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Phone: +381 18 257 095 Telefax: +381 18 257 950
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Editor-in-Chief: **Dejan Spasić**, e-mail: *fueaoed@junis.ni.ac.rs*
University of Niš, Faculty of Economics, Republic of Serbia, 18000 Niš, Trg Kralja Aleksandra 11
Phone: +381 18 528 629, Fax: +381 18 523 268

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Original Scientific Paper

TESTING MARKET EFFICIENCY: THE ROAD TO INTRINSIC VALUATION

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Nenad Gajić[1], Vanja Grozdić[1], Jelena Demko Rihter[1], Jarmila Duháček Šebestová[2]

[1]Department of Industrial Engineering and Management, Faculty of Technical Sciences, University of Novi Sad, Republic of Serbia
[2]Department of Business Economics and Management, School of Business Administration in Karvina, Silesian University in Opava, The Czech Republic

ORCID iD:	Nenad Gajić	https://orcid.org/0000-0002-3555-0091
	Vanja Grozdić	https://orcid.org/0000-0003-3804-3076
	Jelena Demko Rihter	https://orcid.org/0000-0001-7762-3095
	Jarmila Duháček Šebestová	https://orcid.org/0000-0002-7493-0759

Abstract. *The paradigm of market equilibrium and the "efficient-market hypothesis" tied to it, dealing specifically with the behavior of capital markets, has no explanation for financial bubbles and their bursting that is leading to stock market crashes. Accordingly, the main goal of this paper is to discuss the inefficiency of markets, with examples of corporate decisions that directly abuse such inefficiency to psychologically motivate desired behavior of potential customers. To test the efficiency market hypothesis, we have used Stoxx Europe 600 index historical closing daily prices, for the period from 2012–2022. Using both non-parametric and parametric tests, such as the Kolmogorov–Smirnov test, run–test for random order, and ARIMA regression, we reject the hypothesis that the market is efficient in a weak form because it doesn't follow a random walk. Also, basic-level problems of economic theory were analyzed, emphasizing the view that perhaps the time has come to align the fundamentals of economic theory with basic concepts that have been used in practice for years.*

Key words: *market, efficiency, stock, price, prediction.*

JEL Classification: G14, G41, C22

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Corresponding author: Jelena Demko Rihter
Department of Industrial Engineering and Management, Faculty of Technical Sciences, University of Novi Sad, 21000 Novi Sad, Republic of Serbia | E-mail: jciric@uns.ac.rs

1. INTRODUCTION

Let's forget, just for a while, the old economic textbooks and all that generations of economists have learned in school. The market is, if we look at the reality on the "ground level", a pretty chaotic system that weighs to extremes, as indicated by crisis and financial bubbles and stock market crashes, while the behaviors of individuals (agents or participants) are unpredictable and psychologically motivated. This is known and used in practice for years now. One of the main motivations that are "opposing" rational behavior is the desire for quick enrichment, or to say it more simply: greed. Although a lot of literature ties "greed and fear" or later "hope and fear" as primary emotions in market psychology (Hersh Shefrin, 2002), simple greed will suffice in this paper. It is now, and it has always been, one of the fundamental parameters of human behavior and a strong motivation for speculative behavior that is undermining the rationality concepts of the market equilibrium paradigm, constantly leading to market crashes. If something is profitable, people will buy it – many because they believe it will continue to be profitable, but some ("smart money") because they hope the market won't crush until they re-sell with the profit and exit – and if the feedback on profitability is not interrupted somehow, this self-fulfilling prophecy creates an endless loop of repeating behaviors which are fuelling the unsustainable speculative bubble that will eventually burst. Likewise, if something stops being profitable, generally everybody sells it, pushing the market downwards to irrationally low prices. We will showcase here how this greed of men is being used and abused by the big companies, and this is one of the reasons why Economics needs to embrace reality and let go of some disproven postulates that are now only "dead meat" on the body of science. In this paper, we are not yet trying to give definite answers, but rather simple guidelines – demonstrating what are the real problems and why we need the solutions, and pinpointing the right direction for search, all in hope of stimulating future efforts from fellow researchers, what is needed to return the economics on track scientifically.

2. THE GAP BETWEEN THEORY AND REAL-LIFE PRACTICES

If we believe in the paradigm of market equilibrium, we generally also believe in "efficient" markets. This was vaguely explained in the most important paper mentioning the term (Fama, 1970), which is also surprisingly the most quoted article in financial economics (Guerrien and Gun, 2011). The term was first used by the same author much earlier, in his published Ph.D. dissertation (Fama, 1965) and the article that followed (Fama, 1965), but this is how the most important explanation looks like: 'A market in which prices always "fully reflect" available information is called "efficient".' This means that all speculative assets (assets with uncertain returns, like stocks) will always incorporate the best information in their prices. This is the statement around which the whole investment theory revolves for almost half a century: we are led to believe for so long that it is, actually, impossible to beat the market, as the prices change only because of the relevant information. Also, the first fundamental theorem of welfare economics of general equilibrium theory states that every competitive equilibrium is Pareto efficient, meaning that no one can be made better off without someone being worse off. Malkiel (2003) similarly explains in another paper that he "will use as a definition of efficient financial markets that such markets do not allow investors to earn above-average returns without accepting above-average risks". The central paradigm in finance is still the "efficient market hypothesis" which is tied to the general equilibrium theory. It is strange to have such long-lasting and unquestionable faith of the general public – and generally the majority of the

economics profession – in a hypothesis that wasn't flawless from the start: it needed to divide market efficiency into three models (or theories) to cover up empiric evidence and give "testable implications" to proposed models ("But some such assumption is the unavoidable price one must pay to give the theory of efficient markets empirical content", as it was explained). LeRoy (1976) reveals another "not minor" flow: that the equations supposed to characterize "market efficiency" were, amazingly, "true as tautologies", and "because the equations imply no restrictions on the data, they cannot possibly generate testable implications contrary to Fama's clear implication".

Before we continue, we must fully understand that the efficient-market hypothesis (EMH) is the theory that holds that the market is always right. It considers stock and bond markets as nearly perfect, even during obvious crazes as the dot-com mania was at the beginning of the century, and that prices on the (stock) exchanges instantly and accurately reflect all available information about publicly traded securities. In 1984, Yale University economist Robert Shiller (1984), who later got more public exposure after the market crash of 1987, which the efficient-markets professors had trouble explaining, called that belief "one of the most remarkable errors in the history of economic thought" when he was explaining one argument for the efficient market hypothesis (that "because real returns are nearly unforecastable, the real price of stocks is close to the intrinsic value, that is, the present value with a constant discount rate of optimally forecasted future real dividends"), yet the same belief in almighty markets contributed mightily to the mortgage bust and the current economic crisis, the biggest one after the "Great Depression" (Fox, 2009). The weight of this crumbling myth is maybe best acknowledged by the former Federal Reserve chairman Alan Greenspan, a vocal proponent of the hands-off policy (believing in the self-regulation efficiency of financial markets – leave the markets to regulate themselves). On October 23, 2008, he admitted in his testimony to the U.S. Congress: "The whole intellectual edifice, however, collapsed in the summer of last year" (WSJ, 2008). His predecessor, another former Federal Reserve chairman Paul Volcker thinks alike, saying it's "clear that among the causes of the recent financial crisis was an unjustified faith in rational expectations, (and) market efficiencies" (Volcker, 2011). Another example is from the book co-written by the U.S. business editor of The Economist and a former British government official, and they state: "The crisis showed conclusively that the efficient market hypothesis is flawed" (Bishop and Green, 2010). We don't need to stay in the present, we can as well go further into the past to see what some of the widely recognized economic minds thought about rational market agents and about the romanticism that is today known as the "efficient-market hypothesis". One aphorism usually attributed to economist and speculator John Maynard Keynes, known for advocating government intervention and deficit spending during economic crises, says: "markets can remain irrational longer than you can remain solvent" (Montier and Strategy, 2002). Keynes wrote of the influence of "animal spirits" (irrational psychological behaviors) on the economy. Another name best known for the free-market philosophy of "The Wealth of Nations" (1937), Adam Smith, also emphasized the importance of psychological values in his lesser-known book "The Theory of Moral Sentiments" (1822).

Nowadays, we are all witnesses that extreme events do happen in financial markets. Nothing in the efficient-market hypothesis can explain the inconvenient truth that some shrewd investors can indeed do better than the market for a very long time (think Warren Buffet), nor can explain speculative bubbles and their busts, or bizarre stock valuations. All of this shows that people are emotional, and when they get emotional they decide to buy (or sell) in unison. This crashes the markets. People crash it. Shiller (1989) goes as far

as to claim that "mass psychology may well be the dominant cause of movements in the price of the aggregate stock market". Even technical analysis books are aware of the human element: "Security prices are determined by money managers and home managers, students and strikers, doctors and dog catchers, lawyers and landscapers, and the wealthy and the wanting. This breadth of market participants guarantees an element of unpredictability and excitement" (Achelis, 2000). Behavioral finance, a now solidly established field that is still rapidly developing as an alternative to the EMH – although still generally embracing the paradigm of market equilibrium – believes that financial man is far from the perfect, mechanical trader depicted in textbooks. He is a rather neurotic fellow who follows the crowd, fails to plan, and often makes mistakes – to think that his every price is perfect is a remarkable error indeed (Lowenstein, 2009). In our century, the assumptions of investor rationality and perfect arbitrage are overwhelmingly contradicted by both psychological and institutional evidence, showing that actual financial markets are inefficient, with less than fully rational investors (Shleifer, 2000). And more than 40 years ago it was well explained that "a full understanding of human limitations will ultimately benefit the decision-maker more than will naive faith in the infallibility of his intellect" (Slovic, 1972) – who knows, if we had put that to good use on time, maybe we could've even evaded the "Great Depression II" whose consequences we still feel.

3. FACE OF CHANGES

According to Gajic and Budinski-Petkovic (2013), Facebook, considering its "intrinsic" value, which is based on its fundamental properties like the number of users and their potential growth, was largely overvalued at its IPO and even before, fueled by the numerous articles that re-tweeted the (fake) belief in its further growth potential. A whole chapter of the prominent book is exactly about the importance of such stories in determining behavior: a historical example would be repeatedly told a story that house prices will always rise, which caused many additional people to invest in housing following the dot-com bust of 2000 (Akerlof and Shiller, 2009). When Facebook made its IPO NASDAQ debut on May 17, 2012, its shares were valued at $38.23 apiece at closing time on the first day. Then the FB share price more than halved in the first four months after the IPO, and since then it was generally slowly trending up[2], fueled by the various stories about new ways of monetarization and new advertisement models like the Facebook Exchange (Carlson, 2012), but it was s still a way off even from the starting level. Now, let's compare this fact with the words from the godfather of efficient markets, as this is how the famous Fama talks about financial prices before he became famous: "Competition among the many intelligent participants leads to a situation where, at any point in time, actual prices of individual securities already reflect the effects of information based both on events that had already occurred and on events which, as of now, the market expects to take place in the future. In other words, in an efficient market at any point in time, the actual price of a security will be a good estimate of its intrinsic value" (Fama, 1965). Fama explains that this intrinsic value he mentions is an "equilibrium price" which "depends on the earning potential of the security". So, to put this into good use, according to EMH the IPO price of Facebook shares reflected everything that happened before IPO, as well as everything that the market

[2]*Source:* NASDAQ, https://www.nasdaq.com

expected to happen afterward. As not much has happened before the IPO, at least financially (with a price-earnings ratio of 104, and it is known that the P/E ratio is often used to estimate true or "intrinsic" value, if annual profit remained the same and fully paid to shareholders who never sell their shares, the initial investment in Facebook would turn a profit after more than a century!), we can only conclude that the investors believed the greatest things are yet to come. And they were mistaken, not only because of the steep price drop of the shares in the next months – but the "earning potential" of Facebook is marketed to be greatly dependent on the further growth of its users (this is also stated in Facebook's US Securities and Exchange Commission Registration), and this growth can't continue in the future in the presented and expected pace simply because the world population is limited! What we are witnessing here is not efficient market behavior – it's hard to imagine that none of the investors had good information when they all should generally know all according to EMH. Why was the price that high initially, then? In this paper we are trying to show how that was the result of a deliberate campaign by both the company and the investment banks responsible for IPO, aimed to psychologically influence potential investors and convince them into buying the overpriced shares. One-time cash-in for Facebook, and the world's economy it was just another financial bubble that burst soon after. If we believe that the market is always right, then nothing was wrong here. But, if we decide to give a benefit of a doubt to the "all-knowing" market from the textbooks, can there be a methodology that could have helped us determine the "real" – or we should also say "intrinsic" – value of the Facebook and similar firms at the time we needed it? Several people believe that there was a methodology for social networks like this (Cauwels and Sornette, 2011), and here we also stated and demonstrated how "intrinsic" value based on the fundamental properties should not be tied to the elusive, psychologically influenced market price.

Before we go to the next more technical chapter, we need to, almost like the definition, expand the already used term of "intrinsic value" to a value that is based on the "fundamental" properties (or how much the company/asset is "really worth", and not how much people are willing to pay for it, which is the current market value). This usage of the term is coherent with its usage in Ecology, where: "Intrinsic value is the value that an entity has in itself, for what it is, or as an end" (Sandler, 2012), and it is also in line with the most common usage of the term in recent non-academic financial literature (although we will restrain from discounting the expected future incomes, as this method particularly uses the unpredictable market influences – psychological factors – which we try avoiding in the estimation of "intrinsic value"). It is important to note that "intrinsic value" of the company may be different if we use different techniques to calculate it (as this is yet to be standardized, because not all companies have the same fundamentals, and not all people may agree on these), and it will always be further modified (sometimes quite substantively) into market price in accordance to the patterns in investors' minds – these patterns are the result of their education, past experiences, current mood and the way they forecast the future (similar to the concept of "behavioral adjusted present value" in Shefrin, 2008), and are also influenced from the outside (e.g. with word-of-mouth or newspaper stories that something is "hot or not" – according to Shiller (2003) feedbacks may even "be an essential source of much of the apparently inexplicable 'randomness' that we see in financial market prices"). So, "intrinsic value", as we use it here, is not the equilibrium concept – the market price probably won't strive for this (although it is the "most probable" or the "fair" price if we present it like numeral); instead, the market price will move unexpectedly and chaotically as it always does, fluctuating based on changes in perceived desirability – but the value of the concept lies in the fact that one needs to have a theory of how prices are

supposed to behave if he wants to estimate are they right or wrong (too high or too low) at the precise moment in time. There is a need to value something, as in finance "the central unifying concept is asset valuation. Certainly, the theory of value, and comparisons of price and value, is what much of finance is about" (De Bondt et al., 2008). And investors are always looking, whether they are aware of it or not, for less risky "bargains" where the "intrinsic" (true) value of the company/asset exceeds its current market valuation/price. This is what Warren Buffet is famous for – in his own words, "the basic ideas of investing are to look at stocks as business, use the market's fluctuations to your advantage, and seek a margin of safety" (Outlook, 2022), and here we accept that margin of safety (or safety margin) is the difference between the intrinsic value of a stock and its market price. This is contrary to Malkiel's (2003) view of efficient financial markets where increased returns can only be achieved by taking greater, not lesser, levels of risk.

4. TESTING MARKET EFFICIENCY HYPOTHESIS

After we demonstrated and explained some of the big problems (and some are yet to come) of Economics theory today, in this chapter we try to suggest the right directions for further research in the search for solutions. As stated in the introduction, we are not trying to give definite answers as most of them are beyond the scope of this paper, but some guidelines may be of use to future researchers. First of all, some theory of asset valuation is necessary to compare prices and values, and the "intrinsic value" proposed here considers the fundamental properties of the asset, making it a good starting point for all "non-EMH" (or shall we, for easier reference, just change the first letter from Efficient to Inefficient, leaving us with the abbreviation IMH) theories and models. Secondly, it is important to understand that the vast majority of the past knowledge, or the building blocks of Economics, can still be used if we question or even reject the EMH. And thirdly, if we accept the concept of inefficient markets, we need to get used to thinking in probabilities: the "intrinsic value" itself is the most probable price guideline in the "moment zero", but it is being substantively modified into the market price after passing through the "human emotion filters". From the moment when the first market price or "emotionally-influenced outcome" is known, all that various models can accomplish is the calculation of the probability of any outcome or price. That is, we can calculate (a) the most probable outcome or price, (b) the probability for that (or any other) outcome or price to happen, and (c) which inputs have the biggest effect on the results. Beyond that is the limit, because of the awareness that markets are inefficient and agents operating on them are irrational, so basically, every outcome or price is possible. This is why there can never be a 100% sure prediction of outcome or price through models based on the concept of "intrinsic value" and inefficient markets (although some models can theoretically come close to this), but what about that? There are yet no economic models that can predict with 100% accuracy. The concept might be hard to grasp or accept at first, but its usefulness is indisputably proven in real life with widely accepted predictions like weather forecasting.

According to Pinches (1970): "The random-walk theory, in its general form, is suggested directly from the nature of the markets under consideration. If the security markets are perfect, or not too imperfect, the participants in such a market will eliminate any profits above the base minimum required to induce them to continue in the market, except for any profits which might accrue to someone who has private information. The price of a security should reflect all of the

information available to participants in the market. In such a market all changes in price should be independent of any past history about a company which is generally available to the public. Except for a possible trend related to the desired rate of return, future stock prices could just as well be determined by the flip of a coin (unless private information is available) as by any elaborate analysis of past data". Under the random walk model, the behavior of prices under the EMH will wander randomly around an increasing trend, with or without drift (Mollah, 2007):

$$X_{t+1} = \delta + X_t + \varepsilon_{t+1} \quad (1)$$

where: ε_{t+1} identically and independently distributed random variable; δ drift.

EMH claims that a market is efficient if a particular information set cannot be used to generate above-average profits over a longer period of time (Hájek, 2007). Moreover, weak form market efficiency implies that the stock prices traded on the market cannot be predicted by using historical price information, which means they are not serially correlated (Borges, 2010). Accordingly, to examine whether the market is efficient or not, we will test the next research hypothesis:

H0: The market follows a random walk, i.e. the market is efficient in the weak form
H1: The market doesn't follow a random walk, i.e. the market is not efficient in the weak form

5. Methodology and Data Analysis

Because econometric models favor the use of daily data in time series analysis (Morse, 1984), for this study we have used Stoxx Europe 600 index historical closing daily prices[3], for the period from Jan 2012–Oct 2022. Stoxx Europe 600 is a stock index of European stocks representing large, mid, and small capitalization companies among 17 European countries: the United Kingdom (composing around 22.3% of the index), France (composing around 16.6% of the index), Switzerland (composing around 14.9% of the index) and Germany (composing around 14.1% of the index), as well as Austria, Belgium, Denmark, Finland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Poland, Portugal, Spain, and Sweden (Stoxx, 2021). To test the research hypothesis and increase the reliability of the research we will use both non-parametric and parametric tests, such as the Kolmogorov–Smirnov Goodness of Fit test (K–S), run–test for random order, and ARIMA regression as the dynamic time series technique. The descriptive statistics for the log-transformed closing daily prices (lnClose) are presented in Table 1.

Table 1 Descriptive statistics

Variable	Obs	Mean	Std.Dev.	Min	Max	Skewness	Kurtosis
lnClose	2799	5.884	.154	5.455	6.203	-.466	2.949

As we can see in Table 1, the prices are skewed negatively, with large negative prices tending to be larger than large positive prices. The level of excess kurtosis is positive, indicating that the price distribution is leptokurtic and therefore has a higher peak than expected from a normal distribution. Negative skewness and leptokurtic frequency

[3] *Source:* NASDAQ, https://www.nasdaq.com

distribution of the price series indicate that the distribution is not normal, i.e. the non-normal frequency distributions of the price series deviate from the prior condition of the random walk model (Molahh, 2007). To confirm this, we also used the non-parametric Kolmogorov-Smirnov Goodness of Fit test (K–S) which provides evidence of whether the distribution fits a normal distribution or not. According to Stata (2013), the directional hypotheses are evaluated with the statistics:

$$\begin{aligned} D^+ &= \max_x\{F(x) - G(x)\} \\ D^- &= \min_x\{F(x) - G(x)\} \end{aligned} \tag{2}$$

where: $F(x)$ and $G(x)$ are the empirical distribution functions for the sample being compared. The combined statistic is:

$$D = max(|D^+|, |D^-|) \tag{3}$$

and the p-value for this statistic may be obtained by evaluating the asymptotic limiting distribution.

