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A Model of International Development Cooperation: The Case of Slovenia

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Abstract

Development aid, one of the most important mechanisms for the redistribution of global wealth, represents financial flows with economic growth and social improvement as their primary objective. Recently, international development cooperation has been in the process of change that requires the involvement of new actors, the use of new instruments, and expanding the fields of work. In this article, the authors introduce the Slovenian model of international development cooperation, emphasising the criteria for deciding the direction of development cooperation. The criteria are clear interest of the beneficiary state, content priority fields, and geographical priority areas. The authors also discuss Slovenia's active collaboration with the United Nations Industrial Development Organization in international development cooperation. Special attention is given to three successful development projects in Africa that Slovenia recently financed. All three selected projects are based on principles of sustainable development and were realized in Kenya, Tanzania, and Uganda.

Introduction

Development aid, often also called Official Development Assistance (ODA), represents one of the most important mechanisms for the redistribution of wealth in the world. ODA is an instrument of international development cooperation for promoting human, sustainable, and gender-equitable development (Sachs, 2012; Ayers & Huq, 2009). One of the modalities of ODA and international cooperation in education for sustainable development is as an agent of change toward more environmentally conscious citizenship (Oikawa, 2016; Chung & Par, 2016). It is widely accepted that rich countries should help poor ones, and the most common way to do so is through development aid policies. The question of development aid and its impact on various economic and social indicators is one of the most debated topics in international and development economics. Although the main reason for aid is to generate growth and development, the leading global issues of less developed countries (LDC) still need to be solved. Much of the existing

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research shows conflicting results, and the question about the efficiency of development aid and its impact on various fields of national economies remains in dispute (Gregl & Logožar, 2017). In recent years, there has been a trend of increasing criticism towards ODA and the optimization of ODA policies in a growing inequality between the Global North and Global South (Chica-Morales et al., 2021).

In recent decades, ODA has faced an intense debate on the effectiveness and coherence of policies, reflected in the low impact of resources used and the lack of adequacy of said resources (Dietrich, 2015; Sianes, 2017). In this respect, the correct planning of development interventions plays an essential role, as the future provision of objectives and resources will depend on this. Bilateral ODA agencies have traditionally used tools based on analysis, observation, and judgment for planning, with the logical framework approach and project cycle management being the prominent representatives, due to their greater ease of use. However, these tools generally need a methodological basis capable of anticipating the quantitative impact of policies (Landoni & Corti, 2011). Over the past 15 years, countries have made serious efforts to reform the development aid system. However, they still need to catch up to what is needed to face the development challenges of today's world because the international reality is changing more profoundly and rapidly than development aid has been able to change (Alonso, 2018).

The 2030 Agenda for Sustainable Development obliges the international community to move towards a radically new Financing for Development framework. Tentative estimates put the resources required for meeting the Sustainable Development Goals (SDGs) at between one and four trillion dollars annually, a magnitude unattainable from current official flows (Sustainable Development Solutions Network, 2015; United Nations Conference on Trade and Development, 2014). Per its ambition and complexity, the 2030 Agenda will require mobilizing resources and capabilities from highly distinct sources, public and private, and domestic and international (Alonso, 2018).

Slovenia is a small, open, export-oriented economy. Like other developed countries, it provides substantial resources in the form of funding for international development cooperation projects (IDCPs) and direct funding for humanitarian aid in the event of natural disasters (famine, drought, floods, outbreaks of severe infectious diseases, volcanoes, wars, and other similar events) to countries in need. All the IDCPs are carried out in partnership between the United Nations Industrial Development Organization (UNIDO) and other organizations in the field of development cooperation and the Government of the Republic of Slovenia, based on the Strategy for International Development Cooperation and Humanitarian Aid of the Republic of Slovenia until 2030. The Strategy provides a framework for Slovenia's action at the multilateral level. It gives orientations of development cooperation and humanitarian aid on geographical and thematic priorities, as well as on the general criteria for government development cooperation.

International development cooperation (IDC) is an essential instrument through which developed countries seek economic, social, and political progress in partner countries. In doing so, they contribute to overall economic progress, poverty eradication, women's empowerment, and the reduction of inequalities between countries, enabling the international community to work together better. Slovenia's active participation in the field of IDC and humanitarian aid is one of the objectives of its foreign policy. The starting point for such activities is international agreements and standards in the field of IDC, sustainable development and humanitarian aid, the values and development orientations of Slovenian society and economy, and Slovenia's experience and comparative advantages to date (Ministry of Foreign Affairs of the Republic of Slovenia, 2020).

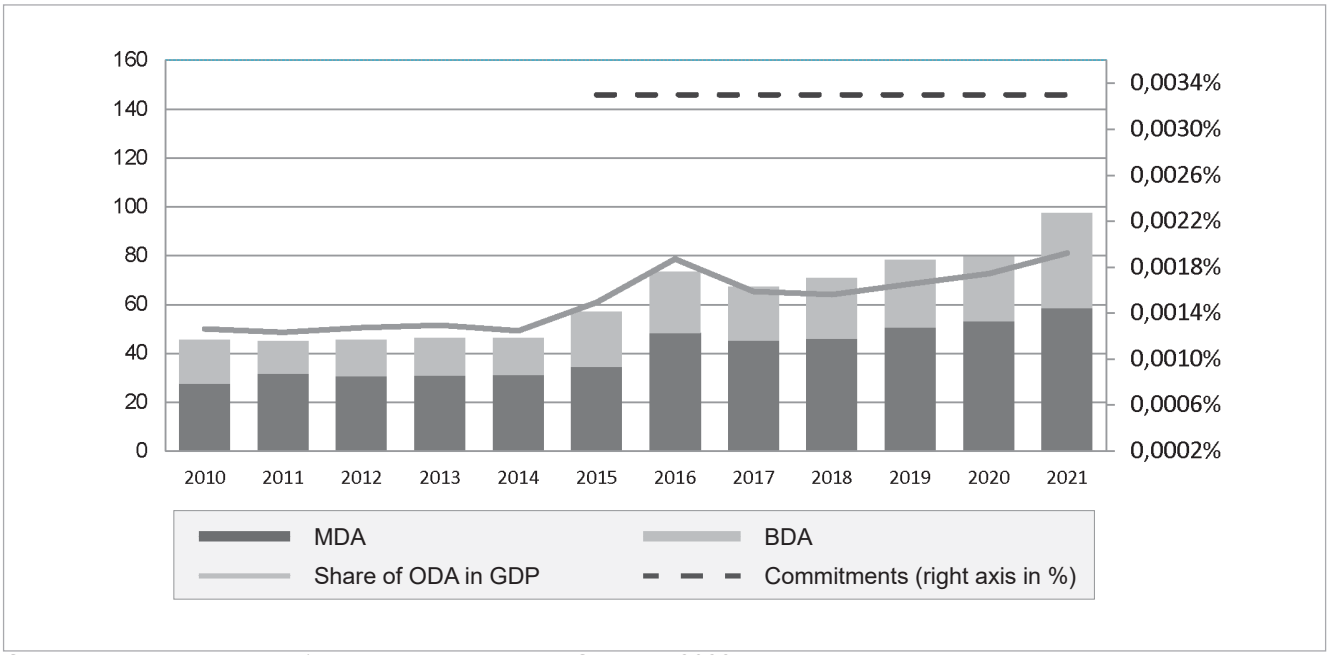
Within the IDC system, Slovenia has established itself as a credible and reliable partner, which it has been meeting by allocating a large share of its resources and other forms of development assistance, given its economic strength, since 2004 (accession to the EU). As an EU Member State, Slovenia committed itself in the context of the negotiations for the New Development Agenda in 2015 to work towards increasing ODA to 0.33% of GDP by 2030 (Ministry of Foreign Affairs of the Republic of Slovenia, 2022).

Figure 1 shows the resources and their share in GDP between 2010 and 2021 that Slovenia has committed to development aid. In 2020, Slovenia allocated €79.6 million to ODA, representing 0.17% of gross domestic product (GDP), while in 2021, it had already allocated €97.48 million, representing 0.19% of GDP.

The Republic of Slovenia conducts bilateral and multilateral development cooperation following international rules and standards and in line with the strategic documents on IDC adopted by the Republic of Slovenia. In 2020, multilateral development assistance (MDA) amounted to €53.12 million, or 67%, and was implemented mainly through the EU, the UN system, and the World Bank Group; €26.49 million, or 33%, was bilateral development assistance (BDA) (Ministry of Foreign Affairs of the

Figure 1

Official Development Assistance (ODA) volume between 2010 and 2020 as share of gross domestic product (GDP) and international commitments of the Republic of Slovenia (in millions of euros, current prices)



Source: Ministry of Foreign Affairs of the Republic of Slovenia, 2022.

Republic of Slovenia, 2022). In 2021, however, it amounted to €58.52 million, or 60 percent, and €38.96 million, or 40%, was bilateral assistance.

The article's main objective is to review the Slovenian model of international development cooperation with emphasis on two priority criteria for deciding the direction of development cooperation. The two criteria are geographical priority areas (e.g., Africa) and content priority fields (e.g., achieving the SDGs). In accordance with the paper's main objective, the article's structure is as follows. First, the formal structure of Slovenia's IDC is reviewed; second, Slovenia's active cooperation with UNIDO is presented; and finally, three development projects in Africa are described as case studies of the successful implementation of SDGs in development projects.

Slovenian Model on International Development Cooperation

The presented model of international development cooperation is based on dialogue between the recipient countries of development cooperation, UNIDO, and Slovenia, and is based on the transfer of technology and knowledge that Slovenia, as an open economy, offers to countries and regions in need. According to mandatory and strategic criteria, the IDCs mainly focus on priority content areas and geographic areas where official Slovenian development assistance can be effective. Aid is geared towards supporting the development efforts of partner countries. Sustainable development strategies are crucial for long-term improvements of "human wellbeing, social equity and environmental integrity, and the particular system qualities that can sustain these" (Leach, Stirling & Scoones, 2010).

The Ministry of Foreign Affairs of the Republic of Slovenia is responsible for IDC and humanitarian aid in the Republic of Slovenia. IDC may be implemented by ministries, bodies attached to ministries, or government departments participating in bilateral technical assistance programmes in the field of IDC. Accordingly, the Ministry of Economic Development and Technology of the Republic of Slovenia (MEDT) has complete competence for implementing IDC projects in the economic field. The IDC is based on strategic documents adopted by the Republic of Slovenia: Law on International Development Cooperation and Humanitarian Aid of the Republic of Slovenia (IDCHA of RS), the Regulation on the Implementation of International Development Cooperation and Humanitarian Aid of the Republic of Slovenia and the Strategy for International Development Cooperation and Humanitarian Aid of the Republic of Slovenia (Strategy on IDCHA of RS) until 2030.

The objectives of IDC and humanitarian aid are set out in the law on IDCHA of RS, namely:

- The objective of IDC is to contribute to the eradication of poverty and the reduction of inequalities, and the promotion of sustainable development in partner countries.
- Humanitarian aid aims to save lives. The IDCs mainly focus on alleviating suffering, preserving human dignity, reducing vulnerability and risk to crises, acting preventively, and building resilience and capacity to respond to crises.

In the context of bilateral cooperation, the MEDT manages the economic policy of the IDC. It is a financier or co-financier of IDC projects or other development activities in the partner country where the development projects are being implemented. The Ministry has a specific budget line in the budget of the Republic of Slovenia for this type of financing, from which funds earmarked for development activities (earmarked funds) are drawn.

Development cooperation is guided by several criteria, among which the following three are the most important:

- A clear expression of interest by the country wishing to benefit from the IDC (i.e., the recipient/beneficiary country),
- the implementation of development projects in the context of thematic priority areas where Slovenia has economic and other advantages that enable Slovenia to contribute to the development and other benefits of partner countries,
- countries falling within the geographical priority areas can receive development assistance (exceptions are possible).

The *priority content areas* are:

a. Promoting the competitiveness of economies through productive employment and quality education. In this area, Slovenia can offer partner countries the opportunity to build inclusive, sustainable, and economically competitive industries based on equal opportunities for all, including the most vulnerable groups. This can be achieved by building capacity and promoting decent jobs through knowledge and technology transfer, sharing best practices, and supporting quality education programmes, including vocational training and lifelong learning.

b. Fostering innovation and digital transformation through technology development and transfer In this respect, while exploiting the potential of the Fourth Industrial Revolution and taking advantage of the industry transition, Slovenia can offer the development of research and high-tech support programmes and contribute to the advancement and application of new technologies and digital solutions in industry (Industry 4.0, Industry 5.0, and Society 5.0).

c. Promoting circular economy activities and environmental protection in the industry From a development perspective, it is of the utmost importance for Slovenia to improve resource efficiency and waste management by applying circular economy principles and achieving the SDGs on climate change, biodiversity, and ecosystem services, including water resources and other environmental resources.

d. Promoting economic activities in the field of clean energy and energy efficiency Slovenia has an active policy on energy efficiency and clean technologies and can offer such development services to partner countries. It has a good track record in promoting knowledge and the use of technologies to harness access to clean energy, reduce industry-related emissions and promote energy security.

The *geographical priority areas* are:

In the area of IDC, Slovenia has identified the following three priority regions where it is ready to pursue development projects actively, based on the emerging needs in the global development environment: The Western Balkans, the European Neighbourhood, and Sub-Saharan Africa.

While joint development support from UNIDO and the Government of the Republic of Slovenia can be provided at both country and regional levels, particular emphasis is given to the least developed countries.

Cooperation Between Slovenia and UNIDO

The cooperation between MEDT and UNIDO is based on the Cooperation Agreement between the Government of the Republic of Slovenia and UNIDO. Most of the development projects implemented so far have been financed and implemented by Slovenia through UNIDO. According to UNIDO, Slovenia is one of the most active members and a role model of the IDC for small open economy countries. Among UNIDO Member States, Slovenia ranks as the leading donor (largest per capita donor) of Millennium Development Goals (MDG) projects in terms of per capita voluntary contributions - between 2012 and 2018, Slovenia ranked in sixth place among more than 170 Member States in terms of per capita development assistance indicator.

This way, support for the development efforts of partner countries is ensured. At the same time, for Slovenia, the IDC also represents one of the general and systemic measures to improve internationalisation through the involvement of the public and private sectors in development cooperation.

Between 2005 and 2022, the Republic of Slovenia allocated €7.134.839 to UNIDO for IDC projects and €3.541.113 between 2012 and 2022 (see Figure 2). Since 2011, we have jointly prepared 20 international projects with UNIDO, mostly involving Slovenian institutions, universities, individual researchers and experts, private companies, and other legal entities, in cooperation with experts from UNIDO and the partner countries.

Case Studies of Development Projects Promoting Inclusive and Sustainable Industrial Development

In the following sections, we present three selected development projects financed by the Republic of Slovenia in the last six years in cooperation with several organizations and companies. All projects are based on implementing the 2030 Agenda for Sustainable Development principles and, in particular, the Sustainable Development Goal on Industry, Innovation and Infrastructure for Global Progress (SDG 9) of the United Nations system to promote inclusive and sustainable industrial development.

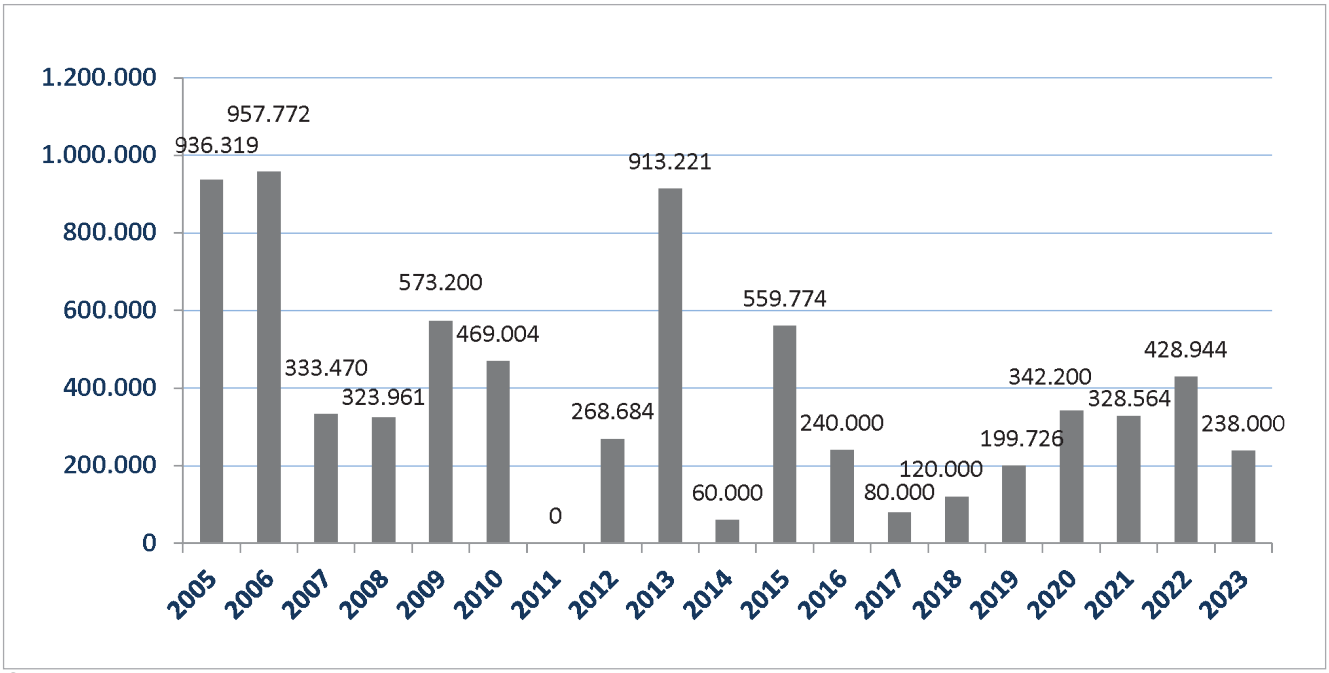
Demonstration and transfer of environmentally sound technology for water treatment in Kenya

Despite sub-Saharan Africa's economic openness and ongoing economic relationships with international players, the region has yet to develop sustainably and substantially reduce poverty. Aspiring development is challenging in sub-Saharan Africa due to a sluggish pace of growth, a consistent record of failed states, conflicts, famines, and disasters, and, therefore, high numbers of inter-regional refugees (Killick, 2005).

Kenya experiences similar development challenges despite sustained economic growth and clear improvements across human development indices (United Nations Development Programme, 2018). Kenya is one of the fastest-growing economies in sub-Saharan Africa and is

Figure 2

Volume of funding for Millennium Development Goals (MDG) projects of the Republic of Slovenia with UNIDO between 2005 and 2023 (in euros, current prices)



Source: MEDT, own calculations.

Note: For 2023, the foreseen volume of funds is indicated

engaged in significant political, structural, and economic reforms to tackle its vital development challenges (Trading Economics, 2020; World Bank, 2022a).

The development project financed by the Republic of Slovenia aimed to find and distribute water in a rural part of Kenya (southern Kenya, south of Mombasa) using the latest technology. The project consisted of two parts. In the first part (2014-2016), a Slovenian company, selected through a public tender, delivered and commissioned a water treatment plant with a hybrid power supply (solar system and solar power plant). Before the project was completed and the infrastructure system was handed over to the local community, the company carried out the servicing of the plant and additional training of the maintenance staff from the local community.

With the help of UNIDO experts and a Slovenian company, the local community in Kenya proposed the construction of additional infrastructure: digging an additional well and connecting it to the newly built water treatment plant. So that the drinking water could be used not only for the local community but also sold to the nearby tourist centres (private-public partnership). The local community also proposed that the purified water from the filtration plant could be connected via a water pipe to the local hospital, which needed a permanent and safe source of drinking water. With additional funding, this objective was also achieved.

The objectives of the project included:

- To find a better water source near the installed water filtration plant and to connect it to the local hospital.
- Install a new larger plant in the existing container or reconstruct the existing plant, which had to be able to desalinate up to 10.000 mg/l of dissolved salts.
- As the salinity and biological contamination of the water varies according to the seasons, it was also necessary to supply portable pH/rx and conductivity meters as part of the next phase of the project so that the water source and the quality of the drinking water could be regularly monitored, even after the final handover of the infrastructure to the local community.

As a result, the mortality rate of infants and children under five years of age has been significantly reduced with the significantly improved quality of the water source. The project's estimated value was €131.000, of which Slovenia contributed €103.183, and UNIDO financed the rest. This project has established an improved water extraction and purification system that will benefit the local community in the long term. The surplus purified water will be used to maintain the facilities (purchase appropriate filters for water purification). At the same time, the local hospital, which previously depended on purchased water or water boiling, has a permanent and clean water source.

Earth observation services for improving water supply management in Uganda

In the last decade, access to drinking water and sanitation have been acknowledged as human rights by the international community; they have also been recognized as a crucial goal for achieving sustainable development for all in the framework of the 2030 Agenda (Colina Martín, 2020). Ensuring access to high-quality drinking water is crucial to the quality of life of every community. In the specific context of the work of international cooperation in the fields of water and sanitation, SDG 6 is devoted explicitly to ensuring the availability and sustainable management of water and sanitation for all and includes six targets, referred to universal access to safe and affordable drinking water; equitable access to adequate sanitation and hygiene (Mara & Evans, 2018); the end of open defecation (Mara, 2017), paying particular attention to the needs of women and girls (Saleem et al., 2019) and those in vulnerable situations; improve water quality by reducing pollution (Ezbakhe, 2018), eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally (Tortajada, 2020).

The Republic of Uganda is a landlocked country in eastern Central Africa. It is situated on Lake Victoria, the largest freshwater lake in Africa. Although it has enough fresh water to meet its population's daily needs, some 44% of its population, or 20 million people, face limited access to quality drinking water (World Health Organization & United Nations International Children's Emergency Fund, 2021). About 19% or 8 million people in the Republic of Uganda get their water from unprotected dug wells, springs, or untested surface water points (rivers, dams, ponds, streams, canals).

A Slovenian high-tech company in the field of satellite data for scanning the surface of areas on the ground was selected in the call for tender. Between 2016 and 2017, the company developed and deployed a Utility Performance Monitoring and Information System (UPMIS) application for capturing and analysing water resources data using data from the European Space Agency's (ESA) Copernicus programme. The UPMIS application is an operational tool for collecting real-time data on rural water sources'

functionality, management, and financial situation. It also collects basic information on the installations and technical characteristics of the water system itself.

The estimated value of the two-year project (2022-2023) is € 229.900, of which Slovenia contributed € 121,000, Slovenian companies contributed € 28.900 (public-private partnership), and the ESA financed the rest. The result of the project, also co-funded by ESA and the Republic of Slovenia, is a system capable of determining the boundaries of rural settlements and population density from 2015 onwards, based on satellite data. At the same time, the system can calculate changes in areas and population density independently every month. In addition to integrating the satellite data and further developing the analytical application, the project also includes training local experts to ensure the system's sustainable, long-term and reliable operation.

Establishment of cross-border interoperable infrastructure node in Tanzania

Over the past decade, despite rapid population growth, Tanzania has achieved relatively strong economic growth and declining poverty rates. The country remains a lower middle-income country despite the global pandemic-induced contraction of GDP per capita in 2020. Much of the country's development success over the decade was predicated on its strategic maritime location, rich and diverse natural resources, socio-political stability, and rapidly growing tourism. Economic activity in Tanzania is recovering, with the 2022 real GDP growth rate projected to reach 4-5% (2021 at 4.3%, up from 2% in 2020). The accommodation and restaurants, mining, ICT, transport, and electricity sectors are driving the recovery (World Bank, 2022b).

