ISSN (online) 2029-8501

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Vilnius
2020

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CONTENT

THREE DIMENSIONS OF HUMAN CAPITAL: QUALITY, QUANTITY & VALUES, AND ITS IMPACT ON THE ECONOMY IN EUROPEAN COUNTRIES

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Abstract of presentation

The aim of the research was to propose a new concept of human capital considering constantly changing economic structure and source of added value creation. As well it was aiming to empirically apply this concept to European countries. The conducted theoretical and empirical research has shown that the proposed new concept of human capital has a place to be. Three dimensions of human capital such as quality, quantity and value have different impacts on the creative economy. The research revealed that value of human capital is the most important component among three others. The values of human capital implies very close statistical interconnections with qualitative dimensions. As a modern economy is characterized as knowledge intensive, that is to say that open, more trusted, tolerant, culturally diverse societies create preconditions for a rise for creative culture which is a source for technology and innovation creation and adaptation in the economy.

Keywords: human capital, culture, quality, quantity, value, creative economy, innovation, technology.

TENDENCIES OF THE ONLINE GAMBLING SECTOR BEFORE AND DURING COVID-19 IN LITHUANIA

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Abstract of presentation

Presentation background. Most of the scientific literature still continues to focus on the regulation and evaluation of land-based gambling sector, however online gambling are becoming the prevailing choice between gamblers (Fiedler, 2018). During quarantine in Lithuania while all land-based gambling establishments were closed online gambling has become the only legal way to gamble in Lithuania.

Purpose of the presentation: This presentation discuss the tendencies of the online gambling sector in Lithuania. The object of this presentation is online gambling sector. The objective of this presentation is to review the changes of online gambling sector activity before and during COVID-19 in Lithuania. First of all, the specifics of the online gambling sector in Lithuania are discussed. Secondly, changes of gambling gross revenue in the online gambling before and during COVID-19 in Lithuania are analyzed.

Methods: The following methods are used: comparative analysis of scientific literature and legal acts, analysis of statistical data.

Findings & Value added: The analysis showed how quickly popularity of online gambling services in Lithuania is growing comparing to the previous years and land-based gambling sector. Also analysis revealed that online gambling sector didn't take over all of the potential revenue from land-based gambling sector during COVID-19.

DNR plan for Future Economy in Lithuania and Opportunities for Educational Institutions

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Abstract of presentation

Research background: Taking into account the worldwide situation due to pandemic, countries take different kinds of financial measures in order to strengthen their economic situation. The economic scenario in Lithuania was reviewed and a DNA plan for the Future Economy was created in order to improve the economic situation. This research paper presents the long-term financial measures for the economics in Lithuania and opportunities for education institutions to participate in this field of public investment.

Purpose of the article: In this article the DNA Plan for the Future Economy in Lithuania is analyzed, and the first priority of the DNA plan – "*Human Capital*" is under consideration. The main Law Regulations on implementation of the DNA plan for Future Economy in Lithuania, responsible institutions and action developers are analyzed. Moreover, the opportunities of educational institutions to participate in this kind of investment are under considerations.

Methods: systemic analysis, review and generalization of the newest scientific researches and legal regulations.

Findings & Value added: The analysis shows that the DNR Plan for the Future Economy in Lithuania has a possibility to have a positive effect, however, this depends in part on the efficiency and effectiveness of the activities of administrative entities. The administrative authorities should cooperate actively to ensure the proper implementation of the DNA plan.

IMPACT OF FINANCIAL DERIVATIVES ON SYSTEMIC RISK

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Abstract. Financial derivatives are a fast-growing area of financial instruments. They take a very important place among other financial products, because not just their value depends on underlying assets, but they are also used in many other financial products. Scientists observe, that financial derivatives are beneficial to country's economy but at the same time pose many risks, which increase country's systemic risk. It can be noticed, that financial derivatives were highly criticized after 2008 global financial crises, and it became very important to assess their impact on country's systemic risk. However, no scientific analysis has been performed so far to asses and justify theoretical impact of financial derivatives on the country's systemic risk. This research analyses scientific literature and theoretical insights are provided regarding the impact of financial derivatives on country's systemic risk.

Keywords: Derivatives, Systemic risk, Factors of derivatives impact on systemic risk

JEL classification:

G01 – Financial Crises

G15 – International Financial Markets

G19 – Other

G23 – Non-bank Financial Institutions, Financial Instruments, Institutional Investors

O16 – Financial Markets, Saving and Capital Investment, Corporate Finance and Governance

Introduction

Financial derivatives are a fast-growing area of financial instruments. Their growth over the last few decades has been staggering. However, research by most scientists reveals that financial derivatives are not only beneficial to the economy, but also pose a systemic risk that has been widely discussed among scientists since the 2008 global financial crisis.

The study conducted by Irena Mačerinskienė et al. (2015) identified factors that could be used to assess the impact of financial products on a country's systemic risk. However, it should be noted that despite the identified factors for assessing the impact of financial products on systemic risk, no scientific analysis has been performed so far to asses and justify theoretical impact of financial derivatives on the country's systemic risk.

Thus, the expected problem of the research is: what is the importance of financial derivatives for the country's systemic risk? The object of the research is the impact of financial derivatives on the country's systemic risk. The aim of the research is to analyse the scientific literature and justify the impact of financial derivatives on the country's systemic risk.

Objectives of the research:

1. To analyse scientific literature regarding the factors, which are studied by scientists when assessing country's systemic risk;
2. To justify the impact of financial derivatives on the country's systemic risk via the identified factors, which impact country's systemic risk.

Methodology of the research:

1. Analysis of scientific literature;
2. Theoretical analysis and generalization.

1. Market Size Factor of Financial Derivatives

As revealed in the research of Irena Mačerinskienė et al. (2015), the impact of financial products on the country's systemic risk can be assessed via six identified key factors. This suggests that it is necessary to evaluate the theoretical basis of these factors and the country's systemic risk and to provide theoretical insights regarding the impact of financial derivatives on the country's systemic risk via those six factors.

The market of financial derivatives is one of the largest markets of financial products in the world. Data from the Bank for International Settlements and the World Bank show that the market of financial derivatives is significantly larger than that of debt and equity securities.

According to scientists, the "size" factor is an important systemic risk factor when assessing the country's systemic risk. Luc Laeven et al. (2016) found that systemic risk increases with the

increase of bank size. The study conducted by Olivier De Jonghe et al. (2015) showed that bank size influences the impact of non-interest income on systemic risk: for large banks, non-interest income reduces systemic risk, while for small ones, on the contrary, it increases systemic risk. The results of the study by John Sedunov (2016) show that important factors of systemic risk are size, securitization, and foreign asset trading. Sergio Rubens Stancato de Souza et al. (2016) conclude that in Brazil, medium-sized banks have a greater impact on systemic risk and small and large-sized banks have a correspondingly smaller impact. Benjamin M. Tabak et al. (2013) emphasize that an uneven banking market in terms of bank size is detrimental to the performance of smaller banks and reduces the stability of the entire system.

