discounting the value of long-term gas contracts and derivatives and thus recognized in the ledgers (non-existent) assets of 21 billion dollars, i.e. 31% of their total assets (Haldeman, 2006, p. 5). At the same time, the FV was used to evaluate the managers' performance and to reward them in the form of bonus payments (Benston, 2006, p. 465).

Accounting estimates by FV have led auditors and audit standards makers to understand not only the assessment models and processes by which management defines model inputs, but also potential management misuse and probable errors in model application, market input identification and assumptions. Auditors should also understand possible sources of audit errors in the audit of financial statements under the FV. Also, auditors must acquire the knowledge and continuous training to audit FV estimates (Carpentier, Labelle, Laurent, Suret, 2008, p. 2). International audit standards makers, consciously or not, change the role of independent auditors who, from independent controllers of the truthfulness and objectivity of financial statements turn into subjective experts in FV assessment (Haldeman, 2006, p. 8).

Numerous financial scandals in early 21st century, like FV estimation problems following the 2008 financial crisis caused a decline in confidence in corporate financial statements, especially FV-based ones, on financial markets in developed countries where these involve central financial institutions, while on underdeveloped financial markets (late transition countries) this problem is not so obvious (due to negligible volume of trade and absence of investors), but is still present. This also demonstrated the exceptional importance of auditing and its safeguarding role, as well as the unsustainable self-regulation of auditors.

Research on the challenges of auditing financial statements based on the FVC in countries with developed economies and financial markets has shown the following:

- Conceptual accounting shift from historical cost to FV – due to the high dose of subjectivism in estimating FV, as well as thepotential for widespread investor deception, a large number of companies take a conservative approach and/or lack initiative to use the FV concept (Haldeman, 2006, p. 11; Cairns, Massoudi, Taplin, & Tarca, 2009, p. 1);
- Increased volatility (the occurrence of major changes in the value of assets and liabilities in the balance sheet and greater fluctuations in the financial result) is due to market instability, inaccuracies and errors in measuring fair value, combined with historical cost accounting in a hybrid reporting model, as well as the feedback effects of its procyclicality (Malinić, 2009, pp. 319,321; Pantelić, 2021, pp. 207.)
- Auditors focus on testing subjective inputs (assumptions and estimation methods/ models) in FV measurement and assessing the adequacy of the measurement method used and the reasonableness of management's assumptions. This causes auditors to acquire knowledge regarding the FV estimate (Joe, Vandervelde, Wu, 2014, p. 1; Griffith and authors, 2012, p. 35; Badertscher, Burks, & Easton, 2012, pp. 59,90; Benston, 2006, pp. 465,484; Doliya, Singh. 2016, pp. 37, 48; Yao, Percy, Hu, 2015, pp. 31,45; Pantelić, 2021, pp. 205,207;);
- Because auditors often lack the knowledge to evaluate FV accounting estimates, they rely on experts (estimators), and do not test the key assumptions and estimation methods used by the estimator. Such experts need to be educated in order to adequately apply the FV concept (Joe, Vandervelde, Wu, 2014, p. 7; Griffith and authors, 2013, p. 35; Peng, Bewley, 2009, p. 13.);
- The need to increase the auditors' awareness of the risks associated with the client's business in FV measurement (Eilifsen, 2010, pp. 79, 93; Dauber, 2009, p. 162);
- The need for special audit obligations in the case of FV accounting fraud (assessing the risks of material misstatement in financial statements, including the risks of criminal activity; gaining an understanding of the design and implementation of client's internal controls for the application of FV accounting in financial statements; conducting audit procedures designed to ensure that FV estimates are made in accordance with the current financial reporting framework, including disclosures in notes to financial statements) (Zack, 2009, p. 203);
- Three key challenges for FV auditing have been identified: unrealized gains and losses, market liquidity or illiquidity, and "distorted" cash flow distribution, with market liquidity being the biggest challenge for auditors (Ryan, 2008, p. 1610);
- Multiple listing of some companies (simultaneous listing on the stock exchanges in China, Hong Kong and the USA) results in different prices for the shares of the same company, necessitating complicated determination of FV (Peng, Bewley, 2009, pp. 26-27);
- High-quality internal audit minimizes the auditor's efforts in auditing FV estimates. (Gremling and authors, 2004, p. 197).
- Research on the challenges of auditing financial statements under the FV concept in developing countries and in underdeveloped and inactive financial markets has shown the following:
- In most cases, auditors support the FV concept in financial reporting, but note problems with the application of this concept in both accounting and auditing (Bratten, Gaynor, McDaniel, Montague, Sierra, 2013, p. 11);
- Auditors sometimes do not understand the key risk factors in FV models used by client management due to lack of knowledge of the methods and models used, resulting

in misinterpretation of key assumptions of the models used (Carpentier, Labelle, Laurent, Suret, 2008, p. 1);

- The need for greater involvement of experts in assessing fair value and their training (Carpentier, Labelle, Laurent, & Suret, 2008, p.1; Kumarasiri, Fisher, 2011, p. 82; Okafor, Ogiedu, 2012, pp. 420-421.);
- The existence of inactive markets for assets and liabilities subject to valuation, which complicates FV measurement on a market basis. (Kumarasiri, Fisher, 2011, p. 68; Amanamah, Owusu, 2016, p. 26;);
- Difficulties regarding variations in FV measurement techniques in different industries (Kumarasiri, Fisher, 2011, p. 82);
- Problems in the application of future events and assumptions in return-based FV estimation models (Kumarasiri, Fisher, 2011, p. 82).

The application of the FV concept in financial reporting has greatly contributed to increased financial results, i.e. artificially increased profits and dividends in the financial statements of companies that have misapplied this method or due to inherent limitations in the application of this method in both developed and non-developed financial markets as well as countries that have experienced a market boom (Siam, Abdullatif, 2011; Nguyen, 2019) or the financial market crisis (Laux, Leuz, 2009; Procházka, 2011; Badertscher, Burks, & Easton, 2012). This has created numerous challenges for auditors, who are expected to express relevant opinion in terms of high inherent risk, since FV valuation arises as a result of judgment.

3. KEY CHALLENGES IN AUDIT OF FINANCIAL STATEMENTS AT FVC IN THE REPUBLIC OF SERBIA

Specific economic conditions, as well as underdeveloped and under-active financial markets in Serbia, cause specific audit of FV estimates in these areas. Auditors face challenges posed by the effects of applying the FVC in a) evaluating FV estimates in Serbia and b) selecting techniques and procedures in auditing FV financial statements.

3.1. Challenges for Serbian auditors in evaluating FV estimates

The regulatory framework for financial reporting under the FVC in the Republic of Serbia is the Law on Accounting, as well as IFRS 13: Fair Value Measurement and other international standards that indirectly relate to the valuation of FV assets and liabilities.

The specificity of IFRS 13 application in financial reporting in Serbia is conditioned by underdeveloped financial market, which causes problems in the selection of an adequate FV estimation method and the specific definition of levels in the hierarchy of inputs for FV determination.

IFRS 13 provides that a company should apply valuation techniques in line with the circumstances with sufficient data available to measure FV and the maximum application of relevant observable inputs and the minimum use of non-observable inputs. The three most common valuation techniques used in FV estimation are (www.mfin.gov.rs): market access, cost approach and revenue approach

IFRS 13 introduces, for the first time, FV hierarchy that classifies valuation inputs used to measure FV in three levels. In Serbia, as a developing economy, active capital markets are underdeveloped, which complicates FV measurement based on market approach. This

also conditions the specific three-level hierarchy for estimating FV in Serbia (Rupić, Bonić, 2015, p. 135): level 1, level 2 and level 3 inputs.