Blockchain technology is one of the most promising technologies in the 4IR era as it addresses several elements such as transactions, verification, and security. The Slovenian National Blockchain Infrastructure Association will partner with the Institute of Information Technology at the University of Dar es Salaam to set up a national knowledge hub to deliver training programmes to enable Tanzania to access blockchain technology. The project's main objective is to ensure the transfer of high-tech knowledge to enable the use of new technologies and the so-called 4IR technologies in Tanzania in the transport sector. The project proposal will also enable Tanzania to access new markets through an improved environment enabling verification, interoperability, and reliability.

The proposed project would introduce the use of improved sustainable production and management processes and the adoption of higher levels of technology and innovative product designs, supported by a strengthened investment ecosystem and improved productivity and quality management. By fostering an enabling technological environment and implementing support programmes for SMEs, the proposed project will also help to identify additional areas for technology transfer and diffusion based on locally available resources and upgraded capacity and incentives for industrial development.

The project is linked to the implementation of the United Nations Sustainable Development Goals 2030 (UN SDGs 2030), which will be achieved through the different phases of project implementation, as the project implementation will contribute to the priorities of the SDGs 2030 and will specifically address vulnerable groups of people.

The estimated value of the two-year project (2022-2023) is € 174.000, which will be fully funded by the Republic of Slovenia and implemented in cooperation with UNIDO and local organisations in Tanzania. The expected benefits for Tanzania will be that the launch of the blockchain infrastructure will contribute to increasing efficiency in delivering public services to citizens and businesses and improving the skills base in Tanzania.

Conclusion

In the last 40 years, much has been done, but more must be done to understand the effects of development aid on various economic and social indicators in LDC. The primary reason for giving aid is to generate development to reduce poverty (Doucouliagos & Paldam, 2008). Slovenia, like all other developed countries, allocates significant resources to countries in need in the form of funding for international development cooperation projects and direct funding for humanitarian aid in the event of natural disasters. This paper presents Slovenia's development cooperation model based on three criteria: a clearly expressed interest of the recipient country, implementation of development projects within the framework of thematic priority areas, and targeting of geographic priority areas.

According to UNIDO, Slovenia is one of the most active members and a model of IDC of small Member States. It ranks among the largest per capita donors of IDC projects implemented by UNIDO in terms of voluntary contributions per capita. As a member of UNIDO, Slovenia participates in the formulation of UNIDO's policies and strategic programmes through active participation in the organisation's bodies, the pursuit of common development objectives, and the implementation of joint development projects.

This article also presents three development projects funded by the Republic of Slovenia in Africa over the last six years in cooperation with several organisations and companies. All three projects are based on the 2030 Agenda for Sustainable Development principles and, in particular, the Sustainable Development Goal on Industry, Innovation, and Infrastructure for Global Progress (SDG 9) of the United Nations system to promote inclusive and sustainable industrial development.

The first project aimed to find and distribute water in rural Kenya using the latest technology. This project established an improved water extraction and purification system that will benefit the local community in the long term. The second project focused on improving access to drinking water in Uganda. The result of the project is a system that can determine rural settlement boundaries and population densities from satellite data. The third project will establish a national knowledge hub that will deliver training programmes to enable Tanzania to access blockchain technology in the transport sector. The project's main objective is to ensure the transfer of high-tech knowledge to enable the use of 4IR technologies.

The main limitation of the article is its descriptive nature regarding the presented case studies. Further research should be conducted focusing on measuring the realization of SDGs in Slovenia-financed development projects in Africa.

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Model mednarodnega razvojnega sodelovanja: primer Slovenije

Izvleček

Razvojna pomoč, eden najpomembnejših mehanizmov za prerazporeditev svetovnega bogastva, predstavlja finančne tokove, katerih glavni cilj je gospodarska rast in izboljšanje socialnih razmer. V zadnjem času je mednarodno razvojno sodelovanje v procesu sprememb, ki zahtevajo vključevanje novih akterjev, uporabo novih instrumentov in širitev področij delovanja. V avtorji predstavljajo slovenski model mednarodnega razvojnega sodelovanja, pri čemer poudarjajo merila za odločanje o usmeritvi razvojnega sodelovanja. Merila so jasen interes države upravičenke, vsebinska prednostna področja in geografska prednostna območja. Avtorji obravnavajo tudi aktivno sodelovanje Slovenije pri mednarodnem razvojnem sodelovanju z Organizacijo Združenih narodov za industrijski razvoj. Posebna pozornost je namenjena trem uspešnim razvojnim projektom v Afriki, ki jih je v zadnjem času financirala Republika Slovenija. Vsi trije izbrani projekti temeljijo na načelih trajnostnega razvoja in so bili izvedeni v Keniji, Tanzaniji in Ugandi.

Ključne besede: mednarodno razvojno sodelovanje, humanitarna pomoč, dvostransko razvojno sodelovanje, večstransko razvojno sodelovanje

Characteristics of the Board of Directors and Dividend Policy: A Case Study of Banks in Western Balkans

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Abstract

This paper examines the influence of the size and participation of women in the board of directors on the dividend policy of banks in Western Balkans. The research covered 104 banks, observing their dividend policy from 2017 to 2019. The dividend payout ratio was measured by the dividend policy. A relatively small number of banks paid dividends during the observation period. By applying the Fixed-Effect model, it was determined that the size of the board of directors has a statistically significant positive impact on the dividend policy of observed banks. Concerning the participation of women on the board of directors, a statistically significant impact on the dividend policy of banks was not identified. In addition to contributing to the existing literature on corporate finances, the research results can be crucial to investors when deciding to invest funds in bank stocks.

Introduction

Dividends are the distribution of company profits to shareholders in proportion to their ownership (Knežević et al., 2019). The decision on dividend payments not only depends on the achieved financial result but can be conditioned by the need to protect funds during crises, increased profit volatility, limited external financing, or a significant need for capital in the future (Franc-Dąbrowska et al., 2020). Dividend payments are regarded as one of the mechanisms for monitoring the company's business (Rozeff, 1982) and one of the most important financial decisions of the company (Bataineh, 2020). Companies should establish an optimal dividend policy that will increase the company's value (Roy, 2015) and will interact with financial and investment decisions (Mądra-Sawicka & Ulrich, 2020). Dividend policy is of interest to existing shareholders, but also of interest to managers, investors and creditors. It is a topic that has been confusing researchers for a long time (Yarram & Dollery, 2015). Therefore, it is the subject of numerous debates in financial literature (Zainudin et al., 2018), with theoreticians and researchers trying to develop models which describe factors that managers need to consider when making decisions on dividend policies (Gill et al., 2010). Most of the research is based on the example of companies from the United States and other developed countries (Jabbouri, 2016).

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Corporate governance plays a significant role in defining dividend policies (Atanassov & Mandell, 2018). Namely, in addition to adopting strategies, plans, and goals, the board of directors decides whether dividends will be paid and in what amount (Boshnak, 2021). In a situation where dividend payments are not made, the available funds intended for dividend payments can be redirected to specific activities by the management, achieving personal interests that may differ from the interests of the shareholders. In this way, an agency problem occurs. By deciding to pay the dividends, thereby reducing the available money, the management strives to reduce the agency problem (Nazar, 2021). The question is why the board of directors would decide to pay dividends and/or dividend payments of higher value when it is in their "nature" to retain surplus money (Mulchandani et al., 2021). Saeed & Sameer (2017) state that one of the possible ways is "involving people of different characteristics, origin, and experience on the board of directors" (p. 1100). The research conducted by *Credit Suisse* in 2012 on a sample of 2,400 global companies found that companies with at least one female member on the board of directors had better financial performance in comparison to companies that did not have a woman on the board of directors (Mulchandani et al., 2021). In recent decades, a trend of increasing female participation on the board of directors was present, which affects better decision-making for shareholders (Huang & Kisgen, 2013), or an increased amount of dividend payments (García-Meca et al., 2022). In other words, characteristics of corporate governance, such as the size of the board, the gender structure of the board, independence of members, expertise, etc., can affect financial decisions, including decisions regarding dividend payments (Nazar, 2021). Also, the efficiency of such decisions depends on the characteristics of the board of directors (Gyapong et al., 2019). As Ain et al. (2021) state, the diversity of the board affects the efficiency of work at the level of individual members and the level of the entire team. However, numerous studies have reached different results when it comes to the influence of the size of the board of directors and the participation of women in the board of directors on the dividend policy of companies, which indicates that these relations are more complex and can significantly differ between companies (García-Meca et al., 2022).

In addition to the fact that recently the number of research papers regarding the dividend policy of banks is growing, a relatively small number deals with examining the impact of the board of directors' characteristics on the same. The subject of this paper is dividend policy in banks operating in Western Balkans. These banks used to operate in the Republic of Serbia, the Republic of Montenegro, the Republic of Slovenia, The Republic of Croatia, the Republic of North Macedonia, and Bosnia and Herzegovina (the Republic of Srpska and the Federation of Bosnia and Herzegovina). This paper aims to examine the influence of the size of the board of directors and the participation of women in the board of directors on the dividend policy of 104 banks in the aforementioned countries during the period from 2017 to 2019. According to the authors' knowledge, it is the first survey that examines the influence of the size and gender structure of the board of directors on the dividend policies of banks in the countries above. Following the subject and the aim of the research, the following research questions were posed in the paper:

1. Does the board of directors' size affect banks' dividend policy in Western Balkans?
2. Does the participation of women on the board of directors affect the dividend policy of banks in Western Balkans?

Data for the research purpose were collected from the financial reports of banks. Data analysis includes descriptive analysis, correlation analysis, and analysis of the panel data series. This paper fills the gap in the literature since there is a small amount of research on the influence characteristics of the board of directors on dividend policies. The findings are essential for investors when deciding to invest their funds in bank shares.

After the introductory considerations, the literature review shall follow. The research methodology is presented in the third part. The results of the research are presented in the fourth part. In the fifth part, the concluding considerations are presented along with research contributions and restrictions, and directions for future research.

Literature Review

A board of directors and their subcommittees can play an essential role in providing a supervisory and disciplinary role and therefore contributes to reducing the agency problem (Yarram & Dollery, 2015). Based on this, the same authors state that the dividend policy in companies depends on the characteristics of the board of directors in many ways. This is also confirmed by a large number of papers designed to determine the impact of the characteristics of the board of directors on the dividend policy of the company. The following is a representation of previous research that examines the influence of the size of the board of directors and the participation of women in the same on dividend policies.

The size of the board of directors is identified as one of the more influential factors in the decision regarding

dividend payments. In the literature, there are two opposing views on the impact of this characteristic of the board of directors on dividend policy. According to the first point of view, larger boards enable managers to specialize, leading to more efficient supervision (Klein, 2002). This will result in the payment of lower dividends (Mehdi et al., 2017). According to another position, a larger board of directors experiences inefficient decision-making and difficulty in coordination, leading to a demand for higher dividends by investors (Jensen & Meckling, 1976). Also, a board of directors with multiple members may decide on higher dividend payments due to efforts to meet the needs of a more significant number of clients (Nazar, 2021). Most of the research conducted determined that the size of the board of directors has a positive impact on dividend policy (Pucheta-Martinez & Bel-Oms, 2016; Chen et al., 2017; Elmagrhi et al., 2017; Suwaidan & Khalaf, 2020; Nazar, 2021; Ain et al., 2021; García-Meca et al., 2022). In other words, companies with more members on the board of directors pay higher dividends. However, specific research indicates that the size of the board of directors does not have a statistically significant impact on the company's dividend policy (Abdelsalam et al., 2008; Setia-Atmaja et al., 2009; Mustafa et al., 2020; Boshnak, 2021).

Research has shown that greater gender diversity on the board of directors leads to more rational decisions and minimizes the agency problem as a consequence, which can result in larger dividend payments (Mulchandani et al., 2021). According to Mustafa et al. (2020), women take the necessary actions to resolve agency problems thanks to their skills and abilities. Namely, women are recognized as good business supervisors and protectors of shareholder rights. This is supported by the fact that female members of the board of directors are more likely to attend meetings and participate in the supervisory board (Adams & Ferreira, 2009). Also, female members of the board of directors are more likely to respect the rules and are more sensitive to corporate issues concerning their colleagues (Ain et al., 2021). However, increased participation of women on the board of directors can result in lower dividend payments. Namely, if female members of the board of directors are recognized as suitable protectors of shareholder rights, this can result in a lower demand for dividends (La Porta et al., 2000). The fact that women have a higher aversion to risk and are more prone to retaining surplus cash (a conservative financial attitude) supports this statement (García-Meca et al., 2022). As in the case of the size of the board of directors, researchers arrived at different results regarding the influence of women's participation in the board of directors on dividend policies. Therefore Wellalage et al. (2012), Pucheta-Martinez & Bel-Oms (2016), Pahi & Yadav (2018), Gyapong et al. (2019), Mulchandani et al. (2021), Trinh et al. (2021) and Ain et al. (2021) determined that the participation of women on the board of directors positively affects dividend policies. In other words, along with the growth of female participation on the board of directors, there is a rise in dividend payments. On the other hand, Mustafa et al. (2020) determined that the participation of women on the board of directors harms dividend policy, while McGuinness et al. (2015) found that this influence is not statistically significant.

When it comes to the influence of the characteristics of the board of directors on the dividend policy of banks, two research papers are relevant. Al-Amarneh et al. (2017), on a sample of 13 commercial banks listed on the Amman Stock Exchange in Jordan in the period from 2005 to 2014 have determined that the size of the board of directors of the bank does not have a statistically significant impact on dividend policy (expressed by dividend payout ratios and dividend yields). Regarding the participation of women on the board of directors, it has been determined that it has a statistically significant positive impact on dividend yield values. In contrast, the impact on the values of the dividend payout ratio is not statistically significant. Observing the banks listed on the Indonesia Stock Exchange in the period from 2009 to 2019, Umar Mai & Syarief (2021) have determined that the size of the board has a statistically significant positive influence on the propensity for dividend payments, while there is a negative statistical impact on the value of the dividend payout ratio. The participation of women on the board of directors has a statistically significant negative impact on the propensity for dividend payments in the banks observed in Indonesia. At the same time, the impact on the value of dividend payout ratios is also negative but not statistically significant.

Research Methodology

This paper includes research on banks that operated in the Western Balkans at the end of 2020, examining their dividend policy from 2017 to 2019[1]. Therefore, the research includes 25[2] banks from the Republic of Serbia, 20 from

[1] *As dividends in the current year are paid for the previous year, at the time of conducting this research, the financial statements of all observed banks were not publicly available for 2021, so it was not possible to review their dividend policy for 2020.*

[2] *According to the data of the National Bank of Serbia, at the end of 2020, 26 banks operated in Serbia, however the Bank of China Serbia A.D. Belgrade was excluded from the research (because it is a bank founded on 22.12.2016., and officially began operation in 2017, so the data from 2016 was not available).*

the Republic of Croatia, 13[3] from Slovenia, 21[4] from Bosnia and Herzegovina, 12 from Montenegro, and 13[5] banks from North Macedonia. The final sample consists of 104 banks, or 312 observations, which is the corresponding sample size[6] according to Tabachnick & Fidell (2007). Banks' individual financial statements were used as data sources for this research.

Dividend policy was observed in dividend payout ratios (DPR). As independent variables, the size of the board of directors (SIZE_BOARD) and the participation of women on the board of directors of the bank (GENDER) were used. In accordance with previous research, as control variables specific for banks, profitability (PROF), leverage (LEV), the growth rate of the interest income (GR_R), and dividends from the previous year (PREV_DIV) were used. Table 1 shows the method of determining the used variables.

The impact of these determinants on the payment of dividends is examined based on a panel regression analysis. It is a method used in earlier, similar research (Franc-Dąbrowska et al., 2020; Mądra-Sawicka & Ulrich, 2020; Boshnak, 2021; Jovković et al., 2021; Mulchandani et al., 2021). In this regard, it is possible to formulate the following general model of the panel regression analysis in research:

$$DPR_{it} = \alpha + \beta_1 BOARD\_SIZE_{it} + \beta_2 GENDER_{it} + \beta_3 PROF_{it} + \\ + \beta_4 LEV_{it} + \beta_5 GR\_R_{it} + \beta_6 SIZE_{it} + \\ + \beta_7 PREV\_DIV_{it} + \varepsilon_{it} \quad (1)$$

In addition to the panel above regression analysis, the results of descriptive statistics will be presented in the paper and correlation analysis. Statistical data processing was performed using IBM SPSS and EViews statistical packages.

[3] *According to the data of the Bank of Slovenia, at the end of 2020, 15 banks operated in Slovenia, however ABANKA d.d was excluded from the research (due to the lack of available financial statements for 2020) and Slovene Export and Development (SID) Bank d.d. Ljubljana (because it is a bank that is 100% owned by the Republic of Slovenia).*

[4] *According to the Central Bank of Bosnia and Herzegovina, at the end of 2020 in Bosnia and Herzegovina (the Federation of Bosnia and Herzegovina and the Republic of Srpska), 22 banks were operational, but the Development Bank of the Federation of Bosnia and Herzegovina was excluded from the research (because it is a bank which is 100% owned by the Federation of Bosnia and Herzegovina, whose task is the implementation of the economic policy of the Government of the Federation of Bosnia and Herzegovina for economic development and employment).*

[5] *According to the National Bank of the Republic of North Macedonia, at the end of 2020 in the Republic of North Macedonia, 14 banks were operational, but the Development Bank of North Macedonia was excluded from the research (because it is a bank which is 100% owned by the Republic of North Macedonia, whose task is the implementation of the economic development and employment).*

[6] *Tabachnick & Fidell (2007, p.123), indicate that the minimum number of observations should be determined according to the formula N>50+8m, with N as the minimum number of observations, while m indicates the number of independent variables. As 7 variables are used in the research, the minimum number of observations is 106.*

Research Results and Discussion

From the 312 observations, dividend payments were recorded in 85 observations. From that number, 22 observations were recorded in Slovenia, 18 in Serbia, 17 in Croatia, 16 in North Macedonia, 10 in Bosnia and Herzegovina, and two in Montenegro. Regarding yearly observations, 38 banks paid dividends for 2018, 37 for 2017, and 10 for 2019. Only seven banks paid dividends for all three observed years. Table 2 shows the results of descriptive statistics.

As seen in Table 2, the average amount of earnings paid out in the form of dividends is 19.51%. Banks' boards of directors have about 4 members on average, which varies from 2 to 8. On average, almost a quarter of the board of directors members are women, whereas it is recorded that in some banks, all members of the board are female in gender. On the other hand, it was also recorded that the board of directors of individual banks consists only of persons of the male gender. The average profitability of banks observed during the period was 0.73%, while the average share of liabilities in total assets was 85.87%. The average growth rate of interest income amounted to 2.85%.

The results of Pearson's correlational analysis are given in Table 3. The existence of a statistically significant positive dependency between the dividend payout ratio and the size of the board of directors was determined, whereas this dependency is small (r=0.136; p=0.016). Also, a positive dependency is present between the dividend payment ratio and the participation of women on the board of directors, but it is not statistically significant. A statistically significant positive dependence has been identified between the dividend payments and the fact that banks paid dividends in the previous year, whereas this dependency is of medium intensity (r=0.468, p=0.000). Also, a statistically significant positive dependency of medium intensity has been recorded between the dividend payout ratio and the size of the bank (r=0.376; p=0.000). A positive statistically significant dependency was identified between the dividend payout ratio and profitability of banks, with a dependence of small intensity (r=0.166; p=0.003). Also, the existence of (positive or negative) statistically significant dependencies between independent variables can be noticed in Table 3, with a small intensity of dependence. Based on this, the presence of multicollinearity shouldn't be expected.

Table 4 shows the results of the Hausman test. This test shows that the Fixed-Effects model is more adequate in analyzing the collected data than the Random-Effects model. The results of the Fixed-Effects regression analysis

Table 1
Research variables

Variable	Symbol	Description
Dependent Variable		
Dividend payout ratio	DPR	Cash dividend/Net profit
Independent Variables		
Control Variables	BOARD_SIZE	Total number of board members
Percentage of female directors on the board	GENDER	The percentage of female directors on the board to board size
Control Variables		
Profitability	PROF	Net profit/ Total assets
Leverage	LEV	Total liability/Total assets
Growth rate	GR_R	(Current interest income-Last year interest income)/Last year interest income
Bank size	SIZE	Natural logarithm of total asset
Previous year's dividends	PREV_DIV	Dummy variable coded as 1 for banks which declared and paid

Source: Authors' research

Table 2
Descriptive statistics

Variables	Mean	Median	Standard deviation	Minimum	Maximum
DPR	0.1951	0	0.452	0	2.9578
BOARD_SIZE	4.22	4	1.585	2	8
GENDER	0.2442	0.2501	0.2133	0	1
PROF	0.0073	0.0077	0.0184	-0.0806	0.1205
LEV	0.8587	0.8702	0.0625	0.5901	0.9873
GR_R	0.0285	-0.0058	0.894	-0.7438	15.3571
SIZE	13.2318	13.1114	1.33631	10.026	16.9839
PREV_DIV	0.343	0	0.475	0	1

Source: Authors' research

Table 3
Correlation matrix

	DPR	BOARD_SIZE	GENDER	PROF	LEV	GR_R	SIZE	PREV_DIV
DPR	1							
BOARD_SIZE	0.136*	1						
GENDER	0.013	-0.069	1					
PROF	0.166**	0.072	-0.063	1				
LEV	-0.019	-0.394**	-0.073	0.046	1			
GR_R	-0.062	0.080	0.033	-0.216**	-0.277	1		
SIZE	0.376**	0.264**	-0.052	0.282**	0.008	-0.181**	1	
PREV_DIV	0.468**	0.034	0.078	0.266**	0.108	-0.070	0.244**	1

Source: Authors' research
*Note: * and ** indicate significance at the 0.05 and 0.01 levels, respectively*

are presented in Table 5. Based on the value of the corrected determination coefficient, it can be concluded that the observed independent variables are capable of explaining variations in the value of the dividend payout ratio, in the amount of 24.89%. According to Field (2013), there is no autocorrelation problem, since the value of the Durbin-Watson test (2.6381) is in an interval from 1 to 3.

Table 4
Hausman test

Test summary	Chi. Sq. Stat	p-value
	12.1466	0.0158

Source: Authors' research

As seen in Table 5, the size of the board of directors has a statistically significant positive impact on the dividend policy of observed banks and this provides us with an answer to the first research question. This indicates a greater likelihood of bank dividend payments if they have more members on the board of directors. Ntim et al. (2015) explain this by the fact that a larger board of directors, thanks to greater knowledge and experience, is more successful in monitoring and controlling the opportunistic behavior of managers, which affects the reduction of the agency problem and improves business results, i.e., dividend payments. Dividend payout positively affects board composition, suggesting that firms with high-payout tend to adopt good corporate governance structures to protect shareholder interest (Nazar, 2021, p. 291). This may affect the awareness of shareholders to hold stocks. In this way, banks can protect themselves from takeovers. When it comes to research conducted on the example of banks, Umar Mai & Syarief (2021) determined that the size of the board positively affects the propensity to pay dividends while negatively affecting the value of dividend payout ratios.