The results from K–S test are presented the Table 2 and they indicate that prices can be distinguished from normally distributed data (we see the p-value provided is .000 and therefore we have significant evidence to reject the null hypothesis that the variable follows a normal distribution).

Table 2 One-sample Kolmogorov-Smirnov test

Smaller group	D	P-value	Corrected
lnClose	.043***	.000	
Cumulative	-.068***	.000	
Combined K–S	.068***	.000	.000

Notes: D - distance. Significance: *** p<.01, ** p<.05, * p<.1.

Another non-parametric test that we used here is the run–test. According to Stata (2013) this test performs a nonparametric test of the hypothesis that the observations occur in a random order by counting how many runs there are above and below a threshold. The expected number of runs under the null is:

$$\mu_r = \frac{2n_0n_1}{\bar{N}} + 1 \tag{4}$$

the variance is:

$$\sigma_r^2 = \frac{2n_0n_1(2n_0n_1 - N)}{N^2(N-1)} \tag{5}$$

and the normal approximation test statistic is:

$$\hat{z} = \frac{\hat{r} - \mu_r}{\sigma_r} \tag{6}$$

The result of the run–test is shown in Table 3. Following Bujang and Sapri (2018), since the test statistics (z = -50.84) is greater than the critical value (+1.96) with significance level at .01, we should reject the null hypothesis.

Table 3 Run–test for random order

Variable	N (runs)	z	Prob>z
lnClose	56	-50.84***	.000

Notes: Significance: *** p<.01, ** p<.05, * p<.1.

Finally, the normality test of both descriptive statistics and the K–S test, as well as the run–test results, confirm our alternative research hypothesis that the market doesn't follow a random walk, i.e. the market is not efficient in the weak form.

On the other side, to test the EMH we have also used a parametric test, i.e. ARIMA regression – the dynamic time series technique – which stands for Autoregressive Integrated Moving Average and which is one of the most popular and widely used techniques for forecasting based on the past values of the time series. The Box Jenkins methodology (Box and Jenkins, 1970) was named after the authors George Box and Gwilym Jenkins, who proposed a three steps method to select an appropriate ARIMA model which will have the ability to forecast economic variables: 1) identification, 2) estimation, and 3) diagnostics and forecasting. ARIMA is written as ARIMA (p, d, q) where "p" is the order of the autoregressive component, "d" is the times we need to differentiate the variable to achieve stationarity, and "q" is the order of the moving average component. The estimating equation for the ARIMA model can be presented as follows:

$$Y_t = c + \sum_{i=1}^{p} \alpha Y_{t-i} + \sum_{j=1}^{q} \theta E_{t-j} + E_t \quad (7)$$

where: c constant; p order of the autoregressive component; q order of the moving average component; α coefficient of the autoregressive model; θ coefficient of the moving average model; E_t error term.

If we look at Figure 1, which presents Stoxx Europe 600 historical closing daily prices, from 2012–2022, we can see that there is definitively a positive trend in the movement of the prices, which indicates the existence of non-stationarity. This can be also confirmed by looking at Figure 2, which shows autocorrelations of our variable of interest (lnClose), where we can see that the decay is very slow, which again indicates the existence of non-stationarity. After confirming non-stationarity, the next step would be to check stationarity again, but this time we should use the first difference of our variable of interest (lnClose). Accordingly, if look at Figure 3, which presents differenced prices (d.lnClose), now we can see that, after differencing, our variable of interest is stationary.

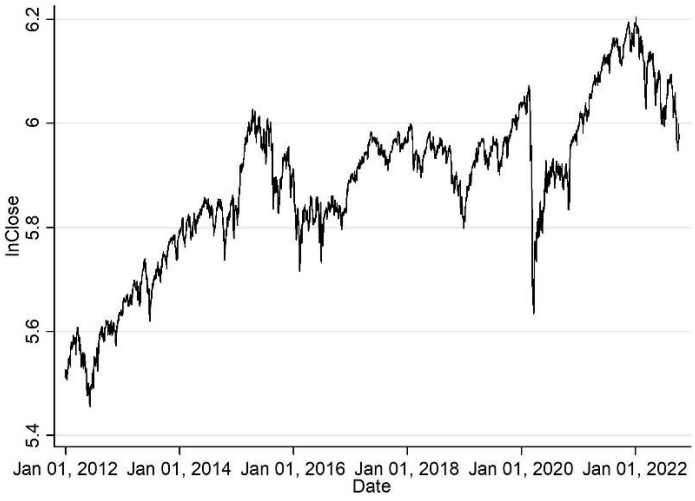

Fig. 1 lnClose prices from 2012–2022

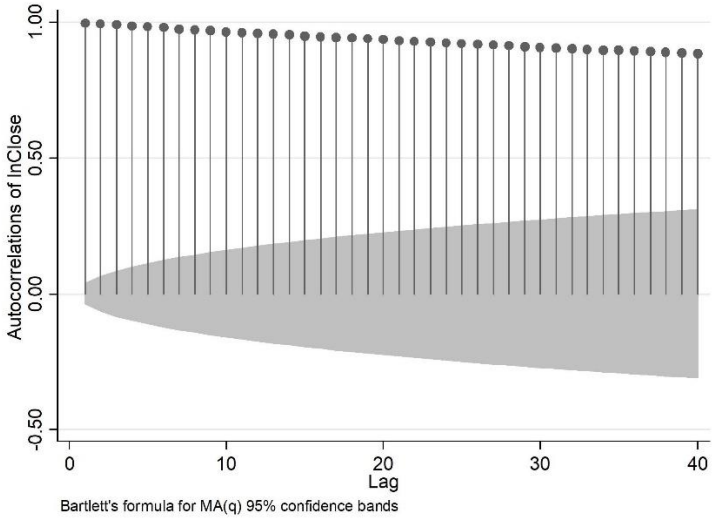

Fig. 2 Autocorrelations of lnClose prices

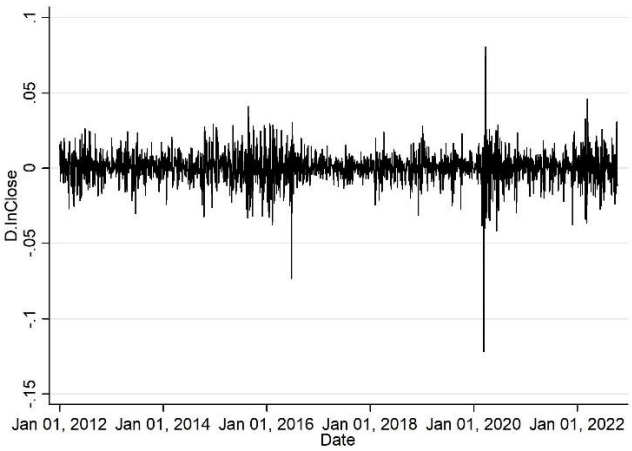

Fig. 3 Differenced lnClose prices from 2012–2022

To confirm these assumptions, we will use the augmented Dickey-Fuller test for unit root. According to Stata (2013), the augmented Dickey-Fuller test fits a model of the form:

$$\Delta y_t = \alpha + \beta y_{t-1} + \delta t + \zeta_1 \Delta y_{t-1} + \zeta_2 \Delta y_{t-2} + \cdots + \zeta_k \Delta y_{t-k} + \epsilon_t \quad (8)$$

where: k is the number of lags.

The null hypothesis is that the variable contains a unit root, and the alternative is that the variable was generated by a stationary process. Because the data show a clear upward trend, we include a constant and time trend in the augmented Dickey-Fuller regression. The results were reached by extracting the levels and differences, respectively. The result of the test indicated that, when the level and difference values of the series are analyzed with intercepts and trends, the prices are non-stationary and stationary, respectively. So, according to the results from ADF test (Table 4) we can see: (a) that we can't reject null

Table 4 Augmented Dickey–Fuller test

	Level	1st difference
lnClose	Coef.	Coef
L1.	-.008***	-1.019***
	(.003)	(.025)
_trend	.000**	-.001
	(.000)	(.000)
_cons	.047***	.000
	(.015)	(.000)
Test statistic	-3.169	-41.323
1% critical value	-3.960	-3.960
5% critical value	-3.410	-3.410
10% critical value	-3.120	-3.120

Notes: This table presents results for unit root tests with an intercept and a trend.
Significance: *** p<.01, ** p<.05, * p<.1. Standard errors in parentheses.
MacKinnon approximate p-value for Z(t) = .091 (level) and p-value for Z(t) = .000 (1st difference).

hypothesis that (lnClose) has unit root, therefore (lnClose) is non-stationary (MacKinnon approximate p-value for Z(t) = .091), and (b) that we can reject null hypothesis that differenced (d.lnClose) has unit root, therefore differenced (d.lnClose) is stationary (MacKinnon approximate p-value for Z(t) = .000).

We have verified that (lnClose) is non-stationary in levels, but stationary in first differences (d.lnClose). Consequently, we use the variable of interest in the first differences (d.lnClose) to identify the order of the autoregressive and moving average components. To determine the order of the autoregressive component ("p"), we have to check the partial autocorrelations of (d.lnClose), which can be seen in Figure 4.

The values that exceed the confidence bands suggest the possible order of the autoregressive component and we can see that two lags (the first and the second) are exceeding the confidence bands and that there are two possible AR components. To determine the order of the moving average component ("q"), we have to check the autocorrelation of (d.lnClose), which can be seen in Figure 5. We can see that two lags (the first and the last) exceed the confidence bands and that there are two possible MA components. So, we will estimate two cases, ARIMA (1,1,2) and ARIMA (2,1,2), and decide which model is the better one. To choose the appropriate model we will look at the significance of the coefficient estimates and the model selection criteria, such as Akaike's and Bayesian information criteria.

The model with the smallest values in the model selection criteria and the most significant coefficient estimates will be the appropriate one. ARIMA regression estimations, including Akaike's and Bayesian information criterion, for the two models, are presented in Table 5.

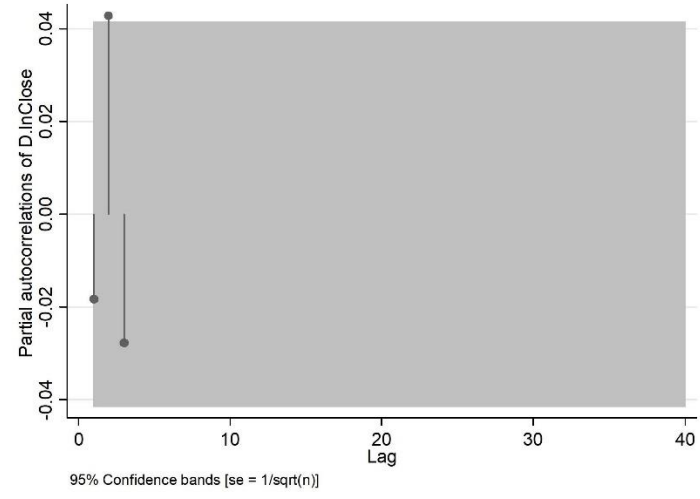

Fig. 4 Partial autocorrelations of d.lnClose

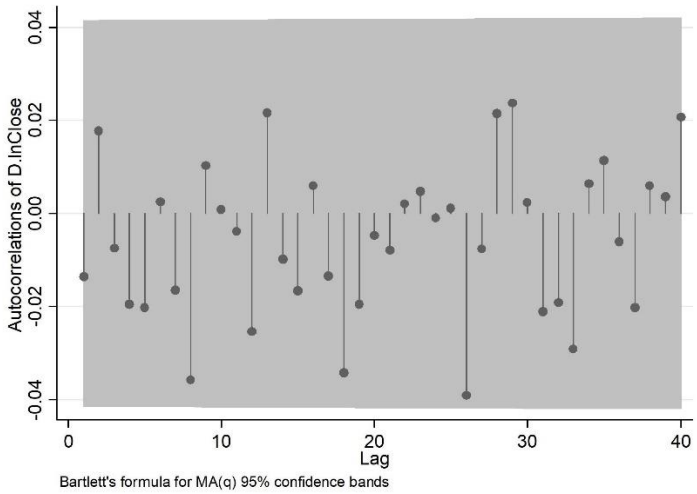

Fig. 5 Autocorrelations of d.lnClose

Table 5 ARIMA regression

	Model (1,1,2)	Model (2,1,2)
lnClose	Coef.	Coef.
Constant	.000	.000
	(.000)	(.000)
arL	-.203	-.306***
	(.688)	(.037)
arL2		-.904***
		(.036)
maL	.186	.285***
	(.691)	(.034)
maL2	.032	.948***
	(.026)	(.035)
/sigma	.01***	.01***
	(.000)	(.000)
AIC	-14149.77	-14159.54
BIC	-14121.21	-14125.27

Notes: ar - autoregressive component; ma - moving average component.
Significance: *** p<.01, ** p<.05, * p<.1. Standard errors in parentheses.

Based on the significance of the coefficient estimates and based on Akaike's and Bayesian information criteria we can conclude that the second model, ARIMA (2,1,2), is the more appropriate one. More precisely, in Model 2 – ARIMA (2,1,2) – all coefficient estimates are statistically significant at a significance level of .001. Also, AIC and BIC values for Model 2 are smaller compared to the same values for Model 1.

Next, we need to check whether this univariate process is stable. Figure 6 shows the residuals and we can see that values are constantly around the mean, which indicates that residuals are white noise. This can be confirmed by the White-Noise test which produces a cumulative periodogram (Figure 7), where we can see that the values never appear outside the confidence bands. The test statistic has a p-value of .629, so we can conclude that the process is not different from the white noise.

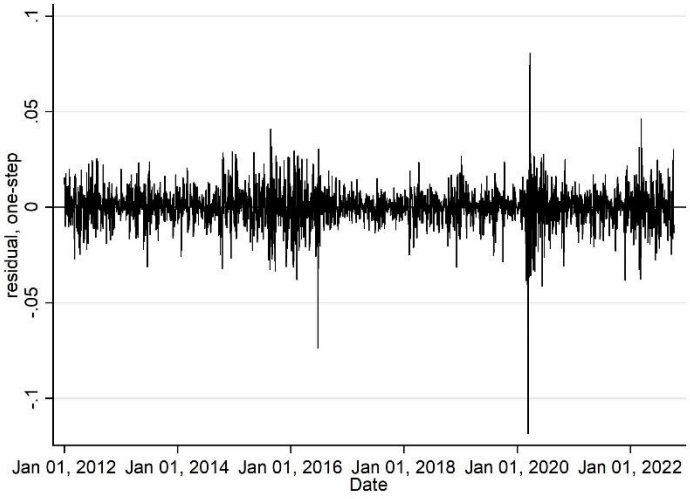

Fig. 6 Residuals (one-step)

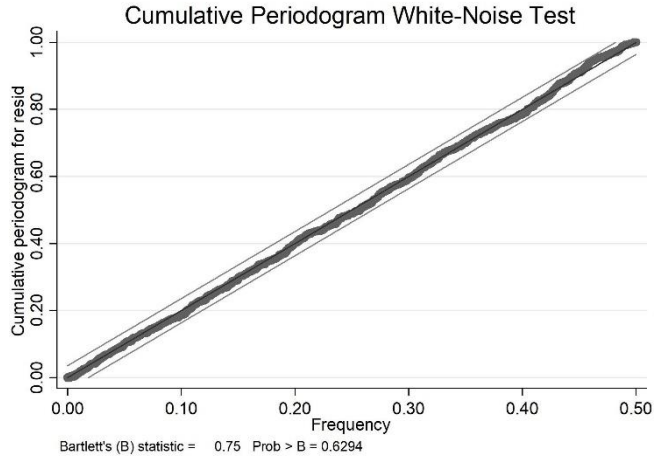

Fig. 7 Cumulative periodogram

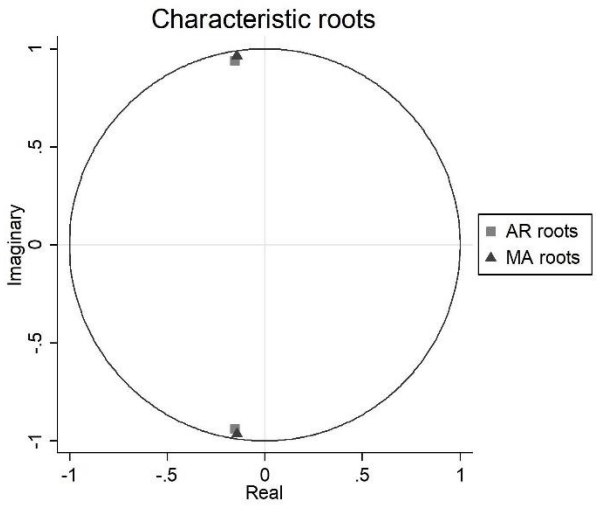

Fig. 8 Characteristic roots

Also, the AR and MA roots of the characteristic polynomials (Figure 8) are not out of the circle which proves that the process is stationary, invertible, and stable for prediction. Finally, the results from the ARIMA regression imply that the stock prices traded on the market can be predicted using historical price information which confirms our alternative research hypothesis that the market doesn't follow a random walk, i.e. the market is not efficient in the weak form. Interestingly, besides a few researchers who didn't validate the EHM (e.g. Hájek, 2007), our results are quite opposite to the findings from most of the studies which examined both developed and emerging European markets (Worthington and Higgs, 2004; Hasanov and Omay, 2007; Pele and Voineagu, 2008; Borges, 2010; Narayan and Smyth, 2007; Dragota and Tilica, 2014; Hepsag and Akcali, 2015; Anlas and Toraman, 2016; Tokić et al., 2018). However, the previous research tested the weak form of the EMH using different methods which were mainly based on the unit root analysis (Erdas, 2019), in which stationarity represented the rejection criterion of the null hypothesis that the market is efficient in the weak form. Our opinion is that the unit root analysis is incomplete and that researchers should not rely only on this approach when testing the EMH. Since EMH implies that stock prices traded on the market cannot be predicted by using historical price information, one should actually evaluate the stability of the prediction process which assumes differencing approach in the case of non-stationarity. This is the reason why we went beyond the unit root analysis and used ARIMA regression as the dynamic time series technique for testing the weak form of EMH – which, besides data novelty, could be seen as the originality of this study. However, as shown in previous studies, the results vary from market to market. Extending the analysis to other markets can also serve as a good foundation for future research direction.

6. CONCLUSION

For decades, the prevailing paradigm of Economy is the paradigm of market equilibrium, in which markets are abstracted as systems with the perfect competition that equalizes supply and demand and participants that are behaving perfectly rationally. However, practice shows that real-life markets operate differently. As we stated at the beginning , the paradigm of market equilibrium (and the "efficient-market hypothesis" tied to it, dealing specifically with the behavior of capital markets) has no explanation for financial bubbles and their bursting that is leading to stock market crashes. Accordingly, the main goal of this paper was to discuss the inefficiency of markets, with examples of corporate decisions that directly abuse such inefficiency to psychologically motivate desired behavior of potential customers. To avoid such manipulations, we expand the concept of "intrinsic value" as the foundation upon which the new theory could be built. Using both non-parametric and parametric tests, we have proved the stability of the stock price prediction process. This means that the stock prices traded on the market can be predicted using historical price information and that the market is not efficient in the weak form because it doesn't follow a random walk. After all that is said, what should we do with this EMH? Simply put, it's hard to reject the claim that prices are right unless you have a theory of how prices are supposed to behave, or, as Fama (1976) puts it himself, "any test is a joint test of efficiency and the model of equilibrium". Let's think for a moment about something that Bill Bryson (2003) said in his bestseller "A Short History of Nearly Everything" when explaining years of scientists' reluctance to embrace the idea of continental drift: "Interestingly, oil company geologists had known for years that if you wanted to find the oil you had to allow for precisely the sort of surface movements that were implied by plate tectonics. But oil geologists didn't write academic papers; they just found oil." This is the right place to, for the first time, completely agree with Fama's term "efficient markets" – he concluded that the notion of market efficiency could not be rejected without an accompanying rejection of the model of market equilibrium (e.g. the price setting mechanism). In the end, we agree with the problem and propose the solution: the joint rejection of the "efficient markets" hypothesis and all market equilibrium models – that is, the rejection of the whole romanticized paradigm of market equilibrium known as the general equilibrium theory.