The analysis of scientific literature shows that size has various impact on systemic risk. This factor is usually analysed in terms of financial institution size. However, in terms of financial derivatives, the best equivalent of financial institution size would be the market size of financial derivatives. According to the authors of this research, it should be emphasized that financial derivatives are one of the channels through which financial institutions establish interconnections in the financial system: one financial institution buys financial derivative, another sells it. The larger the market of a financial instrument, the more various financial institutions depend on that financial instrument, its price fluctuations, market stability. An assessment of the balance sheet of the financial statements of an individual financial institution may provide information about the extent to which a particular financial institution is dependent on a financial product. However, the overall market size of a financial instrument indicates the extent to which the entire financial system is dependent on the financial product.

Furthermore, closely related to the size factor is diversification, which is widely analysed by many scientists. Diversification, as observed by Paolo Tasca et al. (2014), Louis Raffestin (2014), Hsiu-Chuan Lee et al. (2016) and many other scientists, is often beneficial to the financial system as it helps to reduce risk, increase profits, and control cash flows more successfully. The more financial products that exist in the financial system, the more opportunities for diversification. However, when financial markets are focused on a few financial products, the diversification effect diminishes. Meanwhile, with excessive diversification, most market participants begin to hold similar assets in their portfolios, leading to increased systemic risk.

In summary, if the market of financial instruments is perfect, it would consist of many different financial products. Similarly to perfectly competitive market, such a market of financial products would provide significant benefits of the diversification effect, because market participants would be able to choose from a wide range of financial instruments. However, in a market of financial instruments, it is also important that the correlation between different financial products is different. If there are many financial products in the market and the prices of all move in a similar way

(correlation close to 1), then the diversification effect decreases. A similar thing happened during the financial crisis of 2008, when market participants started selling various financial instruments and their price changes became more similar. According to the authors of this research, the market size of a financial instrument, correlation between different financial instruments and systemic risk can be described as in Figure 1.

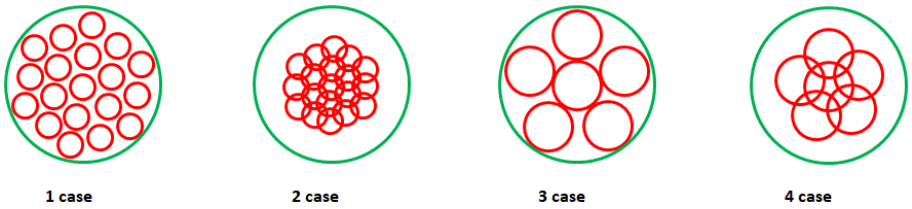

Figure 1. Market size of financial instruments and correlation impact on systemic risk

Each case in Figure 1 can be described as the following:

1. If the market of financial products is perfect, then existing different correlations between products decrease systemic risk;
2. If the market of financial products is perfect, then similarly fluctuating prices of products increase systemic risk;
3. If the market of financial products is concentrated, then existing different correlations between products decrease systemic risk;
4. If the market of financial products is concentrated, then similarly fluctuating prices of products increase systemic risk.

In the first case of market size and correlation impact on systemic risk, there systemic risk should be lower than in the third case, because market participants would be able to choose from a wide range of financial instruments. Thus in a perfect market of financial products, in the event of a financial shock, the impact on the financial system would be small. Meanwhile, in a concentrated market, a large proportion of market participants would have a concentrated financial instrument as an asset, which would transmit a financial shock to a large number of market participants and have a more significant impact on the financial system.

In the second case, there systemic risk should be lower than in the fourth case. Although asset prices would move similarly in both situations, in a perfect market of financial products, market participants would be able to choose from a wide range of financial instruments. Possibly some market participants would not hold all financial instruments, but only a part of all existing products. Scientists note that the financial shock is gradually being absorbed by market participants, in other words, the impact of the spreading shock is gradually diminishing. Accordingly, a shock would spread among many financial instruments and fade faster than in a concentrated market (fourth case). In a

concentrated market, a large proportion of market participants would also have a concentrated financial product as an asset, which would transmit a financial shock to a large number of market participants. Due to the slower absorption of the impact of the financial shock and similar movements in the prices of financial instruments, a financial shock would have a more significant impact on the financial system in a concentrated market.

It should be noted that, according to the authors of this research, the market of financial derivatives is significantly large, so the current market of financial products is not perfect. It is clear that the monitoring of financial derivatives in such a market is important and necessary and that the assessment of systemic risk should consider such market concentration.

2. Interconnections With Other Financial Instruments Factor of Financial Derivatives

The "linkage" or "interconnections" factor is quite often studied by scientists in assessing the country's systemic risk, but there is no clear consensus on the impact of this factor on systemic risk among scientists. Frank Betz et al. (2016) emphasized that the financial crisis of 2008 was influenced by such factors as contractual relations between market participants, counterparty risk, and the consequences of price changes. The study conducted by Ramaprasad Bhar et al. (2013) shows that fluctuating interconnections have been observed between financial sectors of France, Germany, the United Kingdom and the United States in the short term, and there have been constant interconnections between the German and the United States financial sectors in the long term. Georgios Magkonis et al. (2016) conclude that interconnections exist between financial and fiscal sectors and these interconnections have recently increased. Shauhrat S. Chopra et al. (2015) note that individual sectors in the United States, such as energy supply, telecommunications, transportation, are highly interdependent and disruptions in one sector can have serious consequences for the entire economy, affecting sectors that are directly and indirectly related to a sector in difficulty. Aymen Ben Rejeb et al. (2016) found that interconnections strengthen in the presence of bull markets in financial market and weaken in the presence of bear markets.

The analysis of scientific literature shows that majority of scientists emphasize the importance of interconnections factor for systemic risk. Scientists usually analyse this factor in terms of interconnections between different countries, markets, sectors, companies. As mentioned earlier, market of financial derivatives is significantly large. The value of financial derivatives depends on other basic assets, and at the same time financial derivatives are used in various other financial products. This means that financial derivatives are significantly connected to various financial products. So having this in mind, according to the authors of this research, interconnections factor in financial derivatives can be examined by analysing the structure of the market of financial instruments.