It was determined that the participation of women on the board of directors negatively affects the dividend policy of banks, whereas this impact is not statistically significant (Table 5). Umar Mai & Syarief (2021) came to similar conclusions. Namely, they found that the participation of women on the board of directors has a negative statistically significant impact on dividend payment tendencies. At the same time, the impact on the value of dividend payout ratios is also negative but not statistically significant. On the other hand, Al-Amarnech et al. (2017) found that the participation of women on the board of directors positively affects the dividend policy of banks expressed by the dividend yield, while there is no statistically significant impact on the dividend payout ratio. As an explanation for the negative, but not statistically significant, participation of women on the board of directors regarding the dividend policy of observed banks, we can state that these banks mainly operate in developing markets. Due to the uncertainty of doing business in these markets, the female members of the board of directors will influence the reaching of conservative financial decisions and the payment of lower dividends (Saeed & Sameer, 2017). This is in line with the theory of gender socialization, according to which women are considered more conservative than men when making financial decisions (García-Meca et al., 2022). The difference in the results about the influence of women members of the board of directors on the dividend policy can also be explained by the fact that earlier research did not examine how many of them voted for the payment of dividends. For these reasons, a survey on this topic should be conducted in future research. This would result in more precise information about the influence of women members of the board of directors on the dividend policy.

Table 5
Fixed-effects regression analysis results

Variables	Coefficient	t-value	Sig.
Intercept	-0.9170	-0.4739	0.6361
BOARD_SIZE	0.1244	2.4139	0.0167
GENDER	-0.2495	-0.7592	0.4486
PROF	-0.7239	-0.3125	0.7549
LEV	-1.1991	-0.9590	0.3387
GR_R	-0.0190	-0.5658	0.5721
SIZE	0.1250	0.7962	0.4269
PREV_DIV	0.1223	0.9735	0.3315
Adjusted R square=0.2489; F=1.9371; (p(F statistic)=0.000); Durbin-Watson stat.=2.6381			

Source: Authors' research

Conclusion

Dividend policy represents a crucial topic in the field of corporate finance. Much research has been conducted to determine the influence of corporate governance characteristics on the dividend policy of companies operating in different markets and industries, whereby researchers arrived at various results. However, in a small portion of the research, the impact of the characteristics of corporate governance on the dividend policy of banks and other financial institutions was examined. This paper

aims to examine the influence of the size of the board of directors and participation of women in the board of directors on the dividend policy of banks which operate in the Western Balkans, whereas dividend payment ratios express dividend policies. By applying the regression Fixed-Effect model, research was conducted on a sample of 104 banks, whereas their dividend policy was observed in the period from 2017 to 2019.

The research found that most banks during the observed period did not pay dividends, whereas this number decreased during the observed period. The most significant number of dividend payments was recorded in banks operating in Slovenia, while the least was recorded in the Republic of Montenegro banks. Less than 7% of the observed banks have made dividend payments during all three years of observation. It was determined that the size of the board of directors of the bank positively affects its dividend policy, i.e., banks with a more significant number of members on the board of directors pay dividends to a greater extent. On the other hand, the existence of a statistically significant influence of the participation of women on the board of directors regarding dividend policies of observed banks was not identified. Also, the impact of control variables (profitability, leverage, the growth rate of interest income, bank size, and dividends from the previous year) on the dividend policy of banks is not statistically significant.

Research offers several theoretical contributions to the existing literature. Firstly, it is complementary to the existing research that aimed to identify factors of the dividend policies of banks. Secondly, it takes into account the impact of the board of directors' characteristics on the banks' dividend policy, and according to the author, this is the first research conducted on a sample of banks in Western Balkans. In addition, the results of this research can be significant, above all, for investors when deciding to invest their funds in bank shares. Namely, they should consider the size of the board of directors when deciding to purchase shares and therefore achieve a higher yield on the basis of dividends.

Several restrictions appear in this paper which provides directions for future research. Since this research only examined the influence of the size and gender structure of the board of directors on the bank's dividend policy, other characteristics of the board of directors should also be included in the future research, such as work experience, education, number of meetings, independence of members of the board etc. Also, in future research, the influence of the ownership structure and the audit committee on the dividend policy of banks should be considered. Since the research covered the dividend policy of banks from 2017 to 2019, the influence of COVID-19 should be examined in future research. Additionally, the impact of the board of directors' characteristics on the dividend policy of other financial institutions, such as insurance companies and leasing companies operating in observed countries, should also be examined.

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Značilnosti upravnega odbora in politika dividend: študija primera bank na Zahodnem Balkanu

Izvleček

Ta članek proučuje vpliv velikosti in udeležbe žensk v upravnem odboru na dividendno politiko bank na Zahodnem Balkanu. Raziskava zajema 104 banke, pri čemer opazuje njihovo dividendno politiko v obdobju od leta 2017 do leta 2019. Dividendna politika je merjena s količnikom izplačila dividend. V opazovanem obdobju je dividende izplačevalo razmeroma majhno število bank. Z uporabo modela s fiksnim učinkom je bilo ugotovljeno, da ima velikost upravnega odbora statistično značilen pozitiven vpliv na dividendno politiko opazovanih bank. V zvezi z udeležbo žensk v upravnem odboru ni bil ugotovljen statistično značilen vpliv na dividendno politiko bank. Rezultati raziskave so lahko, razen tega, da prispevajo k obstoječi literaturi s področja korporativnih financ, pomembni tudi za investitorje, ko se odločajo o vlaganju sredstev v delnice bank.

Ključne besede: banke, upravni odbor, struktura po spolu, dividendna politika, Zahodni Balkan

Digital Divide and the Use of Digital Public Services During the COVID-19 Pandemic

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Abstract

The COVID-19 pandemic enhanced digital transformation. With the spread of the pandemic and the introduction of epidemiological measures, citizens were enforced to use the Internet to an increased extent. The digital divide among citizens and the capability of citizens to get an equal level of services has also come to the fore. The paper explores the changes in the use of e-government services and the impact of the pandemic on the citizens' attitudes toward Internet use in Croatia. The analysis is based on the survey data. The results show that due to the pandemic, citizens became more dependent on IT equipment. Citizens spend more time using digital public services than in the pre-pandemic period. The results also reveal differences in the COVID-19 impact on the use of digital public services between different groups of population.

Introduction

The COVID-19 pandemic changed digitalization's role and perception and boosted digitalization in the public sector (European Commission, 2021, European Commission, 2021a). With the spread of the pandemic and the introduction of epidemiological measures to combat the pandemic (lockdown, closure of numerous activities that required physical contact, socializing or gathering, etc.), there was a greater necessity for citizens to use digital technologies. Digital technologies became necessary to work, learn, shop, access many public services (including health services), get information, and entertain. The report made by Crahay et al. (2021) on the digital response to COVID-19 in the European Union (EU) countries shows that member countries developed or enhanced the implementation of digital technologies and solutions in the public sector (online platforms, informative chatbots, repositories, mobile applications, online portals, etc.) and that pandemics enforced governments and public administrations to provide additional ways to deliver public services. However, the research of Roseth et al. (2021) implies that despite the digitalization of a range of services in a short period, improvements in the availability and quality of digital public services are needed.

Very soon after the pandemic started, those with no network connection, necessary devices, or IT knowledge became excluded (De et al., 2020; Seifert et al., 2020). So, the pandemic has reemphasized the digital divide and inequalities associated with digital exclusion (Li, 2022, Lai and Widmar, 2021). The paper explores the change in the use of digital public services and the impact of the pandemic on the citizens' attitudes toward Internet use. The paper primarily focuses on the situation on the islands for several reasons. Croatia has 78 islands and 524 islets (Ministry of Regional Development and EU Funds, 2022), and 49 islands are permanently inhabited. Although there are no official data on the density of broadband access on the islands, the literature indicates that the relevant indicators of the density of broadband access on the islands are lower than the Croatian average and that there is not sufficient commercial interest in building broadband networks on the islands (Lator d.o.o., 2011). There are several limitations due to which there is insufficient interest or there are high costs of developing broadband networks on the islands, such as the different distances between the islands and the mainland, the number of settlements on the islands, the population density of the islands and others (Lator d.o.o., 2011). In addition, due to the restriction of passenger transportation from the island to the mainland and epidemiological measures during the lockdown, it was more difficult for island residents to access different services. During the pandemic, there were many challenges on the islands, and the digital gap between the islands and the mainland came to the fore even more. Therefore, the paper investigates how people on the islands adapted, to what extent they used the Internet during the pandemic and for what purposes, and how the pandemic affected the acceptance of digital public services among residents.

The remainder of the paper is structured as follows. The second section contains a review of the literature. The third section provides a short overview of the methodology. The fourth section contains the survey results and the fifth section summarizes the conclusions.

Theoretical Background

Literature review

Digital public services or e-government services can be defined as the use of technology to provide services to the citizens and the use of information and communication technology in public administration procedures and consist of obtaining information, downloading and/or returning filled-in forms, and going entirely electronically through an administrative procedure (Eurostat, 2022; European Commission, 2023). Literature indicates many positive impacts of e-government. European Commission (2021b) stresses the public sector as one of the flagships of the EU's Recovery and Resilience Facility that will help Europe emerge stronger and more resilient from the current crisis. Countries with a higher level of public sector digitization were more successful in providing public services to citizens during the lockdown that followed as a response to the pandemic. Also, they proved to be more resilient in continuously providing public services to the citizens (Crahay et al., 2021).

Crahay et al. (2021) notice 3 groups of factors on which, viewed from the perspective of public administration, the spread of public services as a response to the health crisis depends. First, human capital factors include the level of civil servants' digital skills, the capacity of public administrations to innovate and change, and public administrations' knowledge of reusable tools that can accelerate digital improvements and change. The second group of factors is government factors which include the level of cross-administration collaboration to mutualize resources and skills and the level of partnership with private organizations, information transparency, availability of financial resources, adequate public procurement schemes, crisis management, and existing framework for delivering digital public services. The third group of factors is technological factors, including access to collaborative communication tools, level of civil servants' access to documents and data, access to hardware for remote work, IT infrastructure, and cybersecurity.

Chatzoglou et al. (2015) investigated the intention to use e-government services in Greece and showed that perceived usefulness, trust, Internet experience, peer influence, computer self-efficacy, and perceived risk are the factors on which the use of e-government services among citizens depends. Kumar et al. (2007) based on a literature review dealing with the use of e-government services, conclude that the adoption of e-government services depends on user characteristics, website design, as well as on data security and privacy. Vishanth et al. (2016) analysis show that satisfaction with the use of e-government services depends on information quality, system quality, trust, and costs.

The literature on the digital divide indicates that Internet use is more widespread among the young population than among the elderly (Lee and Porumbescu, 2019). Alzahrani et al. (2018) investigate the differences in citizens' trust in e-government between men and women. Al-Hujran et al. (2015) investigate factors that impact the adoption of e-government and show that citizen attitude toward using

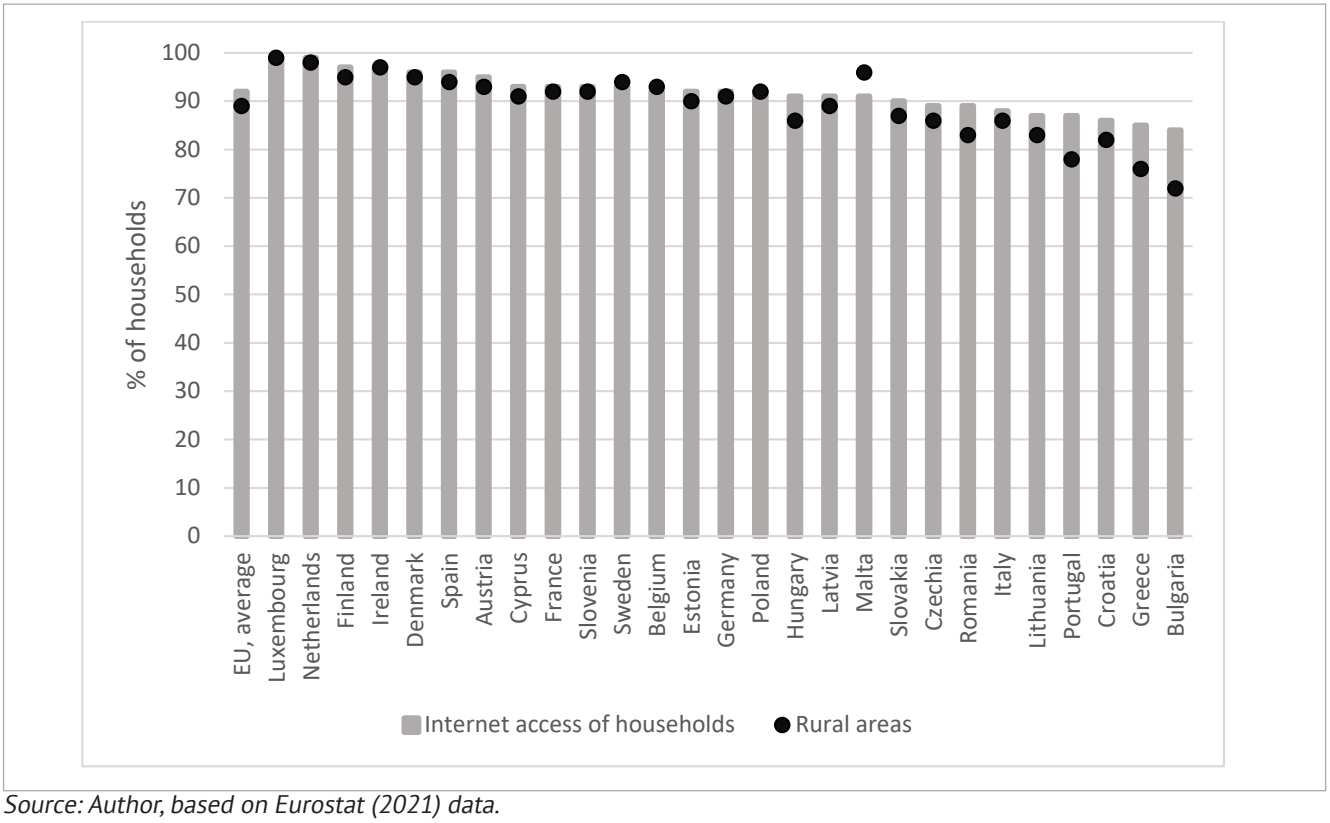
e-government services is the most significant determinant of citizen intention to use e-government services. Hooda et al. (2022), Carter and Bélanger (2005), and Bélanger and Carter (2008) notice that the intention to use e-government depends on the trust in e-government, trust of the Internet, and perceived ease of use. Samsami and Schøtt (2022) and Acheampong (2021) investigate entrepreneurs' adoption of digital technologies before and during the pandemic. Some literature deals with how the pandemic affected citizens' acceptance of digital technologies. The literature indicates that many still prefer traditional service delivery over digital public services (Alzahrani et al, 2018). Citizens' attitudes about digital public services are essential for accepting this type of service.

COVID-19 revealed many weaknesses and vulnerabilities in the digital space (European Commission, 2021a). Some categories of the population are excluded from using digital technologies. The problem is that many citizens are still not Internet users or do not have access to the Internet (European Parliament, 2015, DigitalEurope, 2022). Moreover, most European countries have a significant urban-rural digital divide due to low network deployment in less-dense areas (DigitalEurope, 2022). In the paper, OECD's definition of the digital divide is used. It refers to "the gap between individuals, households, businesses, and geographic areas at different socio-economic levels concerning both their opportunities to access information and communication technologies (ICTs) and to their use of the Internet for a wide variety of activities" (OECD 2022, 200-201).

Digital divide and Internet use in the European Union

According to Eurostat (2021) data, the share of households with internet access in EU countries has been increasing. In 2021, on average 92% of households had internet access in the EU. Croatia is below the EU average, and it is, along with Greece and Bulgaria, the country with the lowest level of Internet access among households (86%) (Figure 1). Eurostat's (2021) data on Internet access of households by the degree of urbanization point to significant differences in Internet access rates in towns and rural areas. This divide is enormous in Croatia. Also, individuals in Croatia used the Internet more rarely than in most other EU countries (Eurostat, 2021).

Figure 1
Internet access in European Union countries, 2021



Source: Author, based on Eurostat (2021) data.

The evidence about the digital divide is stark. As stated in the European Commission (2021a) COVID-19 showed a new digital divide, not only between well-connected urban areas and rural and remote territories, but also between those who can fully benefit from an enriched, accessible, and secure digital space with a full range of services, and those who cannot. Thus, European countries' Recovery and Resilience Plans and the European Commission proposed "Path to Digital Decade" plan shows that EU countries are putting efforts to foster digital transformation and achieve better global resilience. EU digital transformation targets for 2030 are a digitally skilled population and highly skilled digital professionals, secure and sustainable digital infrastructures, the digital transformation of businesses, and the digitalization of public services (European Commission, 2021a, European Commission, 2022).

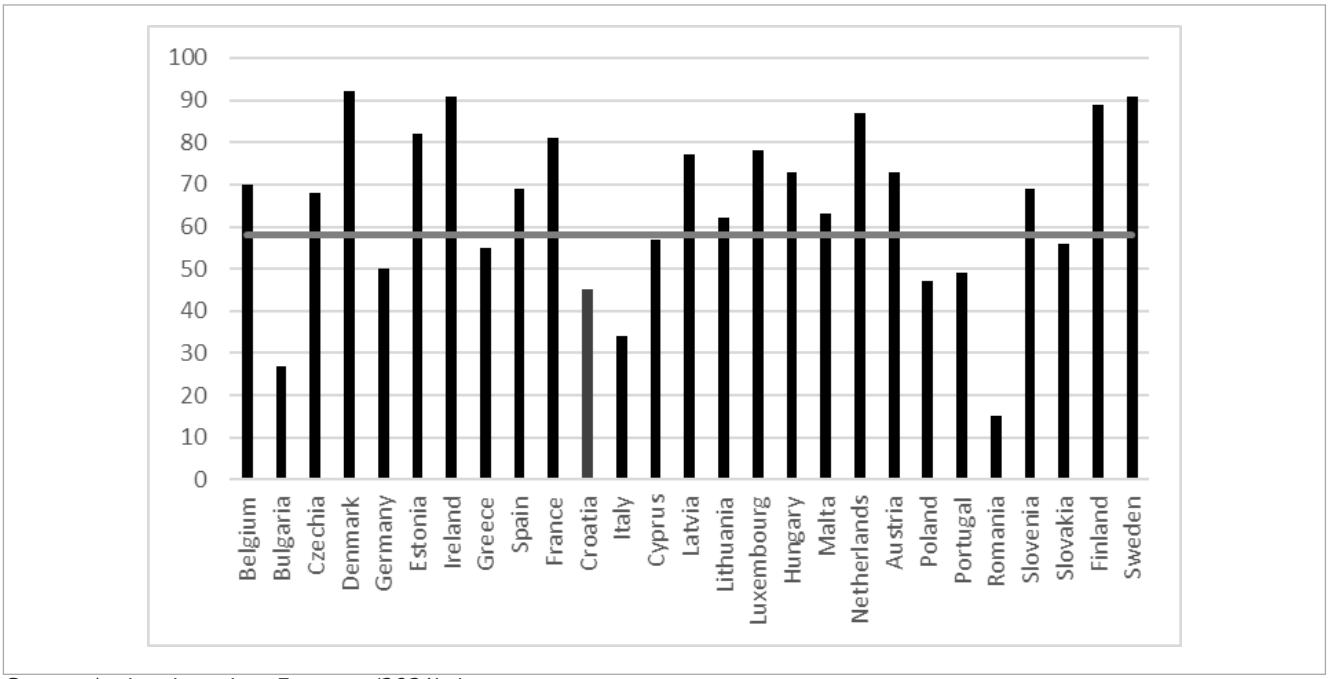
In 2021, 54% of EU and 63% of Croatian citizens had at least basic overall digital skills (Figure 2). The level of overall digital skills varies by gender and by age. In most countries, more men than women have at least basic digital skills. Also, the share of people with at least basic overall digital skills is higher among people younger than 25 than among people older than 55.

Data in Figure 3 show an increase in citizens' use of the Internet for interacting with public authorities during the ten years. EU citizens most frequently used e-government services to obtain information from public authorities' websites (47% of citizens in 2021), followed by submitting completed official forms (44%) and downloading official forms (38%).

Croatia is among the EU countries with the lowest percentage of citizens who use the Internet for interaction with public authorities (Figure 4.). Croatian citizens mostly used e-government services in 2021 to obtain information (42%). Only 34% of the citizens used it for downloading official forms and 24% for submitting completed official forms.

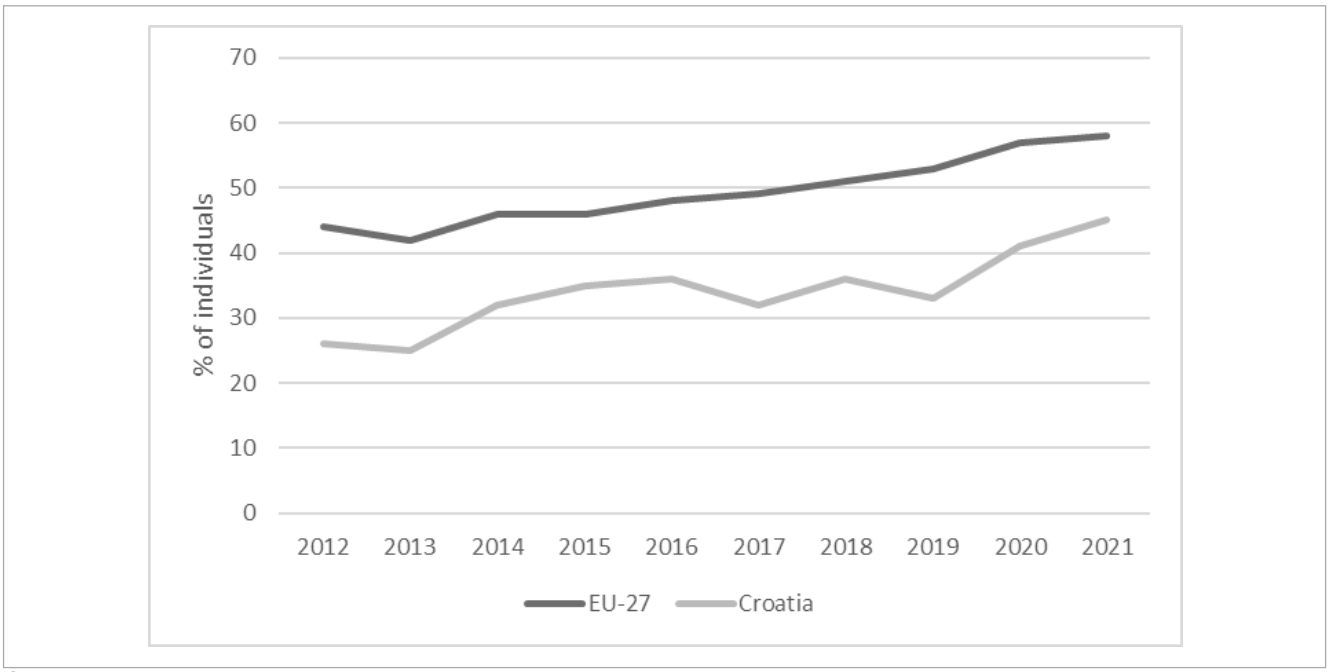
Digital Economy and Society Index report also notice a slight increase in the use of digital solutions during the COVID-19 pandemic by citizens and enterprises (European Commission, 2022). The EU 2030 digitalization targets for public services are that all vital public services should become online, 100% of citizens should have access to medical records, and 80% of citizens should use digital IDs.