Why not? Because of Montaigne's axiom that "nothing is so firmly believed as that which least is known"? Why are we holding to malfunctioning theories so firmly, after so many crashes and crises? That's probably just a psychological effect of risk aversion, as it may be too terrifying to leave something as clean and simple as the equilibrium paradigm for something else that embraces chaos. But, if we want our economic theories to reflect real-life behaviors instead of being outdated dogmas, we shouldn't panic. If something is chaotic, it doesn't mean it can't be predicted. Nature teaches us that. We don't know exactly how long the desert storm will last or how strong it will be, but we can still predict, with underlying certainty, the regular linear forms it will leave on the dunes. We don't know exactly how long the rain will last, but if it lasts longer than some predictable threshold, we can be sure it will leave a pool of water in our backyard. To quote Bill Bryson (2003) and his bestseller about the science for the second time: "Complexity is a natural, spontaneous, entirely commonplace event. There may or may not be a great deal of life in the universe at large, but there is no shortage of ordered self-assembly, in everything from the transfixing symmetry of snowflakes to the comely rings of Saturn". We should learn from nature and discover the methods – and design systems and models – for predicting

chaotic behaviors of the financial markets. It may take a leap of fate to get it started, but the human race has done so much more in the past, and here we argued only the need for switching the paradigm to better explain reality. Not very much, but we may be on the verge of a new and exciting era for economic science.

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TESTIRANJE EFIKASNOSTI TRŽIŠTA: PUT KA UTVRĐIVANJU SUŠTINSKE VREDNOSTI

Paradigma tržišne ravnoteže i za nju vezana „hipoteza efikasnog tržišta“, koja se posebno bavi ponašanjem tržišta kapitala, nema objašnjenja za finansijske mehure i njihovo pucanje koje dovodi do kraha berze. Shodno tome, osnovni cilj ovog rada je da se diskutuje o neefikasnosti tržišta, uz primere korporativnih odluka koje direktno zloupotrebljavaju takvu neefikasnost da bi psihološki motivisale željeno ponašanje potencijalnih kupaca. Za testiranje hipoteze efikasnosti tržišta koristili smo Stoxx Europe 600 indeks istorijskih dnevnih cena akcija u periodu od 2012–2022. Koristeći neparametarske i parametarske testove, kao što su Kolmogorov–Smirnov test, run–test i ARIMA regresija, odbacujemo hipotezu da je tržište efikasno u slabom obliku jer ne prati slučajni hod. Takođe, u radu su analizirani i osnovni problemi ekonomske teorije, naglašavajući stav da je možda došlo vreme da se fundamenti ekonomske teorije usklade sa osnovnim konceptima koji se godinama koriste u praksi.

Ključne reči: *tržište, efikasnost, akcije, cena, predviđanje*

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Original Scientific Paper

DIGITAL TECHNOLOGIES IN LOGISTICS AND SUPPLY CHAIN MANAGEMENT

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Volodymyr Rodchenko[1,2], Yuliia Prus[3]

[1]Mendel University in Brno, Faculty of Business and Economics, The Czech Republic
[2]V. N. Karazin Kharkiv National University, Karazin Business School, Ukraine
[3]Kauno kolegija Higher Education Institution, Faculty of Business, Lithuania

ORCID iD: Volodymyr Rodchenko https://orcid.org/0000-0003-0298-4747
Yuliia Prus https://orcid.org/0000-0003-0320-0131

Abstract. *The aim of the research is to summarize current trends in the use of digital technologies in logistics and supply chain management, to study the nature of their impact on the development of the logistics system of an economic entity. The article summarizes the main trends in the digitalization of supply chains and logistics in trade and industry. The methodical aspects of digital transformation of supply chains were considered. It is established that the emphasis in the organization and management of supply chains has shifted towards the transformation of traditional chains into the space of the digital economy. The article identifies promising areas and challenges for the use of digital technologies in logistics and supply chain management: the Internet of Things, blockchain, cloud services, augmented reality, robots, drones, and 3D printing. The trends in the development of digital technologies are explored, as their integration into global supply chains can accelerate, simplify and reduce the cost of the supply process at almost all stages. Digital technologies that improve the process of goods movement in supply chains are presented in the article in terms of logistics in the context of managing the relevant flows: material, information, financial, service. The state of development of cooperation between the main types of economic activities that produce technological and digital technologies and types of economic activities that provide logistics and supply management in the European Union was assessed.*

Key words: *logistics, digital technologies, supply chain management, augmented reality, Internet of things, cloud services, blockchain.*

JEL Classification: M21, R41

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Corresponding author: Yuliia Prus
Kauno kolegija Higher Education Institution, Faculty of Business, Pramones pr. 20, LT-50468 Kaunas, Lithuania | E-mail: yuliaprus@karazin.ua

1. INTRODUCTION

The transition to digital manufacturing and e-commerce defines the focus of changes that should take place in logistics and supply chain management under the influence of the transition to cyber manufacturing. If we consider the changes caused by IT technologies (changes in the structure of companies, a set of key competencies, business models and business strategies), then electronic supply chain management (e-SCM) in such realities becomes strategically important for combining business processes into a single infrastructure of the country's digital economy.

Analysis of reports on trends in the development of logistics and supply chain management (Deloitte, 2021; McKinsey & Company, 2021) for the period up to 2030 by leading consulting, analytical and IT companies allows us to identify global trends that confirm the relevance of the study of digital logistics:

- Big Data together with automated technologies: Blockchain, IoT, AR/VR, ML, AI will be used to improve logistics efficiency.
- The use of big data will change logistics analytics. It will strengthen the role of predictive analytics and forecasting.
- Cloud services will support flexible and dynamic (agile) logistics.
- Chatbots and robots will be used to manage most logistics operations.
- More and more companies will look for their own digital technology solutions for last-mile logistics.
- The challenges of autonomous delivery (driverless cars) will become apparent.
- Logistics security and cybersecurity systems will be top priorities in the field of logistics technology.
- Logistics service providers will increase the adoption of mobile applications.

What is happening today with the digital transformation of individual processes/ operations, business units, enterprises and the entire supply chain in industry, trade, services cannot be called anything other than "digital chaos". Today, many digital technologies are used in any supply chain, but decisions on digitalization are spontaneous, subject to short-term interests and challenges, rather than strategically aligned. In addition, the opportunities to use digital technologies/tools are underutilized, either due to insufficient knowledge and competencies or complexity of technical/software implementation.

At the same time, the method of digital transformation itself, especially with regard to logistics and supply chain management, is not sufficiently developed, despite the work of experts in this field. In particular, the internationally proven methodical approach based on the SCOR model is rarely used.

Given the increase in transaction volumes and the growing demands of customers, logistics service providers are forced to demonstrate increasing flexibility, efficiency and reliability, as well as to produce innovative delivery solutions that meet current customer expectations, such as: guaranteed delivery times, longer working hours, flexible and personalized services, fast processing of returns, etc.

2. LITERATURE REVIEW

The problems of using digital technologies in logistics and supply chain management are currently devoted mainly to foreign publications and research of leading world companies and groups of professionals (Deloitte, 2021; McKinsey & Company, 2021).

Kayikci Y. (2018), based on factor analysis, identifies the following areas of digital business processes of the company: digital logistics focused on internal, external activities of the organization and communication. Nitsche B. et al. (2021) "classified the latest technologies used in logistics and supply chain management into automatic identification technologies, communication technologies, information technologies".

Witkowski K. (2017) classified logistics information systems into the following groups: basic logistics information systems, e-business support information systems, mobile business, supporting logistics information systems. The authors identified the competitive advantage due to innovative information technologies that allow to create a market space for e-business logistics.

Based on empirical research, Grabara J. et al. (2015) found that digital technologies improve the quality of logistics services, the productivity of the organization, thereby providing it with competitive advantages in the logistics services market.

The active use of digital technologies in the provision of logistics services affects customer loyalty in various areas of retail trade (Elke, 2018). Studies have shown that digital capabilities have an indirect positive impact on the financial efficiency ratio, as they provide flow and information management to support operational (real-time), tactical and strategic decisions for both logistics service providers and customers (Ginters, 2019).

Netreba E. (2021) "highlighted the following opportunities of Industry 4.0 in the context of logistics management: products and services are flexibly connected via the Internet and other network applications (blockchain), digital communication allows automation and self-optimization of the production of goods and services, including delivery without human intervention (production systems based on transparency and predictive capabilities)".

At the same time, many aspects of the use of digital technologies in logistics and supply chain management remain poorly understood or even unexplored. In addition, to date, there are few scientific works of researchers that would be devoted to the digitalization of logistics systems and supply chain management processes. That is why this work would like to fill this gap to some extent.

3. Exploring Promising Digital Technologies in Logistics and Supply Chain Management

Digitalization is one of the powerful trends of modern socio-economic development, which has an increasing impact on the economy and society as a whole. This impact is so great that many authors talk about the beginning of another technological revolution – the information technology revolution (Chui et al., 2021). A significant impetus to its development was given by the COVID-19 pandemic: measures of social isolation and social distancing stimulated the use of remote work technologies, which not only transformed some business processes and processes of human interaction in private life, but also led to the development of digital competencies of the population. The latter is an important prerequisite for further development and acceleration of digitalization.

The impact of digitalization processes on different areas is different. The subject of our research in this article is the logistics sector, the development of which in the context of active digitalization depends on the spread of e-commerce. According to a survey by Deloitte in Ukraine (Symonenko, 2021), on the eve of the war, an important trend was observed for the second year in a row: a twofold predominance of online trade growth over offline. A study by

Soul Partners and Baker Tilly on Ukraine shows (Netreba, 2021) that "the e-commerce market grew by 41% in 2020 and reached $4 billion, accounting for 8.8% of the total retail trade in Ukraine. This share was expected to reach 9.2%, or $4.4 billion, in 2021".

Digital transformations have a significant impact on logistics. In particular, business is facing new challenges today, the biggest of which, according to the authors, are the following:

- The rapid development of new digital technologies and their widespread availability, which simplifies many aspects of life, encouraging people to actively adopt and massively apply them. This is forcing businesses and their ecosystems to transform to improve and maintain their competitive position in a digitized world.
- End consumers gain access to more suppliers, solutions and services, meaning that choice is greatly expanded and barriers to change are continuously reduced. Customers are gaining new leverage and competition is becoming fiercer, which in turn is driving businesses to embrace digital innovation as a basis for competitive advantage.

At the present stage, "many logistics professionals involved in planning, executing and monitoring the flow of products from the point of origin to the point of consumption confirm the need to revise existing models and increase the flexibility of business operations to provide omni-channel delivery, reduce costs and meet constantly changing consumer demand" (Abdirad et al., 2020). At the same time, the way to improve operational efficiency and customer satisfaction is through the digitalization of logistics processes.

The digital transformation of the logistics industry is almost inevitable today due to such factors as: significant advances in software development, a growing global economy and fierce competition. As the supply chain is a source of significant amounts of structured and unstructured data, the Internet of Things, artificial intelligence, and blockchain are driving digital transformation in logistics and supply chain management.

The procedure of digital transformation of supply chains should include a number of design solutions related to the formation of a multiparty network and a supply chain control tower.

"By collecting information generated by connected equipment (sensors) and logistics software, and correlating actual data with machine learning models implemented in cloud resources, enterprises can provide greater supply chain transparency and significantly reduce operating costs. Although the pace of cloud computing adoption in the logistics sector has been significantly high over the past few years, so far few industry companies are working with IoT software" (Richnák, 2022). This creates good prospects for further growth of digitalization in the industry.

Consider digital technologies that are expected to have a significant impact on logistics.

3.1. Augmented reality

Augmented Reality is a digital technological trend in logistics associated with the development of robotics, automation of logistics business processes, and the use of artificial intelligence systems, which aims to reduce the number of operations performed by humans, thereby reducing the impact of the human factor. Augmented reality technology allows to increase the efficiency of such operations by reducing the number of errors and speed of decision-making.

The most popular augmented / virtual reality systems are Artoolkit, ARtag, Osgart, Vuforia (Damiani et al., 2018). In systems that support the implementation of warehouse

operations, the task of integrating augmented reality technology with RFID is becoming relevant. Authors of the article proposed a conceptual solution that combines RFID and AR to implement an order picking system (Fig. 1).

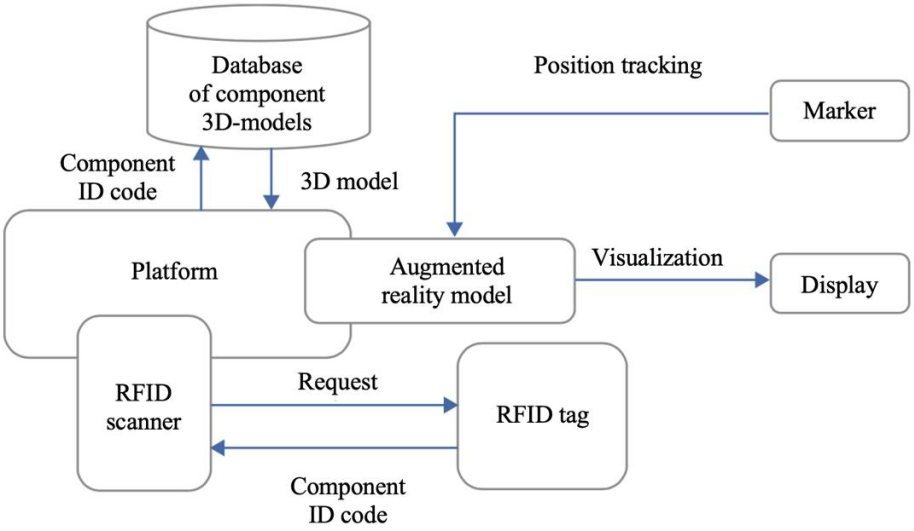

Fig. 1 Diagram of interaction between augmented reality and RFID applications
Source: own study

The RFID scanner reads the identification code of the storage unit / article (SKU) from the RFID tag. In the database of 3D models of articles, the corresponding three-dimensional model is located and visualized on the screen of the augmented reality device in accordance with the positioned object determined on the basis of the marker.

According to the DHL analytical report (DHL, 2021) and research, the promising areas of augmented reality application in supply chains are:

Optimization of order picking. A person sees a "digital pick list" on the display of an augmented reality device. When the person selects an item, the device calculates the most efficient path through the warehouse, and the display directs the person to the item, scans it as "picked" in the warehouse management system, and directs the picker to the next closest item on the list.

Planning of warehouse premises. With the help of virtual/augmented reality technology, a warehouse can be visualized in full scale before construction begins. You can simulate logistics processes in the warehouse, conduct test measurements, redesign zones – all this virtually.

Loading boxes/pallets/containers. Loaders see on the display of the augmented reality device a list of goods to be loaded and step-by-step instructions on how to load the container in the most efficient way, taking into account the size, shape and weight of the goods included in it.

Dynamic motion support. Head-up and frontal augmented reality displays allow drivers of forklifts and other material handling equipment in the warehouse to efficiently redirect loads on the go without taking additional actions that distract the driver. The driver can see critical information on the display regarding the parameters of the route.

Repair and return logistics. Augmented reality technology can be used to transmit a video stream from the consumer to the service department to quickly identify the causes of damage to durable goods and possible ways to repair and restore them.

In addition to proposing new areas and ways of using augmented reality applications, a number of works are devoted to the study and evaluation of the effectiveness of using augmented reality devices.

Studies (Stoltz et al., 2017; De Souza Cardoso, 2020) emphasize the benefits of using augmented reality technology in manufacturing and logistics processes:

- reduction of errors (no need to memorize the sequence of actions, automatic double check can be easily performed);
- increased flexibility (the device leaves hands free, which is convenient for operations, information can be displayed anywhere in the warehouse and at any time);
- increased reliability (work requires less concentration as instructions are easily displayed on the screen);
- increasing the speed of training and adaptation of new employees;
- increase in the speed and safety of operations;
- improving the image of the company through the use of new technologies.

3.2. Internet of things

According to the McKinsey Global Institute, the Internet of Things will annually bring the world economy from 4 to 11 trillion US dollars by 2025. (Chui et al., 2021). It involves equipping various equipment with electronic devices that can interact with each other automatically, without human intervention. The main components of the Internet of Things are sensor-equipped equipment; infrastructure that facilitates data exchange; software. The Internet of Things in logistics blurs the boundaries between the digital and physical worlds, forming a cyber-physical logistics system. As a result, almost any object (vehicles, warehouse equipment, etc.) can potentially be tracked in real time.

"Equipped with IoT software solutions, manufacturing, retail, and transportation companies can track the location of goods in real time and ensure that they arrive on time, at the designated location, and in the appropriate condition. In addition, IoT solutions allow businesses to estimate demand based on data history and automate replenishment processes. In addition to RFID-based tracking and barcoding, applications of IoT technologies in logistics include" (Cichosz et al., 2020):

- "autonomous delivery vehicles. On-board GPS trackers, equipment to detect signs of drowsiness of car drivers and fuel level sensors have already become a reality in modern logistics; further advances in electronics and computer vision will lead to the emergence of unmanned technical delivery devices, including drones and unmanned trucks. Their use will allow the automation of delivery services;
- "smart" warehouse. Unlike traditional warehouse management systems, IoT solutions allow warehouse workers to track goods down to the item level, optimize order processing time with the help of picking robots and significantly improve inventory accuracy" (Cichosz et al., 2020);

- IT-accessories. With the use of IT accessories in logistics, supply chain management and transportation covers the connection of various devices to a single digital system. For example, electronic elements on clothing and hats of employees, the use of which speeds up picking operations in the warehouse, allows you to control the production environment and provide remote management of employees using wireless devices.

The Internet of Things technology is closely related to Big Data analysis, which allows to efficiently process numerous data obtained from the Internet of Things. To reduce the cost of information service and support of these technologies, as well as for more convenient use in business, the Internet of Things is often used in conjunction with cloud services.

3.3 Cloud services

Cloud services is a concept/technology for providing convenient on-demand network access to a set of configured computing resources (e.g., networks, services, data warehouses, applications, and services) that the user can quickly use for their tasks while minimizing interaction with the service provider or their own management efforts. This concept is aimed at increasing the availability of settlement facilities and includes three service models:

1. Cloud Software as a Service (SaaS).
2. Cloud Platform as a Service (PaaS).
3. Cloud Infrastructure as a Service (IaaS).

As a rule, cloud services for small companies are business automation applications that are distributed on the SaaS (Software as a Service) model through the public cloud and are available to a wide range of customers at an affordable price.

Today, cloud services are widely used by IT companies and system integrators (in particular, SAP, Oracle, IBM, Generix) to manage logistics business processes in supply chains.

According to the analysis (De Souza Cardoso et al., 2020), the following advantages of using cloud technologies in logistics and supply chain management can be identified:

- Cloud services make supply chain business process automation more accessible.
- The cost of cloud services is constantly decreasing, and the implementation of such applications is becoming easier and faster.
- Cloud technologies allow supply chain participants to increase the speed and accuracy of the implementation of basic logistics business processes, which is extremely important when fulfilling a customer order.
- TMS-systems provide automated accounting of the current location of vehicles and road conditions, as well as information on delivery and shipment acts.
- Accelerating the turnover of goods, improving the reliability of delivery, thereby increasing the level of service.
- All data and information of the cloud technology user is stored in a single system in the cloud, so you need not be afraid that if you lose a device (tablet, laptop), important information will be lost – it is all securely stored in the cloud and will be available to the owner from any other device.