Before our era, then currency and coins were created. State-guaranteed paper money was created in China in 1024. The first stock exchange was established in Amsterdam, in which shares were traded, in 1602. An investment fund was established in the Netherlands in 1774. Inflation-linked bonds were created in Massachusetts in 1780. The securitization of the United States real estate loans began in 1970. An exchange traded fund (ETF) was established in Canada in 1989. The origins of financial derivatives are found before our era, but they began to develop most rapidly in the 19th and 20th centuries. Nowadays newer and more sophisticated financial instruments, structured products, etc. are being developed. Noting such development of financial products, the authors of this research would like to draw attention to a fundamental trend in the development of financial instruments – newly created financial instruments are more complex derivatives of existing financial instruments / assets. This trend can be illustrated as in Figure 2.

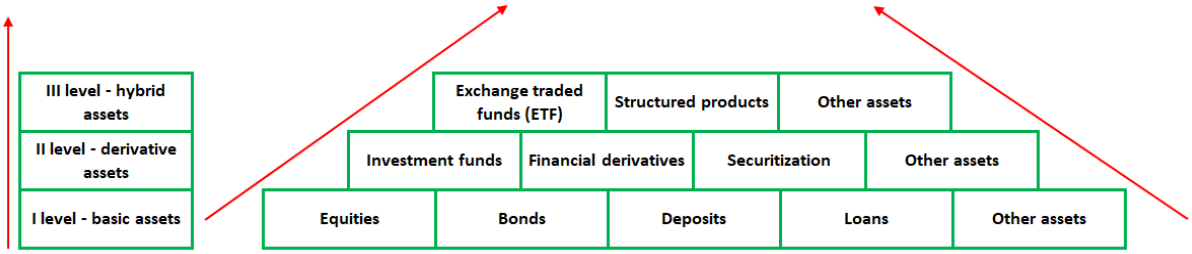

Figure 2. Market structure of financial products

Level 1 in Figure 2 shows the underlying assets, which are assets whose value depends on their own price fluctuations, demand / supply. Level II shows derivative assets, the value of which depends on the price fluctuations of the underlying assets. Level III shows hybrid assets, the value of which may depend not only on fluctuations in the prices of the underlying assets, but also on fluctuations in the prices of derivative assets. There is a clear trend in the development of financial instruments – it's not new basic products that are being developed, but derivatives based on basic products. In this way, a pyramid of financial instruments is created. Intuitively, such a structure of financial instruments is not stable, because when any underlying asset collapses, the whole pyramid of financial instruments collapses. Due to a similar situation, the global financial crisis of 2008 had significant negative consequences for the global financial system. As the real estate prices in the United States began to decline, the value of financial instruments linked to those prices also began to decline. The sale of linked financial instruments was launched and, due to the interrelationships between the financial instruments, such sales also had a negative impact on the prices of other assets. Then prices of many assets began to fall, and the long-standing negative historical correlation between some assets suddenly increased and became a positive correlation.

Obviously, for the market structure of financial products to be stable, new underlying assets

should be created. This in turn would increase the benefits of diversification. Financial derivatives are at level II in Figure 2. Therefore, in terms of interconnections, in order to assess the impact of financial derivatives on systemic risk, it is important to assess the links between financial derivatives and other assets, both underlying and hybrid assets.

3. Leverage Factor of Financial Derivatives

Another important factor, which is often analysed by various scientists, for assessing systemic risk is "leverage". The study conducted by Sanjai Bhagat et al. (2015) showed that financial institutions took on more risk by increasing leverage between 2002 and 2012. Such behaviour by banks contributes to less stability in the financial system, as, according to various scientists, high leverage can significantly worsen the situation of any company in times of economic difficulties. Christopher Bierth (2015) concluded that systemic risk is low in the global insurance sector, and the main systemic risk factor in the insurance sector is leverage of policyholders. Tarik Roukny et al. (2018) found that leverage increases uncertainty in both the interbank market and the external assets market. S. Thurner (2011) demonstrated that higher leverage leads to increased price variability in financial markets, which in turn increases risk. In addition, small random events, that do not normally cause damage at low leverage, can have a strong impact on the entire system at high leverage.

The analysis of scientific literature shows that leverage factor is usually considered as having negative impact on systemic risk and is usually analysed in terms of financial institution leverage, which is called financial leverage in microeconomics. However, leverage is also sometimes analysed in financial markets as a credit to supplement speculative investments. In terms of financial derivatives, the best equivalent of leverage would be the "leverage as a credit to supplement speculative investments". Financial derivatives enable market participants to acquire large amounts of assets for a sum of several or tens of times less than the value of the assets being acquired. Considering observations made by S. Thurner (2011), "leverage" factor of financial derivatives has two features: a) the multiplier and b) the speculative (see Figure 3).

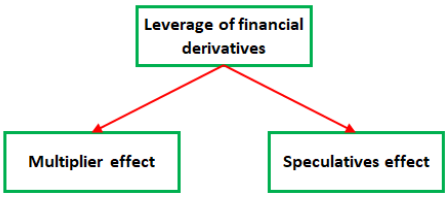

Figure 3. Impact of leverage of financial derivatives on financial system

The first feature of leverage encourages money creation, much like the multiplier effect in the financial system. In this way leverage creates additional demand / supply in assets markets and encourages price variability. For the second feature of leverage the nominal value, for which the

financial derivative allows to execute (buy / sell) the transaction in relation to the underlying asset, of the financial derivative becomes very important. Despite the fact that a large proportion of financial derivatives are settled in cash rather than by delivery of the underlying asset, it is the nominal value that indicates the amount of the underlying asset of the transaction. If financial derivatives were used only for risk management, the nominal value of financial derivatives should not exceed the value of the underlying assets existing in the market. However, according to BIS data, the value of financial derivatives is significantly higher than the value of underlying assets. Such a situation is speculative. According to various scientists, speculation destabilizes the financial system by raising asset prices too much during good times and by dropping prices too much during bad times. Therefore, the leverage of financial derivatives and the ability to settle without delivering the underlying asset creates favourable conditions for market participants to use financial derivatives for speculative purposes, which in turn inflates asset prices and increases their variability, in other words, systemic risk increases.