Level 1 inputs in Serbia are inputs on active financial markets at quoted prices for the Belgrade Stock Exchange listed and prime market stocks and bonds, the Commodity Exchange Novi Sad quoted prices of agricultural products, as well as inputs from publicly organized sales at the publicly available real estate prices and the catalog sale of motor vehicles of the Serbian Auto-Moto Association (Negovanović, 2014, p. 182). The level 1 inputs in Serbia are scarce, due to underdeveloped financial markets. Perhaps the best illustration of the underdeveloped financial markets in the Republic of Serbia is the number of companies listed on the Belgrade Stock Exchange "prime market", being only four at the time of writing this paper: NIS ad Novi Sad, Airport Nikola Tesla ad Belgrade, Energoprojekt holding ad Belgrade and Fintel energija ad Belgrade.

In some cases, the inputs for FV measurement of assets or liabilities can be classified into categories within different levels of the FV hierarchy. In these cases, FV measurement is categorized as a whole at the same level of the FV hierarchy as is the lowest-level input that is significant for the entire measurement. Assessing the significance of a particular input for the entire measurement requires judgment. The availability of relevant inputs and their relevant subjectivity may influence the choice of appropriate valuation techniques. However, the FV hierarchy prioritizes the inputs to the choice of valuation technique rather than the valuation techniques used to measure FV.

Level 2 inputs are inputs that are observable for an asset or liability directly or indirectly on the market. Level 2 inputs include quoted prices for similar assets or liabilities on an active market, quoted prices for identical or similar assets or liabilities on markets that are not active. An example of level 2 inputs in Serbia are inputs with market prices for company shares on a multilateral trading platform (MTP).

Level 3 inputs are unobservable inputs for an asset or liability, which should be applied to FV measurement if relevant observable inputs are not available. Unobservable inputs should reflect the assumptions that market participants would use when determining the price of an asset or liability, including risk assumptions. Risk assumptions include the risk inherent in a particular valuation technique applied to FV measurement, as well as the risk inherent in Level 3 inputs. IFRS 13 provides that an entity should develop unobservable inputs using the best available information under the given conditions, which may include the entity's own data. An example of Level 3 input in Serbia may include FV estimate of the share for which there is no active market, nor quoted prices for similar entities that were subject to sale, so the application of the return method based on the present value of future cash flows projected by management is imposed as a logical choice.

3.2. Challenges in auditing financial statements based on FVC in Serbia regarding the selection of techniques and procedures in the audit of FV estimates

The regulatory framework within which auditors operate in Serbia is the Audit Law and ISA 540: Auditing Accounting Estimates, including Fair Value Accounting Estimates, and Related Disclosures.

The FV estimation is intended to determine the exit price on the measurement date from the perspective of a market participant who has an asset or a liability (www.mfin.gov.rs). According to ISA 540, an auditor should obtain sufficient and adequate audit evidence that the

accounting estimates are reasonable, including FV accounting estimates in financial statements, and related disclosures thereon. Also, accounting estimates based on significant assumptions are characterized by a relatively high degree of uncertainty, which is especially true in the case of FV accounting estimates of non-publicly traded derivatives, as well as FV accounting estimates based on a specialized client-developed model or estimates based on assumptions that cannot be verified on the market.

The challenges and problems auditors face in auditing FV financial statements in Serbia are multiple. First of all, FV accounting is a much bigger challenge for auditing than historical cost accounting. Auditors do not have sufficient skills in assessing FV estimates, which is partly due to the underdeveloped and inactive financial market in Serbia. Also, there are very few experts in Serbia (real estate appraisers, actuaries and other specialists) who have the necessary knowledge and skills in applying the appropriate FV estimation techniques and International Valuation Standards that auditors could engage in the audit process. There are also difficulties with the application of variations in FV measurement techniques in different industries, as well as with the application of future events and assumptions in FV estimation models. Assistance in addressing these challenges auditors in Serbia face should come from audit professional organization – Chamber of Chartered Certified Auditors. The Chamber should identify the main problems auditors encounter in auditing financial statements under the FVC and assist in resolving them, and provide auditors with additional professional training on the valuation of assets and liabilities under the FV in order to conduct a quality audit under this concept.

4. Research Hypothesis, Phases and Methodology

The following hypotheses have emerged from the research of the challenges in audit of financial statements at FVC in Serbia:

Main hypothesis (H): The underdeveloped and under-active financial market in Serbia does not provide sufficient conditions for the application of all FV accounting (FVA) techniques, and thus conditions specific challenges to audit of FVA estimation.

Auxiliary hypotheses:

(H1): Auditors' awareness of the application of FVC in Serbia is closely related to the understanding of IFRS 13 and ISA 540;

(H2): The dominant challenge in FVA in Serbia is the complexity of assessing FV estimates and the need to hire an expert (appraiser, actuary, expert) for FV estimation;

(H3): Auditors in Serbia do not have sufficient technical knowledge of the techniques and procedures for auditing FVA estimation.

The stages in the research of the challenges in audit of financial statements at FVC in Serbia are:

Phase 1 – Selection of variables from the sample based on the criteria of their relevance for the application of the FVC in audit in the Republic of Serbia.

Phase two – Applying descriptive statistics to consider homogeneity of respondents' responses to challenges in financial reporting and auditing at FVC in Serbia.

Phase three – Applying factor analysis of selected variables using the PCA (Principal Component Analysis) method to reduce the constraints of variables and create new latent variables that would play the role of independent variables in the regression analysis.

Phase four – Applying multiple regression analysis to measure the impact of three independent variables on the dependent variable. The dependent variable implies that the belief about the reality of valuation under the FV in Serbia is harder to come by, much like in other developing countries, compared to developed countries. The three independent variables are:

- Auditor's awareness of the importance of fair value estimation issues. This variable contains 4 components: 1) Auditors fully understand IAS 39; 2) Auditors fully understand IFRS 13; 3) IFRS 13 seeks to reduce the subjectivity of an accounting estimate that has an effect on the amounts in the financial statements; 4) Auditors fully understand ISA 540.
- Challenges of auditors in evaluating accounting estimates under FV. This variable contains 5 components: 1) Determining the FV of assets is significantly more complex than determining the historical cost of assets; 2) Determining FV assets and liabilities is a time-consuming task; 3) Most assets and liabilities subject to FV estimation in business practice in Serbia are not subject to transactions on active markets; 4) FVC requires the auditor to continuously acquire additional knowledge regarding the specific assets and liabilities that are subject to FV estimation; 5) Verification of FV measurement of assets and liabilities requires the involvement of an expert.
- Challenges of auditors conditioned by the choice of techniques and procedures in auditing the financial statements under the FV. This variable contains 3 components: 1) Auditors in Serbia do not have sufficient technical knowledge on FV measurement; 2) Techniques for determining FV may vary significantly from one industry to another; 3) Auditors have effective procedures for verifying the accuracy of transactions and balances that are valued at cost, but these procedures are not very helpful in measuring FV.

The methodology for researching the challenges in audit of financial statements at FVC in Serbia includes: a) descriptive statistics, b) factor analysis and c) multiple regression analysis.

4. Sample Description and Descriptive Statistics of the Variables Selected

The research used the primary source of data obtained through the survey method. The basic research tool used was the questionnaire. The questionnaire is a pre-prepared set of questions/statements to be answered by the respondents in the form of expressing agreement on a one-to-five scale (Likert scale), where 1 indicates total disagreement with the statement (I totally disagree), 2 indicates disagreement with the statement (I don't agree), 3 indicates indeterminacy (I neither agree nor disagree), 4 indicates agreement (I agree) and 5 indicates full agreement (I fully agree).