Figure 2
Individuals with basic or above basic overall digital skills, %



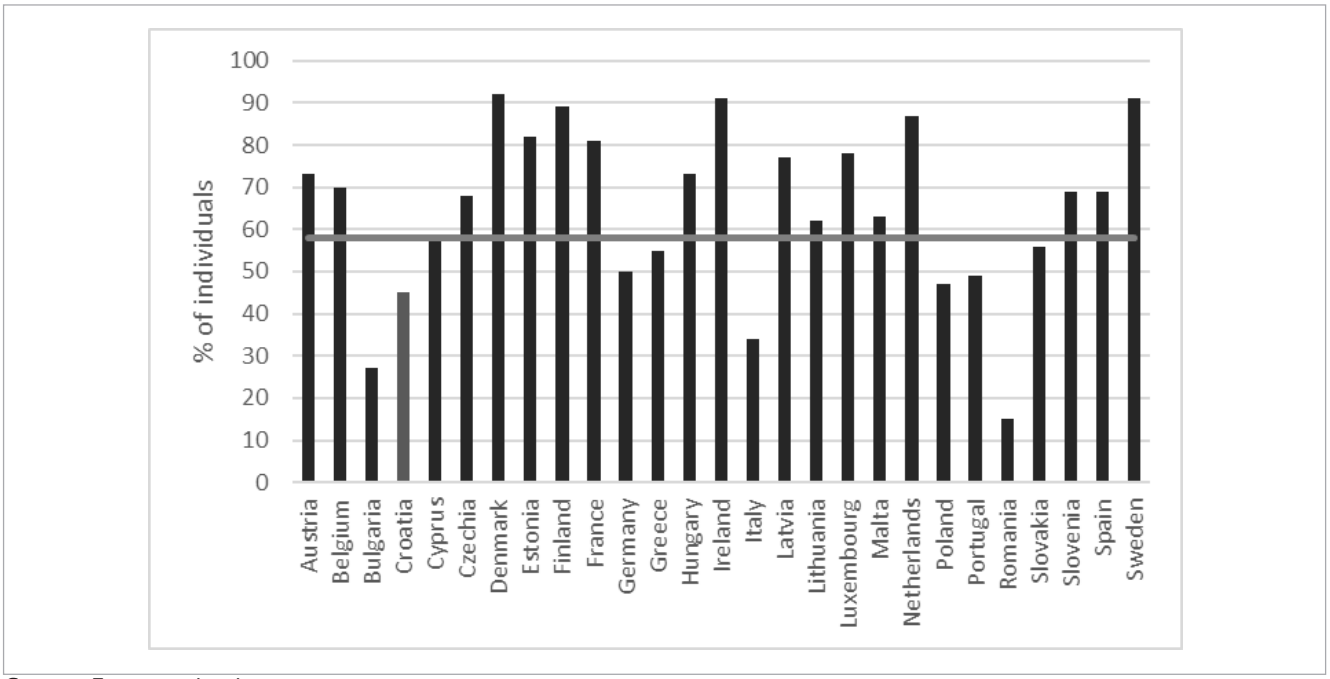
Source: Author, based on Eurostat (2021) data

Figure 3
Internet use for interaction with public authorities in EU-27, 2012-2021



Source: Eurostat database.

Figure 4
Internet use for interaction with public authorities in the last 1 year, 2021



Source: Eurostat database.

Methodology

In this paper, the analysis is based on the survey conducted in 2020 among Croatian citizens living on the islands. The survey covered participants from islands of different sizes and different proximity to the mainland of Croatia, namely islands Pag, Dugi otok, Krk, Cres, Rab, Vir, Lošinj, Pašman, Ugljan, Iž, Susak, Olib, Ilovik, Silba, and Zlarin.

The questionnaire was sent to around 1,000 citizens by e-mail. E-mail addresses were collected from the Internet and covered owners of family farms, citizens who rent apartments, companies on the islands, and other individuals living on the islands. The snowball sampling technique[1] was then used, which is common sampling procedure used when it is very hard or expensive to use other sampling procedures. The survey was made in LimeSurvey, and could be accessed on a computer, tablet, or mobile phone. The results were analyzed using the statistical program SPSS Statistics 23.

The questionnaire consisted of several themes related to this topic. Most questions were measured using a 5-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). Additionally, the survey contained questions revealing the participants' socio-demographic characteristics (age, level of education, gender, residence, etc.).

The age of the survey participants ranged from 24 to 77 years. 42% of respondents were males, and 58 females. Data about education show that 36% of respondents had at least secondary education, and others had higher education. 87% of respondents stated that they are permanent residents of the island, 10% spend more than 3 months per year on the island, and the rest spend less than three months per year on the island.

Empirical Analysis

The COVID-19 pandemic has affected the use of IT equipment. Of the total number of surveyed citizens, 41.7% stated that they use IT equipment more than in the pre-pandemic period. Slightly more women than men increased the use of IT equipment. At the same time, people under the age of 65 increased the use of IT equipment to a greater extent than older people, which is expected considering the introduction of remote work and education during the lockdown, which demanded more significant use of IT equipment. 25.0% of people over the age of 66 increased their use of IT equipment during the lockdown.

Further, 38.6% of respondents used e-payments more than in the period before the pandemic. At the same time, the most significant increase occurred among the elderly population, i.e. people over 65 years old. 50% of people over 65 used e-payments more than before the pandemic. Observed by gender, women started using e-payments more than men compared to the pre-pandemic period.

The results indicate a positive relationship between security and privacy concerns due to increased Internet use and age. Thus, older people are most concerned about safety and privacy, and people under 30 are the least concerned. By gender, women are more concerned about Internet security and privacy than men. As many as 58.5% of men are not concerned about security and privacy, while this percentage among women amounts to 40%.

Furthermore, during the pandemic, the most significant number of respondents began to spend more time on the Internet searching for daily news and general information, 28.6% of them. In addition, 25.0% of respondents started spending more time online shopping, and 17.9% on sending and receiving e-mails. 15.2% of respondents stated that they now spend more time on digital public services than in the pre-pandemic period (Table 1). At the same time, slightly more women (17.7%) than men (13.3%) increased the time they use digital public services, although the t-test tests no statistically significant differences.

Statistically significant differences in the time spent on the Internet during the pandemic exist when differences are observed concerning the age of the respondents. Thus, during the pandemic, people between 30 and 59 increased the time spent on digital public services the most, while those under 30 did the least (chi-square: 0.110).

Most respondents stated that after the pandemic, they would continue to use the Internet as they did during the pandemic. This is what 67% of respondents claim, while 16% of them disagree with that statement. Interestingly, among the people who stated that they would continue to use the Internet to the same extent, the majority are citizens older than 60. In the group of people who said that after the pandemic, they would no longer use the Internet to the same extent as during the pandemic, the majority are people under 35. This indicates a reduction in the differences between the younger and older population in Internet use. Observed by gender, 63.3% of female and 77.5% of male respondents stated that they would use the Internet to the same extent as during the pandemic.

[1] *Snowball sampling is a non-probability technique where participants are asked to recruit other participants in the research which could be difficult to reach otherwise.*

Table 1

Time spent on the Internet for different activities compared to the pre-pandemic period

	Searching for the daily news and general information	E-mails	Games	Shopping	E-banking and m-banking	Public services
	%	%	%	%	%	%
Less time	8.9	3.6	21.4	9.8	0.9	14.3
The same time as before	62.5	78.6	64.3	65.2	82.1	70.5
More time	28.6	17.9	14.3	25.0	17.0	15.2

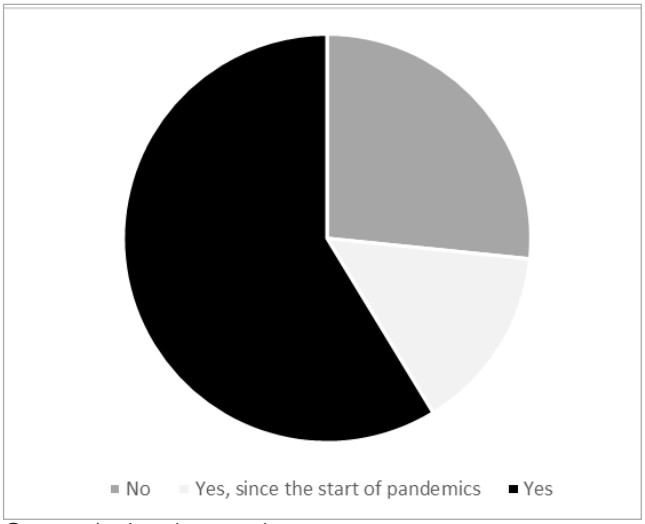
Source: Authors' research

Figure 5 shows how many people use the e-government service and whether they used it before the pandemic or started using it only after the start of the COVID-19 pandemic.

The survey results indicate that 59% of respondents used the e-government service before the pandemic. Furthermore, 15% of respondents started using the e-government service after the start of the COVID-19 virus pandemic. This indicates that the pandemic has encouraged some citizens to use digital public services. Of these, 98.1% stated that even after the pandemic, they would continue to use digital public services, which leads to several conclusions. First, among some citizens, the need for public services has overcome resistance to digitization, and it will have lasting positive consequences on the use of public services. Second, although the survey did not examine the satisfaction of using public services, the fact that the respondents stated that they plan to continue to use digital public services indicates satisfaction with the use and that there has been an increase in trust in these services.

Figure 5

Use of e-government services

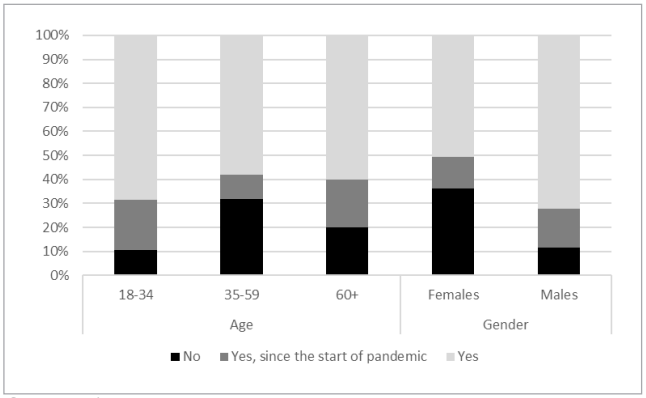


Source: Authors' research

Observed according to the age of the respondents, as many as 89.5% of people under 35 stated that they use the e-government service and many of them do this since the pandemic. Every fourth person (25.0%) under 30 stated that they did not use the e-government service before the pandemic but started using it. Also, many citizens older than 60 stated that they have started using e-government services since the pandemic. As many as 22.2% of people over 65 started using the e-government service during the pandemic. Mensah and Mi (2017) research showed a positive relationship between age and intention to use e-government services. This research shows that the pandemic influenced the increase in the use of e-government services among all age categories.

Figure 6

Use of e-government services by age and gender



Source: Authors' research

Observed by gender, more men than women started using the e-government service during the pandemic. Thus, 16.3% of men stated that they did not use e-government services before the pandemic but had started using them. The same is true for 13.1% of women. Interestingly, as many as 36.1% of women stated that they did not use and do not plan to use the e-government services in the future, while 11.6% of

men stated the same. The low level of digital skills hampers the more significant expansion of digital public services and could deepen the digital divide.

Table 2

Differences in attitudes between users and non-users of e-government services

		Users	Non-users
I use IT equipment more due to the pandemic, mean	Mean	3.13	3.10
	S.D.	1.340	1.520
The pandemic increased digitalization in the public sector, mean	Mean	3.91	3.85
	S.D.	1.085	1.231
I am concerned about security and privacy due to the increased use of the Internet, mean	Mean	2.68	2.86
	S.D.	1.286	1.484

Source: Authors' research

The data in Table 2 show differences in attitudes between users of e-government services and those who are not users of e-government services. The survey results indicate no correlation between the increase in the use of IT equipment during the pandemic period and the use of e-government services. Both users of e-government services and those who do not use e-government services increased their use of IT equipment to the same extent during the pandemic.

Users of e-government services agree to a greater extent that the digitization of public services has increased during the pandemic. Such results indicate that the dissemination of information about available digital public services could contribute to an increase in the number of users of e-government services.

The research results indicate that people who do not use e-government services have higher online privacy concerns than users of e-government services. This is a significant result that shows that the level of online privacy concern could be one of the predictors of citizens' intention to use e-government services. Investigating the development of smart city models, van Zoonen (2016) stressed that smart city technologies and urban big data create privacy concerns among citizens. The survey results in Croatia also show that the similar is valid on the public sector level.

Conclusion

This research contributes to the literature dealing with the digital divide and the acceptance of digital public services by analyzing the changes caused by the COVID-19 virus pandemic from the perspective of citizens. The COVID-19 pandemic has increased the need for the use of IT equipment among citizens regardless of their socio-demographic characteristics. The survey results indicate that since the pandemic started, citizens have spent more time on the Internet. Also, the pandemic accelerated digitization in the EU's public sector, which indicates the results of research conducted in Croatia. Thus, 72.1% of citizens living on the islands consider that the digitization of the public sector increased during the pandemic. However, the problem is that Internet infrastructure is not equally available on the whole territory of the Republic of Croatia. Thus, the quality of service is not the same. This problem could be noticed on the islands, where there is often a problem with poor internet availability, but also it is more difficult for the population living on the islands to get products and services than on the mainland. During the lockdown period, transportation from the island to the mainland was difficult and significantly reduced due to the implementation of epidemiological measures. On some islands, the Internet is slower or less accessible, leading to problems with digital public services. This problem was particularly pronounced during the lockdown period and during the entire pandemic period when the need for health-related and education-related public services was greater.

The COVID-19 pandemic influenced the level of acceptance of digital public services. The research results indicate that all population categories began to use the Internet and digital public services more during the pandemic. Differences between younger and older people in Internet use are decreasing. However, regarding digital public services, research results show a lower tendency for women to use digital public services. Thus, COVID-19 exposed many gaps and inequalities where improvements are needed. Despite the development of digital public services, the differences between citizens have deepened during the pandemic. A low level of digital skills hampers a more substantial increase in the use of digital public services. In addition, research results reveal that people's tendency to use e-government services also depends on their trust in those services and online privacy concerns. The pandemic additionally raised the question of the digital divide among citizens and the capability of citizens to get an equal level of public services.

This research contributes to understanding the limitations of greater use of digital public services, which is essential to analyze how to remove these obstacles and to avoid further deepening the gap between users and non-users of public services. Namely, even though further digitization brings numerous advantages, providing all citizens with equal availability and quality of public services is essential.

This research has some limitations. First, it would be necessary to investigate the impact of the pandemic on the use of e-government services on a larger sample of citizens in different European countries. Second, it would be interesting to investigate the level of trust in e-government services among citizens and sources of differences in more detail. The above provides opportunities for further research.

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Digitalni razkorak in uporaba digitalnih javnih storitev med pandemijo COVID-19

Izvleček

Pandemija COVID-19 je okrepila digitalno preobrazbo. S širjenjem pandemije in uvedbo epidemioloških ukrepov so bili državljani prisiljeni v večji meri uporabljati internet. V ospredje je dodatno stopilo vprašanje digitalnega razkoraka med državljani in zmožnosti državljanov, da dobijo enako raven storitev. Članek raziskuje spremembe pri uporabi storitev e-uprave in vpliv pandemije na odnos državljanov do uporabe interneta na Hrvaškem. Analiza temelji na anketnih podatkih. Rezultati kažejo, da so državljani zaradi pandemije postali bolj odvisni od uporabe informacijske opreme. Državljani porabijo več časa za uporabo digitalnih javnih storitev kot v obdobju pred pandemijo. Rezultati razkrivajo tudi razlike v vplivu COVID-19 na uporabo digitalnih javnih storitev med različnimi skupinami prebivalstva.

Ključne besede: digitalne javne storitve, storitve e-uprave, državljani, digitalni razkorak, uporaba interneta

The Impact of COVID-19 on Bank Efficiency in the Western Balkans: A DEA Approach

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Abstract

This paper aims to assess and compare the relative efficiency of commercial banks in six Western Balkan developing countries (North Macedonia, Serbia, Montenegro, Bosnia and Herzegovina (B&H), Kosovo[1], and Albania), using the leading nonparametric methodology Data Envelopment Analysis (DEA) for the period 2016-2020, and investigating the impact of the COVID-19 pandemics on the performance of banking systems in these countries. The output-oriented DEA model has been implemented with interest expenses and non-interest expenses as inputs and interest revenue and non-interest revenue as outputs. Our findings show that the average efficiency of the six Western Balkan banking systems differs, and Kosovo's banking system has noted the highest average efficiency in the whole observed period (2016–2020). In contrast, the banking system in Bosnia and Herzegovina noted the lowest average efficiency. The COVID-19 pandemic decreased the relative efficiency of the banking sectors in all six of the Western Balkan countries observed, except Kosovo. However, additional research that includes all pandemic years is recommended to assess the impact of the COVID-19 pandemic on the banking systems in the Western Balkans. This study provides invaluable insights for academic members, banking management and regulatory bodies, governments, and the interested public. It is the first empirical study that includes a glimpse of the first impact of the COVID-19 pandemic on banking systems in the developing countries of the Western Balkans.

Introduction

With the disintegration of the Socialist Federal Republic of Yugoslavia (SFRY) and the Union of Soviet Socialist Republics (USSR) at the end of the 1980s and the beginning of the 1990s, the countries of Central and Eastern Europe abandoned the system of "planned economies". They began to rapidly build economic systems based on market principles and rules that were compatible

[1] *All references to Kosovo in this document should be understood to be in the context of United Nations' Security Council Resolution 1244 (1999).*

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and comparable with those of developed countries (Cvetkoska et al., 2020). Except Albania, the six Western Balkan countries studied were all part of SFR Yugoslavia until 1991. Therefore, these countries underwent a transition process that included "the transition of ownership, of the market, and of the political structure" (Vojnić, 1995). This, of course, implied a fundamental restructuring of their banking sectors as well. Namely, in the past economic system, banks were "financial organizations that in most cases were designed to support the central planning apparatus" (Cvetkoska et al., 2021). However, other authors (Radzic & Yuce, 2008) claim that "Yugoslavia's banking market differed from other planned economies in the sense that its banks participated in commercial as well as financial activities for enterprises."

In this transition process, the Western Balkan countries experienced quite some challenges in restructuring their banking sectors, such as numerous reorganizations (mergers, acquisitions, changes in management, etc.) (Toci, 2009). The main characteristic of these countries' financial sectors is that, unlike in developed countries, they are "largely dominated by banks rather than the capital market." The financial systems of the Western Balkan countries are dominated by banks (banks hold 83–98% of financial sector assets, except for Kosovo with 65%), which are mostly foreign-owned. Banks operate on a traditional business model characterized by the taking of deposits and the provision of loans. Their banking systems are "well capitalized and liquid," but challenges regarding asset quality and indirect credit risk remain. Furthermore, they "seem less prone to financial stress from maturity mismatches" (ECB, 2019).

This paper aims to assess the efficiency of the banking sectors in six Western Balkan countries and then analyze and comment on the impact of the COVID-19 pandemic on their efficiency. This study addresses the inevitable question: How has the COVID-19 pandemic affected the efficiency and performance of banks in the Western Balkan?

The efficiency of any business is crucial for its sustainability and growth. It refers to "the minimization of inputs used by a firm to produce a given level of outputs or the maximization of outputs produced by a given set of inputs under a given state of technology" (Toci, 2009). The leading non-parametric methodology, DEA, is "the most widely used efficiency evaluation method" (Radojicic et al., 2018). As a result, the DEA-window technique with two inputs and two outputs was used in this study from 2016 to 2020 (5 consecutive years). The findings reveal that the average efficiency of the six Western Balkan banking systems differs over the observed period, and Kosovo's banking system has noted the highest average efficiency in the whole observed period (2016-2020). In contrast, the banking system in Bosnia and Herzegovina noted the lowest average efficiency. The COVID-19 pandemic decreased the relative efficiency of the banking sectors in all six of the Western Balkan countries observed, except Kosovo. These findings will be important to bank management, regulatory bodies, investors, and the public.

The rest of the paper is structured as follows: After the introduction, Section 2 presents a literature review of studies concerning bank efficiency with DEA for each of the six Western Balkan countries. Section 3 presents the methodology used, variables, and data. Section 4 presents and analyses the findings. Section 5 discusses the results, while Section 6 concludes the paper.

Literature Review

The literature on the efficiency of banks in the Western Balkans is still "relatively scarce, though growing, with the parametric approach dominating the non-parametric approach" (Toci & Hashi, 2013). Data Envelopment Analysis is one of the leading non-parametric approaches to measuring efficiency. Since its introduction in 1978 by Charnes, Cooper, and Rhodes, the DEA methodology has gained popularity and spread its application in many industries. Moreover, DEA has been implemented in numerous studies regarding banking worldwide. According to Emrouznejad & Yang's (2018) study, banking is one of the top five areas in which DEA is most commonly applied, along with agriculture, supply chain, transportation, and public policy.

This study conducts an in-depth review of the literature on bank efficiency studies with DEA approach in each of the Western Balkan countries examined (eight in Serbia, six in North Macedonia, none in Montenegro, three in Albania, three in Kosovo, five in Bosnia and Herzegovina, and six cross-country studies that include any of these Western Balkan countries). Table 1 provides an overview of the scholarly literature on bank efficiency in each of the countries studied.

Methodology

In this paper, we assess and compare the relative efficiency of commercial banks in each of the six Western Balkan developing countries (North Macedonia, Serbia, Kosovo, Montenegro, Albania, and Bosnia and Herzegovina) using the DEA window analysis technique for the period 2016-2020, in order to assess the impact of the COVID-19 pandemic on the efficiency and performance of the six countries' banking sectors.

Table 1

Scholarly literature regarding Western Balkan bank efficiency

Cross-country studies	North Macedonia	Bosnia and Herzegovina	Serbia	Albania	Kosovo	Montenegro
Toci (2009)	Giustianiani & Ross (2008)	Efendić & Avdić (2011)	Mihailović et al. (2009)	Spaho (2015)	Zogjani & Kelmendi (2015)	none
Anayiotos et al. (2010)	Cvetkoska (2010)	Abu-Alkheil et al. (2012)	Marković et al. (2015)	Spaho, Mitre & Shehu (2015)	Zogjani, Mazelliu & Humolli (2018)	
Toci & Hashi (2013)	Micajkova & Poposka (2013)	Memić & Škaljić-Memić (2013)	Radojicic et al. (2015)	Braimllari & Benga (2019)	Sahiti & Sahiti (2021)	
Varesi (2015)	Naumovska & Cvetkoska (2014)	Efendić (2017)	Popović, Stanković & Marjanović (2017)			
Cvetkoska, Fotova Čiković & Tasheva (2021)	Naumovska & Cvetkoska (2016)	Husejinović (2019)	Lukić, Sokić & Kljenak (2017)			
Milenković et al. (2022)	Fotova Čiković & Cvetkoska (2017)		Savić et al. (2017)			
	Cvetkoska and Fotova Čiković (2020)		Radojicic et al. (2018)			
			Bošković & Krstić (2020)			

Source: Authors' research

Data Envelopment Analysis is one of the most prominent nonparametric methodologies extensively used in different industries and "applied in more than 6500 publications" (Radojicic et al., 2018) since its introduction in 1978. DEA is a technique of operations research that is used in the efficiency evaluation of homogeneous units called decision-making units (DMUs) (Braimllari & Benga, 2019). The DMUs can be banks, hospitals, police stations, tax offices, defense bases, schools, insurance companies, libraries, university departments, etc. DEA is a "productive efficiency measurement method" (Rabar, 2013) with the use of the "same multiple inputs and multiple outputs" (Jemrić & Vujčić, 2002). The basic DEA model introduced by Charnes, Cooper, and Rhodes (1978) assumed a constant return to scale (CRS). This model was extended in the study of Banker, Charnes, and Cooper (1984), who introduced the BCC DEA model with a variable return to scale (VRS) (Anayiotos et al., 2010). Furthermore, a DEA model can be input- or output-oriented. The input orientation focuses on the minimization of inputs while satisfying at least the given output levels. In contrast, the output orientation attempts to maximize outputs without requiring more of any of the observed input values (Cooper et al., 2007).