Among the cloud platforms used for IT support of logistics and supply chain management, the most popular are the platforms of large system integrators – SAP and Oracle.

"SAP Cloud Platform is an open Platform-as-a-Service (PaaS) that provides customers and partners with in-memory capabilities, underlying platform services, and unique business services to build and extend customized, collaborative, mobile cloud applications. SAP Cloud Platform is designed to accelerate digital transformation in business, allowing supply chain counterparties to create an application to support and invest in local infrastructure. Based on open standards, SAP Cloud Platform provides complete flexibility and control over the choice of clouds, frameworks and applications" (Zhan et al., 2020).

SAP Cloud Oracle includes comprehensive, unified business processes that address the supply chain of the XXI century. Whether it is blockchain, the Internet of Things or adaptive intelligence, Oracle SCM Cloud allows you to model a digital supply chain with capabilities including innovative product design, strategic sourcing, outsourced manufacturing, integrated logistics, full-scale fulfillment, and integrated supply and demand planning, making Oracle SCM Cloud the most complete set of SCM functionality in the cloud. Oracle SCM Cloud allows you to deploy functionality incrementally, with minimal risk, lower cost and maximum flexibility – all combined with continuous functional innovation and a more resilient supply chain (Jacobs et. al., 2013).

3.4. Robots

The fourth industrial revolution is characterized by the widespread use of robotics, which has the following advantages:

- Workers are freed from performing low-skilled and dangerous work. Robots perform it faster, more accurately and more economically.
- There is an opportunity to expand production and solve a number of problems, including, for example, the lack of specialists.
- Robotics fundamentally changes our lives and the way we earn money in it.

In addition, robots are more flexible mechanisms that can adapt to the environment and learn to perform new operations.

The areas of application of robots in logistics and supply chain management in terms of operational activities are very diverse. Most often they are used in such functional areas of logistics as warehousing and production logistics. If we talk about warehousing and cargo transportation at logistics infrastructure facilities (cross-docking terminals, distribution centers, etc.), the robotic equipment used in them is very diverse: from fully automatic warehouses to robots that perform individual operations of warehouse.

The transition to robotic (fully automatic) warehouses is a global trend. This is due to the need to speed up logistics processes in large warehouses, where human capabilities have reached their limits. Inventory management (and inventory) using robotic systems is cost-effective, eliminates errors, minimizes accidents and risks to people. Today, this is one of the best examples of the Internet of Things – the potential of such automation is great. According to Markets Research (Market Research, 2022), the "robotization" of warehouses for the period from 2017 to 2022 shows an average annual growth of 11.8%, and the market volume will increase to 4.44 billion US dollars.

Today, the leadership in automatic warehousing systems belongs to vertical warehouses. These are systems of world-known manufacturers such as System Logistics and Modula (Italy), Kardex (Switzerland), Haenel and Vander Lande (Germany), Constructor Group (Finland). The main purpose of these systems is to provide the highest possible storage density per unit of occupied area, that is, these systems are as close as possible to the technological height of the warehouse and always "grow" in height.

Logistics giants (DHL, Amazon.com, Walmart) have long made robotics part of their leadership strategy and are actively promoting their achievements in this area. For example, back in 2012, Amazon acquired Kiva, a manufacturer of production robots for picking and packing goods in the warehouse. According to Deutsche Bank, the use of these robots allowed Amazon to reduce operating costs by 20%, which amounted to 22 million US dollars per distribution center. Today, Kiva is used in 13 such Amazon centers, but if the project is scaled to all 110 centers of the company, it will be able to achieve cost savings of 800 million US dollars.

Such savings are achieved by increasing the efficiency of warehouse processes: with the help of Kiva, the cycle of warehouse operations for a specific product has been reduced from 60–75 to 15 minutes, and the warehouse space has been optimized by 50% due to its more rational use.

3.5. Unmanned aerial vehicles

Unmanned aerial vehicles (UAVs – drones) began to gain popularity in the early 2010s, driven by the development of wireless networks and the emergence of powerful computers capable of controlling complex devices, as well as advanced programming languages. The auditing company PwC estimated the UAV market in 2020 at 127 billion US dollars, most of which (61%) was used in servicing infrastructure projects and in agriculture.

According to experts (Elke, 2018; Richnák, 2022), drones will be playing a supporting role in global logistics for quite some time. Most likely, drones and traditional vehicles will be used together in the near future.

Let us consider some typical examples of the use of drones in logistics. The main manufacturers of drones for use in the civilian sphere, including logistics, are DJI, Flirtey, Project Wing, Matternet. Companies that implement drones in logistics: Amazon, UPS, DHL and others. Drones are used to deliver small parcels (weighing up to 8 kg) over short distances, usually on the "last mile" part of the route. Drones allow logistics services not only to reduce costs for the "last mile" (the most expensive part of the delivery), but also to deliver the parcel to hard-to-reach places.

Amazon's efforts to create new standards for online commerce with the help of drones and attempts to move from "day-to-day" to "hour-to-hour" delivery continue to attract the attention of the world. The consulting company McKinsey expects that in the future drones and unmanned vehicles will deliver up to 80% of all parcels.

The world's largest retailer – Walmart – generally intends to use drones not in delivery, which is associated with regulatory difficulties, but inside large warehouses and logistics/distribution centers: drones can move around the warehouse, taking 30 photos per second, and this information can be used for inventory. If such a process would take about a month when done "manually", then with the help of flying robots, a huge warehouse can be inventoried in one day.

4. Evaluation of Digital Transformation Processes of Logistics Systems

In the modern economy, there is a tendency to transform it into a "real-time economy", in which information about all events and processes comes to decision-making centers very quickly, almost without delay. This opens up new opportunities for improving the quality of logistics. Speed, timely decision-making, and operational data management are key factors for

ensuring the success of logistics companies. Obtaining these competitive advantages is directly related to the development of digital transformation processes.

Assessment of the digital transformation processes of logistics systems in Europe can be carried out using the Input-Output analysis, which is a powerful analytical method.

To assess the trends in the growth of the role and place of digital technologies in logistics, the hypothesis was used regarding the growth of relevant cost items in the intermediate consumption of economic entities of the relevant economic activities.

For the analysis, we used data (Eurostat, 2022) on the volume of trade of companies in two groups of economic activities: the first group is the main producers of digital technology solutions, the second group is logistics service providers. The first group includes the following types of activities:

- Manufacture of computers, electronic and optical products.
- Manufacture of electrical equipment.
- Manufacture of machinery and equipment not elsewhere classified.
- Manufacture of other transport equipment.
- Telecommunications.
- Computer programming, consulting and provision of services in the field of information.
- Scientific research and development.

The total output of products and services of these types of economic activities that were consumed by other types of activities is shown in Fig. 2. We can observe a tendency of constant growth of indicators.

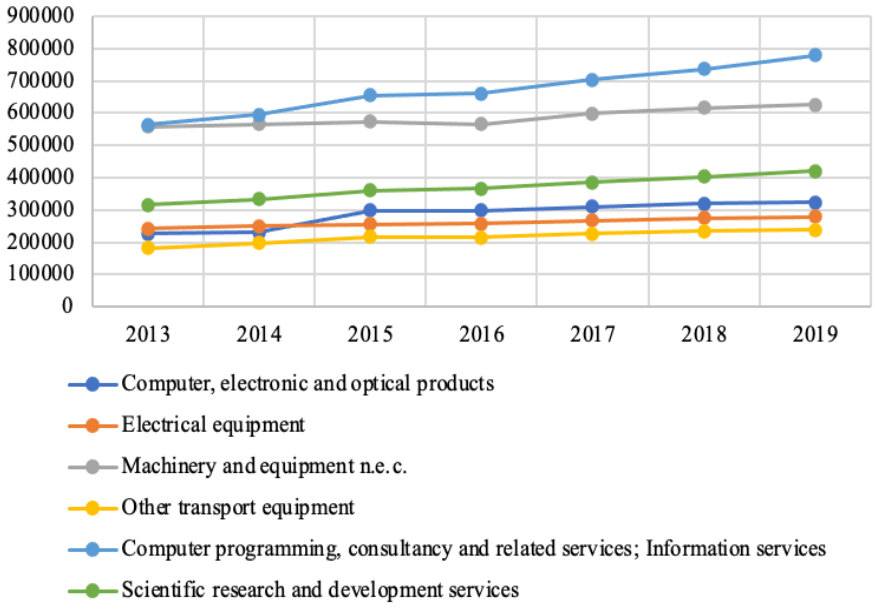

Fig. 2 Total production of goods and services in the EU countries by types of economic activity, EUR million
Source: Own study

The second group includes economic activities that provide supply chain logistics:

- Wholesale trade, except trade in motor vehicles and motorcycles.
- Land transport and pipeline transportation.
- Water transport.
- Air transport.
- Warehousing and auxiliary activities in the field of transport.

Fig. 3 shows the share of consumption of products and services by the second group of economic activities. Thus, it can be argued that the economic activities that provide logistics and supply chain in total consume no more than 3% of products and services of the economic activity Computer programming, consulting and information services, and no more than 2% for such activities as Scientific research and development and Manufacture of computer electronic and optical products.

The above gives grounds to assert the low level of integration of the main sectors of manufacturers of digital technological solutions and sectors of logistics service providers. This, in turn, determines the limited prospects for further rapid spread of digital technologies in logistics and supply chain management.

Also, this trend may indicate multidirectional vectors of technological development of industries due to the development of intra-industry technologies, their possible further encapsulation and the formation of new challenges in the field of system integration of various sectors of the logistics and supply industry.

Perhaps the identified problem will be solved within the framework of the implementation of the EU initiatives "Solidarity Roads", announced in May 2022 (Yermolenko, 2022). The amount of funding for this project is more than 1 billion euros at the expense of EU countries and international partner (Connecting Europe Facility, European Investment Bank).

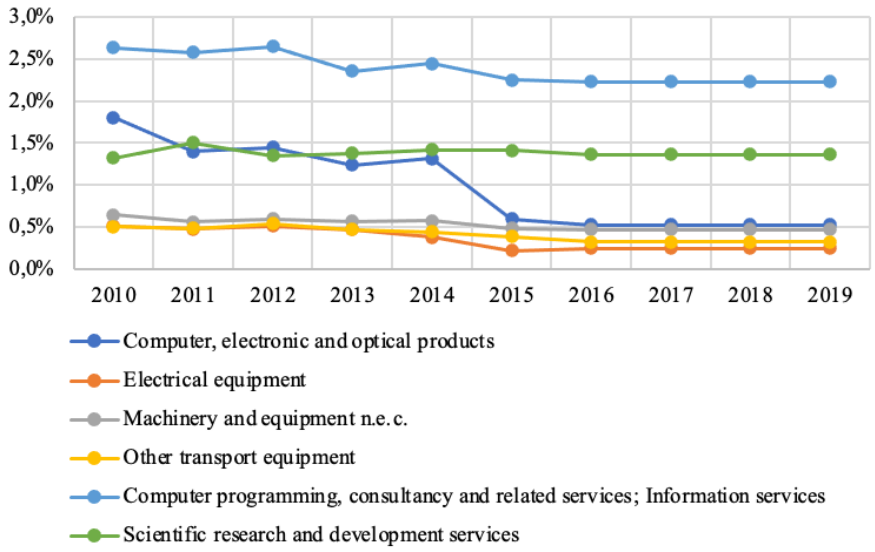

Fig. 3 The share of consumption of products and services by types of economic activity of the second group, %
Source: Own study

5. CONCLUSIONS

As a result of the conducted analytical review and analysis, it can be concluded that the implementation of methods and practical tools for the digitalization of logistics and supply chains of business entities provides benefits and opportunities for supply chain management: from end-to-end visibility to advanced analytics and automation of control and management of processes in the supply chain. Let us summarize the key features:

- End-to-end visibility – visibility across supply chain counterparties, including suppliers, contract manufacturers, carriers, 3PL providers, etc.
- Collaborative information sharing – real-time collaboration among supply chain counterparties based on a multi-layered network structure and blockchain technology.
- Early warning and exception management – eliminating disruptions in the supply chain before they affect the business of chain counterparties.
- Predictive and prescriptive analytics and decision support – using advanced forecasting techniques, artificial intelligence, computer simulation and multi-agent systems.
- Autonomous decision-making and control – reducing routine operations and increasing the productivity of personnel, production and logistics infrastructure through the use of digital technologies: AI, ML, AR/VR, robotics and 3D printing.
- Self-controlled supply chain with optimal decision-making and machine learning.

In such conditions, the possibilities of horizontal cooperation of supply chains in the formation of a digital ecosystem, in particular between different types of economic activity, were expanding. The development of integration, including information integration, initiates the formation of a digital ecosystem that allows offering customers comprehensive services. Digital solutions can help value chain counterparties work together more precisely. Focal supply chain companies can either form and organize a digital ecosystem on their own or focus on a niche service that adds value to customer service and becomes part of an existing ecosystem.

At the same time, the analysis of the economic performance of European Union companies shows a low level of cooperation between the main economic activities that produce technological and digital technologies and the economic activities that provide logistics and supply management.

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DIGITALNE TEHNOLOGIJE U LOGISTICI I UPRAVLJANJU LANCEM SNABDEVANJA

Cilj ovog istraživanja je da rezimira aktuelne trendove u upotrebi digitalnih tehnologija u logistici i upravljanju lancem snabdevanja, da bi proučio prirodu njihovog iticaja na rayvoj sistema logistike ekonomskih entiteta. Rad rezimira glavne trendove u digitalizaciji lanaca snabdevanja i logistike u trgovini i industriji. Razmatrani su metodološki aspekti digitalne transformacije lanaca snabdevanja. Ustanovljeno je da je akcenat u organizaciji i upravljanju lancem snabdevanja pomeren u pravcu transformacije tradicionalnih lanaca snabdevanja ka prostoru digitalne ekonomije. Rad identifikuje obećavajuće oblasti i izazove za upotrebu digitalnih tehnologija u logistici i upravljanju lancem snabdevanja: Internet Stvari, blokčejn, cloud usluge, proširenu stvarnost, robote, dronove i 3D štampanje. Istraženi su trendovi u razvoju digitalnih tehnologija, budući da njihova integracija u globalne lance snabdevanja može da ubrza, pojednostavi i umanji troškove procesa snabdevanja u skoro svim fazama. Digitalne tehnologije koje poboljšavaju process kretanja robe u lancima snabdevanja su u radu predstavljene u smislu logistike u kontekstu upravljanja relevantnim tokovima: materijalnim, informacionim, finansijskim, uslužnim. Procenjen je nivo razvoja saradnje izmedju glavnih tipova ekonomskih aktivnosti koje stvaraju tehnološke i digitalne tehnologije i tipova ekonomskih aktivnosti koje pružaju logistiku i upravljanje snabdevanjem u Evropskoj Uniji.

Ključne reči: *logistika, digitalne tehnologije, upravljanje lancem snabdevanja, proširena stvarnost, Internet Stvari, cloud usluge, blokčejn.*

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ENTREPRENEURIAL ECOSYSTEM OF AGRICULTURAL SOCIAL FRANCHISING

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Suzana Stefanović[1], Milica Stanković[2]

[1]University of Niš, Faculty of Economics, Republic of Serbia
[2]Academy of Applied Technical and Preschool Studies, Niš, Republic of Serbia

ORCID iD: Suzana Stefanović https://orcid.org/0000-0001-7799-6385
Milica Stanković https://orcid.org/0000-0001-5390-6138

Abstract. *Although the implementation of the social franchising concept is relatively new in agricultural business, examples of successful business stories have recently appeared, especially in the underdeveloped countries of Asia, Africa and South America. The aim of the paper is to determine the best examples of entrepreneurial ecosystems of agricultural social franchising by applying a qualitative multiple case study analysis and point out the importance of the implementation of agricultural social franchising in the development of agribusiness in the Republic of Serbia. The experiences of analyzed social agricultural franchises from Kenya, Bangladesh and Nigeria can serve as an example of good practice for the development of social franchising in rural areas in Serbia, with the aim of developing productive agriculture that will lead to economic development. It is very important to enable the development of social agricultural franchising through the Strategy of agriculture and rural development, bearing in mind a number of benefits that can be realized in Serbian agriculture, primarily when it comes to the development of rural areas and the increase in the income and social welfare of farmers.*

Key words: *agricultural social franchising, entrepreneurial ecosystem, franchising, social franchising, agriculture*

JEL Classification: O13, Q12, Q18, L26, L31

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Corresponding author: Milica Stanković
Academy of Applied Technical and Preschool Studies, Beogradska 18, 18000 Niš, Republic of Serbia
| E-mail: milica.stankovic.visokaskola@gmail.com

1. INTRODUCTION

In the last few decades, the interest of theorists and practitioners in the field of business strategy and entrepreneurship, as well as regional development, in entrepreneurial ecosystems has been growing. Although originally used in a biological context, the ecosystem concept in economic science and management gained importance with the work of James Moore (1993), who promotes the so-called business ecosystems. James Moore (1993) used the concept of a business ecosystem as a metaphor and analogy, which is a common approach in illuminating certain phenomena in science, in order to determine how the interconnection of participants in a certain environment and the dynamics of their relationships affect their development and even survival (Peltoniemi & Vuori, 2004; Anggraeni et al., 2007).

Today, in addition to business ones, we are talking about different types of ecosystems, from innovative, entrepreneurial and knowledge ecosystems (Ianioglo, 2022; Cobben et al., 2022; Jacobides et al, 2018; Van de Wiele, 2017), all the way to the latest - digital business ecosystems (Senyo et al., 2019; Sussan & Acs, 2017). Therefore, there are different types of ecosystems, where entrepreneurial ecosystems represent only one type (Acs et al., 2017). The term entrepreneurial ecosystem appeared at the beginning of the 2000s, but has become a dominant concept in the economic literature, when talking about the company's environment, somewhere since 2016 (Malecki, 2017).). Bearing in mind that this is a relatively recent phenomenon, Stam (2015, p. 1761) points out that "There is not yet a widely shared definition".

One of the most famous scholars in this field, Isenberg (2010, 2011), sees the entrepreneurial ecosystem as a set of numerous individual elements that he groups into domains, such as politics (government and leadership), human capital (work force and educational institutions), entrepreneurial culture (successful ventures and social norms), finance (private equity, business angels, venture capital, microcredit, debt), market (networks of entrepreneurs and multinational companies, as well as early adopters) and various support organizations (support institutions, infrastructure, non-governmental organizations), which interact in numerous and complex ways. Only taken together, they can contribute to the growth and development of innovative entrepreneurial organizations and their success. Isenberg (2011) pointed out that it is the combination of elements that is always unique, leading to the advantage of one entrepreneurial ecosystem over another.

Increasing interest in entrepreneurial ecosystems in theory and business practice occurs in times of economic crisis and stagnation, accompanied by increasing disparities in the economic development of individual countries and regions (Spigel et al., 2020). It is emphasized (Gonzàlez Flores & Katonànè Kovàcs, 2018, Spigel et al., 2020) that the development of entrepreneurial ecosystems has a positive impact, both on the economy (encouraging innovation, contributing to the development of certain sectors and the creation of new jobs), and on the overall social development.

In addition to the attention attracted by ecosystems located in large cities and regions, some researchers, as well as policy makers, are beginning to pay more attention to entrepreneurial ecosystems located in small, peripheral cities or rural areas (Roundy, 2017a). Also, entrepreneurial ecosystems are very heterogeneous in nature, so attention should be paid to the connections and relations between the elements of the entrepreneurial ecosystem, rather than to the elements themselves (Fredin & Lidén, 2020).