The questionnaire is to a certain extent based on world experience, i.e. on previous research by Kumarasiri and Fisher (66-87). These authors conducted a survey in 2011 on the audit perception of FVA in developing countries and concluded that auditors are generally in favor of applying FVA, although they are aware of the specific issues and issues they face when performing audit.

The questionnaire was sent to licensed certified auditors, members of the Chamber of Certified Auditors from Belgrade, who are auditing the financial statements in our country under the Audit Law. The aim of the survey is to collect information directly from the questionnaire from practitioners who, in their daily professional work, face the challenges posed by the application of FVC.

The survey was conducted in November and December 2014 by sending the questionnaire electronically to all 258 licensed certified auditors in Serbia. The register of licensed certified auditors is publicly available on the Chamber of Chartered Certified Auditors website. Due to the complexity of the subject matter and the purpose of the research, and in order to obtain as representative results as possible, the questionnaire was only sent to licensed certified auditors, not to all auditors in Serbia. Of the total number of licensed certified auditors in Serbia, 86 auditors completed the questionnaire, or one third (33.33%), i.e. every third licensed certified auditor answered the questionnaire. The data collected was statistically processed using IBM SPSS Statistics 20 software.

Regarding the age structure of the respondents, 40% of the respondents were between 26 and 40 years old, 32% of the respondents between 41 and 55 years of age, while auditors over 56 made up 28% of the respondents.

The number of male and female respondents was almost the same (51% vs. 49%). Regarding the position of certified auditor in the audit company, 47% of the respondents were audit partners, 45% audit managers and 8% auditors (senior and junior). Another important parameter of the respondent structure in terms of sample representativeness and the relevance of research results relates to professional audit experience, where as many as two thirds of respondents (65%) had more than ten years of audit experience, 26% between six and ten years, and only 9% between one and five years.

It is interesting to analyze the structure of the respondents from the point of view of the audit firm in which they are employed (the so-called "Big Four" (KPMG, Price Waterhouse Coopers, Deloitte & Touche, Ernst & Young or other audit firms), with auditors working for the so-called "Big Four" audit firms making up 14% of the respondents, while the other 86% referred to auditors employed by other audit firms in Serbia. According to publicly available data from Chamber of Chartered Certified Auditors for 2014, the "Big Four" auditors had 42 licensed certified auditors, which is 16% of the total number of licensed certified auditors in Serbia. The share (percentage) of the total number of auditors working in large audit firms answering the questionnaire almost coincides with the proportion of "Big Four" auditors in the total population of licensed certified auditors in our country (14% vs. 16%).

Respondents' views, which are the research subject in this paper, are grouped into 3 areas:

1. Justification for the FVA application
2. Auditors' awareness of the issue of FV measurement
3. Audit challenges regarding the FV accounting estimates and the selection of techniques and procedures in the audit of FV estimates.

Each of these areas gave a set of views that, in the author's view, was directly related to the research subject in this paper. The mean values of the degree of respondents' agreement with the selected statements, as well as the variance in attitudes are given in the following table.

Table 1 Descriptive statistics of selected variables (statements)

Group	Statement	Mean	Std. dev.
Justification of FVA implementation in Serbia	The belief in fair value estimate reality is harder to come by in developing countries like Serbia than in developed countries (Var1)	4.35	0.682
Auditors' awareness of FV measurement issues	Auditors fully understand IAS 39: Financial Instruments: Recognition and Measurement (Var2)	2.77	1.28
	Auditors fully understand IFRS 13: Fair Value Measurement (Var3)	3.42	0.99
	IFRS 13: Fair Value Measurement seeks to reduce subjectivity in an accounting estimate that has an effect on the amounts in the financial statements (Var4)	3.72	0.85
	Auditors fully understand ISA 540 Audit of accounting estimates, including fair value accounting estimates and related disclosures (Var5)	3.49	0.93
Audit challenges regarding the evaluation of FV accounting estimates and the choice of techniques and procedures in auditing FV estimates	Auditors in the Republic of Serbia do not have sufficient technical knowledge to measure fair value (Var6)	3.84	1.06
	Determining the fair value of assets is significantly more complex than determining the cost of assets (Var7)	4.65	0.647
	Determining the fair value of assets and liabilities is a time consuming task (Var8)	4.42	0.727
	Fair value techniques may vary significantly from industry to industry (Var9)	4.37	0.81
	Most assets and liabilities that are subject to fair value measurement in our business practice are not subject to active market transactions (Var10)	4.12	0.90
	Auditors have effective procedures for verifying the accuracy of transactions and balances that are valued at cost, but these procedures are of little use in measuring fair value (Var11)	3.72	1.025
	Fair value requires the auditor to continuously acquire additional knowledge of the specific assets and liabilities that are being measured at fair value (Var12)	4.37	0.87
	Verification of fair value measurement of assets and liabilities requires the involvement of an expert (Var13)	4.09	0.94

Source: Authors' calculations

Judging by mean values, respondents expressed the highest degree of agreement with the statement *Determining the fair value of assets is significantly more complex than determining the cost of assets* (4.65), while standard deviation of dispersions in the respondents' answers in this regard is the lowest (0.65). Auditors expressed the lowest degree of agreement with the statement *Auditors fully understand IAS 39: Financial Instruments: Recognition and Measurement* (2.77), with their views being the most heterogeneous in this respect (standard deviation is 1.28).

5. RESEARCH RESULTS AND DISCUSSION

Following descriptive statistics, factor analysis was applied to the data obtained from the survey. Factor analysis is a method of multivariate analysis, which is used in research to reduce the number of variables while retaining the amount of information they carry.

The factor analysis was first applied to the *Auditors' awareness of the issue of FV measurement*.

After verifying that all the assumptions related to the application of factor analysis have been fulfilled, the Principal Component Analysis (Nicoletti et al. 2000) was applied to extract the factors. The purpose of applying factor analysis in this case was to create a new variable that will play the role of composite indicator by which respondents' views of the 4 statements from this group will be expressed. The weights assigned to each of the statements in the composite indicator structure were based on the value of factor loadings (Janković-Milić, Jovanović, 2019). Factor loadings show the degree of agreement of the original variable (statement) with the newly formed composite indicator, while squared factor loadings show the degree of variability of the original variable explained by the newly created factor, i.e. composite indicator. In accordance with the structure of the variables involved, this indicator has been called *Auditors' awareness of the issue of FV measurement* (CI1).

Table 2 Factor loadings and weights in the first composite indicator

Statement (variable)	Factor loadings	Weights
Var2	0.800	0.252
Var3	0.856	0.269
Var4	0.714	0.224
Var5	0.812	0.255

Source: Authors' calculations

Based on the weight value (Table 2), it can be observed that all four statements are generally equally represented in the CI1 structure. Nonetheless, greater share (significance) of views related to the statement *Auditors fully understand IFRS 13: Fair Value Measurement* may be noted (weight = 0.269), while the least important views were with the statement *IFRS 13: Fair Value Measurement seeks to reduce subjectivity in an accounting estimate that has an effect on the amounts in the financial statements* (weight = 0.224).

Factor analysis was also applied to the respondents' views of the *Audit challenges regarding the FV accounting estimates.* The application of the Principal Component Analysis in factor extraction in this case resulted in the extraction of two factors.

Table 3 Factor loadings and weights in the second composite indicator

Statement	Factor		Weights	
	1	2	Factor 1	Factor 2
Var6		0.679		0.324
Var7	0.494		0.153	
Var8	0.820		0.254	
Var9		0.634		0.302
Var10	0.493		0.153	
Var11		0.784		0.374
Var12	0.680		0.211	
Var13	0.741		0.229	

Source: Authors' calculations

According to the values of factor loadings, the first factor in this factor analysis consists of the following statements:

- Determining FV assets is much more complex than determining the historical cost of assets;
- Determining FV assets and liabilities is a time-consuming task;
- Most assets and liabilities subject to FV estimation in Serbia are not subject to transactions on active markets;
- FVC requires the auditor to continuously acquire additional knowledge related to the specific assets and liabilities subject to the FV estimation;
- Verification of FV measurement of assets and liabilities requires the involvement of an expert.