4. Market Liquidity Factor of Financial Derivatives

The analysis of scientific literature shows that "liquidity" factor is usually analysed both from microeconomics and macroeconomics aspects. In the first case liquidity is examined in terms of companies', financial institutions' liquidity. In the second case liquidity is examined in terms of individual financial products or overall market of financial products liquidity. Giovanni Dell'Ariccia et al. (2014) observed that the 2008 crisis may have been triggered by low interest rates and the high level of asset liquidity that existed at the time, prompting financial institutions to take excessive risks, thereby increasing asset prices and leverage in the financial system. Eleonora Iachini et al (2016) also highlighted that the financial crisis of 2008 revealed how market liquidity can suddenly decline. Liquidity changes over time for both individual securities and the overall securities market. Andreas A. Jobst (2014) also noted that funding decisions by individual banks can have a direct impact on the vulnerability of other banks. When a financial institution faces financial difficulties, it has to sell its assets or avoid taking on too much risk. In this case, the prices of the assets may start to fall or their liquidity may decrease, which will also affect other market participants related to the bank in financial difficulties or related to the capital markets in which such a bank is trading.

Viral V. Acharya et al (2016) described the relationship between leverage and liquidity, arguing that leverage helps to increase liquidity, provides an opportunity to choose better assets. But on the other hand, scientists agree that high leverage makes the financial system fragile. At this point, the authors of this research would like to object to Viral V. Acharya et al (2016) opinion on the relation between leverage and liquidity. According to the authors of this research, greater leverage in the financial system creates the impression of a larger amount of money, but the existence of leverage

does not increase the actual amount of money and any other assets. As a result, greater liquidity and leverage would only lead to higher asset prices. It is intuitive that such a situation creates the impression of greater liquidity, but does not increase actual liquidity, so the authors do not agree that it is fair to assume that liquidity driven by leverage benefits the financial system.

Mabrouk Chouchène et al (2017) investigate the spread of liquidity shocks, by focusing their research on interbank lending during the 2008 financial crisis in the French state. The scientists have found that the interbank deposit channel plays an important role in transmitting liquidity shocks in the banking system. Scientists' research shows that the impact of liquidity factor can affect systemic risk via one of the many possible channels – the interbank lending market. Considering analysed scientific literature, in terms of financial derivatives, the best equivalent of liquidity would be overall market of financial derivatives liquidity. Financial derivatives are different market of financial products, and similarly to interbank lending market, liquidity shocks via financial derivatives market should also affect systemic risk.

The market of financial derivatives is large in size, and takes up a large share of financial products markets, so a sharp drop in liquidity could have a significant impact on most global financial institutions or other market participants. And due to the existing leverage feature in financial derivatives, a lack of liquidity can lead to a sharp drop in the prices of various other financial products.

5. Market Volatility Factor of Financial Derivatives

The analysis of scientific literature shows that "volatility" factor is usually analysed from macroeconomics aspect. In their analysis, scientists analyse price volatility of individual financial products. As noted by various scientists, price volatility is higher for those assets that have leverage, longer maturity, or options. Inchang Hwang et al. (2017) examine volatility in relation to hedge fund returns. Their results suggest that hedge funds with higher systemic risk yield higher returns. Elyas Elyasiani et al. (2017) also investigate hedge funds. The scientists observe that hedge fund volatility shocks have side effects on other hedge funds, major banks, and major asset classes. In their study, Massimiliano Caporin et al (2017) propose a three-factor model composed of a constant factor that reflects long-term volatility; a short-term factor that reflects the temporary component of the volatility index; the volatility jump factor that determines the distribution of volatility in the right tail of the frequency distribution graph. Their study shows that the likelihood of volatility jumps increases dramatically during financial crises.

Hayette Gatfaoui (2013) found that during the crisis in the United States real estate market, the overall level of volatility increased, as did the likelihood that volatility would be passed on to other regions. According to the scientist, the process of transmitting volatility shocks takes place simultaneously in all financial markets. Lucia Baldi et al. (2016) analysed the spread of volatility

between agricultural commodity and stock markets and concluded that the spread of volatility increased sharply after the 2008 global financial crisis. According to scientists, this demonstrates the growing interdependence between financial and agricultural commodity markets. Scientists often agree that volatility has a significant impact on systemic risk, especially in cases where leverage is high, because even small fluctuations in such an environment could cause significant damage.

According to the authors of this research, the impact of volatility on systemic risk is quite evident – larger fluctuations increase risk and uncertainty in the financial system, which in turn increases systemic risk. In terms of financial derivatives, as already mentioned, the market is significantly large. Price fluctuations in such large market can affect a large number of market participants. If losses were to be incurred in such a market, many market participants would suffer. In conclusion, it is important to emphasize once again that the volatility of financial derivatives is an important factor in the context of other factors, and that high volatility can have a significant impact on most global financial institutions or other market participants.

6. Complexity Factor of Financial Derivatives

The analysis of scientific literature shows, that scientists often find that the financial system can be seen as a complex system and financial products as increasingly complex and difficult for other market participants to understand. As Mariolia Kozubovska (2017) observes, financial products have become so complex that an investor would have to read about 200 pages to understand the characteristics of real estate bond securities and understand how they work. An investor, who wants to understand components of asset backed securities, would need to read over one million pages. This, according to the scientist, automatically explains the challenges required to fully understand the complexity of structured products.

Jing Ma et al. (2019) found that the financial system is so complex that the model of heterogeneous interbank network and overlapping portfolios developed by the scientists cannot fully reflect the complexity of the system. Prasanna Gai et al. (2011) in their study demonstrate how greater complexity in the financial system can increase the vulnerability of the financial system. Akhigbe et al. (2018) conclude that it is difficult for investors to understand the impact of the use of bank interest rates on financial derivatives on future cash flows. Kaeck et al. (2020) note that the most successful pricing models for VIX financial derivatives are highly complex.

In terms of financial derivatives, these financial products are considered as highly complex. It is difficult to understand how they work, difficult to calculate their value (many financial derivatives require highly complex calculations to find their price) and to read their legal material, which consists of many pages. In conclusion, it is important to emphasize that the analysis of complexity in research is still not very advanced, as it is quite complex to assess “complexity” and

its impact on systemic risk. There is no consensus among scientists as to whether higher complexity really increases systemic risk, but many scientists usually follow such point of view. Nevertheless, all scientists agree that complexity has a significant impact on systemic risk.

Conclusions

Analysis of the scientific literature and provided theoretical insights regarding impact of financial derivatives on the country's systemic risk have shown that financial derivatives are highly interconnected to other financial products. The value of financial instruments is calculated on the basis of the underlying assets. In addition, financial derivatives are used in other financial products, which creates the pyramid of financial products. Such market structure of financial products should be vulnerable and pose high systemic risk. The impact of the size factor of financial derivatives on the country's systemic risk could be best described via the concentration of financial products. The leverage impact of financial derivatives affects systemic risk via multiplier and a speculative features. The liquidity and volatility impact of financial derivatives affects systemic risk via the change in liquidity of financial derivatives market and the change in financial derivatives values. The impact of the complexity factor of financial derivatives on the country's systemic risk could be best described via the limited ability of market participants to properly understand and evaluate these financial instruments.