In addition, recent literature indicates that there is a need for a mix of entrepreneurs, including social entrepreneurs, to appear in one ecosystem, rather than only those who

are market-oriented, i.e. profit-oriented (Malecki, 2017; Roundy, 2017a). As Roundy (2017b) points out, „social entrepreneurs are also affected by many of the factors of the entrepreneurial ecosystem that affect conventional entrepreneurs", so we can also talk about the social enterprise ecosystem. In addition to the geographic focus (regional, national and international), networking of social enterprises is increasingly taking place based on the sector of activity (e.g. agriculture, tourism, services) or the type of business model they implement (Borzaga et al., 2020). Thus, for example, „agricultural entrepreneurship is generally seen as a sub-domain of rural entrepreneurship, but it can also be linked to urban, sustainable and social entrepreneurship" (Björklund & Johansson, 2020). Similar to conventional enterprises, rural social entrepreneurship can be seen as connecting the entrepreneurial and social mission of the enterprise and emphasizing processes that encourage innovative and entrepreneurial activities with a social purpose (Ibid.). Rural social entrepreneurs use their capacities to solve socioeconomic problems in rural regions. In this regard, the creation of social entrepreneurial ecosystems in agriculture is particularly interesting, as well as the application of innovative business models, such as social franchising, for the successful connection of actors and elements in these ecosystems.

2. Research Aims and Methodology

Bearing in mind that the entrepreneurial ecosystem concept is a relatively new phenomenon in entrepreneurship research, and especially the emergence of new types of these ecosystems, a method suitable for such research is conceptual analysis (Peltoniemi & Vuori, 2004), based on the collection and research of literature and comparison and evaluations of the different interpretations of numerous authors. As pointed out by Spigel et al. (2020) new qualitative research methods, such as Qualitative Comparative Analysis (QCA), are promising in an attempt to point out the specificities of different types of ecosystems, and to show how the different configuration of elements, specific to certain types of ecosystems, should lead to the same goal, and it is the achievement of success for both entrepreneurs and the wider social community. The aim of this paper is to shed light on the phenomenon of entrepreneurial ecosystems, their constituent elements, i.e. the factors that shape them, and to investigate the possibility of applying modern business models, such as social franchising, in shaping specific types of these ecosystems, in a certain local (e.g. underdeveloped regions) and sectoral (e.g. agribusiness) context. Also, the aim of the paper is to determine world best practice in the implementation of these models by applying a qualitative multiple case study analysis and point out the possibilities of entrepreneurial agribusiness ecosystem development in the Republic of Serbia and give certain recommendations to policy makers in our country.

After the introduction, as well as aims and methodology remarks, the third part of the paper deals with social franchising and the construction of the so-called social franchising ecosystem, especially in agribusiness. The next part of the paper provides a multiple case study analysis of the development of social franchising models in agriculture and their ecosystems, followed by the implications and possibilities of applying the model in the practice of agribusiness in the Republic of Serbia. At the end of the paper, the authors' concluding remarks on the analyzed issue are given.

3. RESEARCH ON SOCIAL FRANCHISING AND AGRICULTURAL ENTERPRENEURSHIP ECOSYSTEM NEXUS

Franchising is a business model based on a franchise agreement between a franchisor and a franchisee, whereby the franchisor grants the franchisee the right to, in a predetermined location and for a predetermined period of time, sell a product or service or use a business model or brand developed by the franchisor. Therefore, "franchising can be defined as a commercial relationship in which one party allows the other party to clone a proven business model" while paying the initial costs of purchasing the franchise and ongoing fees (Stanković, 2014; Stefanović & Stanković, 2017, 2022).

Social franchising involves applying the principles of business franchising to achieve social goals (Christensen et al., 2010, Agarwal & Satish, 2018). This business concept achieves great impact due to the easy expansion to a large number of franchise units with the combination of the franchisor's global knowledge and experience and the franchisees' local knowledge. In this way, it contributes to global brand recognition and the creation of new local jobs (Christensen et al., 2010, Palmer et al., 2020). Social franchising as a business concept emerged in the middle of the first decade of the 2000s, initially with the aim of reducing poverty (Lawson-Lartego, 2016). "Social franchising offers innovative solutions to social problems (unemployment, poverty, etc.) and environmental issues (climate change and pollution, etc.)". Due to its great potential, it deserves further consideration in academic and business circles as an extremely suitable business model for achieving wider social impact and solving important social problems, especially in the local community (Kabbaj et al., 2016, Ortuno, 2020).

Poverty is one of the biggest obstacles to economic growth and development. About 75% of the world's poorest people live in rural areas, engage in agricultural activities and depend on agriculture. Nevertheless, "agriculture plays a significant role in reducing poverty for most developing countries and regions" (FAO, 2019). The share of agriculture in global GDP has been stable and amounts to about 4% since 2000. Value added from agriculture increased by 78% between 2000 and 2020, to around $3.6 trillion (FAO, 2022).

However, despite the importance of agriculture for the economic development of numerous countries, the development of entrepreneurial ecosystems in agriculture is still in the shadow of conventional entrepreneurship ecosystem researchers (as a rule, related to urban environments and developed countries), and it is quite neglected in the literature, leaving a large knowledge gap (Björklund & Johansson, 2020). However, lately some authors are trying to point out the specifics and key components of agricultural entrepreneurial ecosystems. Agricultural entrepreneurial ecosystems may differ "from non-rural entrepreneurial ecosystems in that some or all of the components (and the coordination between them) are limited to rural areas" (Khanna & Palepu, 2005, Newbery & Bosworth, 2014, McKague et al., 2017). "Agricultural entrepreneurship that contributes to greater agricultural productivity and economic growth is a way out of poverty and food insecurity for a large number of people in the world" (Baumol, 1990). In the case of the implementation of the social franchising model, the specificity is reflected in the fact that the franchise system, in addition to making a profit, also has a social goal, i.e. welfare for the wider social community. If we specify social agricultural franchising, in that case we are talking about the concept of social franchising in the field of agriculture, where the franchisors and franchisees are social enterprises from the agricultural field, and the end

customers are usually small farmers. Although small farmers are vital to the development of world agriculture, they still face numerous challenges, including lack of knowledge, experience, access to finance and supply chains (Jensen & Sutter, 2009, McKague et al., 2017, Langyintuo, 2020). Social agricultural franchising is the solution to the most of challenges faced by small farmers in rural areas, especially in underdeveloped countries.

"Agricultural franchising has the potential to solve a large number of problems that accompany the agricultural sector in many countries. Primarily, the franchise concept ensures the rationalization of agricultural production, given that the franchisees operate under a well-known business name and under the constant supervision of the franchisor" (Stanković, 2014). Agricultural social franchising contributes to the optimal use of factors of production, bearing in mind that franchisors most often supply franchisees with factors of production and provide input management support. Considering that agricultural companies that are franchisees use a proven business model that survives on the market for a long period of time, they face a much lower risk than in the case of starting their own business. The initial costs of starting a business are much lower, and better earnings can be achieved with smaller investments, while simultaneously achieving social goals. Intensive dispersion and increase in the number of social agricultural franchises, especially in regions where there was a problem of insufficient amount of agricultural and food products, should contribute to ensuring regularity in food supply, with greater security of the products they buy. In this way, by offering a standard product and quality through a proven business system, franchisor can gain trust and loyalty to brand and products (Ibid.).

4. Multiple Case Study Analysis and Discussion of Results

Agriculture-led growth that can contribute to sustainable development, poverty reduction and food security requires a significant increase in productivity in agriculture, especially of small farmers. This includes increasing access to inputs and knowledge that will enable productivity gains for small farmers. Those inputs that enable the increase of productivity in agriculture, for small farmers in particular, include not only animal feed and fertilizers, but also advanced pharmaceutical products, such as veterinary drugs, livestock insemination material, agrochemicals, etc. (McKague et al. 2017, McKague et al., 2018, McKague et al., 2021). There are also possibilities of an innovative approach to supply chains, especially product distribution (McKague, 2014a), as well as knowledge related to product placement and other advisory services (ibid). Since small farmers, in underdeveloped countries particularly, do not have the opportunities, knowledge and experience, as well as entrepreneurial capacities (McKague et al., 2017) to provide those inputs that would increase their productivity and earnings, agricultural franchising, and especially the development of social franchises in agriculture, proved to be a good business model in achieving those goals. Although the application of the concept of social franchising is relatively new in agricultural production, examples of successful implementation of this concept have recently appeared, especially in the underdeveloped countries of Asia (Bangladesh, China, India) (McKague et al., 2021) and Africa (Morocco, Nigeria, Ghana, Kenya, Mali, Zimbabwe) (McKague et al., 2021), South America (Bolivia) (Ortuño, 2020), while the implementation of this concept in developed countries is extremely rare (McKague et al., 2017). Some examples of successful agricultural social franchises in the mentioned countries, and comparison of their characteristics are summarized in Table 1.

Table 1 Comparative analysis of agricultural social franchises

Franchise/ Country	Franchisor and franchisees	Business area/ Franchise objectives	Franchise results	References
Honey Care Africa / Kenya	Franchisor is social enterprise Honey Care Africa, which seeks to increase income for small farmers through beekeeping. Franchisees are rural entrepreneurs engaged in beekeeping and honey production. End customers are individuals who buy honey that Honey Care Africa buys from franchisees.	Honey production Objectives: ▪ Achieving rural development through stimulating the development of beekeeping ▪ Reducing poverty and increasing the employment rate through the inclusion of rural entrepreneurs in the social franchise ▪ Promotion of sustainable beekeeping	The Honey Care Africa franchise has become a source of income for around 7,800 of the poorest small farmers who have become franchisees. Biodiversity is enhanced through the "bees for trees" partnership, in which local farmers receive free beehives in exchange for reforestation of the land.	Wheeler et al., 2005, UNDP, 2012
Seed, Stock and Supplies /Kenya	Franchisor is Seed, Stock and Supplies, a social franchise that performs centralized procurement of agricultural inputs and distribution to franchisees. Franchisees are entrepreneurs in rural areas who sell agricultural products and services in their franchise units. End customers are small farmers.	Sale of agricultural products and services Objectives: ▪ Increasing the productivity and income of small farmers ▪ Decreasing the unemployment rate ▪ Poverty reduction ▪ Availability of quality agricultural products and services even in the most remote rural areas	Seed, Stock and Supplies franchisees earn 5 times more than local non-franchise farm store owners.	Diochon et al., 2017
Babban Gona / Nigeria	Franchisor is a Babban Gona social franchise that provides its franchisees with quality agricultural inputs, financial and marketing support, and training and education services. Franchisees are rural entrepreneurs	Production of corn, rice and soybeans Objectives: ▪ Poverty reduction ▪ Increasing the small farmers income ▪ Reduction of unemployment ▪ Provision of high-quality inputs at the best prices	"Skoll Award for Social Entrepreneurship 2017" for poverty reduction in Nigeria. In the period 2012-2016 the company grew 250 times. Babban Gona franchisees produce an average of 4 tons of maize per hectare compared to the	Agarwal & Satish, 2018, Babban Gona, 2023.

	who cultivate the land and grow corn, rice and soybeans. End customers are large companies such as Nestle, but also smaller companies from the food sector and poultry farmers.		national average of 1.5 tons per hectare. Franchisees have reduced input costs by 50% and sell their products at a 35% higher price. On average, Babban Gona franchisees earn $555 per hectare.	
Krishi Utsho Shop / Bangladesh	Franchisor is Krishi Utsho, a company that performs centralized procurement of agricultural inputs and distribution to franchisees. Franchisees are entrepreneurs in rural areas who sell agricultural products and services in their franchise units. End customers are small farmers.	Sale of agricultural products and services Objectives: ▪ Improving the lives of rural entrepreneurs and poor families in rural areas through the expansion of the franchise network ▪ Increased access to quality agricultural products and services for small farmers in Bangladesh	Small farmers increased their income by 81%. Franchisees could earn up to $1,480 per month.	McKague et al., 2014a, McKague et al., 2014b, McKague et al., 2014c, McKague et al., 2015, McKague et al., 2017, CARE, 2023
Farm Shop / Kenya	Franchisor is Farm Shop, a company that performs centralized procurement of agricultural inputs and distribution to franchisees. Franchisees are entrepreneurs in rural areas who sell agricultural products and services in their franchise units. End customers are small farmers.	Sale of agricultural products and services Objectives: ▪ Improving food safety ▪ Increasing the productivity of small farmers ▪ Increasing access to quality agricultural inputs, knowledge and services ▪ Increasing the capacity of small farmers and franchisees ▪ Gender equality	By early 2018, Farm Shop had grown to a network of 74 stores serving 30,000 small farmers. 26,578 small farmers received training on various aspects of agronomy and animal husbandry (52% women). 38% of Farm Shop employees, 51% of franchisees and 54% of salespeople in franchise units are women.	McKague et al., 2018, McKague et al., 2021, Devex, 2023, Farm Shop, 2023

Source: Authors based on cited literature

The above analyzed business examples of the agricultural social franchises in the countries of Asia and Africa provide opportunities to learn certain lessons and see the implications and possibilities of applying the model in our country. When it comes to certain elements of the ecosystem of agricultural social franchises, we can highlight the following conclusions from the analyzed case studies.

- When it comes to securing *financial resources*, a large number of social franchises manage to attract large grants, thanks to the social mission which they are dedicated to. For example, in 2015, the social franchise Farm Shop received a grant for global impact on food security from the International Development Research Center and Global Affairs Canada within the Canadian International Food Security Research Fund (CIFSRF) (McKague et al., 2021). When it comes to the Krishi Utsho Social Franchise, CARE Bangladesh, through partnership with microfinance institutions, helps Krishi Utsho franchisees to get start-up loans of USD 500. It is important to mention the contribution of the Bill and Melinda Gates Foundation in the form of a donation, all for the purpose of fighting global poverty (McKague, 2014a, McKague, 2014b, McKague et al., 2015). In Honey Care franchise, there is a partnership arrangement with microfinance institutions and non-governmental organizations that allows franchisees access to microfinance loans for the purchase of beehives and beekeeping training (Wheeler et al., 2005). In the Seed, Stock and Supplies franchise, they saw that the franchisee's capital is a stumbling block for successful business and the expansion of the franchise network, and the franchisor initially provides loans to franchisees (Diochon et al., 2017). Babban Gona Franchise helps its franchisees with loans of USD 1,000 per hectare with a repayment term of 18 months at an annual interest rate of 18%, with a loan repayment rate of as high as 99.9%. Babban Gona also helped its franchisees raise additional funds through the crowdfunding platform www.kiva.org (Agarwal & Satish, 2018).
- When it comes to *human capital*, social franchise Farm Shop organizes trainings for franchisees, employees in franchise units, but also farmers on agriculture and agricultural inputs, as well as crop and livestock management (McKrauge et al., 2018). Krishi Utsho conducts training for franchisees in the areas of bookkeeping, inventory management, marketing and financial planning, but also in the domain of entrepreneurship and opportunity recognition, which directly contributes to expanding the capacity of entrepreneurs in the rural areas where this franchise operates (McKague et al., 2017). Honey Care collaborates with non-governmental organizations and the Kenyan government in the implementation of training for franchisees on beekeeping and the provision of advisory services. Initial training for franchisees includes assistance with setting up hives, collecting honey and familiarizing them with ways to maintain quality standards to ensure maximum yields. Ongoing support refers to visits by the franchisor to the franchisees at least twice a year with the aim of monitoring the franchise progress (Jensen & Sutter, 2009). In order to improve capacity, Babban Gona launched Farm University, as a training platform that enables franchisees to develop an entrepreneurial mindset, master organizational, business and agricultural skills and adopt best practices to improve their yields (Agarwal & Satish, 2018). Seed, Stock and Supplies provides agricultural training to its franchisees, so they can provide support and advice to small farmers on the agricultural products and services they offer. It is the training and support provided by franchisors to franchisees that differentiate franchise systems from other farm shops. In other agricultural stores, small farmers only buy products, while in the franchise unit they also receive professional advice, thus improving the franchisee's reputation in the local market (Diochon et al., 2017).
- ltural products and services they offer. It is the training and support provided by franchisors to franchisees that differentiate franchise systems from other farm shops. In other agricultural stores, small farmers only buy products, while in the franchise unit they

also receive professional advice, thus improving the franchisee's reputation in the local market (Diochon et al., 2017).

- When it comes to *supporting* agricultural social entrepreneurs, a good example is the Krishi Utsho franchise, which through the non-governmental organization and its founder CARE Bangladesh received primarily financial support of over 9 million US dollars in funding from the Bill and Melinda Gates Foundation for the improvement of the dairy sector in Bangladesh (McKague, 2014a, McKague, 2014b, McKague et al., 2015). Honey Care launched the "bees for trees" project, funded by NGOs and their donors and the Kenyan government, in which farmers receive free beehives in exchange for afforestation of land areas (Wheeler et al., 2005). Seed, Stock and Supplies received as much as 250,000 USD from the Tofina Foundation for the realization of its social mission in Kenya (Diochon et al., 2017). Initial support for the development of the Babban Gona franchise was provided by the Alliance for a Green Revolution in Africa (AGRA) in 2012, which helped take the first step towards improving the incomes and livelihoods of small farmers in Nigeria. Later, Babban Gona received support from various organizations in the form of grants/donations, loans and professional support. Some of these organizations are: Bill and Melinda Gates Foundation, International Institute for Tropical Agriculture (IITA), United States Agency for International Development (USAID), Skoll Foundation and Department for International Development (DfID) (Agarwal and Satish, 2018).
- When it comes to *the market*, the Farm Shop franchise strives to build a relationship of trust between the franchisor and franchisees, but also with end customers, through greater access to distribution channels and quality agricultural inputs (Farm Shop, 2023). Similar to Farm Shop, CARE Bangladesh has organized Krishi Utsho franchise units into a cohesive network through a shared supply chain, product distribution from centrally located warehouses to individual franchisees, and ongoing capacity building and training (McKague et al., 2017, Care, 2023). Honey Care distributes high-quality Langstroth hives to its franchisees in rural communities, provides intensive beekeeping training, buys honey produced by franchisees at fair market prices and markets it (UNDP, 2012). Babban Gona provides members with high-quality inputs at the most affordable prices, with marketing support, centralized supply and distribution, which resulted in attracting Nestle as the franchise's first customer (Agarwal & Satish, 2018). Seed, Stock and Supplies is a franchise that was founded precisely with the aim of improving the quality of agricultural products and services offered to small farmers and making these products and services available even in the smallest rural areas (Diochon et al., 2017).
- When it comes to *the culture* of entrepreneurship, most social franchises (such as the analyzed franchises Farm Shop, Krishi Utsho, Babban Gona, etc.) encourage the entrepreneurial spirit of franchisees through their training and education programs. The results of entrepreneurial training are notlacking, and thanks to the franchise business model, the positive social impact is multiplied precisely through expansion through franchise units owned by franchisees. The aforementioned contributes to the reduction of poverty and the unemployment rate, along with the employment of vulnerable categories of the population and the increase of franchisees income (McKague et al., 2018).
- Finally, in terms of *policy* as an element of the entrepreneurial ecosystem, the governments of Kenya, Bangladesh and Nigeria provide support for social franchising, but they still do not sufficiently understand the importance of franchising for the achievement of global social goals, and these franchises rely more on the help of non-

governmental organizations, funds and international organizations and institutions. Some of them which focus on social entrepreneurship and franchising in their activities are: International Development Research Center and Global Affairs Canada within the Canadian International Food Security Research Fund (CIFSRF), the World Bank and the International Finance Corp., Swiss Contact & Swiss Development Corporation, UNDP, U.S. Ambassador's Fund, German Embassy, Embassy of Finland, Aga Khan Foundation, Community Action for Rural Development (CARD), Gates Foundation, World Vision, Farm Africa and others (UNDP, 2012).

5. Implications and Possibilities of Applying the Model in the Republic of Serbia

Agriculture represents an important sector of the economy of Serbia, whose gross added value (GVA) participates in the total GVA with about 8% and whose participation in the formation of the GDP of the Republic of Serbia is 5.3% (RZS, 2022a, 2022b). Agriculture with the food industry is the only sector of the Serbian economy that achieves a positive foreign trade balance, whereby agricultural and food products participate in the total value of Serbia's export with 21.3%, and import makes up 8.8% of the value in 2020. The number of agricultural farms decreased by 9.9% from 2012 to 2018. As much as 99.7% of agricultural farms in Serbia are family farms, while legal entities (i.e. companies and firms) and entrepreneurs (as agricultural farms) participate in the total number of farms with only 0.3%. The average area of agricultural land per farm is 6.1 ha, with 38% of farms having agricultural land of up to 2 ha. The facts that the average age of the head of the farm is 61, and that only every 14th head of the farm is younger than 40 years, are worrying (Ministarstvo poljoprivrede, šumarstva i vodoprivrede, 2022a). Therefore, perhaps the biggest problems of our agricultural sector are elderly households, the migration of young people from the countryside and fragmented farms. The above implies problems related to the absence of the use of modern agricultural methods and the latest knowledge in the field of agriculture. In this sense, it is necessary to modernize the agricultural sector, by attracting young people and improving their capacities, all with the aim of increasing the productivity of the Serbian agricultural sector.