Given the content of the above statements, a factor created may be called *Auditors' challenges in evaluating FV accounting estimates* (CI2). In this case, the weights, which show the importance of certain statements in the composite indicator structure, were calculated on the basis of factor loadings. According to the weight values, the most important in the structure of this indicator is the statement *Determination of FV assets and liabilities is a time-consuming task* (0.254), while the equally low (weight = 0.153) importance goes to statements *Determination of FV assets is much more complex than determining the historical cost of assets* and *Most assets and liabilities subject to FV estimation in Serbia are not subject to transactions on active markets*.

The following statements are included in the structure of the second factor:

- Auditors in Serbia do not have sufficient technical knowledge on FV measurement;
- Techniques for determining FV may vary significantly from one industry to another;
- Auditors have effective procedures for verifying the accuracy of transactions and balances that are valued at historical cost, but these procedures are of little use in measuring FV.

The content of the statements included in the second factor suggests the name of the newly created composite indicator, i.e. *Auditors' challenges conditioned by the choice of techniques and procedures in auditing financial statements under FV* (CI3). According to the weight values, which indicate the relative importance of certain statements in the structure of this indicator, it can be concluded that the greatest relative importance in the structure of this indicator goes to the statement *Auditors have effective procedures for checking the accuracy of transactions and balances that are valued at historical cost, but these procedures are not of great use when measuring FV* (0.374). The following statement, by importance, is that *Auditors in Serbia do not have sufficient technical knowledge on FV measurement* (0.324), while the least significant statement in the structure of this indicator FV is *Determination techniques may differ significantly from one industry to another* with a weight of 0.302.

Multiple regression analysis was applied to examine the impact of respondents' views on the *Auditors' awareness of the issue of FV measurement* (CI1), *Audit challenges regarding the FV accounting estimates* (CI2), and *Auditors' challenges conditioned by the choice of techniques and procedures in auditing financial statements under FV* (CI3) on the belief that fair value estimate reality is harder to come by in developing countries like Serbia than in developed countries (Var1). In the created multiple regression model, variables CI1, CI2 and CI3 were denoted as independent variables, while Var1 had the role of a dependent variable. First, the assumptions for applying the regression analysis

were checked and it was concluded that there were no obstacles for the application of this method of statistical analysis.

Although the adjusted determination coefficient (0.127) points to the fact that the selected independent variables explain only 12.7% of the variability of the dependent variable, testing its significance leads to the conclusion that the estimated model is representative (Sig. 0.003) (Tabachnick, Fidell, 2007. p. 147).

Table 4 ANOVA[b]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	15.827	3	5.276	5.106	.003[a]
	Residual	84.731	82	1.033		
	Total	100.558	85			

a. Predictors: (Constant), CI1, CI2, CI3.
b. Dependent Variable: Var1

The values of the regression model parameters were estimated using ordinary least squares. This method provides parameter estimates that are at the same time unbiased, consistent and efficient.

Table 5 Regression coefficients

	Unstandardized Coefficients		Standardized Coefficients		
Variables	B	Std. Error	Beta	T	Sig.
(Constant)	-1.477	1.250		-1.181	.241
CI1	.458	.148	.345	3.093	.003
CI2	.491	.200	.262	2.448	.017
CI3	.362	.171	.240	2.120	.037

Dependent Variable: Var1

The standardized values of the regression coefficients indicate the importance of the independent variables in predicting the value of the dependent variable. According to these values, the highest relative importance in predicting the belief that fair value estimate reality is harder to come by in developing countries like Serbia than in developed countries belongs to *Auditors' awareness of the issue of FV measurement* (0.345), while the views on *Auditors' challenges regarding the FV accounting estimates* and *Auditors' challenges conditioned by the choice of techniques and procedures in the audit of financial statements by FV* are of minor importance. Based on the results of testing the significance of the regression coefficients, it can be concluded that the impact of all independent variables is statistically significant (Sig. <0.05).

6. CONCLUSION

The survey showed that the respondents are most in agreement with the statement that the *Determination of FV assets and liabilities is much more complex than the determination of historical costs* (mean value is 4.65) and their views on this statement are the most consistent (standard deviation is 0.65).

Based on the results of factor analysis:

- Within the *Auditors' awareness of the issue of FV measurement*, the auditor's views regarding the *Understanding IFRS 13: Fair value measurement* are of the greatest relative importance. Auditors in the Republic of Serbia, as well as auditors in other developing countries, need more additional professional training to fully understand IFRS 13, compared to auditors in developed countries.
- In the structure of *Auditors' challenges in evaluating FV accounting estimates*, the statement *Determining FV assets and liabilities is a time-consuming task* is the most important. This also leads to more time (number of working hours) required to audit a company measuring assets and liabilities per FV. It should be borne in mind that the average fee for audit services in Serbia has been declining in recent years, primarily due to the increased number of audit firms and licensed certified auditors, on the one hand, while on the other, the number of companies that are bound by statutory audits is more or less constant. Due to the above, the possibilities of auditors in Serbia for additional professional development in understanding the concept of FV and auditing in the circumstances of FV application, or hiring an expert to evaluate by FV, have been further reduced. The above calls into question the quality of the audit carried out under the conditions of FV application.
- Within the *Auditors' challenges conditioned by the choice of techniques and procedures in auditing financial statements under the FV*, the most important statement is *Auditors have effective procedures for verifying the accuracy of transactions and balances that are measured at historical cost*, but these procedures are of little use in measuring at FV. Audit companies have a growing need to hire external experts in the field of permanent property valuation according to FV but their number in the Republic of Serbia is relatively small, especially when it comes to FV estimation of plants and equipment.

Based on the results of the regression analysis: The greatest relative importance in predicting the belief that fair value estimate reality is harder to come by in developing countries like Serbia than in developed countries belongs to *Auditors' awareness of the issue of FV measurement*.

The research showed that auditors in Serbia face similar problems in auditing FV assessments as auditors in other developing countries, and that solving them requires additional training of auditors and an increased need for audit firms for assessment experts. An important factor limiting the application of FVC and revision of FV estimates in Serbia are underdeveloped capital markets, which requires the development of techniques for FV assessment for various business activities, which are not based on market model estimates, and future research in Serbia related to this topic could be focused in that direction.

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IZAZOVI U REVIZIJI FINANSIJSKIH IZVEŠTAJA U USLOVIMA KONCEPTA FER VREDNOSTI U EKONOMIJAMA U RAZVOJU: SLUČAJ REPUBLIKE SRBIJE

Neke stavke bilansa stanja su rezultat prosuđivanja, uključujući procene fer vrednosti, tako da je revizorima veoma teško da prikupe relevantne dokaze, pa je rizik od pogrešnog prikazivanja u finansijskim izveštajima je neizbežno veći. Cilj istraživanja u ovom radu je a) isticanje problema sa kojima se susreću revizori iz zemalja u razvoju prilikom revidiranja računovodstvenih procena FV; b) identifikovanje izazova sa kojima se susreću revizori iz Srbije prilikom revidiranja računovodstvenih procena FV; c) sagledavanje mogućnosti adekvatnog odgovora na te izazove u reviziji u Srbiji. Istraživanje je pokazlo da su problemi revizora u Srbiji u reviziji procena po FV generisani neefikasnim tržištima kapitala, i da se prvenstveno nalaze na polju procene FV što je povezano sa nemogućnošću primene tržišnog modela i pojačanom volatilnošću finansijskih izveštaja, kao i na polju revizorskih tehnika koje se koriste za pružanje uveravanja o objektivnosti procena FV u različitim delatnostima, što zahteva dodatne edukacije revizora. Time je istraživanje potvrdilo sličnost porblema u Srbiji sa problemima u reviziji FV procena u zemljama u razvoju.