DEA has several advantages over parametric methodologies, including "a single unambiguous measure of performance, the handling of multiple input and output variables in different measurement units, and without any assumptions on data distribution; a focus on DMU best practices and recommendations by calculating a virtual DMU efficiency for each DMU under evaluation" (Mihailović et al., 2009); "the ability to include more than one output and not set assuages" (Cvetkoska & Fotova Čiković, 2021). The DEA methodology provides a separate evaluation of the efficiency of each DMU in the sample relative to its reference set, thus "providing a relative measurement of efficiency for every single DMU" (Anayiotos et al., 2010).

In this study, the leading nonparametric DEA technique Window analysis under the VRS assumption, based on the Banker-Charnes-Cooper (BCC) model, has been used, and more specifically, the operating (income-based) approach has been applied following Cvetkoska & Fotova Čiković (2020). The input and output variables were chosen using the model in Banker et al. (2010) and Cvetkoska & Fotova Čiković (2020). Therefore, in this study, two input and two output variables have been selected: interest expenses and non-interest expenses as inputs and interest revenue and non-interest revenue as outputs. The data for those variables have been drawn from the official financial reports of each commercial bank. The detailed specification of the variables is presented in Table 2.

Table 2

Inputs and outputs of the DEA model

Character of variable	Variables	Elements of the variables
INPUT	interest expenses (I1)	
	non-interest expenses (I2)	Expenses on fees and commissions General administrative expenses and depreciation Expenses on value adjustments and provisions Other operating expenses
OUTPUT	interest revenues (O1)	
	non-interest revenues (O2)	Income from fees and commissions Other operating income

Source: Authors' research

The envelopment form of the output-oriented BCC DEA model is given in (1) – (5):

$$(BCC-Oo) \qquad \max_{\eta_B,\lambda} \eta_B \tag{1}$$

$$subject\ to \qquad X\lambda \le x_0 \tag{2}$$

$$\eta_B y_0 - Y\lambda \le 0 \tag{3}$$

$$e\lambda = 1 \tag{4}$$

$$\lambda \geq= 0 \tag{5}$$

where η_B is a scalar. The input data for DMUj (j = 1, …, n) are (x1j, x2j, …, xnj), and the output data are (y1j, y2j, …, ynj); the data set is given by two matrices X and Y, where X is the input data matrix, and Y is the output data matrix, λ is a column vector and all its elements are non-negative, while e is a row vector and all its elements are equal to 1 (Cooper et al., 2007, pp. 22, pp. 91–92), (Cvetkoska & Barišić, 2017, pp. 33–34). The BCC efficiency requires the fulfilment of two conditions: (1) the result of the BCC efficiency to be equal to 1 (100%), and (2) all slacks to have a zero value (Cvetkoska et al., 2021).

The "window analysis" technique is defined as "subdividing the entire period of data into smaller windows to be analyzed separately" and is often used to "analyze the evolution of efficiency trends over time." With the window analysis, every window is separately analyzed with DEA (Paradi et al., 2018). Moreover, the window analysis is also treated as "a method for studying the stability of DEA results" because it involves the removal of entire sets of observations and their replacement by other (previously not considered) observations (Cooper et al., 2007). This technique is one of the methods used "to verify productivity change over time," which makes it very applicable in "detecting performance trends of a decision-making unit over time" (Repkova, 2014).

The DEA analysis's most significant advantage is that it is advantageous with small samples and works well when multiple inputs and outputs are selected. This method increases the number of observed DMUs and introduces dynamicity and a time dimension into the DEA model (Cvetkoska & Fotova Čiković, 2020). According to Repkova (2014), the DEA window analysis technique can be perceived as "a special case of a sequential analysis." Its advantage is reflected in the possible comparison and contrast of the performance and efficiency of each DMU against itself and other banks, as well as its performance in other periods in addition to the performances of other units.

This method's most frequently mentioned limitation is that entities in the first and last periods are not tested as frequently as others (Cvetkoska & Fotova Čiković, 2020). Due to the notion that efficiency changes over time, we found that the DEA window analysis technique is the most suitable and appropriate technique for this study.

Research Analysis and Results

The six samples consist of a total of 92 banks that include 13 Macedonian banks (excluding one commercial bank that ceased to operate in August 2020), 24 Serbian banks, 8 Kosovo banks (out of a total of 11, since Komercijalna Banka AD Beograd is a branch of the Serbian Komercijalna Banka AD Beograd; Turkiye Cumhuriyeti Ziraat Bankasi does not publish its statements on its website; and Credins Bank is a newly founded bank that started operating on March 17, 2020), 12 Montenegrin banks, 12 Albanian banks, and 23 Bosnia and Herzegovina banks. The banks' efficiency and performance over the past five years (2016–2020) are analyzed, and then a three-year window is selected. The length of the window was determined using Sun's (1988) formula, which is n = 92,

five years from 2016 to 2020 (k = 5), the length of the window is three years (p = 3), and the number of windows is three (w = k + p + 1 = 5 + 3 + 1 = 3). In each window, there are 276 banks, and the number of "different" banks is 828. The national development banks have been excluded from the analysis due to their specific development and support roles in the financial market. The panel data used for all six samples is strongly balanced and is drawn from the audited financial reports for 2016–2020.

Every window includes three years (for example, window 1 includes three years: 2016, 2017, and 2018; whereas, in the next window (window 2), the data for 2016 is removed and the data for 2019 is added; and the final window (window 3) begins in 2018 and ends in 2020, as shown in Table 3.

Table 3

Inputs and outputs of the DEA model

Window 1	2016	2017	2018		
Window 2		2017	2018	2019	
Window 3			2018	2019	2020

Source: Authors' research

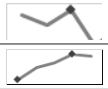
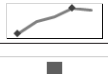
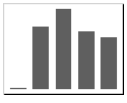
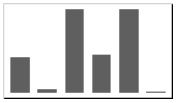
Table 4 shows the average relative efficiency of the banking system in each analyzed country by year, with yellow highlighting the average efficiency greater than 0.9000 (90.00%). These results show that Kosovo had the highest average relative efficiency in 2018 (0.9385, i.e., 93.85%). Additionally, the average efficiency of the banking system of each country for the whole period is presented, based on which we can state that Kosovo is the leader with 90.01%. Also, the column sparkline (in green) for the average efficiency for the whole period for each country's banking system is presented. The previous column has a line sparkline with red markers at the lowest and the highest points. Furthermore, we show the average efficiency of all systems for banking efficiency by year (the highest is achieved in 2018 (83.61%)) as well as a column sparkline (orange colour) for those efficiencies.

The results show that the Kosovo banking system is the most efficient (90,01%), while the B&H banking system is the least efficient (71.84%) over the entire 5-year period studied. However, the crucial analysis explores whether and how the COVID-19 pandemic has impacted these Western Balkan economies and, thus, their banking systems.

The obtained results for the Serbian banking sector show that the lowest efficiency (62.15%) was observed in the first examined year (i.e., in 2016), while the highest efficiency (78.04%) was observed in 2018. An evident decrease in efficiency after 2018 resulted in an efficiency score of 71.47% in 2020. The results regarding each bank indicate that large banks in Serbia note the highest efficiency (from 89.71% for Komercijalna Banka AD Beograd to 99.55% for Banca Intesa AD Beograd), whereas the small-sized banks (e.g., Mobi Banka AD Beograd and Api Bank AD Beograd) note the lowest efficiency (0.3206 and 0.3650, respectively). The study's findings are also consistent with those of Savic et al. (2012), who claimed that the majority of Serbian commercial banks have efficiency scores ranging from 60% to 70%.

Table 4

The average efficiency of the Western Balkan banking systems (2016-2020)

Western Balkan Country	Average efficiency of the whole banking system					Line sparkline	Average efficiency for the whole period for each country's banking system
	Year						
	2016	2017	2018	2019	2020		
North Macedonia	0,8041	0,8112	0,8160	0,7643	0,7771		0,7945
Serbia	0,6215	0,7566	0,7804	0,7491	0,7147		0,7245
Montenegro	0,8475	0,9170	0,9250	0,9125	0,8969		0,8998
Albania	0,7495	0,8361	0,8306	0,8143	0,7753		0,8012
Kosovo	0,9242	0,8977	0,9385	0,8396	0,9008		0,9001
Bosnia & Herzegovina	0,5932	0,6939	0,7260	0,7998	0,7792		0,7184
Average efficiency for the whole period of all analyzed banking systems	0,7567	0,8188	0,8361	0,8133	0,8073		

Source: Authors' research

The results for North Macedonia's commercial banks show that efficiency has been slowly increasing in the period 2016–2018, reaching its highest score of 81.60% in 2018, and after that decreasing in the period 2019–2020 (the slight increase from 76.43% in 2019 to 77.70% in 2020 is insignificant). When analyzing the average efficiency per term per bank (Appendix 1), it is evident that the group of large banks seems to outperform regarding efficiency (except for HalkBank AD Skopje, which notes an efficiency score of 69.98%). Moreover, small-sized banks note the lowest efficiency in the sample. Ohridska Banka AD Skopje is the least efficient bank in the sample, with an efficiency score of 63.15%, which is in line with the previous findings of Cvetkoska et al. (2021). Namely, this bank has noted "high impairment costs of financial assets in 2016," including the portfolio's growth provisions, as well as additional reservations at the discretion of the relevant bodies of the bank. It was acquired by Steiermaerkische Sparkasse Group in 2019 (Cvetkoska et al., 2021). In contrast, Stopanska Banka AD Skopje is the most efficient bank, with an efficiency score of 1 in 4 out of 5 years and an average efficiency of 99.89%.

The Montenegrin banking system showed its lowest efficiency in 2016 (84.75%) and its highest in 2018 (92.50%). It has noted a decrease in efficiency in 2019 and 2020. However, Montenegro's banking system is the second most efficient in the observed period, with 89.98%. The results for each commercial bank show that the largest banks are the most efficient. Crnogorska Komercijalna Banka AD Podgorica is the most efficient Montenegrin bank, with four years, a relative efficiency score of one, and an average efficiency of 98.80%.

The DEA window analysis technique results for the Albanian banking system show that 2016 was the least efficient year (with an efficiency score of 74.95%), whereas 2018 was the most efficient year (83.06%). What is captivating is that this is the only sample in which a bank has been relatively efficient in all of the observed years (Raiffeisen Bank S.A.), and this is a bank that belongs to the large banks' group. The large banks note the highest efficiency in the Albanian banking system (ranging from 89.38% to 100.0%).

The banking system in Kosovo shows inconsistent results, and it is the only Western Balkan country that noted a significant increase in efficiency from 83.95% in 2019 to 90.08% in 2020. Furthermore, it is the most efficient banking system in the sample, with an average efficiency of 90.01% for the whole observed period. The most efficient banks are large banks (in particular, ProCredit Bank, which notes a relative efficiency score of 1 in 3 out of 5 years). The least efficient bank is Banka Per Biznis, with an average efficiency score of 0.78462. These findings do not correspond with Varesi (2015) findings, where the Kosovar banking system was the least efficient (together with the Albanian).

Interestingly, the DEA window analysis results for Bosnia and Herzegovina show that no bank in this sample is relatively efficient in all of the examined windows and/or years. The average efficiency result for the entire period under consideration is 71.84%. The lowest efficiency has been recorded in 2016 (59.32%), whereas the highest was in 2019 (79.97%), followed by a slight fall to 77.92% in 2020. The most efficient banks are the large ones, except Intesa Sanpaolo Bank, which noted an average efficiency of 76.60%. This result is due to the overall low efficiency in the first studied year, 2016. The findings are consistent with Efendic and Avdic (2011)'s finding that B&H banks are "on average significantly inefficient," but not with Memić & Škaljić-Memić (2013)'s claim that small banks are more efficient than large banks.

Except for North Macedonia and Kosovo, which saw a slight increase in efficiency (from 76.42% in 2019 to 77.70% in 2020) and a significant increase in efficiency (from 83.95% in 2019 to 90.08% in 2020), all of the Western Balkan countries studied saw a decrease in efficiency in 2019 and 2020.The obtained results also show that the highest efficiency scores mainly were in 2018 (for North Macedonia, Serbia, Montenegro, and Kosovo; 2019 for Bosnia and Herzegovina, and 2017 for Albania), i.e., before the COVID-19 pandemic, whereas the lowest efficiency was noted in the first studied year: 2016 (and 2019 for North Macedonia and Kosovo).

Furthermore, the findings indicate that, in general, small-sized banks are least efficient. In contrast, large banks are most efficient in the Western Balkan countries, which is in line with the findings of Guistininani & Ross (2008), Micajkova & Poposka (2013), Fotova Čiković & Cvetkoska (2017), and Cvetkoska et al. (2021).

Discussion

In this paper, the relative efficiency of the banking sectors of six developing Western Balkan countries - North Macedonia, Serbia, Montenegro, Kosovo, Albania, and Bosnia and Herzegovina - has been evaluated by using the window DEA analysis technique for the period from 2016 to 2020. A balanced panel of data has been used for the six samples. The output-oriented BCC DEA window model results show a decrease in efficiency in most (four out of six) of the examined countries in 2020, which could potentially prove that the COVID-19 pandemic influenced these countries' banking systems. Even though it took a time lag for the spillover effects of the GFC (Global Financial Crisis) in 2008/09 in small and developing countries with underdeveloped financial systems (such as the sample countries of the Western Balkans), the COVID-19 pandemics and thus the crisis year (2020) affected all countries regardless

of their economic development and geopolitical position. The COVID-19 pandemic greatly impacted economies and societies globally because countries needed to face the new situation with numerous challenges for private, public, and business entities "while minimizing the negative social and economic implications" (Fotova Čiković, 2021). More importantly, it impacted every industry and every business sector globally. This empirical study supports this fact. However, if we want to confirm the impact of the COVID-19 pandemic on the Western Balkans' banking systems' efficiency, additional analyses, including those for 2021 and 2022, need to be conducted.

According to the findings, small banks are the least efficient, and large banks are the most efficient in the Western Balkan countries, as previously reported by Guistininani and Ross (2008), Micajkova and Poposka (2013), Fotova Čiković and Cvetkoska (2017), and Cvetkoska et al. (2021).

Except for North Macedonia and Kosovo, which saw a slight increase in efficiency (from 76.42% in 2019 to 77.70% in 2020) and a significant increase in efficiency (from 83.95% in 2019 to 90.08% in 2020), the other Western Balkan countries recorded a decrease in efficiency in 2019 and 2020. The obtained results also show that the highest efficiency scores mainly were in 2018 (for North Macedonia, Serbia, Montenegro, and Kosovo; 2019 for Bosnia and Herzegovina, and 2017 for Albania), i.e. before the COVID-19 pandemic, whereas the lowest efficiency was noted in the first studied year: 2016 (and 2019 for North Macedonia and Kosovo).

This is the first study that addresses and empirically measures the efficiency of the banking systems of Western Balkan countries, including the first pandemic year (2020), and thus the first study that addresses the COVID-19 pandemic impact on banks' efficiency and performance. For these reasons, this research represents a gain for the scientific community but also provides invaluable insights for banking management, regulatory bodies, governments, potential investors, the interested public, and other bank stakeholders.

Conclusion

This paper aimed to assess and compare the relative efficiency of commercial banks in each of the six developing countries in the Western Balkans - North Macedonia, Serbia, Kosovo, Montenegro, Albania, and Bosnia and Herzegovina - in the observed period from 2016 to 2020 and to explore the impact of the COVID-19 pandemic on the efficiency and performance of the banking sectors of the six Western Balkan developing countries in the year 2020. The DEA Window analysis technique has been employed with two inputs and two outputs: interest and non-interest expenses as inputs and interest and non-interest revenues as outputs.

According to the DEA Window O-V model results, the average efficiency of the six Western Balkan banking systems significantly differs. The highest average efficiency of the whole banking system in the whole observed period (2016–2020) has been noted in Kosovo, whereas B&H noted the lowest average efficiency, followed by the Serbian banking system.

There are no studies on the efficiency of the banking sectors of the six studied Western Balkan countries and no studies on the impact of COVID-19 pandemics on the efficiency and performance of banking systems in these countries.

This study, however, is not without limitations. Even though it is among the first studies to evaluate and assess the impact of the COVID-19 pandemic on the efficiency and performance of six Western Balkan economies, it only analyzes the first year of the pandemic (i.e., 2020). Furthermore, while 2020 was the most difficult pandemic year to date (due to the surprise effect and the countries' lack of preparedness for a crisis of this magnitude), more research should be conducted to gain new insights into the total impact and consequences COVID-19 left on these economies. Moreover, the DEA methodology itself has a few limitations. As Stolp (1990) claimed, "the enthusiasm for DEA has not been universal, and many detractors have criticized it on several methodological and substantive grounds." According to Jemrić and Vujčić (2002), "the main disadvantage of DEA is that the frontier is sensitive to extreme observations and measurement errors, since the basic assumption is that random errors do not exist and that all deviations from the frontier indicate inefficiency." Another caveat of DEA is that the classification of the relative efficient DMUs means those DMUs are "only efficient compared to the others in the sample" (Repkova, 2014). DEA, on the other hand, provides a "complete unbiased numerical score, ranking, and efficiency potential improvement targets for each of the inefficient units" (Popović et al., 2017) and should be viewed as "more conventional statistical methods, as an informative and useful tool for systematic sensitivity analysis" (Stolp, 1990) and "a significant diagnostic tool" that provides new insights to policymakers, investors, and other stakeholders" (Fotova Čiković & Lozić, 2022).

In future research, the ability of the banking management to cope with the crisis in the analyzed Western Balkan countries could be investigated.

Appendix 1

Table 5

Average efficiency by term for the Serbian commercial banks (2016-2020)

BANK	YEAR					Average score
	2016	2017	2018	2019	2020	
Addiko Bank AD Beograd	0.5550	0.5995	0.6255	0.6584	0.6500	0.6177
Agroindustrijsko Komercijalna Banka AD Skopje	1.0000	1.0000	1.0000	0.9729	1.0000	0.9946
Alta Banka AD Beograd	0.6297	0.6749	0.9120	0.9735	0.7337	0.7848
API Bank AD Beograd	0.2842	0.4228	0.4800	0.3374	0.3005	0.3650
Banca Intesa AD Beograd	0.9775	1.0000	1.0000	1.0000	1.0000	0.9955
Banka Postanska Stedionica AD Beograd	0.4854	0.7446	0.6943	0.6625	0.6878	0.6549
Bank of China Srbija AD Beograd	n.a.	1.0000	1.0000	0.6869	0.3534	0.6081
Credit Agricole Banka Srbija AD Novi Sad	0.6271	0.6213	0.6823	0.7105	0.7193	0.6721
Direktna Banka AD Kragujevac	0.3902	0.9663	1.0000	0.6827	0.6938	0.7466
Expobank AD Beograd	0.3666	1.0000	0.7938	0.5744	0.5371	0.6544
Erste Bank AD Novi Sad	0.7493	0.7918	0.7776	0.7324	0.7039	0.7510
Eurobank AD Beograd	0.8072	0.7694	0.8419	0.7962	0.7557	0.7941
Halkbank AD Beograd	0.6459	0.6616	0.7113	0.7246	0.7016	0.6890
Komercijalna Banka AD Beograd	0.7674	0.9324	0.9930	0.9704	0.8223	0.8971
Mirabank AD Beograd - Novi Beograd	0.2245	0.2545	0.4019	0.4564	0.9996	0.4674
Mobi Banka AD Beograd	0.2121	0.2777	0.3497	0.3677	0.3957	0.3206
NLB Banka AD Beograd	0.7068	0.6903	0.7845	0.6394	0.6618	0.6966
Opportunity Banka AD Novi Sad	0.9142	0.9347	0.9553	0.9709	0.8920	0.9334
OTP Banka Srbija AD Novi Sad	0.5957	0.5348	0.6202	0.9901	0.6204	0.6722
ProCredit Bank AD Beograd	0.8143	0.7533	0.6846	0.6290	0.6192	0.7001
Raiffeisen Banka AD Beograd	0.9311	1.0000	1.0000	1.0000	0.9114	0.9685
Sperbank Srbija AD Beograd	0.6259	0.6472	0.6662	0.6212	0.5575	0.6236
Srpska Banka AD Beograd	0.6398	1.0000	0.7560	0.8204	1.0000	0.8432
Unicredit Bank Srbija AD Beograd	0.9669	0.8810	1.0000	1.0000	0.8359	0.9368

Source: Results from the window DEA model

Table 6

Average efficiency by term for the North Macedonian commercial banks (2016-2020)

BANK	YEAR					Average score
	2016	2017	2018	2019	2020	
NLB (Tutunska) Banka AD Skopje	0.8610	0.9849	0.9287	1.0000	0.8890	0.9327
Stopanska Banka AD Skopje	1.0000	1.0000	1.0000	0.9949	1.0000	0.9990
Komercijalna Banka AD Skopje	0.9350	1.0000	0.9907	0.9708	1.0000	0.9793
Halk Banka AD Skopje	0.6975	0.7024	0.7348	0.7154	0.6489	0.6998
Uni Banka AD Skopje	0.6832	0.8371	0.7327	0.6510	0.7431	0.7294
ProKredit Banka AD Skopje	0.6841	0.7169	0.6577	0.6555	0.6765	0.6781
TTK Banka AD Skopje	1.0000	0.9899	0.9571	0.9321	0.8528	0.9464
Kapital Banka AD Skopje	0.8367	0.4585	1.0000	0.9187	1.0000	0.8428
Stopanska Banka AD Bitola	0.6640	0.6443	0.6390	0.5839	0.7287	0.6520
Sparkasse Banka AD Skopje	0.8878	0.9042	0.7857	0.7427	0.6531	0.7947
Ohridska Banka AD Ohrid	0.6824	0.6791	0.7030	0.5506	0.5427	0.6316
Centralna Kooperativna Banka AD Skopje	0.6774	0.6284	0.6520	0.6530	0.6762	0.6574
Silk Road Banka AD Skopje	0.8439	1.0000	0.8260	0.5669	0.6906	0.7855

Source: Results from the window DEA model

Table 7

Average efficiency by term for the Montenegrin commercial banks (2016-2020)

BANK	YEAR					Average score
	2016	2017	2018	2019	2020	
Crnogorska komercijalna banka AD Podgorica member of OTP Group	1.0000	0.9404	1.0000	1.0000	1.0000	0.9881
Hipotekarna banka AD Podgorica	1.0000	0.9746	0.9940	1.0000	0.9299	0.9797
Prva banka Crne Gore AD Podgorica	0.9477	0.8890	0.7457	0.7796	0.7753	0.8275
ERSTE Bank AD Podgorica	1.0000	0.9445	0.9460	1.0000	1.0000	0.9781
NLB Banka AD Podgorica	0.9459	0.9133	0.9260	1.0000	0.8568	0.9284
Komercijalna banka AD Podgorica	0.2926	0.9198	0.9118	0.8556	0.7422	0.7444
Addiko Bank AD Podgorica	0.4359	0.9169	0.8867	0.8040	0.9374	0.7962
Universal Capital Bank AD Podgorica	0.8843	0.8459	1.0000	1.0000	0.9086	0.9278
Lovćen banka AD Podgorica	0.9135	1.0000	1.0000	0.9700	0.9642	0.9695
Zapad banka AD Podgorica	1.0000	0.8874	0.9776	0.6382	0.6483	0.8303
ZIRAAT Bank Montenegro AD Podgorica	0.7505	1.0000	0.9915	1.0000	1.0000	0.9484
Adriatic Bank AD Podgorica	1.0000	0.7726	0.7212	0.9030	1.0000	0.8794

Source: Results from the window DEA model

Table 8

Average efficiency by term for the Albanian commercial banks (2016-2020)