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APPROACHING BUSINESS SYSTEMS THROUGH THE LENS OF KNOWLEDGE MANAGEMENT TECHNOLOGIES

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Abstract. Any business system is designed to achieve the business strategy. It can be reached by connecting all an organization's parts and processes to work together effectively and efficiently. Knowledge management technologies can facilitate it to a great extent. These technologies are essential for contemporary organizations to become and grow successfully in the marketplace. However, the level at which organization applies these technologies varies. The approach on how to analyze business systems from knowledge management technologies perspective is essential because of the rapid change of the business environment in which effective and efficient business strategy seeks to be implemented. Knowledge management technologies are enablers to simplify knowledge identification; acquisition of knowledge; knowledge development; knowledge sharing and dissemination; use of knowledge; knowledge preservation, and others. There are endless cycles of information transfer. Knowledge management processes ensure the smooth transfer and use of knowledge in organizations. The paper aims to present the approach to valuing business systems from knowledge management technologies perspective. As the term knowledge management technologies is complex and confusing, first based on a literature review, the analysis of how to classify those technologies is performed. The business system is analyzed from a socio-technical system perspective and approach to valuing it is presented. The paper contributes with these findings: 1) provides the results of scientific analysis on approaches how to classify knowledge management technologies, 2) determines an approach to valuing business systems from knowledge management technologies perspective consisting of five-level maturity construct. Based on the approach in the future, the evaluation methodology will be constructed. As the paper provides the theoretical background of the business system evaluation strategy from knowledge management technologies perspective, the future work will incorporate the development of the method for practical applications.

Keywords: business systems, technologies, knowledge management, evaluation, criteria.

INTRODUCTION

Business systems can be seen and analyzed from different perspectives. The perspective taken on it depends on the field of science, level of abstraction, others point of view. Despite the huge variety of approaches to the business systems, the common agreement among scientist and practicum is that any business system is designed to achieve the business strategy and it can be reached by connecting all an organization's parts and processes to work together effectively and efficiently. Knowledge management technologies can facilitate it to a great extent. However, by valuing business performance, the role of knowledge management technologies must be considered as well. With the aim of this paper, a business system is interpreted as an abstraction of a company from a socio-technic system perspective, which consists of technology, people, resources and processes (Töhönen et al., 2020) with the extension to business strategy (Malhotra, 2005).

Knowledge management (KM) is a broad and complex term. Although KM has a lot of advantages and disadvantages at the same time, still organizations demonstrate a growing interest in KM since they have recognized that effective application of knowledge assets and resources make them more innovative, enable them to meet customers' demands and to help them survive in an ever-growing competitive economy (Hashemi et al., 2018). However, approaches proposed decades ago in the scientific literature are no longer satisfied with today's organizations, because of significant changes, ever-increasing competition, a lack of skilled knowledge workers and other challenges inherent in today's economy that are forcing a change in attitudes towards KM (North & Kumta, 2018). In contemporary organization KM is analyzed in various deeper sections by assessing individual activities, processes, influences and performance for different organizations by identifying specific spheres of influence depending on the type of organization and activities (Alrubaiee, L., Alzubi, H. M., Hanandeh, R., & Ali, 2015).

KM today is integral to information technologies. New technologies are accelerating KM processes and increasing their power. This interface shapes a new approach to KM in an organization. It amends a paradigm of KM: "Organizations that want to make knowledge transfer and communication, both external and internal, as smooth, and convenient as possible use technology because technology is the way the organization connects and helps to reach great to a good performance of the business system. Since KM technologies are always used in the context of KM initiatives, if those initiatives support a knowledge strategy, then the technologies have strategic value" (Saito et al., 2007).

Technologies for KM or knowledge management technologies (KMT) are a broad category of research issues on KM. Therefore, technologies and applications of KM are attracting much attention and

efforts, both academic and practical (Hashemi et al., 2018; Liao, 2003; Saito et al., 2007). KMT are presented from various aspects. However, there is no comprehensive framework that has a consolidated approach covering all the factors in KM technologies' classification (Hashemi et al., 2018). Although there are several attempts to provide evaluation strategy of KMT (Centobelli et al., 2017), still theoretical basis of business system value evaluation in the perspective of KMT is scattered, and even more evaluation practices are missing. This paper takes a goal and presents an approach to value business systems from knowledge management technologies perspective. The paper provides the theoretical background of the business system evaluation strategy from knowledge management technologies perspective, and the future work will incorporate the development of the method for practical applications.

The purpose of the scholarly analysis – to provide the results of scientific analysis on approaches on how to classify knowledge management technologies and represents the approach to valuing business systems from knowledge management technologies perspective.

Research object – knowledge management technologies within the business system.

Applied methods – scientific literature analysis.

The remainder of this paper is organized as follows: Section I reviews the concepts of business systems and knowledge management; knowledge management technologies for business systems management; Section II describes methodological approach how to value business systems from knowledge management technologies perspective and determines five-level concept for classification; Section III presents conclusions.

I. BACKGROUND

1.1 CONCEPTS OF BUSINESS SYSTEMS AND KNOWLEDGE MANAGEMENT

There are different approaches to the business system. In business terminology, a *business system* refers to the value-added chain, which describes the value-added process, meaning the supply of goods and services. A business can span one or several business systems[1]. The perspective taken on the business system depends on the field of science, e.g. economic, psychology, system engineering, level of abstraction, e.g. system, subsystem, or another viewpoint. For example, (Witt et al., 2018) defines it from an economic perspective and distinguish all business systems into nine types: Highly Coordinated, Coordinated Market, Liberal Market, European Peripheral, Advanced Emerging, Advanced City, Arab Oil-Based, Emerging, and Socialist Economies. From the systems engineering point of view, the definition

[1] https://sourcemaking.com/uml/modeling-business-systems/business-processes-and-business-systems

is given by (Souchkov, 2015): “A business system consists of several components and interactions between them. It also involves various interactions with its supersystem. Key system and supersystem components and interactions can be presented by a business model which provides a unified framework to model a large diversity of business systems, value creation chains and network. A business system deploys some business processes and activities which add value after each activity in each business process. Today most business systems operate based on business processes which clearly define various aspects of a business system functioning and behaviour. A modern business system possesses a well-defined structure and well-described relationships between its internal parts and their external system: a supersystem”. Others define the business system as an abstraction for a focal company enclosing a specific IT system (Töhönen et al., 2020). A business system can be seen as well as a socio-technical system, consisting of technology, people, resources and processes (Töhönen et al., 2020). The latter approach enables to analyze the business system in a structured manner by taking into account main components of the system because according to (Souchkov, 2015) “business systems operate with people and therefore they have different principles of evolution rather than technical systems”. Any business system is designed to connect all of an organization’s intricate parts and interrelated steps to work together for the achievement of the business strategy (Hashemi et al., 2018). The competitive necessities for companies today are to develop capabilities that are deeply embedded into functions, operations and business decisions (North & Kumta, 2018). In this paper business system is interpreted as an abstraction of a company as a socio-technic system, which consists of technology, people, resources and processes (Töhönen et al., 2020) with the extension to business strategy to incorporate in KM strategy-pull model according to (Malhotra, 2005).