Despite efforts to achieve the goals stated in the Strategy for Agriculture and Rural Development of the Republic of Serbia, average monthly net earnings in agriculture are 14-15% lower than average net earnings at the economy level. Therefore, it is extremely important to increase the competitiveness of agricultural producers and products and services they offer, through increasing quality in order to meet the demands of the global market (Ministarstvo poljoprivrede, šumarstva i vodoprivrede, 2022a). In this way, social agricultural franchising as a business model can be of great help, bearing in mind that franchises offer standard quality products and services and enable relatively fast expansion of the franchise network. Therefore, it is very important to foresee the development of social agricultural franchising in the Strategy for Agriculture and Rural Development. The National Program for Agriculture should include incentives for the development of social agricultural franchising, in order to achieve economies of scale and increase productivity through the multiplication of positive social effects with the implementation of the franchise business model. From a broader point of view, the social entrepreneurship sector in Serbia is still not sufficiently recognized by decision-makers. In fact, social enterprises in Serbia are almost exclusively

developed with support from non-governmental organizations and international institutions (KoRSE, 2021).

Based on the analysis of the Coalition for Solidarity Economy Development KoRSE (KoRSE, 2022), it is concluded that the ecosystem of social enterprises in Serbia is something that needs to be built in the future, because the current state, types and interconnection of actors can hardly be called an ecosystem. The social entrepreneurship sector in Serbia is characterized by a weak connection between actors, insufficiently developed connections and relationships between them, and little interest of the public and private sectors in the realization of social ideas. A large number of social enterprises have maintained their operations thanks to donations from non-governmental organizations, international donors or fundraising through crowdfunding campaigns (KoRSE, 2021, KoRSE, 2022). Social enterprises expect support in the form of financial incentives not only from non-governmental organizations and donors (donations, grants), but also in the form of state subsidies and loans from commercial banks. Greater support is also needed from the government, The Chamber of Commerce and professional associations in terms of organizing training in the field of management, as well as acquiring business and communication skills.

One example of good practice is the social enterprise Bio Idea, which operates according to the principles of social franchise. Bio Idea is a social enterprise that has been actively contributing to the development of social entrepreneurship in Serbia since 2011. The goal of this social enterprise is to educate and network the hard-to-employ categories of the population (franchisees), so that they can independently start entrepreneurial workshops for the production of ecological hygiene products. Bio Idea buys raw materials from farmers and trains women, especially women from remote and rural areas, to become franchisees. Bio Idea soaps are made from natural raw materials without synthetic preservatives, additives and colors (Solidarna ekonomija, 2020, 2022). The Bio Idea social franchise, in addition to entrepreneurs, also networks social and agricultural cooperatives. The production of soap from used cooking oil is one of the innovations that enables the sustainability of the network within the circular economy (Biznis vesti, 2022). Based on the example of good practice, as well as the above-mentioned examples from other countries, social franchises can be started in rural areas, and contribute to the self-employment of local farmers, the employment of vulnerable categories of the population, and the increase of agricultural yields and income. The interaction of different actors of the ecosystem contributes to networking and cooperation, which serve the purpose of exchanging and increasing knowledge.

The experiences of analyzed social agricultural franchises from Kenya, Bangladesh and Nigeria can serve as an example of good practice for the development of social franchising in rural areas in Serbia. Social agricultural franchising in Serbia would contribute to reducing poverty in rural areas, increasing the employment rate, and increasing agricultural income. The examples of the analyzed countries are significant, bearing in mind that there are some common characteristics between Serbia and the aforementioned countries. Primarily, social agricultural franchises receive the most support from the non-governmental sector, while the support of the state and public institutions is still insufficient. The situation is similar, as can be seen from the above, in the case of social enterprises in Serbia.

The key recommendations for developing the ecosystem of social enterprises and social franchising in Serbia refer to: connecting actors and sharing knowledge, promotion and education, but also the development of policies that will stimulate the social entrepreneurship sector. It is extremely important to promote the existing good practices

of social enterprises, as models that have a positive role in the social community. It is equally important to direct promotion and education about social entrepreneurship to the public sector, the private sector, and all individuals in the community (KoRSE, 2022).

6. CONCLUSIONS

Poverty is one of the biggest obstacles to economic growth and development.. Agriculture plays a significant role in reducing poverty for the most developing countries and regions, as it represents the second largest source of employment in the world after the service sector. Agricultural franchising has the potential to solve a large number of problems in the agricultural sector in many countries. The aim of the analyzed social agricultural franchises is to improve the quality of life of rural entrepreneurs by offering them a financially sustainable business solution.

Based on a detailed analysis of business examples of the development of agricultural social franchises in the countries of Asia and Africa, we can draw certain lessons and possibilities of applying this business model in our country. When it comes to securing funding, a large number of social agricultural franchises attract large grants thanks to their social mission. In addition, these franchises cooperate with microfinance institutions and non-governmental organizations that enable franchisees to access microloans. Some franchisors provide favorable loans to franchisees and help them raise additional funds through crowdfunding platforms. When it comes to human capital, the analyzed social agricultural franchises organize initial and ongoing training for all franchisees. The expansion of the franchise network contributes to multiplying the positive social impact, reducing poverty and the unemployment rate.

When we talk about the possibility of implementing social agricultural franchising in the Republic of Serbia, it should be emphasized that the biggest problem of our agricultural sector is the lack of use of modern agricultural methods that can contribute to development of productive agriculture, bearing in mind the predominantly elderly households, the migration of young people from the countryside and fragmented farms. Through the inclusion of rural entrepreneurs in franchise systems and their continuous training, social agricultural franchises can significantly contribute to reducing poverty and unemployment and improving the quality of life in rural areas. The ecosystem of social enterprises in Serbia still needs to be built, primarily through connecting actors and sharing knowledge, improving access to financing, promotion and education, but also the development of policies that will stimulate the social entrepreneurship sector. The experiences of analyzed social agricultural franchises from Kenya, Bangladesh and Nigeria can serve as an example of good practice for the development of social franchising in rural areas as well as agriculture entrepreneurs ecosystem deployment in Serbia, with the final aim of developing productive agriculture that will lead to overall social development.

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PREDUZETNIČKI EKOSISTEM AGRARNOG SOCIJALNOG FRANŠIZINGA

Iako je primena koncepta socijalnog franšizinga relativno nova u agrarnom biznisu, u poslednje vreme se pojavljuju primeri uspešnih poslovnih priča, posebno u nerazvijenim zemljama Azije, Afrike i Južne Amerike. Cilj rada je da se primenom kvalitativne analize višestrukih studija slučaja utvrde najbolji primeri preduzetničkih ekosistema socijalnih franšizinga u poljoprivredi i ukaže na značaj implementacije socijalnog agrarnog franšizinga u razvoju agrobiznisa u Republici Srbiji. Iskustva analiziranih socijalnih agrarnih franšiza iz Kenije, Bangladeša i Nigerije mogu poslužiti kao primer dobre prakse za razvoj socijalnog franšizinga u ruralnim područjima u Srbiji, sa ciljem razvoja produktivne poljoprivrede koja će voditi ekonomskom razvoju. Veoma je važno omogućiti razvoj socijalnog agrarnog franšizinga kroz Strategiju poljoprivrede i ruralnog razvoja, imajući u vidu niz pogodnosti koje se mogu ostvariti u poljoprivredi Srbije, pre svega kada je reč o razvoju ruralnih područja i povećanju prihoda i socijalnog blagostanja poljoprivrednika.

Ključne reči: *agrarni socijalni franšizing, preduzetnički ekosistem, franšizing, socijalni franšizing, poljoprivreda*

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Original Scientific Paper

SOME CHALLENGES IN THE CONSOLIDATION OF UNREALIZED INTRA-GROUP PROFITS AND LOSSES

UDC 657.375

Vojislav Sekerez[1], Dejan Spasić[1,2]

[1]University of Belgrade, Faculty of Economics and Business, Republic of Serbia
[2]University of Niš, Faculty of Economics, Republic of Serbia

ORCID iD: Vojislav Sekerez https://orcid.org/0000-0003-1009-0524
Dejan Spasić https://orcid.org/0000-0002-8540-579X

Abstract. *Procedures for eliminating internal results in practice may vary due to the different nature of the relationship between related parties, but also due to the vagueness of the accounting regulation, which opens up space for alternative procedures in practice. The ways of eliminating internal profits and losses differ primarily depending on whether full consolidation of financial statements or one-line consolidation, followed by the application of the equity method, is performed. At the same time, with both mentioned consolidation procedures, questions are raised regarding whether downstream and upstream transactions should have the same treatment, that is, whether the total internal result should be eliminated or only its part that is proportional to the ownership share. The aim of this paper consists in analyzing specific issues of eliminating internal results, while considering the current state and the possibility of improving accounting regulations in that field.*

Key words: *consolidated financial statements, separate financial statement, one-line consolidation, intercompany transactions, internal results, equity method.*

JEL Classification: M41

INTRODUCTION

Consolidated financial reporting has been subject to dynamic regulatory changes in recent decades due to global harmonization efforts. In fact, the need for harmonization and improvement of the principles and methods of consolidation is caused not only by the

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Corresponding author: Vojislav Sekerez
University of Belgrade, Faculty of Economics and Business, Kamenička 6, 11000 Belgrade, Republic of Serbia | E-mail: vsekerez@ekof.bg.ac.rs

creation of new instruments and possibilities for exercising control by the parent company over the subsidiary, but also by the complexity of intra-group transactions (Spasić & Sekerez, 2022, p. 20). It is known that generally accepted accounting principles, that is, the conceptual framework and accounting standards are based on theoretical concepts and requirements of business practice (Needles, Powers, & Crosson, 2011). Therefore, the "practice of introducing new and more complex concepts through a series of progressive changes" (Peng & van der Laan Smith, 2010, p. 24) requires a permanent review of both the regulation and the practice of corporate reporting. Regardless of the approach to creating standards (based on principles or rules where there are still significant differences - Guillaume & Pierre, 2016), complex accounting issues must be addressed very carefully. Group reporting is particularly affected by complexity of intragroup transactions, which also requires careful creation and application of financial reporting standards. Therefore, Brown, Huffman and Cohen (2023, p. 43) point out that "the nature and volume of accounting standards and diversity in the treatment of similar transactions are key sources that tie directly to mandatory accounting guidance and the resulting disclosures".

The key challenges of consolidated financial reporting since the beginning of the 21st century are largely a consequence of changes in accounting standards. More recently, research has been predominantly focused on the new concept of control and its implications on consolidated financial statements (Hsu, Duh & Cheng, 2012; Ben-Shahar, Sulganik & Tsang, 2016; Beck et al., 2017; Bedford, Bugeja & Ma, 2022), goodwill accounting (André, Filip & Paugam, 2016; Li & Sloan, 2017; Amel-Zadeh, Glaum & Sellhorn, 2023; Just, Honold & Meckl, 2023), including other intangible assets acquired in a business combination (Skinner, 2008; Su & Wells, 2018; Tunyi et al., 2020; Barker et al., 2022), accounting treatment of non-controlling interests (Lopes, Lourenço & Soliman, 2013; Welc, 2017; Sotti, 2017; Lopes et al., 2021) and other specific reporting areas in accordance with the acquisition method.

Other areas of financial statement consolidation seem to have been neglected in recent research. Although calculating, recording and eliminating the effects of common intercompany transactions within the group may be viewed as "routine" matters, there is still a need for their ongoing review and discussion. Our aim is therefore to highlight and discuss specific challenges in eliminating unrealized profits or losses under both the acquisition method and the equity method, as well as the implications of the chosen method in the event that the parent company prepares separate financial statements.

The importance of our research stems from the fact that the elimination of internal results is a challenge both for professional accountants and for the study of this matter at academic level and/or through professional trainings. In other words, "teaching and learning accounting for consolidations is a challenging endeavor" (Murphy & McCarthy, 2010, p. 101). Although there is research on how to teach consolidated accounting (Murphy & McCarthy, 2010; Churyk & Stenka, 2014; Hsiao & Han, 2021), our goal is not to educate, but to renew the discussion on the specific issues of financial statement consolidation, especially the treatment of unrealized intra-group results.

Accounting for intra-group profits and losses affects the reliability of the analysis of consolidated financial statements (Aceituno et al., 2006), i.e. their value relevance (Abad et al., 2000; Hevas et al., 2000; Srinivasan & Narasimhan, 2012). Therefore, our goal with this paper is also to renew the interest of professional accountants including financial analysts in this topic.

One of the key tasks during the process of consolidating financial statements consists in eliminating intragroup transactions between related entities in order to show the financial position of the group and the success it has achieved in relations with its environment. This implies the elimination of internal revenues and expenses, as well as all internal results that, as a rule, arise during mutual transactions between companies within the group. Eliminating internal results primarily involves identifying the internal transactions on the basis of which they arise, which may refer to the sale of inventory and fixed assets, the provision of various services or financing. Regardless of the nature of internal transactions, which can be very diverse, they can all be broadly grouped into the following four categories (Krimpman, 2015):

- transactions for immediate sale (further sales occur in the same period);
- transactions for later sale (resale occurs in the following period);
- transactions for own use;
- transactions for own consumption.

The method of eliminating internal results will depend not only on which of the aforementioned categories of transactions they refer to, but also whether they are contained in tangible assets, intangible assets or services. Even when it comes to internal results contained in tangible assets, the method of their elimination differs depending on whether they are contained in goods, finished products, work in progress, material incorporated into finished products, or fixed assets. Also, the elimination of internal results will be determined by the applied method of calculation of results, that is, whether the profit and loss statement is compiled by function or by nature. The four basic transactions (for immediate sale, for later sale, for own use and for own consumption) rule the lines in the balance sheet and profit and loss statement that have to be used for elimination, both on the sender`s and receiver`s side. In summary, the way of elimination of internal results will depend on the following factors:

- type of transaction (four types);
- subject of transaction (goods, materials, finished products, services etc.);
- method of calculation of result (by nature, by function);
- consolidation method (equity method, full consolidation);
- direction of transaction (downstream, upstream).

The listed factors are interconnected, so all of them should be taken into account when considering a specific situation.

In the paper, we will focus on the elimination of internal results contained in inventories when it comes to transactions for later sale and assuming that the profit and loss statement is compiled by nature. The specifics of eliminating internal results in the aforementioned circumstances will be analyzed, with a parallel consideration of how to eliminate them under the conditions of applying the equity method (one-line consolidation) and the method of full consolidation of parent company and subsidiaries. The common feature of both methods is that the internal results cannot be considered realized from the point of view of the group, until it comes to a sale to outside party. Finally, the paper will consider the specifics of eliminating internal results during downstream and upstream transactions, both under applying equity method and full consolidation.

1. Elimination of Internal Results from Ending Inventory – Full Consolidation

In general, it is undisputed that the profit or loss resulting from transactions between companies within the consolidation group should be eliminated while simultaneously adjusting the book value of the ending inventory in the consolidated balance sheet. According to the guidelines in IFRS 10.B86, "…profits or losses resulting from intragroup transactions that are recognised in assets, such as inventory and fixed assets, are eliminated in full."

Since transactions can occur downstream (sales from a parent to a subsidiary) and upstream (subsidiary sells to parent), a question may arise about the treatment from a group perspective of non-controlling interests (NCI)-related unrealized gains or losses. In the case of downstream transactions, this problem does not arise, because NCIs do not participate in the parent's ownership. However, NCI may be affected if a partially-owned subsidiary sells to the parent an asset that has not been externally realized at the reporting date. Apart from the general approach defined in the already cited IFRS 10.B86, IFRS does not contain explicit guidelines for recognizing the share of NCI in unrealized profit or loss. On the other hand, US ASC 810-10-45-18 allows a choice between two approaches. Namely, elimination of unrealized profit or loss in upstream transaction may either be fully attributed to the parent, or attributed proportionately between the parent and NCI. The first approach is in the line with the basic assumption that consolidated financial statements show the financial position and results of the consolidated group as a single economic entity.

However, if NCI's share of unrealized profit is not taken into account, the net profit attributable to the parent company may be underestimated. For this reason, Beams et al. believe that "the second approach that allocates unrealized profits and losses from upstream sales proportionately between noncontrolling and controlling interests is conceptually superior because it applies the viewpoint of the consolidated entity consistently to both controlling and noncontrolling interests" (Beams et al., 2018, p. 175).

It is important to note that the FASB does not permit the use of this approach when dealing with an upstream transaction involving a consolidated variable interest entity. Although the first approach is less complex, the second approach would still have an impact on the analytical value of the consolidated financial statements, not only from the perspective of minority shareholders but also with regard to the information needs of financial analysts. In other words, the existence of NCIs and their adequate accounting treatment is an important determinant of the value relevance of consolidated financial statements (Sotti, 2017).

The issue of NCI's share in unrealized profit or loss is also important for intragroup transactions between subsidiaries. If the transaction involves partially owned subsidiaries, the elimination of the unrealized profit or loss should generally be consistent with the accounting principles for sales to the parent company. In other words, in such transactions, if the selling subsidiary is partially-owned, NCI's share of the unrealized profit or loss should be also determined.

In addition to the issue of eliminating unrealized gains and losses attributable to the NCI, deferred taxes may arise on intercompany sales. This is pointed out in continuation of the already cited IFRS 10.B86: "IAS 12 Income Taxes applies to temporary differences that arise from the elimination of profits and losses resulting from intragroup transactions."

Temporary differences arise in a transaction that changes the tax basis of the goods that are the subject of the purchase transaction (IAS 12.18(e)). In this case, the temporary difference is the result of eliminations within the group, i.e. the unchanged book value of

assets or liabilities in the consolidated financial statements. In other words, "the problem of deferred-tax accounting in group accounts is essentially the problem of a difference between the accounting entity and the tax entity" (van Hoepen, 1981, p. 168).

Basically, "deferred tax assets and liabilities shall be measured at the tax rates that are expected to apply to the period when the asset is realized or the liability is settled, based on tax rates (and tax laws) that have been enacted or substantively enacted by the end of the reporting period" (IAS 12.47). In addition, IAS 12 generally requires that "entity measures deferred tax liabilities and deferred tax assets using the tax rate and the tax base that are consistent with the expected manner of recovery or settlement" (par. 51A). Consistent with this requirement, deferred tax should be measured at the tax rate of the buying company, not the seller. However, this rule should be reconsidered if the requirements of a country's tax authorities impose special rules regarding the tax history of assets or liabilities. In other words, for the purposes of measuring deferred taxes in consolidated financial statements, the general principles of IAS 12 should be re-considered as to which tax rate to apply.

The previous brief overview of the main issues of eliminating unrealized profit or loss in parent-subsidiary transactions remains challenging for both regulators and practitioners, which is why we consider these issues important for the wider academic community as well. However, the effects of transactions with associates and joint ventures have no less importance on the information power of consolidated financial statements, which will be discussed below.

2. Elimination of Internal Results from Ending Inventory – Equity Method

For the purpose of "counting for investments in associates or joint ventures, over which the investor exercises significant influence or joint control, it is necessary to use the equity method", according to IAS 28. It is the accounting method whereby "the investment is initially recognized at cost and adjusted after the acquisition date for the changes in the investor's share of the net assets of the investee" (IAS 28.3). In contrast to the full consolidation of subsidiaries, the equity method implies an on-line consolidation procedure, during which only the investment in the associate or joint venture is consolidated in the investor's balance sheet. However, regardless of the differences in the consolidation process between the equity method and full consolidation, when eliminating internal results, both methods start from the same initial idea that the results contained in internal transactions must be deferred until the inventory is sold to third parties. This means that internal sales transactions between the investor and the investee are viewed in the same way as transactions between parent and subsidiaries, due to their interconnection resulting from the significant influence of the investor. Therefore, there is a need to eliminate all internal transactions and internal results that arise on that occasion, as well as during the full consolidation of financial statements.