BANK	YEAR					Average score
	2016	2017	2018	2019	2020	
Alpha Bank - Albania S.A.	0.5178	0.6690	0.5989	0.6008	0.6504	0.6074
American Bank of Investment S.A.	0.5610	0.7182	0.6720	0.6534	0.8899	0.6989
Credins Bank S.A.	0.6641	0.7058	1.0000	0.8210	1.0000	0.8382
First Investment Bank, Albania S.A.	0.6777	1.0000	0.9804	0.6621	0.6902	0.8021
Intesa Sanpaolo Bank Albania S.A.	0.9099	0.9139	0.7643	0.9980	0.8831	0.8938
National Commercial Bank S.A.- BKT	0.8191	1.0000	1.0000	0.9417	1.0000	0.9522
OTP Bank Albania S.A	0.7440	0.8128	0.9444	1.0000	0.9494	0.8901
Procredit Bank S.A.	0.6706	0.5352	0.4886	0.3937	0.3729	0.4922
Raiffeisen Bank S.A.	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Tirana Bank S.A.	0.5967	0.7826	0.7140	0.9397	0.8356	0.7737
Union Bank S.A.	0.8334	0.8962	0.9067	0.7615	0.6487	0.8093
United Bank of Albania S.A.	1.0000	1.0000	0.8984	1.0000	0.3838	0.8564

Source: Results from the window DEA model

Table 9

Average efficiency by term for the Kosovar commercial banks (2016-2020)

BANK	YEAR					Average score
	2016	2017	2018	2019	2020	
NLB Bank	0.9310	0.9288	0.9286	1.0000	1.0000	0.9577
Banka për Biznes	0.6683	0.8561	0.9245	0.7759	0.6983	0.7846
Banka Ekonomike	0.8349	0.8339	0.8139	0.7831	0.6830	0.7898
Raiffeisen Bank Kosovo	0.9591	1.0000	0.9932	1.0000	1.0000	0.9905
ProCredit Bank	1.0000	1.0000	1.0000	0.9770	0.9996	0.9953
TEB J.S.C	1.0000	0.9695	0.9950	0.9216	0.9892	0.9750
Banka Kombëtare Tregtare	1.0000	0.8358	0.8526	0.5873	0.8365	0.8224
Turkiye Is Bankasi	1.0000	0.7572	1.0000	0.6716	1.0000	0.8858

Source: Results from the window DEA model

Table 10

Average efficiency by term for the B&H commercial banks (2016-2020)

BANK	YEAR					Average score
	2016	2017	2018	2019	2020	
Addiko Bank Banja Luka	0.5856	0.6127	0.6145	0.6759	0.6267	0.6231
Addiko Bank FBIH	0.4099	0.6406	0.7124	1.0000	1.0000	0.7526
ASA Banka	0.4379	0.4479	0.5936	0.7205	0.6759	0.5752
Bosna Bank International	0.5365	0.6994	0.7437	0.7968	0.6757	0.6904
Intesa Sanpaolo Banka	0.4957	0.7086	0.8778	0.9239	0.8240	0.7660
Komercijalna Banka Banja Luka	0.4423	0.5882	0.6807	0.7489	0.7508	0.6422
Komercijalno investiciona banka	0.9921	1.0000	1.0000	1.0000	0.8325	0.9649
MF banka	0.3459	0.6269	0.7120	0.8798	0.7484	0.6626
Naša banka	0.3936	0.5964	0.5193	0.6306	0.8004	0.5881
NLB Banka AD Banja Luka	0.8367	0.9836	0.8922	1.0000	1.0000	0.9425
NLB BANKA d.d. Sarajevo	0.5778	0.7151	0.7666	0.7872	0.7483	0.7190
Nova banka	0.7302	0.7068	0.6838	0.7161	0.6842	0.7042
PrivrednaBanka Sarajevo	0.8132	0.5910	0.6902	0.6988	0.7374	0.7061
ProCredit Bank	0.4199	0.4245	0.5497	0.5753	0.6175	0.5174
Reiffeisen Bank	0.9035	0.9740	1.0000	1.0000	0.9578	0.9671
Sberbank AD Banka Luka	0.4778	0.5567	0.7110	0.8679	0.9705	0.7168
Sberbank Sarajevo	1.0000	0.5842	0.6273	0.6929	0.6157	0.7040
Sparkasse Bank Sarajevo	0.6287	0.7448	0.7749	0.8139	0.8107	0.7546
UniCredit Bank Mostar	0.8006	0.9165	1.0000	1.0000	0.9703	0.9375
UniCredit Bank Banja Luka	0.4919	0.7663	0.8442	1.0000	0.8227	0.7850
Union Banka	0.4023	1.0000	0.5788	0.6590	0.7187	0.6718
Vakufska banka	0.5504	0.5610	0.6253	0.6041	0.7568	0.6195
ZiraatBank BH	0.3707	0.5144	0.4993	0.6027	0.5766	0.5127

Source: Results from the window DEA model

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Vpliv COVID-19 na učinkovitost bank na Zahodnem Balkanu: pristop z metodo analize ovojnice podatkov

Izvleček

Namen tega prispevka je oceniti in primerjati relativno učinkovitost poslovnih bank v šestih državah v razvoju na Zahodnem Balkanu - Severni Makedoniji, Srbiji, Črni gori, Bosni in Hercegovini (B&H), Kosovu in Albaniji - z uporabo vodilne neparametrične metodologije Data Envelopment Analysis (DEA) za obdobje 2016-2020 ter preučiti vpliv pandemije COVID-19 na uspešnost njihovih bančnih sistemov. Implementiran je bil izhodno usmerjen model DEA z obrestnimi in neobrestnimi odhodki kot vhodnimi podatki ter obrestnimi in neobrestnimi prihodki kot izhodnimi podatki. Naše ugotovitve kažejo, da se povprečna učinkovitost šestih bančnih sistemov Zahodnega Balkana razlikuje, pri čemer je bila v celotnem opazovanem obdobju (2016-2020) ugotovljena najvišja povprečna učinkovitost bančnega sistema Kosova, medtem ko je bila najnižja povprečna učinkovitost ugotovljena pri bančnem sistemu Bosne in Hercegovine. Pandemija COVID-19 je zmanjšala relativno učinkovitost bančnih sektorjev v vseh šestih opazovanih državah Zahodnega Balkana, razen na Kosovu. Vendar je za oceno vpliva pandemije COVID-19 na bančne sisteme na Zahodnem Balkanu priporočljiva dodatna raziskava, ki bi vključevala vsa leta pandemije. Ta študija zagotavlja neprecenljiva spoznanja za akademike, bančne upravne in regulativne organe, vlade ter zainteresirano javnost. Gre za prvo empirično študijo, ki vključuje vpogled v prvi vpliv pandemije COVID-19 na bančne sisteme v državah v razvoju na Zahodnem Balkanu.

Ključne besede: bančni sektor, analiza ovojnice podatkov, COVID-19, Zahodni Balkan

Blockchain as an Instrument for Improving Banking Processes

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Abstract

One of the best-known innovations of the recent past is blockchain. Due to its usability, it has generated considerable interest in several economic areas. A decentralised system's approach can potentially reshape existing industries or make them redundant. Such technology can add a new dimension to processes, which is particularly relevant for the banking sector in the future. This demonstrates a great necessity to deal with blockchain with respect to market position and competition. This paper aims to provide insight into the current potential of blockchain applications in banking procedures. The benefits of process improvement in the financial sector are also outlined. This research shows that many experiences and adequate knowledge are already available. According to recent research, this technology will benefit banks' business models, performance, and capabilities. However, blockchain is still in the phase of research and development, which is a crucial aspect of the banking industry.

Introduction

„Banking is necessary, banks are not!". The statement made by Microsoft founder Bill Gates has been proven more than ever through contemporary innovations (Ficht & Alich, 2018). This is primarily because of the technological advances present nowadays, such as blockchain technology. It is one of the most recent developments, which has the potential to disrupt various economic industries and their business methods. A large number of economic stakeholders are interested in this development. Especially because of its wide applicability and potential (Deloitte Blockchain Publications, n.d.). The greatest attention is placed on the possibility of being able to use resources more efficiently and, thereby, gaining market advantages (Osmani et al., 2020, p. 892). The benefits are transparency, cost reduction and increasing efficiency in the transaction environment. In order to gain these benefits, numerous industries and governments worldwide have started to deal with blockchain (Osmani et al., 2020, p. 885-886).The same applies to the European Union, which proclaimed its political and legislative support for blockchain technology in

the European Blockchain Strategy brochure. Blockchain is regarded as one of the EU's most significant technologies (European Commission, 2021). Another component of this awareness is the capacity of blockchain to influence the transformation of entire economic organizations. This innovation is anticipated to have a greater influence on economic competitors who typically perform the function of middleman in business circumstances (Tapscott & Tapscott, 2017).

Why are many predicting a blockchain-based banking revolution? The banking business is accustomed to changes. Even in the past, technology and its progress have been a crucial part of banking development (Martino, 2021, p. 1), due to the fact that innovation brings about modifications, challenges, and, moreover, new opportunities. This engagement was driven not just by the will of the banks, but also by the constant changes in the corporate environment, society, and market competitiveness. Further developments, particularly with the arrival of the internet, have become a necessity and trigger the expectation of tomorrow's customers to follow suit (KPMG, 2018, p. 10,16,20). Despite the fact that banks continue to play the role of middlemen in the modern financial system, blockchain has attracted growing attention. It must be pointed out that the banking area is one of the industries that can be seriously affected by blockchain technology. Furthermore, banks are being compelled to examine their future strategic direction in light of this technological evolution (Tapscott, & Tapscott, 2016, p. 37). The rationale is that blockchain offers decentralised operations, which is the exact opposite of traditional banking institutions. Therefore, the current demand to save various resources, as well as political and regulatory constraints, may be met more effectively - beginning with the company's services and concluding with its business model. Consulting firms like Deloitte, which are heavily invested in blockchain issues, indicate that the current structure of banks will undergo a radical transformation. It is considered that a revolution in the financial sector could occur (Deloitte., n.d.-c) - especially now, that blockchain has produced new financial industry participants. These include financial start-ups and Internet giants such as Google, Amazon, Facebook, and other major corporations seeking to extend their business ecosystems using blockchain technology (Jaksic & Marinc, 2019, p. 8-9). Some experts believe that current start-ups are establishing themselves and becoming a vital part of the financial scene. Many of these businesses are optimistic that they will be able to meet this goal. In comparison to a typical bank, their strength is that they are perceived as modern and inventive. As a result, various stakeholders must be made aware of the impending danger (Hawser, 2017). It is obvious that this leads to additional pressure and should encourage reconsideration. However, it is a strength of traditional banks since they already have a solid foundation on which to respond to these difficulties and contribute to the progress (Deloitte., n.d.-c). Therefore, it is essential not to disregard this development, but to embrace the change. Don and Alex Tapscott (2017) put it simply in their article “If you don’t, someone else will.”

This paper illustrates the potential power of blockchain technology based on the literature now accessible in the blockchain area. Particular emphasis is placed on the influence and effect of this evolution on the financial system. A demonstration of insight and its benefits is provided, as well as a synthesis of diverse fields of knowledge. It should help underline the significance of addressing this technology, notably in the financial industry, and raise the issue's visibility. This is done to highlight the utility of this innovation and the competitive advantage enjoyed by some economic entities. Consequently, this work is founded on the hypotheses that blockchain technology is applicable in a variety of banking areas and will change processes, as well as procedures. Accordingly, this work aims to advise stakeholders to address this technological development in a timely manner. The remaining chapters cover the following subjects: The first chapter presents a more detailed overview of blockchain technology and explores its applicability to the banking area. A non-technical explanation, supported by examples, provides a greater understanding of the technology. Furthermore, the meaning of the term revolution in the context of banks and blockchain is illustrated. The second and third chapter constitute the main body of this article. They examine the application of blockchain, as well as its impact on banking procedures. The benefits of implementing blockchain are outlined with a focus on pertinent banking applications. It provides an outline of the substantial advantages of blockchain adoption in the banking sector at present. Additionally, the focus is placed on the financial processes where this new development is useful and leads to a transformation. The remaining chapters contain the results and further research topics, a discussion and a final conclusion. The discussion interprets the findings gained in the literature review and provides a critical view of the current state of the antiquated financial system and its challenges regarding blockchain development. Once again it emphasizes the importance of blockchain technology in the banking sector and the need to consider it in future investment decisions.

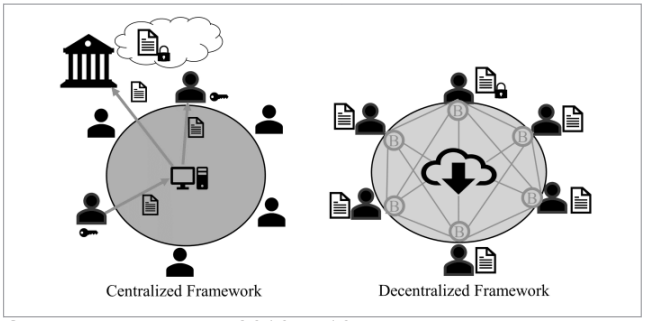
Theoretical Background

Key characteristics of the blockchain system and its relation to the banking sector

Blockchain, a new technological advancement, has received a lot of attention. The cause for this was the recent intensive media coverage of crypto currencies (Sladic et al., 2021, p. 1). This technology encourages decentralisation since it was created to facilitate the transmission of digital currency, like Bitcoin, with the intention that these transactions takes place without a middleman (Martino, 2021, p. 9-10). The emphasis is placed on the database and transaction area, which is best explained by the idea of a digital book, where everything is recorded and not erasable (Kosanovic & Bozovic, 2021, p. 144). However, it became evident that blockchain has much more scope than simply being the technology underlying the crypto realm. The database, which is distributed rather than centralised, is a key element. Each contributor possesses a copy of the database, which is why it is referred to as "distributed". (Deloitte., 2016-b, p. 3-4). Moreover, this occurs in real time, with equal access and insight for all participants. This innovation allows users to record and share a common view of a system´s state across a distributed network, which additionally aims to provide integrity and trust in such environments. It means nothing else than that equal members interact directly with one another, without having any central coordination, knowing that all database entries are preserved and cannot be changed. Therefore, this is commonly known as a peer-to-peer network (Wie funktioniert eine Blockchain?, n.d.).

Figure 1

Centralised and decentralised framework

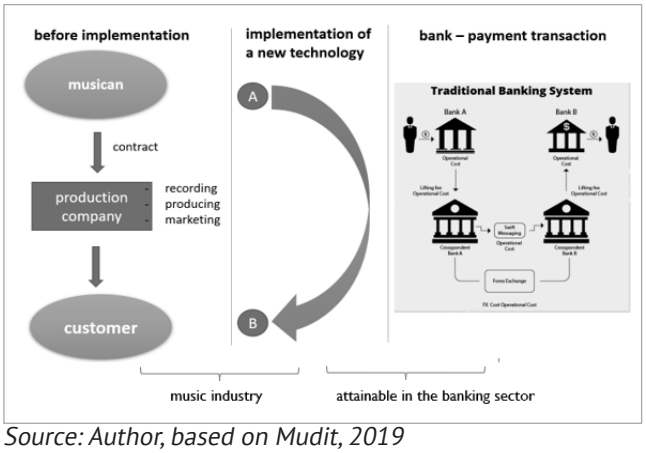


Source: Puthal et al. , 2018, p. 18

Figure 1 depicts and contrasts the interaction between the stakeholders in such a system, as well as the concepts of centralised and decentralised approaches. The right side of the illustration shows a typical decentralised setup of a blockchain. Participants marked with a B represent the members of this decentralised environment. Without a central authority, all parties have the same insight and access. There is no central authority responsible for control. Furthermore, the lines within this circle represent the connection between the members and indicate the possibility of data transmission. The left side of figure 1 is the opposite. A typical centralised system found in many service industries that retain the role of an intermediary. Control and networking are exclusive to the central unit. All other participants in this area are not connected to one another and, therefore, cannot share information, which is also a common system in the financial industry, particularly in the traditional banking sector (Drescher, 2017, p. 21). Within this network, transmissions are aggregated to form a block. In order to prevent fraudulent actions, these transactions are always subjected to verification so that their legitimacy may be confirmed. If the verifiers, called miners, find a match the block is added to an existing chain. This block-to-chain approach is also derived from the term blockchain. Further, Deloitte utilizes the analogy of a string of pearls to make the complex process more understandable for non-technical audiences. Each bead symbolizes a block, and within each block are the transactions. It is vital to note that a blockchain might be of infinite length, with different values in each block, which is typically not the case with a pearl necklace. This is, of course, one of the most significant differences, excluding the other technological elements (Deloitte., n.d.-d). This unique functionality and structure of this technology have the ability to force entire industries to change or even become obsolete (Drescher, 2017, p. 24).

Figure 2

Influence of a P2P-system: Music industry/banks



Source: Author, based on Mudit, 2019

According to Drescher (2017), a banking professional in electronic security trading, the music industry is an outstanding example, which shows the impacts of a peer-to-peer network, even though this industry has nothing to do with banking. Nonetheless, it demonstrates the potential impact of emerging technologies and should contribute to awareness. This is to highlight the challenges and opportunities that blockchain technology advancement presents. The purpose of Figure 2 is to portray the strategy followed by the music industry at the time and to emphasize

the transformation that ensued after the introduction of new technological solutions.

The left side of the graph depicts the usual approach in the music industry throughout those years. It was typical at that time that a production firm distributed the musician's music to the music buyer. The songs were produced and marketed by the production firm. This activity was regulated by a contract between the musicians and the producer. No direct relationship existed between the musician and the end user. With the advancement of digitalization and the creation of the Napster platform, musicians have gained the ability to operate more independently, starting from the production of music to the launch. Consequently, the peer-to-peer system spread rapidly, and the production company became quite redundant. This example shows the rapid obsolescence of enterprises whose primary function is to act as an intermediary for services. With this renewal, the musicians could connect directly with those who were interested in their music, which is illustrated in the graph's middle section.

The current strategy for foreign transactions is depicted on the right side of the graph. International payments are a good example in the banking business, which may be susceptible to such a change, especially considering the centralised nature of the current banking system (Drescher, 2017, p. 20-22). What the figure also demonstrates is that correspondent banks are frequently required for overseas payments, affecting cost, time, and other process variables (Schlatt et al., 2016, p. 26-27). Furthermore, banks are under increasing pressure to become more efficient and cost-saving. Several components of the existing payment system could be simplified and made less expensive through the use of blockchain technology. Costs could be reduced by avoiding intermediary correspondent banks. Various parties would benefit from the partial removal of expenses, losses, uncertain currency fluctuations, speed, and regulatory and security needs. This process alone is designed to be simplified with a decentralised procedure. The P2P system provides the precondition. Firstly, it must be recognized that financial institutions still employing a conventional strategy should recognize the need for change (Mehta et al., 2021, p. 186-187). Particularly considering that it is known that, new competitors have appeared in the banking industry. These are frequently better acquainted with technology such as blockchain and are attempting to strengthen their presence through innovative services and products. Secondly, as is well known, larger companies such as Microsoft and IBM are heavily engaged in the development and research of blockchain technology. The technology giant Microsoft argues that the scope of blockchain is unclear and should be addressed immediately due to its competitive advantages. It is comparable to the evolution of the Internet at the time. These arguments are supported by several projects that are currently ongoing (Ritz, 2018; IBM, n.d.-a). Furthermore, Internet heavyweights such as Facebook, Amazon, and Google, among others, are attempting to gain banking licenses in order to diversify their product portfolios. Attention is suggested because these firms also own IT companies and are actively involved in the investigation of new technologies (Jonietz et al., 2018, p. 373-374). One critical reality is that blockchain illuminates prospects for both banks and non-banks (Harris & Wonglimpiyarat, 2019, p. 627).

Finally, it is important to note, that despite the benefits of this technology, the same old hazards might emerge; risks which are now successfully kept under control by the current banking sector. It is not enough to be blinded by the potential of new technology. Therefore making it necessary to try to identify, handle risks and vulnerabilities in a timely manner, since economic growth requires a stable financial system (Buch, 2021), which was generated following previous crises, for example, through the implementation of regulatory measures in Europe. Claudia Buch, Vice President of the German Federal Bank, points out an essential fact in a publication: profitable financial institutions do not ensure financial system stability. Profitability can be linked to a high level of risk-taking. History has demonstrated that a solid financial system is frequently decisive. As a result, new business models should have a healthy balance between the promise of new innovations and the tolerance for risks (Buch, 2018). Furthermore, consumer protection, IT security, cyber threats, data protection, compliance issues and a variety of other concerns must be resolved (Fußwinkel & Kreiterling, 2018; Europäisches Parlament, 2023; Deloitte AG, 2019).

Potential benefits of using blockchain technology in the banking sector

The traditional banking sector is facing a particularly demanding market environment and challenges in the financial sector. Based on KPMG research on banking environment expectations, banks are increasingly confronted with changing political and economic circumstances. New players, shifting society expectations, and emerging technologies like blockchain are driving banks to reconsider their current business model. Flexibility, resource efficiency, cost structure, and adaptation will be among the primary concerns of traditional financial organizations. For example, as a result of new developments, new regulatory measures will increase and become more focused. Furthermore, new client generations are becoming increasingly interested in simple and customizable service offerings, which are

provided by new market entrants, such as fintechs (KPMG, 2018, p. 14-16). According to Tapscott (Tapscott, & Tapscott, 2016, p. 82-83), the financial industry is one of the last to experience a significant technological shift. Some stakeholders consider that certain processes are outdated and, thus, excessively time-consuming, as well as lacking a high level of security. This is because in the past, new technologies were frequently installed and processes were not modernized in the background. Allowing and implementing technologies like blockchain should allow a variety of parties to participate in the economy more efficiently (Tapscott, & Tapscott, 2016, p. 37). Further, blockchain provides a significant element that resolves the issue of trust in business procedures. This makes it possible to eliminate various middlemen from existing business practices. Many processes will not require the involvement of banks, notaries, or the government. Streamlining procedures while leveraging benefits would be possible. This then leads to using various advantages of this innovation for its needs and acting more competitively (Deloitte., n.d.-d). The simplification of present banking procedures would benefit both clients and financial organizations, with the goal of improving speed, lowering costs, increasing security, reducing errors, and eliminating error sources and key areas of attack (Tapscott, & Tapscott, 2016, p. 20). What is already evident, and can be found repeatedly in the literature, are the benefits that blockchain technology offers. This innovation carries with it a variety of advantages that can help banks remain competitive in the face of this difficult market (Osmani et al., 2020, p. 884-885).

Transparency is one of the most well-known advantages made possible by blockchain technology. This level of transparency was previously unattainable in the banking industry, but is currently made possible by this technological progress, which can facilitate a financial environment procedure (Jung, 2019). This transparency is made feasible by the fact that every transaction that occurs within the network is documented and can be monitored. Thus, a transaction history is accessible to all parties involved. Additionally, this system may keep any type of information and documentation (Ji & Tia, 2022, para. 3.4). Knowing the date and time of each transaction increases the level of transparency, hence, reducing the likelihood of fraud. Further, this option is intended to improve and make it more accessible for customers regarding data insights. There is already a need for transparency in the securities business, as investors require access to essential and accurate investing data. Access to information leads to prudent investment choices (FMA, n.d.-b). Transparency can facilitate decision-making for individual investors and institutions equally (Tapscott, & Tapscott, 2016, p. 51). It can also be advantageous for regulatory requirements. A simplified accountability is provided for tracking the actions of financial organizations, which, of course, could aid in preventing future financial crises like 2008, when the authorities' knowledge was a big factor (Tapscott, & Tapscott, 2016, p. 82-83). Banking and regulatory communication would be streamlined. Responsiveness regarding process difficulties and possible violations would be increased through real-time functionality (Kawasmi et al., 2020, p. 119-120). It has to be highlighted that transparency, and, thus, stability, is one of the European Banking Union's objectives for the banking industry in the EU (FMA, n.d.-a).