Organizations demonstrate a growing interest in KM since they have recognized that effective application of knowledge assets and resources make them more innovative, enable them to meet customers’ demands and to help them survive in an ever-growing competitive economy (Hashemi et al., 2018). All businesses have access to an extensive pool of knowledge - whether this is their understanding of customers' needs and the business environment or the skills and experience of staff. The way a business gathers, shares and exploits this knowledge can be central to its ability to thrive. It does not just apply to huge multinational companies. Knowledge management can benefit everyone from a local newsstand to a manufacturing firm[2]. KM is not a new topic to organizations (Gao et al., 2003). However, approaches proposed decades ago in the scientific literature (Liao, 2003; Rao, 2005) are no longer satisfied with

[2] https://www.infoentrepreneurs.org/en/guides/importance-of-knowledge-to-a-growing-business/

today's organizations, because of significant changes, ever-increasing competition, a lack of skilled knowledge workers and other challenges inherent in today's economy that are forcing a change in attitudes towards knowledge management (North & Kumta, 2018). In contemporary organization knowledge management is analyzed in various deeper sections by assessing individual activities, processes, influences and performance for different organizations by identifying specific spheres of influence depending on the type of organization and activities (Alrubaiee, L., Alzubi, H. M., Hanandeh, R., & Ali, 2015). Moreover, (Saito et al., 2007) found out that there are different approaches to KM strategy: KM strategy as an approach to KM (reflects the diversity of perspectives presented in the field and the lack of consensual models), KM strategy as knowledge strategy (links KM to business strategy), KM strategy as KM implementation strategy (applies mainly to the executives and managers responsible for the KM function or KM programs in an organization). The latter approach helps to identify the establishment of evaluation criteria of KMT.

Knowledge management today is integral to information technologies. New technologies are accelerating knowledge management processes and increasing their power. This interface shapes a new approach to knowledge management in an organization and amends a paradigm of knowledge management. Knowledge management (KM) may simply be defined as doing what is needed to get the most out of knowledge resources (North & Kumta, 2018). (Sabherwal et al., 2014) defines KM as performing the activities involved in discovering, capturing, sharing, and applying knowledge to enhance, in a cost-effective fashion, the impact of knowledge on the unit’s goal achievement. The review of KM processes shows that there are as many frameworks of KM life cycles or processes as authors (Shongwe, 2016). Organizations still demonstrate a growing interest in KM since they have recognized that practical application of knowledge assets and resources make them more innovative, enable them to meet customers' demands and to help them survive in an ever-growing competitive economy (Hashemi et al., 2018). (Malhotra, 2005) researched and concluded with two approaches how KM is approached within organization: technology-push or strategy-pull model of KM. The author concludes that, in contrary to the technology-push model of KM, strategy-pull model business performance not as the residual but as the prime driver of information utilization as well as IT-deployment. The key emphasis is on strategic execution for driving selection and adaptation of processes and carefully selected technologies (Malhotra, 2005). Therefore, the methodology valuing business systems from knowledge management technologies perspective takes an important place.

1.2 APPROACHES TO KNOWLEDGE MANAGEMENT TECHNOLOGIES

Technologies that can support KM or KM technologies are presented from various aspects. However, there is no comprehensive framework that has a consolidated approach covering all the factors in KM technologies' classification (Hashemi et al., 2018). Table 1 provides systemized approaches to KMT.

Table 1. Approaches to knowledge management technologies

Approach	**Authors**
From the viewpoint of KM processes	(Antonova et al., 2006; Sabherwal et al., 2014)(Hashemi et al., 2018)
From the viewpoint of KM system architecture	(Maier, 2007)
From their relationship with KM strategies	(Saito et al., 2007)
From the viewpoint of types of knowledge	(Maier, 2007)
From the viewpoint of the functionality of KMS	(Maier, 2007)
Supporting KM/Managerial KMT	(Centobelli et al., 2017; North & Kumta, 2018; Rao, 2005)

The usual approach is to associate KMT with knowledge management processes, e.g. creation, storage and retrieval, transfer, and application (Antonova et al., 2006); or socialization, externalization, combination, and internalization, but the processes identified vary widely, hindering a more general understanding. Knowledge processes are too complex and context-dependent to be used as a general criterion for classifying KM technologies (Saito et al., 2007). Although according to (Saito et al., 2007) the analysis of existing approaches to identify, describe, and organize KM technologies reveals that the usual approach relating them to knowledge processes is problematic, this approach is helpful to provide some useful criteria for distinguishing and explaining them in the view of the business system. Therefore, the analysis of scientific literature would give some insights about the most relevant KM processes. Technology can be seen both as enabler (supports the diffusion and implementation of innovative organizational models, such as the learning organization, allowing faster and more efficient communication and information flows, introduce elements of process optimization and efficiency) and as a mediator (the use of KM technology systems removes information barriers and gives a sense of greater freedom of access to it (Yiu & Law, 2016). Moreover, web evolution (Król, 2020; Patel, 2013) provides some insights and describes opportunities for knowledge management context as well.

(Rao, 2005) classifies all KMT into three families based on their core functional focus: content, collaboration, and computation. It is noticed that these three categories, to some extent, can be represented

by the repository (content), sharing (collaboration), discovery (computation). The meta-analysis of the newest literature reviews (Antonova et al., 2006; Hashemi et al., 2018; Liao, 2003; Shongwe, 2016) shows that most frequent categories applied within KM processes are: Sharing (relevance 98%), Creation (relevance 79%), application (relevance 79%) and Storing (relevance 61 %).

(Maier, 2007) differentiated all the classifications of KMT into two categories: a) Market view. These classifications try to cover either technologies, tools and systems that potentially support KM (wide view) or they cover the functionality of knowledge management systems (narrow view); b) Theoretical view. These classifications are based on existing models describing types of knowledge (abstract view) or organizational learning processes or tasks, respectively (concrete view) that could potentially be supported by ICT in general or KMS.