Ključne reči: *koncept fer vrednovanja, MSFI 13, revizija finansijskih izveštaja, MSR 540*

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Review Paper

SELECTION OF SUPPLIERS IN THE SUPPLY CHAIN

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Abstract. *In recent decades, procurement has been defined as an integrated strategic business activity that aims to create high added value based on the focus company's relationship in the supply chain with its suppliers. The selection of suppliers in the supply chain is a complex task that should be performed in a cost-effective manner, taking into account the numerous requirements of business practice. The optimal supplier choice affects not only the product quality but also the formation of its price. The right choice of suppliers leads to timely, continuous and quality production. The decision on the choice of a supplier is a multi-criteria problem. A large number of models and techniques are used to make such a decision. The paper develops a framework to support decision-making and criteria-based prioritization of suppliers. The aim of this paper is to present the elements and specifics of the application of the Analytic Hierarchy Process as one of the multi-criteria decision-making techniques and SpiceLogic Ration Will software package as well as their relevance for supplier selection. In addition, based on the analyzed literature, the paper indicates the criteria used when choosing a supplier. The obtained results show that supplier 1 is the most important among the analyzed suppliers. The application of the SpiceLogic software package is justified, as the proposed package provides a platform for manufacturers to better understand the capabilities that sustainable suppliers must have in order to continue working with them and successfully manage the supply chain.*

Key words: *supplier selection, supply chain, AHP method, software package*.

JEL Classification: C02, C44, M11

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INTRODUCTION

One makes decisions every day, either out of habit (whether to drink coffee and go to lectures this morning or continue to sleep) or with the investment of great effort, time and money. Numerous and complex decisions lead to good business results. Making such decisions comes with uncertainty, which can have a decisive impact on the competitiveness and profitability of companies and their supply chains. Making adequate decisions requires a wide range of real information, the availability of which is variable to managers.

Today, there are a large number of scientific papers in which the conditions for calculating weight coefficients and supplier ranking are presented. The knowledge gained from these works can help company managers establish an adequate system for managing information, materials and services, from the supplier through the retailer to the end customer. In a large number of companies, the costs of raw materials and work-in-progress amount to 60-70% of the total cost of products. Supplier selection is one of the key management activities in the supply chain environment. It is important to establish long-term relationships with suppliers for continuous quality improvement, but also the reduction of procurement costs. Accordingly, business entities strive to find and establish relationships with suppliers who are financially stable, deliver goods on time, have high-quality goods that they sell at appropriate prices, because only an agile and optimal supply chain can lead to improved performance and profit on a turbulent market. However, this is not an easy task, so decision-makers use different criteria when selecting and evaluating suppliers, which they then assign weight factors that will affect the overall supplier performance. Today, a large number of software packages have been developed that are used for decision-making.

The aim of this paper is to select suppliers in the supply chain using secondary data and appropriate methods, but also to obtain recommendations on the reliability of the use of new software methods to increase productivity and efficiency of supply chain management. The structuring of decision-making problems and the evaluation of selected criteria is realized within the Analytic Hierarchy Process (AHP). After that, the model is tested using the previously mentioned software in order to confirm the obtained results and perform a sensitivity analysis.

The structure of the paper consists of three parts, conceptually and logically connected. The first part of the paper gives an overview of literature pointing to the importance of selecting suppliers in the supply chain. The methodology for applying the AHP method and the SpiceLogic Rational Will software package, which allows supplier selection, is given in the second part of the paper. The final part presents the results, recommendations and limitations of the model used.

1. LITERATURE REVIEW

The company's procurement activities affect its competitiveness and productivity. This activity is the most important part of the supply chain. Procurement managers evaluate supplier performance to retain those that meet company requirements. The selection of inadequate suppliers can cause operational and financial problems while by selecting adequate suppliers, the company reduces costs and solves quality problems.

As the company's procurement function accounts for "between 40% and 60% of final product sales, reducing these costs will increase the efficiency and profitability of the company" (Grzybowska & Gajdzik, 2014). For this reason, identifying relevant criteria

for selecting suppliers is a key activity in supply chain management. The existence of suppliers who provide timely inputs of appropriate quality and who incur lower costs guarantees successful and long-term cooperation with the company (Hanlin & Hanlin, 2012).

By researching the academic literature, we come across different approaches when choosing the criteria for selecting suppliers. Dickson (1996) was the first to define the supplier selection criteria from the selected set. This author was the first to create a study on supplier evaluation in which he defined 23 criteria which he divided into four groups according to the degree of significance. The first group consists of criteria that are of *high importance*, and they are: quality, delivery, history of performance and guarantees and receivables policies. Production facilities and capacities, price, technical capabilities, financial capacity, procedural compliance, communication system, reputation and position in the industry, desire for work, management and organization and operational control are another group of criteria that are of *high importance* (Dickson, 1996). Criteria of *medium importance* are: repair service, impression of the supplier, ability to pack, records of labor relations, geographical location, number of completed jobs and training material, and they form the third group. Dickson attaches *little importance* to the fourth group of criteria, which consists of mutual arrangements.

Pal et al. (2013) note that the following criteria are used when selecting suppliers (Pal et al., 2013): price, quality, delivery, past business performance, warranty and receivables policy, production facilities and capacities, technical capability, financial capacity, reputation and industry position, desire for work, repair service, supplier access, packing ability, employment records, geographical location, amount of past loans and mutual arrangements.

Shukla (2016) points out that when choosing a supplier, one should rely on the criteria such as: cost, quality, delivery, reliability and flexibility. These criteria significantly affect business performance. Further selection and performance of each supplier implies that the baseline criteria are divided into sub-criteria. Shukla points out that the cost criterion affects the production flow. The goal is to create maximum benefit for the company during the procurement. The continuous improvement program, customer satisfaction, certificates and the percentage of timely deliveries describe the quality criteria. Poor quality negatively affects the company and can cause an increase in product return rates due to customer dissatisfaction. Delivery is especially important for products with a short life cycle. That is why product delivery time, from the place of origin to the destination, is crucial. Delivery includes: place of delivery, delivery time, total delivery time of the order and trade restrictions. A sense of trust, the political situation, price fluctuations and guarantee policies make for reliability. The feeling of trust varies from supplier to supplier and can be measured by quality and timely delivery. The last criterion that Shukla states is flexibility. Flexibility in the supply chain allows a company to cope with environmental uncertainties, changing demand and a new environment. Therefore, the capacity, availability of stocks, exchange of information, components of negotiations and adjustment of suppliers should be checked.

Growing trends in outsourcing and environmental and social protection require companies to integrate criteria that include economic, environmental and social elements in their supply chain activities (Ghayebloo et al., 2015).

Zimmer et al. (2016) analyze 143 articles published in the period from 1997 to 2014 and identify the following ten best economic, environmental and social criteria: "Economic criteria are: *quality; flexibility; price; delivery term; relationship; cost; technical capacity; logistical costs; reverse logistics; rejection rate;* Environmental criteria are: *environmental management system; resource consumption; ecological design; recycling; ecological impact control; energy consumption; reuse; air emissions and environmental code of conduct.* The

third group includes social criteria: *stakeholder engagement; staff training; commitment in social management; commitment to health and safety management; stakeholder relations; code of social conduct; donations for sustainable projects; rights of interested parties; safety practices and annual number of accidents."* In addition to these, Gahona-Flores (2021) points out that they are highly valued as ecological criteria for health and environmental management (Gahona-Flores, 2021).