The cost aspect of blockchain's advantages is a further area of emphasis. Due to how blockchain works, it can have a positive impact on a business cost structure. The elimination of intermediaries alone would cut financial institutions' expenses. As a result, a significant number of bank processes can be streamlined and made more effective (Martino, 2021, p. 45). Estimates from numerous institutes consistently indicate amounts of billions of dollars that can be saved by this conversion (Martino, 2021, p. 63; Osmani et al., 2020, p. 890). Any adoption to this technology can positively lower corporate costs by, for example, focusing on minimizing manual processes, favouring automation, and, in particular, adopting a peer-to-peer system. This, in turn, can entail updating IT solutions and infrastructure in some banking institutions, thereby increasing their competitiveness (Wilkie & Smith, 2021, p. 163-164). Another major part in the overall cost issue is the topic of sharing. The distributed approach regarding this innovation has a beneficial effect on overhead costs. On the one hand, costs are reduced due to the absence of middlemen, on the other hand, there are more users. Blockchain can provide people with access to the financial system that was previously unavailable. Finally, expanded and shared use of the blockchain network reduces server development, and operational expenses. Consequently, some anticipate that the prices of blockchain applications could be equivalent to those of internet usage today (Ji & Tia, 2022, para. 3.2;6).

The security of such a system is a recurrent issue of conversation surrounding emerging technologies. Due to its standards, a blockchain-based system is regarded as secure. The level of security offered by this development differs from that of the centralised system in use today, specifically, because this system is decentralised, distributed, consensus-based, and transactions are irreversible (Kawasmi et al., 2020, p. 122). This means, in greater detail, that all processes within such a network are not kept centrally. Each member of this chain has access to the transaction history map. Further, the encryption is conducted using a cryptographic method. This assigns a unique code to each transaction within this network, which must match the prior transaction. Selected

members of this system verify and certify the integrity of the entire operation (ÖAW Österreichische Akademie der Wissenschaft, 2017). Transparency is a crucial factor in this case and reduces the opportunities for manipulation, fraud, and cyber threats (Drescher, 2017, p. 194). Moreover, protection against single points of failure is also a crucial function of the blockchain network. The fact that all data is not held centrally, but instead is shared, protects the system from such an incident (Miles, 2017). According to a report by the German Federal Office of Information Security, the security maturity of blockchain technology offerings is higher, which is quite remarkable, given that this concept is still in its earliest stages of creation and investigation (Bundesamt für Sicherheit in der Informationstechnik, 2019, p. 47). Evidently, digitalization plays a significant part in contemporary business and personal life; hence, a higher level of security is anticipated (Schlatt et al., 2016, p. 27). It should be emphasized that there are currently a variety of blockchain versions (public and private), with varying levels of security (Miles, 2017).

Some of the various advantages of this development are the automation, efficiency, and time gains. As stated by KMPG, a number of financial organizations have already identified automation as an obvious benefit for the banking sector. Particularly in the case of repeating processes, the shift is regarded as highly useful. This can lead to improvements in quality, cost, employee accountability, and detection of error sources (KPMG, 2022). Companies would be forced to review and assess their operations as a consequence of the change to such technologies. It would lead to a revaluation of procedures, which might result in their becoming leaner and more efficient. These activities as a whole would enable the reduction of expenses, which can then motivate automation (Drescher, 2017, p. 243). Moreover, it might have an impact on the time component and lower some execution periods (Ji & Tia, 2022, para. 3.5). In this evolution, the prospect of digital contracts, also known as smart contracts, offers a contribution to efficiency and automation. These contracts can lessen the amount of work required by respective institutions, as their application coordinates the flow of transactions (JPMorgan Chase & Co logo, n.d.). Rapid technological advancement over the past few years has made this reconsideration essential. It has contributed to a rise in the volume of data that must be processed. This has changed the criteria and approaches to financial institutions. As just one response, there is an ever-increasing interest in blockchain technology, as it provides a great deal of what a business needs in terms of fluctuating requirements (KPMG, 2018, p.10,14-15). However, all of the modifications will have the potential to make the procedure easier and quicker, which will have a good economic impact on the companies (Kawasmi et al., 2020, p. 119,123). It must be reiterated that the elimination of middlemen plays a crucial role in this regard (McKinsey & Company, 2019, p. 3).

A note on the traceability element of this blockchain ecosystem should be made, as it is a key factor that influences and simplifies a number of other system properties. All of this is made possible by the blockchain's functionality, with transaction records in particular standing out. The blockchain exists to eliminate the need for a third party to process transactions between two business parties. Existing transparency and traceability should provide the required confidence in a business process (Wie funktioniert eine Blockchain?, n.d.). The database can be inspected and traced at any time, hence, absolute trust is theoretically unnecessary (Engelschall, 2019, p. 206). Another benefit of this function is that it simplifies and reduces the effort required to meet regulatory requirements. Through the new technology, it will be feasible, on the one hand, to simplify the current supervision measures and, on the other hand, to comply with the expanding rules (KPMG, 2018, p.15). Additionally, everything will be enabled in real time, which is not the case today (Martino, 2021, p. 50).

Using blockchain technology to improve banking processes

Blockchain is regarded as one of the most important innovations of the modern period (Kimani et al., 2020, p. 1). Particularly because its potential applications have sparked considerable debate among many parties (Martino, 2021, p. 39). A conviction exists that this technological progress will cause some adjustments in many sectors of the economy. According to research, the banking business, particularly its financial services, is poised to undergo significant transformation (Kimani et al., 2020, p. 2). This innovation has imposed new obligations on the financial industry and prompted numerous market participants in the banking area to reconsider innovation and adaptability. Current business structures, processes, and services are coming into focus and are to be reconsidered, which could be replaced by more innovative and fresh alternatives (Hacioglu, 2019 p. 22-23). Particularly, it is suggested that banks address this trend, as they stand to gain a substantial advantage or, in the worst-case scenario, face extinction. This is especially critical given the traditional banking industry's primary activity is intermediation (Schlatt et al., 2016, p. 25) and is already recognizable by the initial implementation of blockchain technology to process value transfers without the involvement of third parties, primarily through banks (Martino, 2021, p. 41). As seen by Deloitte, financial institutions must be innovators and actively support and participate in the future generation of

blockchain, since it will have an impact on a wide range of banking services and procedures, which include securities, finance offerings, international payment operations, and numerous other procedures (Deloitte., n.d.-d). However, it is known that the potential of this development has not yet been exhausted. Nevertheless, there are certain examples in the financial sector that have already initiated blockchain walkthroughs (Ritz, 2018). An illustration of this is the collaboration amongst several of the world's top banks to form the R3 Consortium project. This initiative aims to provide a common understanding of blockchain-based solutions in the financial sector (Tapscott, & Tapscott, 2016, p. 100). Moreover, the European Investment Bank has provided bonds on a blockchain platform. They believe digitalization will be equally advantageous for the emissions market (Europäische Investitionsbank, 2021). Since 2015, Wall Street has shown a keen interest in this technological development and wants to take advantage of the benefits (Tapscott, & Tapscott, 2016, p. 92, 99). Further, it must be stressed that numerous large financial institutions, including Goldman Sachs, RBC, Barclays, and many others, are displaying a great interest in blockchain technology (Tapscott, & Tapscott, 2016, p. 96). Another conclusion from a survey was that more than half of respondents stated blockchain technology is part of their company's long-term strategic plan. This demonstrates that the importance of this progress has been partially recognized (Deloitte Insights, 2020, p. 4).

Banks are still reliant on manual labour for the time being, which raises execution costs, creates fraudulent concerns, and maintains process transparency. Therefore, blockchain can aid in the reduction of numerous time-intensive processes, thereby significantly influencing profitability. Blockchain, based on literature, would bring identifiable value in the following use case scenarios:

- *Compliance and fraud*: Banks are required to secure consumer data and must follow certain regulatory guidelines. In a report by McKinsey, banks are spending billions on AML and fraud prevention, and the trend is increasing. Moreover, the costs associated with the required process modification or deployment are high. Besides, the upkeep of KYC processes is tough and becoming increasingly challenging. For proper operation, all of these procedures require rules, digitization, and timely information flows. The implementation of a blockchain system would be beneficial in these areas. The potential of a shared network, where multiple banks may access the data, would be quite valuable. This would save money, avoid fines, and eliminate fraudulent activities. Practical examples are already available. A realistic example is a blockchain-based KYC network test in the Asian banking market. This experiment yielded positive results and had a positive effect on efficiency (McKinsey & Company, 2019, p. 4-6).
- *Securities trading*: Blockchain is also gaining traction in the securities industry. The rationale for this is the possibility of improving settlement processes in the securities business. The current process has some risk and inefficiency. These transaction processes could be enhanced by eliminating middlemen and minimizing liquidity and counterparty risk (Schlatt et al., 2016, p. 27). A direct transaction mechanism would thus be available for securities trading. There would be no need for custodial or residential banks (Deloitte., n.d.-d). Wall Street is equally interested in adopting this technology to increase productivity and reduce risk (Tapscott, & Tapscott, 2016, p. 96). Furthermore, the financial product portfolio could be broadened. Offers via ordinary financial instruments would be possible. This offers the added benefit of increasing liquidity, lowering costs, and saving time (IBM, n.d.-b).
- *Payments*: The existing payment transaction process, particularly the international one, is resource-intensive and complicated (Kulkarni, 2017). This necessitates the participation of numerous parties, such as correspondent banks and clearing houses. In turn, this impacts the time, economy, and customer requirements, among other factors (Martino, 2021, p. 48-49). It is frequently related to the method of communication between the institutes, which is not always the best and can, therefore, delay the process (Faustino Bauer et al., 2019, p. 42). Frequently, fees are costly, and regulatory inspections can make the process even less efficient. Additionally, time zones regarding acceptance deadlines and monetary matters can be an issue. Since there is no obvious transparency in this process and a number of factors make it tiresome, it is no longer adequate for today's business needs. The direct method of transmission in a blockchain system can enhance and simplify executions. This technology unites the parties engaged in a transfer and provides them with opportunities that were not available before. In theory, this is a must in today's economic environment, and upgrading is desired. This would be beneficial in terms of expenses, security, runtimes, and traceability. Furthermore, payment transactions can be completed and tracked in real time. Another crucial element will be participation in the payment system, which is now open to non-banks as well as banks (Monetary Authority of Singapore, 2022). The reduction in fraud cases and payment losses with diverse origins is a further positive side effect. There are already market pioneers, such as Santander, Visa, and J.P. Morgan, who have established

and tested such a transaction system (Martino, 2021, p. 48-49; Mason, 2022).

- *Accounting*: The accounting of a bank necessitates clear consensus and data accuracy. Additionally, the regulatory requirements are lengthy and challenging. To assure the accuracy of the outcomes, these tasks require a significant amount of resources (Deloitte., 2016-a, p. 2-3). The purpose of explicitly is to avoid past occurrences that resulted in large losses and hence had an impact on the capital market. Lehman Brothers was one of the most well-known examples of this. Today's most pressing difficulties for modern accounting are: mistakes caused by human carelessness, intentional adulteration of the content, fraud cases and compatibility with contemporary corporate operations (Tapscott, & Tapscott, 2016, p. 107-109). It was acknowledged that blockchain has the potential to succeed in this field and improve numerous processes. This technology's ability to provide real-time and permanent documentation is a significant advantage for supporting the process change (Deloitte.,2016-a, p. 3-4). This would be advantageous for a number of parties, as they would receive regular financial data and procedure updates (Tapscott, & Tapscott, 2016, p. 108-109). Moreover, the auditor's scope of tasks in the field of audits would shift, allowing time to focus on critical transactions (Deloitte.,2016-a, p. 3-4).
- *Product management*: This new innovation will obviously effect a bank's product management in terms of banking products and services. This is due, in part, to the widespread digitization of the financial sector and customers' altered expectations for banking services. It is anticipated that traditional financial institutions cannot accommodate this transformation with their current product portfolio. In the future, conventional institutions will need to think outside the box in order to compete with newer, more technologically savvy businesses. Importantly, there will be digitalized product offers and new sales channels creating new opportunities (KPMG, 2018, p. 20). The function of product design will include a greater emphasis on real interaction and comprehension of the customer. There is a demand for new kinds of products that are simultaneously more efficient and resource-light (FMA, 2019, p. 19). Some traditional organizations' positioning strategies will be quite crucial and essential, since not only financial firms compete with their products, but huge technology groups are also important here (FMA, 2019, p. 9-11). These companies have the advantage of not being subject to the conventional regulatory bank requirements; hence, their product implementation is considerably more flexible. In certain areas, they were bolstered by low entry barriers, such as in the domain of payment transactions. Moreover, the impact will be felt across several product categories, including payments, loans, cards, wealth management, and niche products (FMA, 2019, p. 15-16).
- *Global trade finance*: New prospects in global trade finance are also being examined and pursued with regard to the usage of technology such as blockchain (Sangha, 2021). The difficulties of monitoring and supervising such trading operations have gained prominence, particularly in the aftermath of Covid-19 and other trading market disputes. Increasingly tight controls and audits, as well as regulatory obligations, make this process exceedingly expensive and challenging (Ernst & Young, n.d.). Some banks have already started collaborating with tech giants to streamline the trade finance procedure (Sangha, 2021). This generates new prospects for financial institutions and global trading partners. It intends to replace the old system by decreasing expenses, reducing bureaucracy, saving time, and streamlining regulatory requirements. All of this is possible because a blockchain platform for world trade eliminates intermediaries, fosters trust, and makes data accessible in real time. Specifically, the digital protocol, the smart contract, is beneficial, because this clearly regulates and automates the operations of trading partners and banks (Deloitte., n.d.-b).

Methodology

The purpose of this article is to provide a high-level review of the current state of knowledge on blockchain and the advantages for banking processes. It is a literature review that employs both comparative and descriptive research approaches. The results serve as a foundation for future blockchain research efforts in the banking sector. The first stage was to analyse, to the best of authors' knowledge, the most relevant literature on blockchain technology, specifically in the financial sector. Care has been taken to use literature from a range of sources so that the overview is not technical in nature, but rather pertains to the economic component. Since it is a fairly new and poorly explored technology, it made sense to gather several perspectives. Thus, publications by scientific experts, renowned auditing firms, large technology firms, government institutions, and financial institutions were consulted. The majority of the literature was from Europe and the United States, published in the English and German.

Following a wide literature search on blockchain to generate clear examples for a better understanding of this technology, the focus was on defined characteristics of this area. This was accomplished by establishing a hierarchy

among the themes, in order to summarize the investigation of this area more effectively. In order to better evaluate and contrast the current sources, it was organized into primary and subcategories. Afterwards, the emphasis was on the main features of this technology, with terms such as costs, security, traceability, efficiency, and transparency were formed. The same was done with regard to banking processes. Those who are currently often discussed in the literature have been selected. Payment transactions, securities, product management, accounting, global trade finance, compliance and fraud are just a few of the main topics. The objective was to raise awareness and draw attention to this issue within the banking industry.

Results

Through the literature analysis and its conclusions, it was possible to develop an overview of the topic of blockchain in terms of its potential advantages in the banking industry. Due to the complexity and diversity of blockchain, the analysis has been able to paint a relatively clear picture of the banking industry.

The consensus among professionals and institutions about blockchain technology and its disruptive character constitutes the first outcome. The banking industry was identified as the sector where the impact, whether positive or negative, is anticipated. Specifically, it was mentioned that the traditional banking sector may be harmed by this development. Since blockchain was created for the transfer of value, the current system, in which financial institutions play a key part in these transactions, may undergo change. Moreover, it was highlighted that emerging market competitors, such as fintech or technology firms, can generate this influence. Through the study of several papers, this has been repeatedly observed in the research with great clarity.

Another insight was the characteristics of this innovation, which were highlighted clearly in the main part of this paper. It was repeatedly suggested how banks might leverage this to their significant advantage, with regard to the cost element or improved traceability, as well as other characteristics listed in this paper, that can have an economic influence on the organization's environment. Furthermore, the many documentations demonstrate how all the things can be applied to banking procedures and their customer, collaboration partner, or regulator needs. Nonetheless, the benefits of blockchain are frequently described in a relatively superficial manner.

Overall, the investigation has shown blockchain's potential as well as the anticipated banking industry developments and that blockchain can provide intelligent solutions for processes and business models that are resource-intensive. The implication is that this technological advancement poses a threat to banks that do not engage with it and, hence, may miss out on adaptability. Due to the fact that this technology still has growth opportunities, it is prudent to participate in research and other projects. However, these promising results need to be investigated further for a more in-depth understanding of blockchain technology and its evident application prospects in the banking industry. It would be useful to look more closely at the various projects in this field and the present status of research. Additionally, it would be beneficial to focus more directly on specific banking areas and to design ways of implementing blockchain there.

Discussion

This research has examined the hypothesis that blockchain technology is applicable in a variety of banking areas and will change processes as well as procedures. Utilizing a literature review that comprised descriptive and comparative methodologies, a current overview and status of research on this topic were obtained. Blockchain is a novel technology that provides numerous benefits due to its decentralised nature and has the potential to change resource-intensive processes and procedures in the banking area. The traditional banking industry and its current central role in practices will be influenced, and new market participants, such as fintechs, will instigate change. Banks may leverage blockchain technology to their benefit in a variety of banking domains and develop, as well as implement, smart solution approaches. Since blockchain technology and its potential applications in the banking sector are still in its infancy, this hypothesis can only be substantiated on the basis of partial theoretical findings.

The contemporary banking market is attracted to technologies such as blockchain due to the ever-increasing demand for efficiency and developing economic challenges. This is supported by the "Banking 2030 Austria" research conducted by KPMG. Due to the changed environment, bank customers particularly expect a response and adaptation to new developments (KPMG, 2018, p. 4,16-17). All of this is supported and pushed by the advent of new business models that are particularly well-suited to the demands of a society that is always evolving and a political climate that is constantly shifting. Fintechs and internet behemoths

are progressively emerging as competitors in the financial environment and establishing new standards, which government agencies such as the Austrian Financial Market Authority reflect in their analyses (FMA, 2019, p. 10).

Traditional banking procedures are no longer suitable for the current era and are losing their competitive advantage as a result of their sometimes still antiquated practices. According to the present literature, a rethinking of current business procedures and business models is required because this transformation constitutes a danger to the banking industry (Martino, 2021, p. 4). This is already aided by the current understanding that blockchain may significantly contribute to resource savings through its implementation. Whether it is blockchain features like transparency, security, or traceability, cost is the key factor and has significance in today's world of global competition. The fact that the savings expected by this technical advancement are in the billions corresponds with beliefs about the importance of the cost element (Osmani et al., 2020, p. 890; Tapscott, & Tapscott, 2016, p. 221).

The banking Industry is undergoing a significant shift. Uncertainty remains regarding the precise nature and scope of blockchain's impact on the future of banking. The benefits of blockchain knowledge and the expanding presence of new revolutionary market participants are obviously expected to have an impact on banking. Deloitte underlines that this transformation will occur in particular economic sectors with an intermediary function and a centralised business approach (Deloitte., n.d.-d). A 2020 survey by Deloitte, based on the perspectives of executives from a variety of economic sectors and countries, provides additional evidence for these conclusions, including a representation of attitude regarding blockchain-related considerations. (Deloitte Insights, 2020, p. 4-6). In addition, the innovation initiatives of various financial institutions highlight the potential effect and interest in the banking process environment (Osmani et al., 2020, p. 886; Tapscott, & Tapscott, 2016, p. 372).

This literature analysis is limited by its emphasis on blockchain and its possible applications, as well as the resulting benefits for banking operations and procedures. Furthermore, a strong emphasis was placed on the conventional banking system and banks´ position as intermediaries, calling their business model into question. It did not address the economic trade-offs and efficiency related to the energy consumption that blockchain partially requires for its operations. Moreover, the regulatory and legal challenges posed by this development, which are crucial for process adaption via blockchain, are not addressed. All of these topics give further prospects for exploration, particularly if they can be linked to recognized blockchain benefits. However, a key conclusion from this investigation is the wide-spread application in certain financial systems, such as a model for conversion and implementation. This is a precise procedure that considers all significant aspects of process adjustment, as well as the relationship with other stakeholders, which is a topic that can cover a relevant gap in the literature and hence contribute significantly to ongoing bank development regarding the blockchain issue. The European Commission states that steps are being taken to construct a legal framework for the use of blockchain technology, but no clear direction has yet been established (European Commission, 2022).

Conclusion

Blockchain is a technology with an infinite amount of potential regarding the financial sector. As a result, banks can benefit from existing understanding of this technology and its characteristics in the present economic and commercial environment (Deloitte., n.d.-c). Furthermore, traditional banking organizations in particular can profit from upgrading and modernizing their somewhat outdated processes (Tapscott, & Tapscott, 2016, p. 37). As the financial market shifts to include new competitors such as fintech startups, internet behemoths and established technology corporations, it is crucial to adapt to the current circumstances. Their services and products are more inventive and enticing than those offered by some conventional financial institutions. They achieve an elevated level of customer satisfaction. Payment transactions serve as an excellent illustration. As blockchain technology greatly simplifies and improves the economic efficiency of this process. Eliminating the customary intermediary points in the remittance process reduces costs and intermediate steps that would otherwise be required (Jaksic & Marinc, 2019, p. 8-10). This underlines that banks' existing function as intermediaries in the service sector renders them redundant in many cases (Martino, 2021, p. 36). In addition, the absence of regulatory requirements creates extra obstacles and uncertainty (FMA, 2019, p. 15).

The availability of literature for the banking sector is given, as well as indications in which areas blockchain is well applied. Even though these findings are partial, they can be utilized as a starting point. Nevertheless, an engagement with this innovation is beneficial, in order to be able to make future strategic decisions for business, especially since it is well-known that numerous international projects have been initiated in various sectors. As history has often demonstrated, technological developments should be treated seriously.

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Veriženje blokov kot instrument za izboljšanje bančnih procesov

Izvleček

Ena od najbolj znanih inovacij v zadnjem času je veriženje blokov. Zaradi svoje uporabnosti je sprožila veliko zanimanja na več gospodarskih področjih. V okviru pristopa decentraliziranega sistema ima potencial, da preoblikuje obstoječe panoge ali jih naredi nepotrebne. Takšna tehnologija lahko procesom doda novo razsežnost, kar je v prihodnosti še posebej pomembno za bančni sektor. To kaže na veliko potrebo po obravnavi veriženja blokov z vidika tržnega položaja in konkurence. Namen tega prispevka je zagotoviti vpogled v trenutno strokovno znanje o aplikacijah veriženja blokov v bančnih postopkih. Razen tega so opisane prednosti izboljšanja procesov v finančnem sektorju. Naša raziskava je pokazala, da je na voljo že veliko število izkušenj in ustreznega znanja. Glede na najnovejše raziskave bo ta tehnologija koristno vplivala na poslovne modele bank, njihovo uspešnost in zmogljivosti. Vendar je veriženje blokov še vedno v fazi raziskav in razvoja, kar je ključni vidik za bančništvo.