(Centobelli et al., 2017) divides KMSs into two categories: knowledge management tools (KM-Tools) and knowledge management practices (KM-Practices) based on work of (Sabherwal et al., 2014): 'The paper identifies three groups of SMEs that seem to point out the stages of the process of adoption of KMSs: Introduction, SMEs that deal with the process of knowledge management exploiting practices and tools that are already known; Growth, SMEs that adopt specialist practices of knowledge management acquiring new organizational and managerial competence in the field of knowledge management; Maturity, SMEs that invest in new technology and that acquire new technological competence in the field of knowledge management." The authors in their continuing research provide not only the methodology for evaluating of the degree of adoption of KMSs by SMEs but (Centobelli et al., 2019) presents the model to assess the efficiency and effectiveness of knowledge management systems (KMSs) adopted by small and medium enterprises (SMEs).

The most prominent approach was proposed by (Saito et al., 2007) with the focus on strategy-based approached and authors emphasize a significant contribution from this approach: the distinction between component technologies and systems. The notion of integration is a characteristic of technology in general: components are integrated into systems, which are integrated into even larger systems. Component technologies are the building blocks of KM systems; KM applications are the generic KM systems, and business applications are the business-driven KM systems. (Figure 1.)

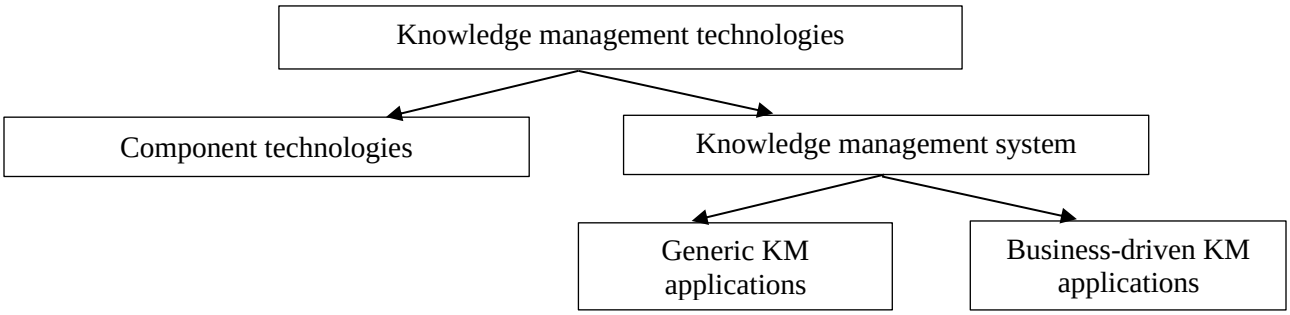

Fig. 1. (Saito et al., 2007) approach to classify KMT

KMT highly depends on technologies trends[3] which will put "people at the centre of your technology strategy highlights one of the most important aspects of technology — how it impacts customers, employees, business partners, society or other key constituencies. Arguably all actions of the organization can be attributed to how it impacts these individuals and groups either directly or indirectly. It is a people-centric approach."

1.3 VALUING BUSINESS SYSTEMS FROM KNOWLEDGE MANAGEMENT TECHNOLOGIES PERSPECTIVE

Based on findings from a recent scientific literature review, the approach to valuing business systems from knowledge management technologies perspective can be represented. As it was already stated a business system in the paper is defined as a socio-technical system. Such a system according to processes (Töhönen et al., 2020) consists of technology, people, resources and processes. For each of these components, specific metrics can be assigned, e.g. technology metrics, process metrics, non-human resources metrics, human resources metrics. So, in a socio-technical system, all the parts are interacting and forming both an ability and culture for the business system to thrive, i.e. it depends on these factors. As KMT is a collection of technologies applicable to foster the performance of the business system, the approach on how to reveal the state "as-is" of KMT in a specific business system is crucial. There were several attempts by researchers providing frameworks valuing business systems (North & Kumta, 2018; Rao, 2005), but the still theoretical basis of business system value evaluation in the perspective of KMT is scattered, and even more evaluation practices are missing.

Starting from the definition of knowledge management technologies provided by (Sabherwal et al., 2014), (Saito et al., 2007) and (Centobelli et al., 2017) the definition of KMT includes knowledge

[3] https://www.gartner.com/en/newsroom/press-releases/2019-10-21-gartner-identifies-the-top-10-strategic-technology-trends-for-2020

management practices (KM-Practices according to (Centobelli et al., 2017) or KM mechanisms according to (Sabherwal et al., 2014)), defined as the set of methods and techniques to support the organizational processes of knowledge creation (discovery), storage (repositories), transfer (dissemination), sharing (collaboration); and knowledge management tools (KM-Tools), namely the specific IT-based systems or components according to (Saito et al., 2007) supporting KM- Practices (Fig. 2). This definition is more comprehensive and includes three categories of KMT: Component technologies which are the building blocks of KM systems; KM applications are the generic KM systems; and business applications are the business-driven KM systems, and any of the group can support business performance in multiple ways, can comprise more than one of possible KM strategies. As the general aim of KMT is to support KM strategy, and KM strategy – to support business strategy, the processing of main KM strategies (knowledge discovery, storage (repositories), transfer (dissemination), sharing (collaboration)) must be considered within the business system at different levels: individual, process and organization.