Therefore, in the case of transactions for later sale, in which the inventory will be resold to an unrelated party in the subequent period, because from the point of view of the group, the earning process is not considered complete until the final disposition of goods to the external buyer.[2] When the equity method is applied, transactions between

[2] On the other hand, in the case of transactions for immediate sale, internally purchased stocks are sold externally in the same period when they werebought, so the complete result is realized and there is no need for its deferment, i.e. eliminating it from the group's financial statements.

related parties can also be classified as either downstream or upstream transactions. Downstream sales refer to investor's sale of goods to the investee, while in upstream sales investee sels the goods to investor (Hoyle, 2011). The direction of intercompany sales does not affect the way of eliminating internal results in a situation where there is significant influence (or joint control) of the investor. However, direction of internal transaction will cause serious differences when there is control, i.e. when the parent company applies the equity method. In this part of the paper we will present the elimination of internal results in the case of the basic application of the equity method, when there is a significant influence (or joint control) of the investor, while the application of this method by the parent company will be discussed in the following parts of the paper.

Downstream sales result in a situation where the internal profit (or loss) is contained in the inventory of the investee (associate or joint venture), as a buyer or sending company, and in the income of the investor (ultimate parent or any subsidiary), as a seller or receiving company. The elimination of the internal result is not done in its entirety, as in the case when the investor has control over a subsidiary company, but only proportionally to the amount of investor's participation. For the amount of the corresponding part of the investor's internal profit, which is the subject of elimination, the amount of his investment, as well as the income from that investment (calculated in the amount of the part of the net profit of the investee that belongs to the investor), are simultaneously reduced. Conversely, in case of an internal loss, the investment and income would be reduced at the same time.

Example: Assume that company A sold goods for 100,000 to company B, in which it has a 30% interest and significant influence. The sales value of the goods includes the investor's profit of 30,000. By the end of the year, Company B has sold half of that stock to external customers, while the other half of the goods are still in stock at the balance sheet date.
Solution: Of the total profit of the investor, only one half (15,000) can be considered realized, while the remaining 15,000 contained in the unsold inventory of company B must be eliminated. Given that the investor's participation is 30%, he eliminates the same percentage of the internal result, i.e. the amount of 4,500 (15,000 * 30%), by reducing the value of its investment and income from that investment.

Upstream sales lead to the situation that the internal profit is contained in the inventory of the investor, who is now in the role of the buyer, as well as in the income and result of the investee, as the seller. Reveiwing company as a buyer may be ultimate parent or any subsidiary of the group. The elimination of the internal result is done in the same way as in the case of downstream transactions, which means that the investor eliminates a proportional part of the total internal result by simultaneously reducing the amount of equity investment and the income from that investment.

Example: Associate B sold to investor A (who exercises significant influence over B) goods for 80,000, with a profit of 20,000. At the end of the year, company A still has a quarter of those goods in stock, while the rest was sold to external customers.

Solution: At the end of the year, company A owns internally procured goods worth 20,000 (80,000/4), which includes an internal profit of 5,000 (20,000/4). Company A owns a 30% interest in associate B, so, according to the equity method, it eliminates only the internal profit of 1,500 (5,000*30%). Therefore, company A, as an investor, will simultaneously reduce the value of its investment and the income derived from it by the amount of 1,500.

3. SHORTCOMINGS OF EQUITY METHOD ACCOUNTING FOR INTERCOMPANY PROFIT TRANSACTIONS

"Notwithstanding the widespread use of the equity method and its positive characteristics, primarily in the domain of providing relevant and useful information on the real economic value of equity investments, this method also exhibits certain shortcomings in practice" (Škarić-Jovanović, 2014). Here we will briefly analyze the shortcomings of equity method accounting treatment of intercompany profit transactions.

The IASB has so far conducted several studies related to transfer of assets between an investor and its associate or joint venture under the equity method accounting. Some of the results suggested the need for amendments to IAS 28 (28.31) to clarify the accounting for downstream transactions in conditions where the internal gain from the transaction exceeds the carrying amount of the investor's interest in associate or joint venture (Bradbury, 2018). Namely, IAS 28 does not offer strict guidelines for situations when the amount of the internal profit "to be eliminated is higher than the carrying amount of the interest in associate". Krimpman (2015) sugests the following solutions that can be applied in practice in that case:

- no elimination of internal profit
- internal profit should be deffered as a separate component of equity or income
- loss recording during the elimination of internal profit.[3]

Another problem in this field is inconsistency between IFRS 10 and IAS 28 regarding the treatment of intercompany profit transactions. Namely, IAS 28 refers to IFRS 10 emphasizing that "many of procedures that are appropriate for equity method are similar to the consolidation procedures described in IFRS 10" (IAS 28.26). In this regard, IFRS 10 sets out three requirements regarding key consolidation procedures: "a) line-by-line consolidation, b) elimination of the cost of the investment and c) elimination of intragroup transactions in full" (IFRS 10. B86). It is obvious that IFRS 10 provides very short and vague guidelines for the application of equity method requiring the elimination of intragroup transactions in full, because there is only one general request.

Three problems arise from this requirement (c) of IFRS 10 in the field of applying the equity method (Bradbury, 2018). The *first problem* relates to the fact that IFRS 10 considers that the group consists of parent and subsidiary companies, so associates and joint ventures are not part of group. Viewed from that angle, there are no intragroup transactions between investors and associates, so the question arises whether internal results should be eliminated. The *second problem* relates to the dilemma of whether the significant influence of investors generally imposes the need to eliminate internal results. In that sense, the investor has significant influence, but not control, so the question is whether he has information at all for the purposes of eliminating internal results. There are several practical questions that arise related to this problem. First, what about normal transactions that take place under market conditions and at fair value? Although we are talking about transactions between related parties, the question here is: is any internal profit unrealized? On the other hand, if the transaction was not carried out under normal market circumstances (out of arm's reach), there are opinions that the investor should

[3] In this case, the carrying amount of investment is reduced to zero, while internal profit above the value of the investment should be recognized as a liability. This is in line with the requirement of loss accounting according to IAS 28.39 and this solution should be preferred. At the moment when internal inventory is sold, a reversal procedure will be implemented.

eliminate the entire amount of unrealized profit, and not just the part proportional to his interest in associate or joint venture (KPMG, 2019). In this regard, the *third problem* consists of the fact that the requirement of IFRS 10 for the complete elimination of intercompany transactions is contrary to the application of the equity method. If the investor owns inventory purchased from an associate, those inventories contain 100% of the internal profit from transaction, but the investor participates in the associate's profit only in proportion to its capital investment. Therefore, it is not obvious from the requirements of IFRS 10 what "elimination in full" means in the context of applying the equity method, i.e. whether 100% of the unrealized profit should be eliminated or only investor's proportion of that profit.

From the above, it can be concluded that the IFRS 10 guidelines do not offer assistance in the application of the equity method and even contradict it. In addition, IFRS 10 does not specify who should perform the elimination of the internal result, the investor or the investee. On the other hand, IAS 28 provides the following guideline for eliminating internal results in transactions between an investor and an associate or joint venture: "Gains and losses resulting from 'upstream' and 'downstream' transactions … between an entity (including its consolidated subsidiaries) and its associate or joint venture are recognised in the entity's financial statements only to the extent of unrelated investors' interests in the associate or joint venture." (IAS 28.28). Therefore, only the investor's share in the associate's or joint venture's gains or losses resulting from these transactions need to be eliminated.

Although it is not clear from the requirements of IAS 28.26 and IFRS 10. B86 whether it is necessary to eliminate intercompany transactions between the investor and the associate (and in what way), paragraph IAS 28.28 provides a very specific request concerning that matter. However, this paragraph is in a certain sense incomplete and contains some ambiguities. In the first place, the question arises as to why a distinction is made between upstream and downstream transactions if the method of their elimination is the same. In addition, paragraph IAS 28.28 does not specify whether internal profit/loss should be eliminated from inventory or from the income statement of the entity in which it is contained. This is followed by the question of whether downstream and upstream transactions should have the same treatment when eliminating internal results. Eliminating the internal result by simultaneously correcting the value of the investment and the income of the entity that is the seller in the transaction is considered a traditional approach, that is almost universally accepted in practice, although adjusting the value of inventory of the buyer is also an acceptable option (Hoyle, 2011).[4] In this regard, some authors believe that when eliminating internal results from upstream transactions, adjusting the investor's inventory is a more apropriate option than adjusting the income of the associate (adjusting of investment should be done in every case) (Krimpman, 2015; Bradbury, 2018). This is related to the question of whether the investor, through his significant influence, can influence the prices of upstream transactions and whether he can know the cost structures and the internal result of the investee.

Finally, the logical extension to the approach of proportional elimination of internal results implies the proportional consolidation of the assets and liabilities of the associate, and not only the consolidation of the proportional part of the net assets. This kind of

[4] Here we can add the previously mentioned dilemmas about whether the internal results should be eliminated at all when the transaction was carried out under market conditions, and if they should be eliminated, whether to do it completely or only proportionally to the investor's participation.

equity accounting (one-line consolidation) is also considered one of the shortcommings of the equity method, but it goes beyond the topic and scope of this paper. Given the aforementioned open questions and dilemmas, the IASB should expand the scope of its equity accounting projects to address these issues. In the first place, the IASB should clarify whether associates are part of a group. If they are, then the procedures for eliminating internal results would be justified, but, on the other hand, if the associates are not part of the group, then it would be necessary to consider whether the significant influence of the investor is a sufficient basis for eliminating internal results, because internal transactions could be arms-length. Also, if it is necessary to eliminate internal results, there is a need to specify the way to achieve it - using proportional or full elimination and answering the question whether upstream and downstream transactions should have the same treatment or not.

4. Elimination of Internal Results when Parent uses Equity Method

The area of application of the equity method expands in situations where the parent company does not prepare consolidated financial statements, but "parent only", i.e. separate financial statements, or when a subsidiary company is exempt from consolidation. In such cases, the parent company can use the equity method and implement the one-line consolidation procedure (Chasteen, 2002). When the parent company applies the equity method, the procedure for eliminating intra-company transactions and results will differ to a certain extent compared to situations when the parent prepares consolidated financial statements or when investor/investee relationship exists (when the "common" version of the equity method is applied). The differences in the elimination of unrealized profits/losses in ending inventory compared to full consolidation or one-line consolidation with significant investor influence are determined by:

- direction of intercompany sales (downstream or upstream)
- percentage ownership in subsidiary

Basically, the specifics of eliminating internal results when the parent company uses the equity method arise from the treatment of non-controlling interest. If there were no minority shareholders (100 percent owned subsidiaries), the internal results would be eliminated in the same way as during full consolidation (elimination in full) or during one-line consolidation (proportionally to the investor's participation) (Beams et al., 2018). Also, while the direction of the transaction (downstream or upstream) does not affect the elimination of internal results neither during full consolidation nor during one-line consolidation, when the accounting company applies the equity method, it will be done in a different way for upstream and downstream transactions.

In this regard, during the consolidation process, parent eliminates any unrealized profit/loss from ending inventory in its entirety, for both upstream and downstream sales. However, during the upstream transactions, the non-controlling interest share can be affected since the subsidiary`s separate income contains unrealized profit/loss. On the other hand, during downstream sales, unrealized profit/loss is included in the separate net result of the parent company, which does not affect a noncontrolling interest share because noncontrolling shareholders have an interest only in the profit of the subsidiary. Therefore, in upstream situations, when the subsidiary`s separate income includes unrealized profit, during consolidation it should be reduced by the amount of unrealized profit related to minority shareholders. More precisely, when the parent company applies

the equity method, unrealized gains/losses on upstream transactions are eliminated proportionally between the controlling and noncontrolling interests. It is essentially the correct option, because both controlling and noncontrolling share of consolidated result are computed on the basis of the realized result from the viewpoint of the group. On the contrary, during downstream transactions, the parent that is applying the equity method eliminates 100% of the internal result, and not only the part that is proportional to its interest in the subsidiary (as in the case of upstream sales), because in such situations minority shareholders have no interest in the result of the parent company.

It should be said that US GAAP is not completely clear on the treatment of internal results during full consolidation, which can lead to inconsistent practice when there are noncontrolling interests. ASC 810 initially requires that "all internal gains and losses be eliminated completely, regardless of the direction of the transaction and the existence of a noncontrolling interest, which is in the spirit of the idea that consolidated financial statements represent the financial position and results of the group's operations" as a single economic entity. However, the same standard further provides "the option that the elimination of intercompany profit or loss may be allocated proportionately between the parent and noncontrolling interest". This possibility indicates that alternative approaches are available in eliminating internal results and computing the noncontrolling interst's share of net income of subsidiary (Hoyle, 2011). The option that the elimination of internal results can be done completely or proportionally can result in an inconsistent treatment of internal results in terms of upstream transactions, both between the parent companies that perform full consolidation, and between consolidation procedures and equity method accounting. Regardless of the previously mentioned option, when the parent company uses the equity method for its separate financial statements, it will eliminate the entire amount of unrealized profits/losses during downstream sales, and only a proportional part during upstream transactions.

Example: To ilustrate, assume that company A owns 80 percent of voting stock of company B. During the period, intercompany sales of 100,000 occur at a profit of 30,000. At the end of the year, inventory includes half of merchandise from the intercompany transactions. Company A does not prepare consolidated, but only separate financial statements, using equity method.

Downstream sales

Sales by a parent company to its subsidiaries increase parent's profit but they do not affect the income of subsidiary until the goods are sold to third parties. Given that the entire amount of internal profit, which is contained in the inventory of company B, increases the profit of the parent company A, entire amount also must be eliminated from the parent income statement. The amount that must be eliminated is 15,000 (30,000/2) because half of the internally transferred goods are still in stock. Under the equity method of accounting, elimination of this internal profit of 15,000 is done by reducing the value of its investment and the investment income of company A.

Upstream sales

Sales by subsidiary to its parent company increase parent's profit but they do not affect the income of parent until the goods are sold to third parties. However, company A recognizes its share of income of company B on a proportional basis, so given that company B is partially owned subsidiary, only proportionate share of subsidiary's internal profit will be deffered (80%). The amount that must be eliminated is 12,000 (15,000*80%) and it will be done by simultaneously reducing investment and investment income of company A.

CONCLUSION

Eliminating intragroup transactions and unrealized results that arise during them is the main prerequisite for presenting the financial position and success of the group as an economic entity through consolidated financial statements. The paper shows that the procedures for eliminating internal results can be very complex and accompanied by certain doubts and problems. The reason for this is the different nature of the relationships between the related parties within the group, as well as the vagueness of the accounting regulation in that area.

The application of the equity method, followed by the one-line consolidation procedure, implies that an investor with significant influence or joint control eliminates only part of the internal profits or losses in proportion to his ownership share. In that case, internal results derived from downstream and upstream transactions have the same treatment during their elimination. However, in situations where the parent company, which presents only separate financial statements, applies the equity method, the elimination of internal results will depend on the direction of the transaction. Then, during downstream transactions, 100 percent of the internal result will be eliminated, while during upstream transactions, only the proportional part corresponding to percentage ownership will be eliminated.

Equity method of accounting for intercompany transactions is often the subject of criticism in the scientific and professional public, which is, among other things, caused by the fact that the IAS 28 guidelines on this matter are not sufficiently clear and harmonized with IFRS 10. The most common doubts in this field refer to whether unrealized results should be eliminated at all if internal transactions between the investor and the investee are arms-length, then whether to eliminate complete or only a proportional part of the internal result, as well as whether upstream and downstream transactions should have the same treatment on that occasion. The vagueness of the accounting regulation opens up space for alternative procedures for eliminating internal results, which leads to inconsistencies in accounting practice. Therefore, the leading accounting regulatory bodies in the world (IASB and FASB) should make additional efforts in order to further clarify the procedures related to the treatment of intercompany transactions, both in the area of full consolidation and in the area of one-line consolidation procedures.

The lack of empirical research can be considered as the main limitation of this paper. However, we believe that our discussions can contribute to both the academic public and the accounting profession, as the focus on eliminating unrealized results from intra-group transactions has been neglected recently. Future research should certainly also provide empirical evidence using a sufficiently selected sample and suitable statistical methods.

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NEKI IZAZOVI U KONSOLIDACIJI NEREALIZOVANIH UNUTARGRUPNIH DOBITAKA I GUBITAKA

Procedure eliminisanja internih rezultata u praksi mogu da variraju zbog različite prirode odnosa između povezanih strana, ali i zbog nedorečenosti računovodstvene regulative koja otvara prostor za alternativne postupke u praksi. Načini eliminisanja internih dobitaka i gubitaka se pre svega razlikuju u zavisnosti od toga da li je reč o punom konsolidovanju finansijskih izveštaja ili one-line konsolidaciji, praćenoj primenom metode udela. Pri tom, kod oba pomenuta postupka konsolidovanja otvaraju se pitanja vezana za to da li downstream i upstream transakcije treba da imaju jednak tretman, odnosno da li treba eliminisati ukupan interni rezultat ili samo njegov deo koji je proporcionalan vlasničkom učešću. Cilj rada se sastoji u analizi ovih specifičnih pitanja eliminisanja internih rezultata, uz razmatranje trenutnog stanja i mogućnosti unapređenja računovodstvene regulative na tom polju.

Ključne reči: *konsolidovani finansijski izveštaji, separatni finansijski izveštaji, one-line konsolidacija, unutargrupne transakcije, interni rezultati, metoda udela.*

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Review Paper

TRENDS AND PERSPECTIVES IN RECOGNIZING CRYPTOCURRENCIES ACCORDING TO INTERNATIONAL ACCOUNTING REGULATION

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Sunčica Milutinović[1], Dragomir Dimitrijević[2]

[1]University of Novi Sad, Faculty of Economics in Subotica, Republic of Serbia
[2]University of Kragujevac, Faculty of Economics, Republic of Serbia

ORCID iD: Sunčica Milutinović https://orcid.org/0000-0002-2155-602X
Dragomir Dimitrijević https://orcid.org/0000-0001-8049-9451

Abstract. *In this paper, the topic of accounting treatment of cryptocurrencies is examined through the lens of International Financial Reporting Standards (hereinafter: IFRS). An overview of the current body of research in this area is presented, along with recommendations for further improvements in cryptocurrency accounting records. This paper is based on a systematic review of scientific and professional literature as well as the current IFRS framework. Specifically, the systematic review is designed to investigate the issue of recognizing cryptocurrency and evaluate its confirmation and evidence in the available literature and IFRS framework. While crypto markets grew rapidly initially, they have enjoyed great investor interest over the past decade, despite the high risk and volatility of earnings, which raised the issue of institutional regulation of cryptocurrencies. The paper attempts to identify the most appropriate accounting treatment of cryptocurrency transactions under existing IFRS, as there is no specific regulation in place*.

Key words: *recognition, transaction, financial reporting, crypto market*

JEL Classification: M41, G38

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Corresponding author: Sunčica Milutinović
University of Novi Sad, Faculty of Economics in Subotica, Segedinski put 9-11, 24000 Subotica, Republic of Serbia | E-mail: suncica.milutinovic@ef.uns.ac.rs

1. INTRODUCTION

During the past decade, cryptocurrencies (hereinafter: CC or CCs) have experienced a tremendous expansion in the world economy, resulting in a number of issues, such as the accounting treatment of digital transactions involving CCs. There are several major challenges facing crypto market participants, such as unequal treatment of this currency as a means of trade and payment in some countries, a lack of legal regulation and an adequate taxation system, as well as a lack of coverage by the IFRS framework. CC is a form of virtual currency with electronic money characteristics that are not supervised by central banks. CCs are not backed by gold or any other material asset; they do not fall under institutional or regulatory jurisdiction, but are based on crypto market supply and demand. Therefore, CCs oscillate greatly in short time intervals. The paradox is that CCs do not fulfill any function of money, although that is why they were created. The most commonly used CCs are Bitcoin, Ethereum, Tether, XRP, USD Coin, BNB, Cardano, Dogecoin, Tron, etc. There are more than 23.000 CCs. That is a far cry from a decade ago, when there were just seven.