Integrating selection criteria allows companies to move towards sustainable development. There should be a positive relationship between sustainable supplier selection and supply chain, as this is the right path leading to sustainable supply chain management (Seuring & Muller, 2008). Due to the discrepancy between sustainability regulations and legislation and the organizational goals of the company, the sustainable selection of suppliers becomes a complicated decision (Zimmer et al., 2016). Therefore, research should be conducted in order to select the best suppliers or suppliers who can meet the requirements manufacturers set as criteria for the sustainability of supply chain management.

Different methods of multi-criteria analysis can be used when ranking suppliers based on the selected criteria. Govindan et al. (2015) review literature and recommend the Analytic Hierarchy Process, also suggesting combining the AHP method with other methods in order to better solve the problems that may arise.

Handfield et al. (2002) use the AHP method to assess suppliers and environmental performance. In addition to the standard AHP method and other mathematical measures, Lee et al. (2009) apply fuzzy logic involving AHP. Chan & Kumar (2007) show that cost and price are the most important criteria when selecting suppliers using the AHP-fuzzy method. Kumar et al. (2018) use the AHP method in their study and take into account costs, ability to deliver, product quality, performance and reputation of the firm when choosing a supplier.

Based on the analyzed literature, it can be clearly seen that the choice of criteria for the selection of suppliers is important and has a decisive influence on the company efficiency. The choice of criteria depends on the activity and the company status. Also, we can conclude that criteria such as quality, cost and delivery time are still of high importance for the selection of suppliers. In addition to these criteria, in the twentieth century, the communication system, method of payment, logistics capacity, supplier audit, etc. are gaining in importance, because the daily company goals require the use of integrated approaches that involve a number of factors and criteria. If there are critical areas, it is necessary to conduct a more detailed analysis and assess the capabilities of suppliers.

2. RESEARCH METHODOLOGY

Analytic Hierarchy Process (AHP) is one of the best-known methods of multicriteria decision-making used to determine the relative importance of a set of attributes, activities, or criteria. The creator of this method is Thomas Saaty. It allows for a comparison of alternatives based on decision assessment, taking into account the importance of the criteria. The AHP method belongs to the class of methods for soft optimization. AHP is often used in solving various problems. Vaidya and Kumar (2006) give a good overview of AHP applications. In addition to the possibility for decision-makers to structure the problem in a clear and simple way, the AHP method also allows the inclusion of objective and subjective consideration when making decisions (Forman, 1983). The process of using the AHP method consists of four phases (Suknović & Čupić, 2003, p. 175):

1. Structuring the problem.
2. Data collection.
3. Estimation of relative weights.
4. Determining the solution to the problem.

The first phase consists of decomposing any complex decision problem into a series of hierarchies, where each level represents a smaller number of attributes (Suknović & Čupić, 2003). The attributes are then decomposed into another set of elements corresponding to the next level. So, at the top of the structure is the goal, and at the lower levels are the criteria and sub-criteria. The alternatives to be assessed are at the lowest level (A1, A2 and A3). The comparison of each pair for each criterion is presented in Figure 1. If there are n elements for comparison then the total number of n (n-1) / 2 estimates needs to be made, because each alternative in relation to itself is represented by the number 1 and those units are set diagonally, and values below the diagonal represent reciprocity. All participants should be involved in defining the hierarchy, because there are different views of the problem, which may be more useful than the ones we originally posed (Clark, 1985). In our example, we will compare three alternatives (suppliers) based on seven criteria. So, we have a total of 21 comparisons (7*(7-1)/2).

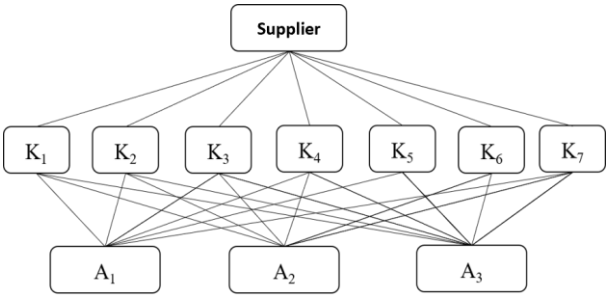

Fig. 1 Hierarchical structure of decision problems
Source: Adapted from: Srđević, B. & Jandrić, Z. (2000). Analitički hijererarhijski proces u strateškom gazdovanju šumama. Novi Sad: J.P. „Srbija šume“, *Šumsko gazdinstvo* "Novi Sad".

The second phase refers to data collection and comparison of pairs of alternatives. The decision-maker assigns relative grades in pairs of attributes of one hierarchical level for all levels of the entire hierarchy attributes (Suknović & Čupić, 2003). In order to perform a relative weight estimation in which the comparison matrix is translated into eigenvalue problems, the best known Saaty nine-point scale is used to obtain normalized and unique weight vectors for all attributes at each level of the hierarchy (Kousalya et al., 2012). Level of preference 1 shows that two alternatives are completely equal, while the absolute advantage of one over the other alternative exists when we assign the number 9 to the pair. Thus, the decision-maker can express his opinion on each pair of elements as: equal importance, slightly higher importance in relation to the other, greater importance, significantly greater importance and absolutely greater importance of one element in relation to another. Descriptive grades are converted into numerical values: 1, 3, 5, and 7, while the numbers 2, 4, 6 and 8 are between them and are used to more accurately express the limit values in case the decision-maker hesitates between two levels.

In the third phase, we determine the relative significance of the criteria, form a matrix A of dimension nxn (criterion level) and mxn (alternative level), where the elements $a_{ii}=1$ (elements of the main diagonal), while the elements a_{ji} are reciprocal values a_{ij} for i are different j, i,j = 1,2, … ,n. In order to be able to obtain our own vectors at this stage, it is necessary to (Despodov et al., 2011):

- Compare the criteria in pairs.
- Find the sum of all the elements in each column.
- Divide the elements of each column by the sum of that column we obtained in the previous step.
- Find the sum of all elements in each row and then determine the mean value of each row (divide the sum by the number of criteria). The column consisting of the mean values thus obtained represents the normalized eigenvector. In this way, the participation or importance of each criterion in the model is obtained.

Determining the problem is actually finding a composite normalized vector (**fourth phase**). When determining the vector of order of values in the criteria in the model, it is necessary to determine the importance of alternatives in the model. After evaluating the alternatives according to individual criteria, we perform an overall synthesis of the problem in which we need to multiply its participation within the criteria with the relative weight of the criteria for all criteria, and then add the obtained values for each alternative separately. By adding these values, the total shares are obtained, i.e. weights for each alternative, thus determining the composite normalized vector. The ranking of alternatives is done on the basis of the values of total weights so that the highest rank is given to the alternative with the highest total weight. Therefore, in this case, we conduct an evaluation of alternatives based on all criteria. Each alternative gains its value.

Finally, each pair comparison should pass a consistency test. Satty suggests that the consistency index be calculated as follows: $CI = (\lambda max - n) / (n - 1)$. The obtained index can be compared with randomly selected indices (RI) and we get the consistency ratio (CR). A CR value less than or equal to 0.1 is considered significantly consistent.

In addition to the standard method of application, the AHP methodology can be implemented using software packages. Software packages as decision support systems aim to help managers apply analytical methods to make an adequate decision. They enable very easy interpretation, visualization and interactivity of different solution scenarios. There are various software solutions (Expert Choice, Super Decisions…). We decided to implement SpiceLogic Rational Will. This software solution is based on the AHP model. It is very easy to use. The program allows us to choose whether to maximize or minimize the criterion (drop-down menu). We repeat the process until we enter the desired number of criteria. When we do not use quantitative data but express a subjective comparison in pairs, the "subjective" option should be chosen.