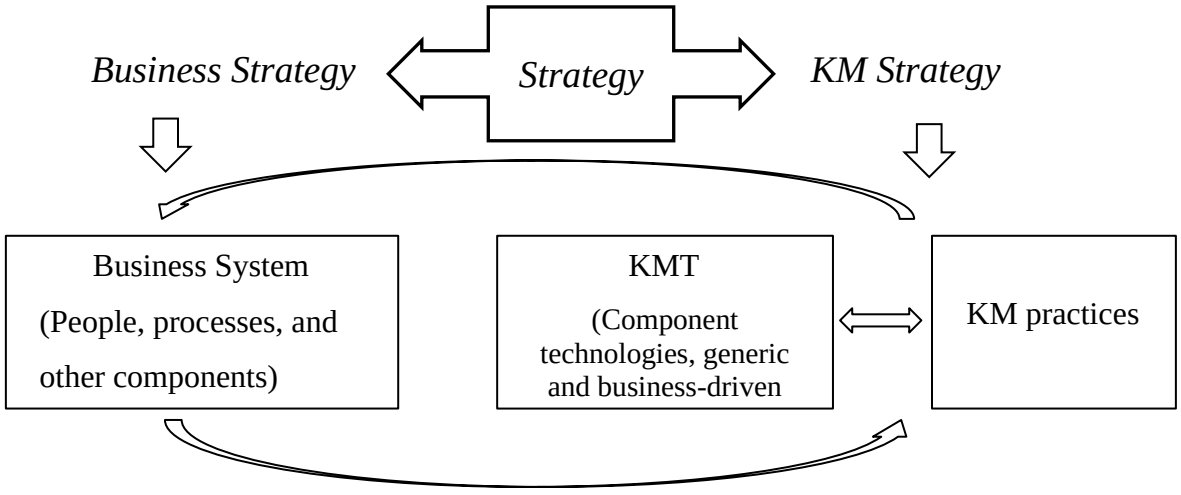

Fig. 2. Position of KMT from a strategy-pull model of KM perspective

An approach on how to value the business system from KMT perspective is based on analysis of its maturity in respect of KMT functionalities to business strategy and KM strategy. On the other hand, the technology functionalities can be conceptualized at a high level into four groups and be represented as collaboration technologies, discovery technologies, dissemination technologies and repository technologies (Figure 3). So, any of the three groups of KMT (Figure 2) – component technologies, general systems and/or business-driven systems can fulfil any of these functionalities. The maturity level depends on business system strategy and KM strategy, which states the requirements for up to date infrastructure

and KM technologies (Figure 3). The complexity of KMT highly depends on the size of the business system, and the context business system is taking place.

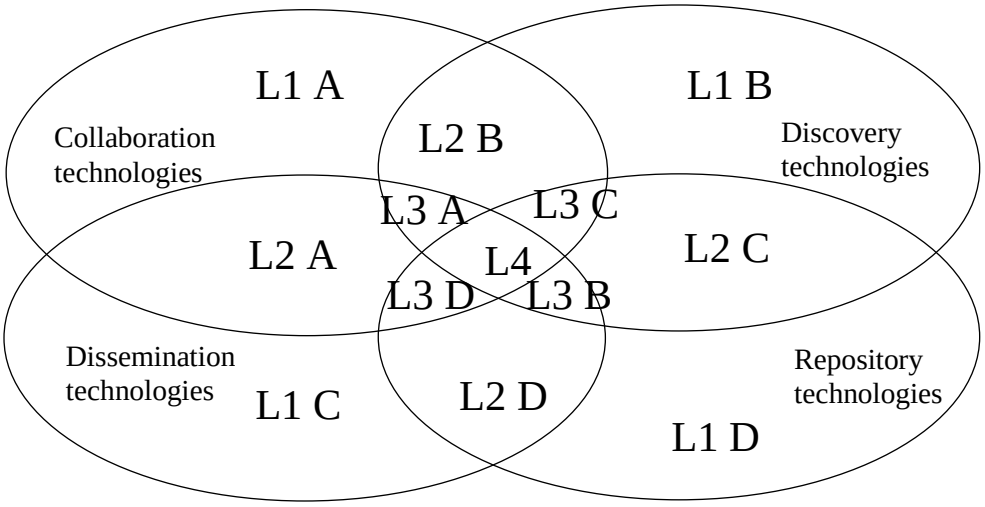

Fig. 3. An Approach to value a business system from KMT perspective

Next, the maturity levels will be determined. Level 0 business systems use no digital KMT, although it applies any of KM practices, e.g. face-to-face meetings. It means people use traditional ones like paper documents, libraries, a co-located collaboration which is an unlikely situation and position for a contemporary business system. These business systems mainly apply component technologies or generic KM technologies which are context-independent.

The business system can be said to be at Level 1 of KMT if it uses not more than one group of digital technologies. It includes business systems that have just made the shift from non-digital to digital document management systems (Level1 D, e.g., from book to e-book use in e-learning process) or the business systems which use basic email lists for knowledge networking (Level 1 C). These business systems usually apply component technologies or generic KM technologies which are context-independent. In some cases it can be applied and business-driven technologies, for example, technologies for finance management or accounting.

If a business system uses two groups of KMT (e.g. intersection Level2 A or 2 D), it can be said to be at Level 2 of KM technological complexity. For instance, the business system started to use e-learning system, which on base is just database of files and include some technological functionalities for the dissemination of these files, but not new technologies are available, i.e. collaborative activities still take place mostly face-to-face, and there are no functions to discover knowledge (Level2 D). One of the examples could be the basic version of the virtual learning environment (VLE) “Moodle”, which mainly

serves as a repository and helps to disseminate knowledge with digital technologies.

The business system which uses three groups of KMT can be said to be at Level 3 of KM technological complexity. Most of the larger business systems not directly working in the data-driven IT context could be profiled at Level 3: they use a wide range of technologies for knowledge management and invest in technology integration for using these technologies. An example could be the extended version of VLE “Moodle" with some technologies for collaboration, e.g. BigBlueButton[4] functionality opens great space for collaboration, dissemination and repository knowledge. The business systems, belonging to this area, usually applies context-dependent KM technologies or adapt general technologies to their needs.

A business system which uses all four families of KMT can be said to be at Level 4. Most of the large business systems working in the data-driven IT context are at Level 4. They provide not only a wide range of technologies to support business system strategy but ensure effective and efficient an integration of these technologies, change management, and capacity building for using these technologies. Table 2 provides a brief comparison of these five levels.

Table 2. Levels of business system maturity from KMT perspective

Level of maturity	**Description**	**Examples**
Level 0	No digital KMT are applied	No digital components technology applied
Level 1 (L1 A, B, C, D)	One group of KMT is applied	Messaging/email or content management
Level 2 (L2 A, B, C, D)	Two groups of KMT are applied	Database + content management
Level 3 (L3 A, B, C, D)	Three groups of KMT are applied	Database + content management + email
Level 4 (L4)	All groups of KMT are applied	Database + content management + email + Knowledge Discovery in Databases, etc.

CONCLUSIONS

The main aim of any business system is to achieve the business strategy. A business strategy requires business systems components to be orchestrated and appropriately managed and is treated as a socio-technical system. In any of these activities, knowledge management plays an important role, and knowledge management technologies facilitate it to a great extent. The paper presents the approach on how to analyze business systems from knowledge management technologies perspective. The approach is based on five levels of business system maturity from KMT perspective. All knowledge management

[4] https://bigbluebutton.org/

technologies are classified into three groups: component technologies, general technologies, and business-driven technologies. These technologies can facilitate any of KM strategies and practices which are categorized as follows: collaboration strategy, dissemination strategy, knowledge discovery strategy and knowledge storage strategy. The future work is to construct the evaluation methodology based on the proposed approach. As the paper provides the theoretical background of the business system evaluation strategy from knowledge management technologies perspective, the future work will incorporate the development of the method for practical applications.

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