As CCs lack tangibility, security and data protection remain the biggest challenges. CCs are not printed, but are created by mining - solving mathematical algorithms by miners to record transactions. CC miners are legal or natural persons paid for their work with newly created CCs. Their primary costs are the high electricity consumption, software licenses, and sophisticated equipment that is either bought or rented to solve the mathematical algorithms that occur each time a transaction is made.

In blockchain technology, two related parties can make CC payments electronically without a third party's involvement (bank, clearinghouse, intermediary). It is a digital public register in which data appears in the form of blocks and in the form of transactions. In addition to being powered by decentralized software and electricity, blockchain is maintained and managed by numerous users - miners. The equipment keeps a record of crypto market transactions that can be viewed by participants. Among the features of blockchain technology that instill confidence and provide security and protection in transactions with CCs are the inability of retroactively altering transactions, their transparency, as well as protection against fraud, corruption, copying, inflation, and human error.

This paper focuses on the problem of (adequate) accounting inclusion of CC transactions. The regulation of CCs can be viewed from several aspects: institutional, legal, tax and accounting. Despite the fact that every aspect of regulation is challenging for the world's biggest economies and international institutions, the authors of this paper will attempt to provide an accounting scope model within the existing IFRS framework.

2. RECOGNITION OF CRYPTO TRANSACTIONS

IFRS does not provide specific guidance on CC accounting, and there is no clear practice among entities, so accounting of CCs could be governed by different standards (Leopold & Vollmann, 2019, p. 4). Although there is no standard or guidance issued by IFRS for CCs accounting treatments, IAS 8 clarifies the requirements for accounting treatment of transactions in the absence of an IAS for those transactions (Shehada & Shehada, 2020, p. 3). According to IAS 8, "management shall use its judgment in developing and applying an accounting policy, in the absence of IFRS that specifically applies to a transaction, other event or condition". Selected policy shall produce information that is relevant to the users' economic

decision-making needs and will be reliable. To make its "judgment, management shall refer to and consider the following sources in descending order:

- The requirements in IFRS dealing with similar and related issues;
- The definitions, recognition criteria and measurement concepts for assets, liabilities, income and expenses in the Framework" (Procházka, 2018, p. 164).

The paper discusses whether CCs can be recognized as:

- Cash (money, currency) or cash equivalent according to IAS 7 and IAS 21;
- Financial instruments (financial assets) according to IAS 32 and IFRS 9;
- Intangible assets according to IAS 38;
- Inventories according to IAS 2; and
- Investment property according to IAS 40.

2.1. Selecting a Cryptocurrency Recognition Model

2.1.1. Cash (money, currency) or cash equivalent

The IAS 7 (SAAA, 2019, p. 601-602) defines cash as "cash on hand and demand deposits, and cash equivalents as short-term highly liquid investments that can be converted to cash quickly and without risk". To be equivalent to cash in the short term (up to three months), the investment should be convertible into a known amount of cash and there should be no risk of its value changing. CC obviously "does not correspond to the definition of the cash equivalent. In most cases, CC is not a short-term operation and is aimed at the long-term period" (Lapitkaia & Leahovcenco, 2020, p. 111). Therefore, CCs for now do not meet the requirements to be considered cash or cash equivalents (Milutinović et al., 2020, p. 5).

However, there are other opinions. For example, Procházka (2018) is of the opinion that CCs should be "presented in financial statements as cash if it is acquired in a business transaction as a medium of exchange, i.e. as a means of payment received for goods or services sold by an entity. IAS 21 should be applied in such cases. Under current development, CCs are not generally accepted as a medium of exchange. Therefore any payment received in CCs should be treated as a transaction in foreign currency, translated into functional currency by applying a spot exchange rate at the transaction date. Any holdings of CCs are monetary items, and, in preparation of financial statements, they shall be translated using a closing rate" (Procházka, 2018, p. 166).

2.1.2. Financial instruments (financial assets)

According to IAS 32 (SAAA, 2019, p. 980-983), "financial asset is cash, an equity instrument of another entity, a contractual right or a contract that will or may be settled in the entity's own equity instruments". Some CCs "cannot be used as a medium of exchange, as they have a limited medium of exchange compared to most traditional flat currencies. The use of CCs has also been banned by a number of financial institutions around the world, as they represent an increased risk in financial transactions" (Lapitkaia & Leahovcenco, 2020, p. 111). A financial liability can be a contractual obligation or a contract that will or may be settled in with the entity's own equity instruments. Equity instrument is any contract that evidences a residual interest in the assets of an entity after deducting all of its liabilities.

The provisions of IAS 32 cannot be applied to CCs since they cannot be recognized as financial assets, financial liabilities, or equity instruments (Milutinović et al., 2020, p. 5). Furthermore, they cannot be recognized as financial instruments, since IFRS 9 (SAAA, 2019, p. 264) allows a financial instrument to be recognized when there "is a contract that gives rise to a financial asset of one entity and a financial liability or equity instrument of another entity". Finally, it should be pointed out that CCs can fall within the scope of IFRS 9 if they are recognized as (any kind of) assets and are designated as a hedged item under hedge accounting, assuming they are reliably measurable. "Similarly, transactions with CCs may directly fall under IFRS 9 when short-selling CCs and other derivative-like contracts, such as CFDs (Contract for Difference), margin trading, or liquidity swaps" (Prochazka, 2018, p. 168).

2.1.3. Intangible assets

According to IAS 38 (SAAA, 2019, p. 1098-1102), "intangible assets are non-monetary assets which are without physical substance and identifiable, while an asset is a resource that is controlled by the entity as a result of past events and from which future economic benefits are expected". Based on the definition, there are three basic conditions for intangible assets: "a) identifiability; b) control; c) future economic benefits. Intangible asset is identifiable when it is separable or arises from contractual rights". Control means an entity's ability to obtain future economic benefits arising from an intangible asset and to limit others' access to those benefits. Future economic benefits may refer to sales revenue, cost savings, and other benefits from assets that the entity uses. For an asset to be recognized as an intangible asset, it does not have to meet all requirements from the definition.

In addition to having no physical substance, CCs can be identified and exchanged, they provide economic benefits to the entity and others cannot access those benefits. Additionally, CCs meet the non-monetary criteria, because their value is neither fixed nor determinable given the wide fluctuations in the crypto market. Therefore, CCs can be recognized as intangible assets with few exceptions (Milutinović et al., 2020, p. 6). "As CCs are digital currencies, not having a physical form, some authors prefer to recognize CCs as an intangible asset on the balance sheet statement, with the cost model as a basic treatment and the revaluation model (fair value) as an available alternative" (Berchowitz, 2017). "However, if the estimated disposal value is lower than cost, the CC should be measured using the estimated disposal value, the difference between the carrying amount should be recognized as a loss. This loss should not be reversed in subsequent periods" (Yatsyk, 2018, p. 58).

"If an active market for the CC exists, such CC should be measured using the market price at the balance sheet date, while the difference between the carrying amount should be recognized as a gain or loss" (Yatsyk, 2018, p. 58). The revaluation model, however, can only be applied if there is an active market for the determination of fair value. Thus, CCs can be defined as intangible assets with an indefinite service life, if there are no factors to indicate a definite useful life (Lapitkaia & Leahovcenco, 2020, p. 112). Having determined that depreciation is not calculated for CCs because they have an indefinite useful life, all that remains is to test them for impairment and record the impairment in the profit or loss statement according to IAS 36.

Fair value accounting of CCs is possible only if an active market exists, so it can be measured correctly. Accounting according to the revaluation method is more complex:

"increases in fair value are reflected in other comprehensive income (OCI), while decreases are registered in profit or loss. The provisions of IFRS 13 are used to determine the fair value of CC. However, the current application of IAS 38 and the measurement of CCs at cost do not correspond to the economic substance and does not provide relevant information to users of financial statements" (Lapitkaia & Leahovcenco, 2020, p. 112).

2.1.4. Inventories

According to IAS 2 (SAAA, 2019, p. 565-567), "inventories include assets held for sale in the ordinary course of business", which means that CCs acquired for resale can be recognized as inventories if the entity is registered for trading/intermediary activity. Inventories are short-term current assets that meet the following conditions cumulatively: a) there is control or ownership of that type of asset; b) acquisition of the asset resulted in an expense; c) ownership of that asset is expected to provide future benefits. CCs acquired for resale meet all three cumulative conditions. The standard does not apply to the measurement of inventories of intermediary traders - who buy goods for resale and who measure their inventories at fair value less sales costs. In these cases, inventories are acquired with the intention of reselling them in the near future and making a profit based on fluctuations in price or margin. These inventories are not subject to the measurement requirements of this standard if they are measured at fair value, less costs to sell. Changes in fair value less sales costs are recognized in profit or loss in the period in which the change occurred. Therefore, when CCs are held for resale as part of an entity's core business, they can be considered inventories (Milutinović et al., 2020, p. 6).

"Regarding the accounting treatment of CCs acquired by mining, the IAS 2 guidance on the cost of conversion shall be applied. The cost of inventories shall comprise all costs of conversion incurred in bringing the inventories to their present location and condition. The costs of conversion of inventories include costs directly related to the units of production as well as a systematic allocation of fixed and variable production overheads that are incurred in converting materials into finished goods. Typical direct costs are electricity and labour (if any) directly related to mining. Indirect production overheads will be formed by depreciation of hardware and mining software, depreciation of the mining "factory" (if any) and other mining equipment (e.g., fans to cool the spaces), wages of programmers and service workers, etc." (Prochazka, 2018, p. 171).

2.1.5. Investment property

According to IAS 40, investment property "is real estate that is owned by an individual or legal entity and generates income from rental payments. The investment property may be held under a contract". Since IAS 40 explicitly applies only to land, building, or both which are held to earn capital appreciation, it is very clear why CC cannot be equated with investment property. On the other hand, "some entities may purchase CCs for themselves in order to earn income and increase the value of CC. But nevertheless, this cannot make them real estate, so the CC cannot be addressed by IAS 40" (Niftaliyev, 2023, p. 83). In particular, "the CC could be investment property acquired in the nature of transaction and any future gain or loss must be recorded in accordance with the IAS 40. It should be noted that some entities hold CCs for capital appreciation, but CCs are not property as specified in the definition of investment property. Therefore, it does not seem that CC is investment property" (Lapitkaia & Leahovcenco, 2020, p. 114).

2.1.6. Fair value issues

The provisions of IFRS 13 (SAAA, 2019, p. 370) may also be applied to transactions with CCs when other standards require or allow fair value valuations of specific items. Fair value can be applied in different situations, such as: inventories of CCs held by brokers and intermediary traders applying fair value less costs of sale, CCs recognized as intangible assets in cases where the revaluation model is used, disclosures about the fair value of CCs held on behalf of others, CCs acquired in business combinations, CCs held by investment funds and service charges paid in CCs (Leopold & Vollmann, 2019, p. 16). Shehada's (2020, p. 7) study showed that "fair value accounting is the most relevant source of useful information for users of financial statements when CCs are acquired for investment purposes".

2.2. Disclosure of Cryptocurrencies

CCs and related transactions are not subject to any specific disclosure requirements. In any case, entities should comply with all financial statement disclosure requirements in the standards they choose to apply to transactions involving CCs. The disclosure requirements are found in the aforementioned IAS 38, IAS 2, and IFRS 13. As CCs have very specific and complex characteristics, entities should consider whether additional disclosures are required beyond those covered by the aforementioned standards. Disclosures that may also be relevant in this case are (CPA Canada, 2018, p. 12; CPA Canada, 2019, p. 11):

- Description of CC, its characteristics and purpose of holding (e.g. whether the purpose of holding is investment or purchase of goods and services);
- The number of units of CCs that the entity owns at the end of the reporting year;
- The manner in which the accounting policy for CCs is established;
- The amount of the fair value of CCs together with the appropriate disclosures from IFRS 13 in the case of using the cost value model;
- Information about the market risk associated with holding CCs (e.g. historical volatility information).

Yatsyk (2018) highlights "the following disclosures:

- The balance sheet amount of virtual currencies held by the entity on its own behalf or of virtual currencies held by the virtual currency dealer held on behalf of its customers.
- For virtual currencies held by the entity on its own behalf, showing separately those with an active market and those without an active market, the quantity and amount of each type of virtual currency. Virtual currencies with immaterial balance sheet amounts can be aggregated.

Disclosures may be omitted if the balance sheet amount of virtual currencies (in the case of a virtual currency dealer, the total of virtual currencies held on its own behalf and virtual currencies held on behalf of its customers) is immaterial compared to the total assets of the entity" (Yatsyk, 2018, p. 9).

There is at least one other reason why entities should consider additional disclosures. Bearing in mind the goal of general purpose financial reporting, which forms the basis of the Conceptual Framework for Financial Reporting (SAAA, 2019, p. 4), the focus is on providing investors, lenders and other creditors with useful financial information about the entity before making decisions regarding the entity's financing. Entities should consider

materiality or importance of the information resulting from the CCs disclosure when determining the scope and type of disclosure. Prior to preparing notes to the financial statements, the entity's management should consider these principles and user requirements (Milutinović et al., 2020, p. 7).

3. CONCLUSION

Numerous factors have prevented the institutionalization of CCs. They include unregulated financial reporting of CCs, the unresolved tax treatment of transactions with CCs, the lack of legal-regulatory frameworks in many countries, as well as issues of origin, security, and (il)legal flows of CCs. Although international professional bodies have not yet adopted global guidelines, instructions, or directives on transactions with CCs, the existing IFRS framework, i.e. international accounting regulation, can be applied.

There is no agreement about a specific accounting model for CCs. IFRS permit certain CCs to be recognized as intangible assets or inventories, depending on the characteristics and purposes of their holding. In spite of this, CCs partially or completely fail to meet the provisions of financial reporting standards applicable to cash and cash equivalents, financial instruments, and investment property. CCs are most similar to intangible assets and in certain cases inventories, so the majority of entities in the world, which started recording transactions from the crypto market, applied the current financial reporting standards pertaining to intangible assets and inventories as a temporary solution. CCs that have an ascertainable market price can be measured either at cost or at fair value. As the more common CCs generally all have an active market, it is important to emphasize that this option or recognition decision may have a significant impact on a financial result of the entity. However, it should be noted that Accounting Standards Board of Japan in its issue *Accounting for Virtual Currencies* (from 2018) proposed to classify CCs as a new independent category of assets, giving the following argument: Virtual currencies did not fit into any of the existing categories. It is a new independent category of assets. A temporary solution would certainly be better than no accounting records and financial reporting on CCs until professional bodies adopt a specific set of entirely new standards for transactions with CCs.

Entities face the following challenges when recording transactions with CCs: the issue of accounting estimates, the issue of measuring CCs (fair value or cost value), unregulated legal nature of CCs, decentralized nature of CCs (without central bank management) and a lack of specific accounting and tax regulations. In view of the fact that this is a growing area of accounting that has yet to be fully developed, entities should pay close attention to developments in this field in order to ensure that their records and reporting of CCs are aligned with the expectations of investors, markets, regulatory bodies and the general public. This paper proposes accounting treatment of CCs for entities performing or planning to perform transactions on the crypto market.

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TRENDOVI I PERSPEKTIVE U PRIZNAVANJU KRIPTOVALUTA PREMA MEĐUNARODNOJ RAČUNOVODSTVENOJ REGULATIVI

Rad obrađuje temu računovodstvenog tretmana kriptovaluta prema Međunarodnim standardima finansijskog izveštavanja. U radu je prikazan trenutni korpus istraživanja u ovoj oblasti i rezimirane su najvažnije preporuke za dalja unapređenja računovodstvenog tretmana kriptovaluta. Rad prati proces sistematskog pregleda naučne i stručne literature i trenutno važećeg okvira za finansijsko izveštavanje. Glavna svrha pomenutog sistematskog pregleda jeste da se pozabavi pitanjem priznavanja kriptovaluta tražeći potvrdu i dokaze u dostupnoj literaturi i aktuelnom okviru za finansijsko izveštavanje. Nakon početne faze nagle ekspanzije, na kripto tržištu već celu jednu deceniju vlada veliko interesovanje investitora i pored velikog rizika i oscilacija u zaradi, što je pokrenulo pitanje regulacije kriptovaluta na institucionalnom nivou. Istraživačka namera rada ogleda se u izboru najprikladnijeg računovodstvenog tretmana priznavanja transakcija u kojima učestvuju kriptovalute u odnosu na postojeće Međunarodne standarde finansijskog izveštavanja, a u odsustvu namenske računovodstvene regulative.

Ključne reči: *priznavanje, transakcija, finansijsko izveštavanje, kripto tržište*.

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Book Review

ORGANIZATIONAL BEHAVIOUR AND LEADERSHIP: CHALLENGES OF THE DIGITAL AGE

Authors: Jamila Jaganjac and Jelena Lukić Nikolić

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Slavica Anđelić
Modern Business School, Belgrade, Republic of Serbia

ORCID iD: Slavica Anđelić https://orcid.org/0000-0003-4021-0822

Many definitions, concepts, methods, and practices in the functioning of organizations have changed as a result of the industrial revolutions, starting from the first to the current fifth industrial revolution. Technology has had a significant impact on the business and operation of every organization throughout history. The book *"Organizational Behaviour and Leadership: Challenges of the Digital Age"*, written by professors Jamila Jaganjac and Jelena Lukić Nikolić, is focused on the changes that have occurred in the digital age in the fields of organizational behaviour and leadership.

The book contains six logically structured chapters. A brief preface precedes each chapter, and at the end of each chapter, there are: a summary, key questions for testing knowledge, and a list of references. There is also a glossary of key terms at the end of the book.

The first chapter is devoted to organizational behaviour and the effects of digital technologies on the process of organizational digital transformation. An organization's digital transformation involves the integration of internal and external resources via information and communication technologies in order to reshape the corporate vision, strategy, organizational structure, processes, capabilities, and culture in order to adapt to the changing digital world.

The second chapter points out modern organizational structure typologies that arose as a result of work process automation and digitalization. Modern organizational structures aim to connect independent partners, adapt more quickly to changes in the environment, increase operational efficiency, and encourage innovation.

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Corresponding author: Slavica Anđelić
Modern Business School, Terazije 27, 11000 Belgrade, Republic of Serbia | E-mail: slavicaandjel@gmail.com

The third chapter is focused on leadership theories and styles suitable for digital age. The key conclusion of this chapter is that analysis of leadership styles identifies the style that best stimulates innovation, which is critical for successful business in the digital age.

The fourth chapter is devoted to human resource management, which is also undergoing significant changes as a result of the digitalization and digital transformation processes. All organizations must be prepared in order to achieve organizational and individual goals through the use of tangible and intangible motivational techniques. Changes in the digital age are primarily aimed at increasing employee knowledge, designing work, and adapting to hybrid work models.

The fifth chapter is entirely dedicated to communication and conflict in the digital age. This chapter highlights the most significant changes in business communication due to modern digital information and communication technologies. New types of communication channels are discussed, along with their key characteristics, benefits, and potential negative effects. Conflicts and their key characteristics are also presented, as well as the specifics of conflict situations in the digital age.

The sixth chapter summarizes organizational challenges in the digital age. These difficulties are primarily associated with changes in the nature of jobs and careers. This chapter discusses the role of human resources experts, job insecurity, work-life balance, and the need of employees to acquire multidisciplinary knowledge and skills that are suitable for the digital age.

The book is written according to a format that corresponds to good practices in academic sphere, with numerous tables and figures, and impressive list of references. In comparison to other books in this field, the book takes a fresh and novel approach. Aside from the theoretical foundation, the book includes numerous examples from practice that can be useful for leaders, managers, entrepreneurs, and every individual interested in organizational behaviour and leadership.

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