We compare pairs using a scale. We respect a consistency relationship that measures inconsistency between pairs. It shows us how much we "violate" the rule of transitivity. When this rule is applied or when we are 100% consistent in our preferences, the deviation will be 0. The higher the number, the greater the deviation. According to Satty, as we mentioned, the consistency ratio (CR) should be less than or equal to 10%. If it exceeds this value, the software warns us that the number turns red and then we have to revise the comparison.

Based on the explained methodology, preference should be given to the SpiceLogic software package due to: time savings when comparing criteria, easier modification of entered data, and more detailed sensitivity analysis.

3. Results and Discussion

The procurement process plays an important role in the operations of manufacturing and service companies. Companies order and buy different categories of raw materials, work-in-progress and finished products. Procurement must be efficient, because it significantly affects the profitability and competitive position of the company.

Proper selection of suppliers affects the efficiency of procurement and is a multi-criteria problem that includes quantitative and qualitative criteria. When choosing the right supplier, it is important to establish a balance between tangible and intangible criteria. Companies evaluate potential suppliers using a number of criteria, to which they assign different weighting factors whose values ultimately affect the overall performance of the supplier.

In this paper, we base the selection of suppliers in the supply chain on the AHP method, the results of which we test using the SpiceLogic Rational Will software package. We collect data for the research from various secondary sources, but primarily from published publications in the automotive industry (data by Hruška et al., 2014). We present the first phase of the AHP method in the second chapter (Figure 1). In this way, we decompose the decision-making problem in the form of a hierarchical structure. At the top of the hierarchy, we have a decision on the choice of supplier that represents the goal. The next level refers to the criteria, while at the lowest level of the hierarchy there are alternatives (in our case three suppliers) that are evaluated in relation to the defined criteria and goal.

The mentioned authors reach the data with the help of research conducted in the automotive industry and rank suppliers based on nine criteria, while for this paper we selected seven criteria: price, product quality, payment deadline, delivery time, storage space, transport and audit of suppliers (Table 1).

Table 1 Supplier selection criteria

Mark	Criterion
K_1	Price
K_2	Product quality
K_3	Payment deadline
K_4	Delivery time
K_5	Storage space
K_6	Transport
K_7	Supplier audit

Source: Adapted from: Hruška, R., Průša, P. & Babić, D. (2014). The use of AHP method for selection of supplier. *Transport*, 29(2), p. 200.

After the defined hierarchical structure, a comparison of pairs of criteria follows (third phase). If, when comparing, one criterion is assigned a higher number than the other, it means that we prefer the first criterion. The comparison of pairs is presented in the form of a square matrix using a comparison scale that provides information on the preferences of the criteria. We synthesize the information to show a general preference (we actually get a vector of the eigenvalues of the matrix). The eigenvector vector of the matrix is shown in Table 2.

Table 2 Matrix eigenvalue vector

	K_1	K_2	K_3	K_4	K_5	K_6	K_7
K_1	1	2	3	3	3	4	3
K_2	1/2	1	2	3	3	4	5
K_3	1/3	1/2	1	2	2	3	4
K_4	1/3	1/5	1/2	1	3	2	3
K_5	1/3	1/3	1/2	1/4	1	3	3
K_6	1/4	1/4	1/3	1/2	1/3	1	2
K_7	1/3	1/5	1/4	1/3	1/3	1/2	1
SUM	3.07	4.48	9.08	8.58	15.33	14.83	21.00

Source: Adapted from: Hruška, R., Pruša, P. & Babić, D. (2014). The use of AHP method for selection of supplier. *Transport*, 29(2), p. 200.

Then we divide each element of the matrix by the obtained sum of the column in which it is located and perform summation by rows of the table, and after that we calculate the average value by alternative to get to the normalized sum of rows. The obtained average value represents the average preference (weight coefficient) of one alternative over the others. Based on the calculation, we arrive at the weighting coefficients: w_1= 0.29 (price); w_2= 0.24 (product quality); w_3= 0.13 (payment deadline); w_4= 0.13 (delivery time); w_5= 0.07 (storage space); w_6= 0.09 (transport) i w_7= 0.05 (supplier audit). We calculate the maximum eigenvalue of the comparison matrix, i.e. λmax by multiplying the matrix of comparison results by the priority vector, i.e. the values from Table 2 are multiplied by the weighting coefficients (multiplication is performed in accordance with the rule of multiplication of the matrix and vector).

The resulting vector is now divided by the values of the weighting coefficients to determine λmax. In our example, λmax is 7.57 (λ_{max} = (7.83+7.73+7.85+7.57+7.46+7.84+6.75)/7=7.57)

In order to determine the consistency index (CI), we must first determine the degree of consistency (CR) based on the Saaty table (1980). The random index for the 7x7 matrix is 1.32 (The value is below 0.1, which shows us that we meet consistency criterion and there is no need for data review).

$$CI=\frac{\lambda max\text{-}n}{n\text{-}1}=\frac{7.57\text{-}7}{7\text{-}1}=\frac{0.57}{6}=0.095$$

$$CR=\frac{CI}{RI}=\frac{0.095}{1.32}=0.072$$

After fulfilling the conditions of consistency in the criteria, we continue the procedure of applying the AHP method when comparing suppliers (for each of the criteria) in order to multiply their weight coefficients and weight coefficients of the criteria to reach the weighted amount based on which we rank suppliers (fourth phase). By the priority order of alternatives (Supplier 1, Supplier 2 and Supplier 3) as a lower-level element, i.e. in relation to the criteria, we can see the relative importance of the given criterion for each of the alternatives when making the final decision on the selection of suppliers in the supply chain. We conclude that Supplier 1 meets the criteria (has the highest value of the weighted amount), and the management should opt for it.

Table 3 Ranking of alternatives

Alternative	Weighted amount	Ranking
Supplier 1	0.473652	1
Supplier 2	0.424006	2
Supplier 3	0.102341	3

Source: Authors' calculation

The SpiceLogic software package suggests Supplier 1 as a recommendation for the selection of suppliers in the supply chain based on the entered values, because its total priority is 59.16%, followed by Supplier 2 with an overall priority of 49.53% and finally Supplier 3 with 49.07%. The presentation is given in the form of a bar graph and a radar panel.

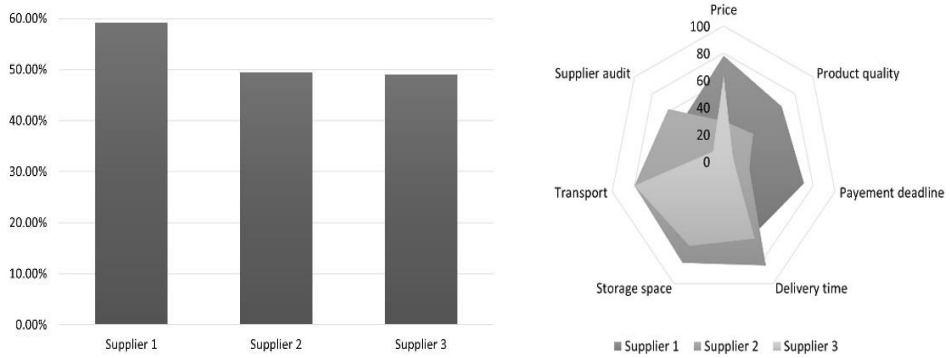

Fig. 2 Solutions obtained using the SpiceLogic Rational Will software package
Source: Authors' calculation using SpiceLogic Rational Will software package

The final decision on the choice of supplier should not be made before conducting a sensitivity analysis. Sensitivity analysis allows us to understand how "firm" our decision is. The software package provides one-way sensitivity analysis and as a result displays a graph of the change in the value of the variable that affects the value of the option. Based on the sensitivity analysis (Sensitivity index = 100 - Ks % (measures the distance that a variable needs to influence a decision). As the value of the weight of the comparison side changes from its total possible value, so will the total value of the other side decrease) in this example, this decision was influenced by the following criteria, which were compared according to the index of importance (from highest to lowest importance): payment deadline, product quality and price (Figure 3). The product quality criterion has a sensitivity index of 31.63%. The higher the index, the higher the sensitivity. If the sensitivity index is zero, the variable is insensitive in that decision context.

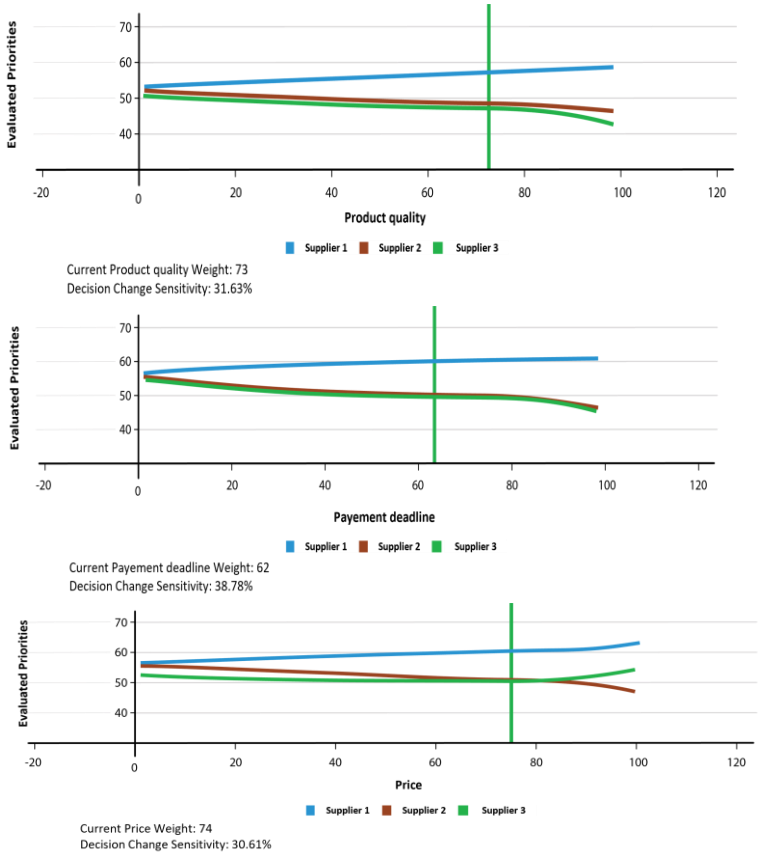

Fig. 3 Sensitivity analysis
Source: Authors' calculation using SpiceLogic Rational Will software package

Making rational decisions requires analyzing the data, which requires time and makes the method unsuitable for quick decision making. Rapid changes on the market require rapid decision-making, so this model can be used mainly in making long-term decisions, rather than short-term or operational ones. Disadvantages when using the software package can occur when management cannot define and assess the problem. In that case, the decision-maker does not have relevant information that would be of help to him, so he uses his experience and instinct when making decisions, and then subjectivity comes to stage. Rational decision-making requires management to have relevant information in the supplier evaluation phase. In addition to the time constraint, the limiting factors may be: lack of financial resources, misinterpretation of data, and insufficient knowledge of the application of software tools.

CONCLUSION

Evaluation and selection of suppliers in the supply chain are activities that companies face on a daily basis. Businesses are often unable to make adequate decisions and therefore have to use appropriate methods and software packages. Analytic hierarchy process is a system that has proven to be a very reliable basis for decision-making because it allows users to rank potential alternatives based on subjective assessments of criteria.

In this paper, we present the gradual application of the AHP method when selecting suppliers in the supply chain. The only thing we can point out as a disadvantage in its application is the definition of decision criteria and assessment of their relative weights. This is so because with other multi-criteria analysis methods the importance of the criteria is determined by the decision-maker, and here we have a comparison of pairs that represent human decisions based on experiences from previous research. Only after the comparison is a decision made.

Globalization of business, shortened product life cycle, constant growth of competition, but also the penetrating and increasingly present development of information and communication technologies have led to the development of the AHP method. The AHP method has gained in importance with the development of quality software. Different software packages solve multi-criteria ranking and enable the use of sensitivity analysis.

In this paper, we perform a multi-criteria selection of suppliers in the supply chain using the AHP method, but also the software package, in order to examine the importance and usability of computer tools. We analyzed three suppliers based on seven criteria and came to the following results:

- The criterion with the greatest importance for the company is the criterion K1 - price with a score of 0.29, while the least attention when making decisions is paid to supplier audit (K6) - 0.05. Using SpiceLogic Rational Will software, the three most important criteria are defined in the following order: payment deadline, product quality and price. Sensitivity analysis shows that there are changes (differences) in the weight of the criteria, but this did not affect the overall ranking when it comes to the position of the best alternative. We can conclude that the existence of a slight inconsistency in the weight of the criteria does not affect the overall system and the final decision.
- By comparing suppliers based on each of the criteria, we conclude that the AHP method and the SpiceLogic Rational Will software solution give the same results. Recommendation for the selection of suppliers in the supply chain according to the software package is Supplier 1 (59.16%), then Supplier 2 (49.53%) and finally Supplier 3 (49.07%).

Based on all the above, we conclude that the company is free to choose Supplier 1 as the optimal choice with full confidence and that in its business it can rely on the proposed software package.

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IZBOR DOBAVLJAČA U LANCU SNABDEVANJA

Poslednjih decenija, funkcija nabavke definiše se kao integrisana strateška poslovna funkcija koja ima za cilj stvaranje visoke dodatne vrednosti zasnovane na odnosu fokusne kompanije u lancu snabdevanja sa svojim dobavljačima. Izbor dobavljača u lancu snabdevanja je složen zadatak koji treba izvršiti na troškovno efikasan način i uz uvažavanje brojnih zahteva poslovne prakse. Optimalan izbor dobavljača utiče ne samo na kvalitet proizvoda već i na formiranje njegove cene. Pravilnim izborom dobavljača postići će se pravovremena, kontinuirana i kvalitetna proizvodnja. Odluka o izboru dobavljača predstavlja višekriterijumski problem. Za donošenje takve odluke koristi se veliki broj modela i tehnika. Rad se bavi razvojem okvira za podršku prilikom odlučivanja i određivanja prioriteta dobavljača na osnovu kriterijuma. Cilj rada je da prikaže elemente i specifičnosti primene Analitičkog hijerarhijskog procesa kao jedne od tehnika donošenja odluka sa više kriterijuma i softverskog paketa SpiceLogic Ration Will kao i njihovu relevantnost za izbor dobavljača. Pored toga, rad na osnovu analizirane literature ukazuje na kriterijume koji se koriste prilikom izbora dobavljača. Dobijeni rezultati su pokazali da je dobavljač 1 najvažniji među analiziranim dobavljačima. Primena softverskog paketa SpiceLogic je opravdana, jer predloženi paket pruža platformu za proizvođača da bolje razume sposobnosti koje održivi dobavljači moraju da poseduju kako bi nastavili saradnju sa njima i uspešno upravljali lancem snabdevanja.

Ključne reči: *izbor dobavljača, lanac snabdevanja, AHP metod, softverski paket.*

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