Ključne besede: veriženje blokov, finančni sektor, bančni sektor, poslovni model, inovacije

Agile Transformation: A Case Study on Early Stage of Agile Adoption

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Abstract

Agile transformation is identified as a facilitator to keep pace with frequent changes within product development. Although initial research exists, the empirical literature on the implementation process of the agile approach, specifically using pilot projects as a change strategy, is scarce. The purpose of this article is to contribute to closing this gap by investigating into effects of piloting agile change projects. To shed light on agile pilots a project within the context of mechatronic system development in the high-tech industry was accompanied over six months. After the initiation of the members and a period of practicing agile a survey was performed. The interviewed team members are bringing up interesting findings, as although they had a different understanding of agile at the beginning of the pilot, they recognized agile values, principles and methods as supportive to the products cycle and specifically development time. Further findings are indicating that professional third-party support is a key success factor. Also piloting, as a change strategy for agile adoption, is proven to be supportive. Although piloting is proven a supportive strategy, the downsides, such as limited scalability caused by extraordinary setups, are identified and analyzed. The limiting factor of this single-case study is the small sample size of data due to the intention of the pilot project to limit impact and risk on the organization.

Introduction

Businesses face a wide range of issues in an increasingly digital world. Including erratic client expectations, changing market dynamics, and the ongoing appearance of fresh information technology advancements (Porter & Heppelmann, 2015, p. 4-6). A possible answer to enable organizations to be more adoptive in times of permanent change may be found in implementing and scaling agile methodologies (Paasivaara, 2017, p. 36).

According to a recent systematic evaluation of the literature by Dikert et al. (2010), pilot projects were identified as one of the frequent strategies in

the transformation of businesses towards agile. Within their detailed reflection of publications related to scaling agile, they found that 26% of the cases included piloting. Within the analysis, they found that available case studies are dealing primarily with the topic in a way of experience reports. In detail it is identified that after a rough clearance of 1875 unique papers 170 were remaining, further consolidation, such as but not limited to duplicates in terms of organizations and perspective, brought the number down to 42 unique papers. That sample was broken further into detail showing 36 papers reflecting the topic from the perspective of industry experience reports, only six papers were applying a specific method and generated quantitative data (Dikert, Paasivaara, & Lasenius, 2016, p. 100).

This paper contributes to further insights by presenting and analyzing small sample survey data. This insight focuses on the early phase of the start of an agile transformation.

Latest publications showed that established original equipment manufacturer such as VOLVO decrease their planned lead time for product development from 60 months in 1991 to a target of 20 months in 2020 (Asnafi, Shams, Aspenberg, & Öberg, 2019, p. 92). Trickling down effects were speeding up life cycle development even further for suppliers such as the case study´s organization. Time pressure is creating frequently the desire to find ways to be as reactive to changes as possible. Specifically, during the product development phase, it was inevitable to adopt fast and still maintain quality and cost.

The presented case study is dealing with a change initiative that was launched within a high-tech automotive company fully focusing on electro-mobility. The target of the initiative was to explore possibilities to implement agile working methods within the organization utilizing a pilot project.

Within this article, the case itself is analyzed and a survey-based investigation, which was carried out four months after the project was launched, is performed. Special attention is given to aspects of organization development and organizational change, by enabling transitions using the pilot project strategy. The main questions arising are dealing with the benefits and risks of the pilot strategy, the acceptance of change initiatives within the team, and success drivers which may become a risk during change transfer to a full organization.

Theoretical Background and Hypothesis

As the context-giving organization is part of a company with more than thirty years of mechatronic system development experience within this chapter a reflection of influencing vectors of the past is done as well as the background of the chosen change strategy is pointed out. As the case is embedded in an ecosystem that is used to perform structured organizational development based on the action research model the piloting strategy was chosen. The target of the transformation was not a full implementation of a dedicated model. Instead, a set of values practices and methods based on Large Scale Scrum should be implemented.

Organizational development

Organizational development deals with a wide array of behavioral science theories and methods to assist businesses in strengthening their capacity for change and achieving higher effectiveness, including improved financial results, customer satisfaction, and employee engagement (Cummings & Worley, 2009, p. 2). Transformation in the context of organizations describes the process of changing, frequently it refers to a strategic approach to identify the needs of the organization's future, define the towardards this ideal scenario and execute changes to reach out (Rothwell, Stavros, & Sullivan, 2016, p. 62). The increasing need of organizations to adopt continuously is also shown by recent studies presenting data indicating that 45% of all asked organizations in a study localized in Australia are starting projects with the target of business improvement and transformation (Sexton & Foley, 2019, p. 6) within the pilot project organization this approach was followed for a period of over ten years. For implementing the adoption or drafting of new processes an action research model-based mode was maintained.

Action research model

The traditional action research paradigm emphasizes planned change as a cyclical process in which preliminary analysis of the organization yields knowledge that directs further action. The action's outcomes are then evaluated to offer new information that will impact future decisions, and so forth. Organizational members and organization development practitioners work closely together in this recurrent cycle of study and action. Before action planning and implementation, it lays a strong emphasis on data gathering and diagnosis, as well as meticulous results evaluation (Cummings & Worley, Organization Development & Change, 2008, p. 25). Practicing action research model oriented therefore means permanently work within cycles and loops of feedback and improvement. Pilot projects are a possible tool to be used in bringing in the feedback of the peer groups, the new factors brought in are directly processed and can be

analyzed without a long-lasting implementation time (Stout, 2018, p. 224). If changes have a broader or deeper scope sometimes additional strategies need to be implemented to cover the complexity which is coming along with bigger changes.

The pilot project as a strategy

In interlinkage with the action research model, piloting change initiatives is a method that allows a step-wise change to reduce the risk of a big bang implementation. This stepwise approach is specifically valuable when starting an agile transformation and it allows teams and organizations to subsequently scale into larger settings (Fuchs & Hess, 2018, p. 2). Breaking down risk reduction, by using piloting as a strategy, four different aspects can be identified, such as (Rodney, 2005, p. 5):

- learning during the pilot project how to mitigate risk brought up by change
- learn to identify and how to reduce the uncertainty of the change process
- learning by testing within a not critical environment
- and proofing efficacy directly.

Beside mentioned risk-reducing and enhancing learning aspects, pilot projects are also a tool to bridge between the phases of change, which can be defined as unfreezing, and permanent implementation and stabilization, also defined as freezing (Boscherini, Chiaroni, Chiesa, & Frattini, 2010, p. 1072). As knowledge is gained by action and checking improvements and measures may directly be derived either feeding back directly into the pilot project or ensuring better quality within the transfer of knowledge between the pilot project and the rest of an organization.

Besides a pilot project itself, the necessary focus on the correct attitude and mindset within an organization under change is shown as a key success factor. So beyond detailed knowledge and understanding of the change content, specifically when it comes to acceptance of new methods, the management buy-in and team attitude plays a key role (Lan, Kannan, Peng, & Balasubramaniam, 2009, p. 339). Other perspectives can be found in interviews that have been carried out in companies dealing with mechatronic system development. Successfully pilots with a long-lasting positive effect on organizations have been gained by finding highly motivated coworkers who are interested in agile development and letting them work together on a pilot project. After accomplishing success, they can report they are positive findings, generate attention and desire within the organization (Goevert, Heimicke, Lindemann, & Albers, 2019, p. 2293).

Criticism of the pilot project strategy is also discussed within the literature; possible downsides are that a pilot project is not reflecting the rest of an organization. Team members may be chosen specifically based on their outstanding skills or openness to change. So, although a pilot may be successful, a successful full scaled roll-out to the rest of an organization may fail, as the setup is different from the pilot project. Constraints and resistance to adopt to new working styles within the outer organization may work against a change.

A possible solution to counter this risk could be to let the organization adopt the results of a pilot step by step. Alternatively, it also shows that the extraction of solution methods and transfer of the methods and patterns seems to be more likely to be successful than harsh copies of successful pilot projects (Asheknas & Matta, 2021, p. 4). Further observations are showing that several significant aerospace, manufacturing, and information technology businesses have reportedly started experimenting with agile approaches. Most project sponsors have employed enthused agile early adopters, using projects with limited risk low degree of innovation, and likeliness to fail without a huge impact on the full organization. Although almost all these pilots were successful, most organizations only have been able to extend that success on a minimal level (Boehm & Turner, 2005, p. 31).

Agility as a philosophy and basis for scaled cooperation models

Agile refers to a set of principles and methodologies for software development that prioritizes flexibility, collaboration, and rapid iteration. The Agile Manifesto, created in 2001 by a group of software developers, outlines four key values (Beck, Beedle, & van Bennekum, 2001):

- Individuals and interactions over processes and tools
- Working software over comprehensive documentation
- Customer collaboration over contract negotiation
- Responding to change over following a plan

Agile development typically involves cross-functional teams working closely together to develop software in short, iterative cycles called sprints. The goal is to quickly develop and deliver working software that meets the needs of the customer or end-user, while also being adaptable to changing requirements and feedback (Barke & Prechelt, 2018).

Agile methodologies such as Scrum, Kanban, and Lean are popular approaches to implementing agile principles in software development. These methodologies provide frameworks for organizing and managing work, tracking progress, and facilitating collaboration and communication among team members. Within the scope of the analysis pilot project an adoption of Large-Scale Scrum was chosen as a leading framework.

Large Scale Scrum

The Large Scale Scrum (LeSS) Method is a scaling scrum model. The model's goal is to coordinate the work of several scrum teams. These scrum teams might be dispersed across various plants and the world. The model's major goal is to deliver products in a lean manner, independent of the number of teams managed. Some key criteria are that there is a single product owner, a single product backlog, one definition of done for all teams, one potentially shippable product increment at the end of each sprint, cross-functional teams, and one Sprint (The LeSS Company B.V., 2020).

Interlinking organizational development, the pilot as a change strategy and the agile context, a working hypothesis can be condensed. The major supposition of this study is that piloting is an effective change strategy for organizations, as it allows for the testing and refinement of new ideas before implementing them on a larger scale, leading to greater success in implementing change.

This working hypothesis comes along with two attached ideas such that professional support during an agile pilot project is beneficial for the successful implementation of the project, as it provides expert guidance and assistance in navigating complex and dynamic project environments, leading to improved project outcomes and increased team effectiveness. A planned pilot approach for organization development increases the likelihood of acceptance and successful implementation of change initiatives, as it allows for stakeholder involvement and feedback, provides a clear roadmap for implementation, and helps to identify and mitigate potential barriers to change.

Research Method

This study project's objective is to conclude the benefits and risks of maintaining changes with the usage of pilot projects in the context of the action research model. A single-case study is carried out to prove or disprove piloting as a beneficial change strategy. In addition to a reflection of documentation, created during project execution, a survey within the pilot team has been carried out. The change initiative was accompanied over six months by a senior Scrum consultant and process development. The team and program were selected based on the commercial and logistical independence of other parallel-running projects. A program manager with experience within agile working methods internally recruited a team primarily based on their field of expertise.

This survey is specifically focusing on the aspects of bringing in external knowledge in the early stage of adoption, the experiences of project team members before the project and four months after the start. Within the survey, a response rate of 91 % was achieved.

The approach of a one-case study was applied to find a deeper insight into piloting agile projects with seemingly comparable units. In this case the method of the one-case study is to generate data that can be compared to already existing research (Glaser & Strauss, 2006, p. 25).

The research design is conducted in an explorative way first and secondly underlaid with quantitative analysis based on interview questions. The research design was structured according to Yin (2018, p. 60):

1. Definition of Case study research questions
2. Creation of propositions in the context of the research questions
3. Case Analysis and analysis of interview questions
4. Logic linking of data and propositions.

Due to the pilot project design, quantitative analysis may indicate a direction, but the limited sample size always needs to be taken into credit as a limiting factor.

The following research questions have been formulated in the context to investigate the relationship between structured organization development, agile values, and pilot projects:

1. Is running a pilot project a beneficial tool to enhance agile transformation within a project team?
2. What might be the benefit of professional support during an agile pilot project?
3. Does a planned pilot approach for organization development pave the way for acceptance?

During the runtime of the agile pilot project several propositions were defined and were the basis for the interview questionnaire:

1. When organizations decide to transform towards agile, expert knowledge is likely to be missing within the pilot team and the total organization.
2. Implementing pilot projects also goes along with certain risks, as they are different in several aspects such as commitment, team setup and organizational support.
3. The more systematical knowledge input can be provided in the early stage, the better a potential output might be.
4. To gain acceptance a well-defined planned approach includes offering knowledge and support.

In Table 1 all interview questions are summarized. The questions themselves were formulated out of pre-defined propositions. Data derived from the survey was used in the context of the study as well as feedback between management and the team of the agile pilot project. Due to limitations in connection with information security and anonymity generic person-related questions, such as gender, age, experience etc., were not allowed to be taken into credit. Only knowledge and agile-related questions were approved to be processed within publications.

Results

The product developed within the presented case study can be defined as a new version of an electronic circuit unit as a subsystem of a complicated mechatronic system. A development team, which is the main investigated group, was interdisciplinarily established. The team size was between nine and eleven experienced technicians, a senior technical leader, and a senior project leader. General responsibilities were established in a traditional project management way, such as there was one project leader and a core team consisting of persons in charge of a certain technical discipline, so-called core team members. Each core team member possibly was in charge to manage sub-teams within the specific technical area. In addition, one internal process specialist has been assigned to support and supervise the organizational development perspective.

Table 1

Interview questions

ID	Question	Answer possibilities
1	Did you understand "agile" in the same way before professional third-party training?	Yes / No
2	Did you work in an "agile" team before?	Yes / No
3	Implementing an "agile" approach, adopted to our products/industry needs, will improve our working environment?	Multiple*1
4	Do you think "agile" may make it easier to adopt to changing requirements or environments?	Multiple*1
5	Do you think by adopting agile requirement management we can optimize the requirements management of our products and applications?	Multiple*1
6	Do you think "agile" may support faster time-to-market and a greater focus on our products?	Multiple*1
7	Do you think following our step-by-step approach with professional third party will improve the project result?	Yes / No
8	Do you see any obstacles to working in this new way in our organization?	Individual
9	Is our pilot project positively influencing the pilot project team members?	Multiple*1
10	Do you think following the four agile values will support our project result? (Individuals and interactions over processes and tools Working software over comprehensive documentation…)	Yes / No
11	In your point of view, shall we continue with the cooperation with professional third party for the pilot project?	Yes / No
12	Do you think what you learned by now is or will be useful in your daily work?	Multiple*2
13	Are processes and tools set up in a supportive way today?	Yes / No

Source: Results from the window DEA model

**1 Strongly agree / Somewhat agree / Neutral / Somewhat disagree / Strongly disagree*

**2 It is already useful for me / It is not useful for me / It may will be useful for me / It will never be useful for me / I don't know*

Although the team members were not specifically selected to support the piloting of agile, the seniority level specifically of leading roles were above the organization's average.

To ensure strategical alignment, management support and target oriented approach, all pilot supportive activities were operated within an organizational improvement project. Major stakeholders were supporting the approach of piloting a change towards more agile methods. As only a limited number of team members were related to the agile topic, third-party support by an agile professional coaching and training team was included.

The case study is covering an observation period of six months from the decision of kicking off the pilot project until a time-fixed milestone. The chosen period of six months was selected to pin down a reflection timing on achievements and risks independently of the progress of the project in terms of scope.

After the general buy-in of the responsible management a set of detailed boundaries was defined. To maintain anonymity and information security a rephrasing is necessary, but the main constraints can be expressed without loss in meaning:

- The scope of the pilot project was the development of a new version of an existing mechatronic system.
- The pilot project was not an organizational project, it is a real product development project supported by an organizational improvement project.
- The team selection was not affected by the pilot, no specific team members were chosen to fit to the agile background.
- After an introduction period a survey was held to have detailed insight into the acceptance of the team and derive improvements.
- General success factors have been established such as sufficient budget, agile professional external training support, and specific project space was provided.
- Project members are assigned to only the specific product development project.

Over the observation period all, besides one, constraints could be maintained. Due to the non-business critical characterization of the development project, a single project assignment of core team members could not be maintained, resulting in core team members who were assigned to two or three projects in parallel.

Team development over time

After a detailed market screening and comparison of potential suppliers a partner to provide knowledge, training and permanent support was selected.

Within a predefined training course team members were introduced to agile according to the four values and twelve principles of the agile manifesto (Beck, Beedle, & van Bennekum, 2001). As well detailed information on the basic practices of SCRUM according to the framework of LeSS was shared in several workshops. The main purpose was direct education within the running product development and the possibility to apply the knowledge directly. All these approaches were reflecting the basic principles of the action research model. Bringing in external professional opinion and support was targeting strongly a fast increase in knowledge and leverage effects on acceptance.

Feedback provided by the team showed that at the beginning skepticism and at the same time excitement played a major role. Within the team a pain point was identified; agile and SCRUM was mainly understood as software-only relevant development method and the link to an electronic circuit unit development was unclear. With the Kick-Off and implementation of the first pieces of training, confidence was settling within the team that also benefits for development in terms of hardware can be derived.

Although the method was not self-carrying at that time, first practices were established. Parallel hands-on training, provided by the third-party trainer, took place and provided even more confidence. Two months after the kick-off the team acknowledged the first positive results. Better communication and an improved cooperation mindset were frequently pointed out.

Also, criticism was raised. The main pain points mentioned were missing interfaces to the rest of the organization and missing developed tools to support the new working methodology. As the scope of the pilot project was defined as the core team of a vaster organization, such as sub-teams within departments, the gap between the different working styles; pilot scope and non-pilot scope could be identified even harsher. This gap created room for criticism but at the same time a kind of positive curiosity was observed within the interfaced organization.

Four months after the project kick-off the survey, reflecting the questions mentioned above, was carried out. Based on the main positive results of the feedback the pilot project

was prolonged. At the time of the publication of this article a transfer to other teams or the full organization was not targeted.

Survey results

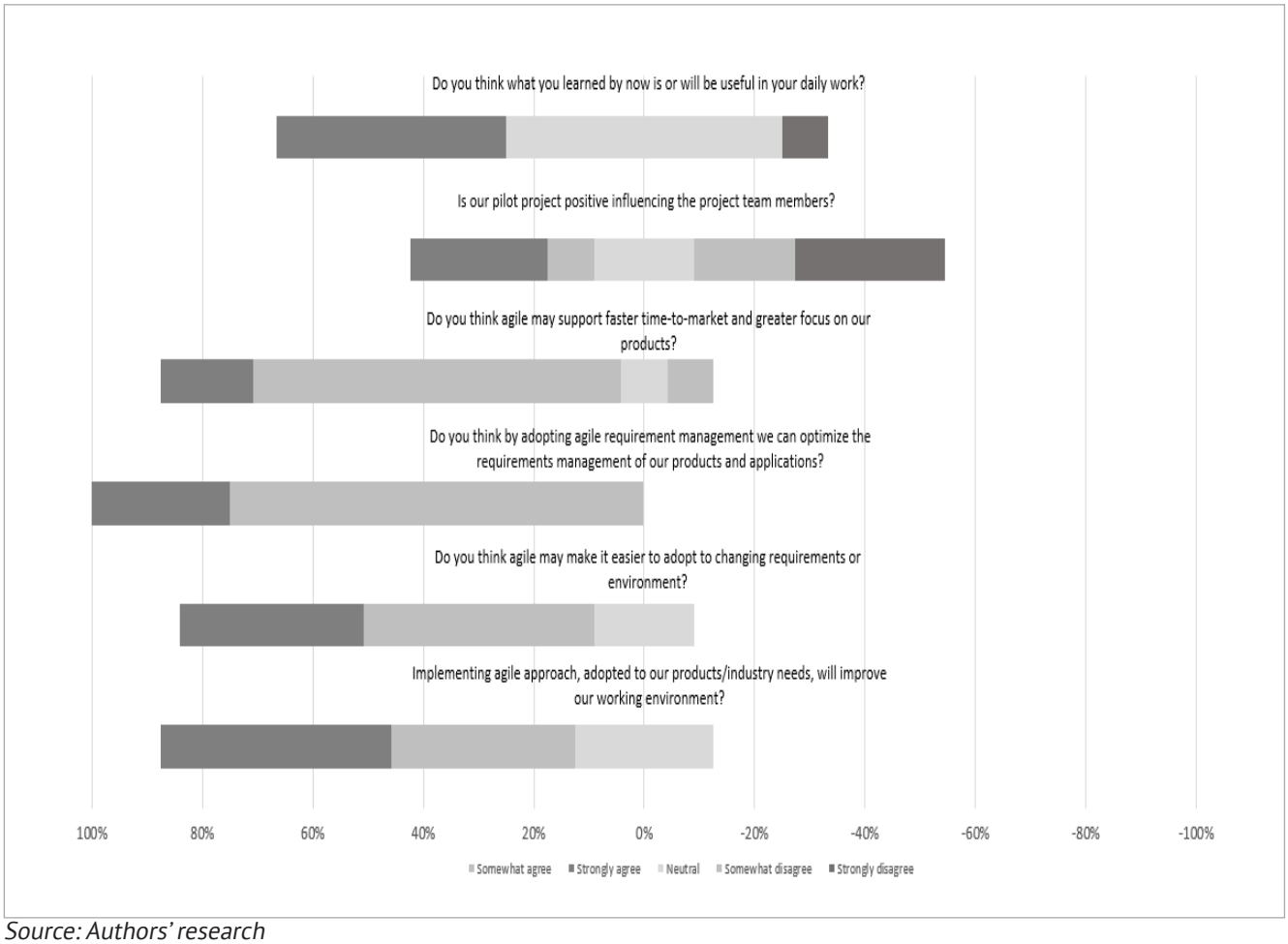
The interview was exclusively addressed to the participants of the pilot project. Out of 12 requested feedbacks 11 full responses were received, equaling a response rate of 91 %. One feedback was only delivered partly, as the questions raised were formulated independently the data were included. By the start of the pilot project 18% of the participants had a professional picture of agile overall. One participant worked in an agile team before. In parallel 64% had a different understanding at the start of the project compared to four months later. 75% of the participants agreed that agile working will have a positive influence on the working environment, none of the participants disagreed. Also 100% agreed that adopting agile requirements management would improve the product-oriented focus.

Reflecting time to market 83 % agreed that an improvement can be generated if the change process would be followed. 9% disagreed slightly. In terms of the basic setup of the pilot project, specifically pointing out to prolong the cooperation with third-party training and coaching support 100 % agreed.

In terms of supportive tools and processes 82% pointed out, that tools are not ready and not yet supportive for the agile approach. The survey participants' opinions differed when it came to the point of direct influence on the team members there a thin majority of 45% over 36% disagreed.

Further analysis of gathered data within Table 2 provides a different perspective. To gain related data the Likert scale was underplayed with values in a linear order from lowest; strongly disagree equaling 1, until highest; strongly agree – equaling 5.

Figure 1
Likert scale analysis



Source: Authors' research

It is shown that at this early stage the project team members were not fully convinced that inputs brought up will be fully useful in their daily work and if those changes will positively influence the project team members. As the standard deviation is within a wide range a heterogeneous opinion within the team can be found.

In regards to improvement of time to market, requirements management and working environment there is a strong leaning on the agreeing side. The average of related questions is around 4.2 with a narrower standard deviation below 0.8.

Summarizing a possible interpretation, in a combination of direct experience during the pilot phase, the project team members consented to the positive aspects which following the agile approach will bring to the product-related aspects, but they did far less agree on a positive impact on their personal daily work experience.

Reviewing the results of binary formulated questions a strong positive influence of third-party training and coaching can be found, as all questions dealing with a third-party approach gain a 100% agreement.

In the qualitative feedback of the survey, it is revealed that the highest likeliness of being an obstacle within the pilot project. out of the team's perspective, could be:

- insufficient management support
- being an organizational alien within the rest of the organization
- context of normative requirements specifically within a related industry
- resource sharing with other projects
- unclear interfaces to non-agile parts of the organization

Bringing these findings in contrast to the above-mentioned aspects of the pilot strategy new facets such as being an organizational alien have been identified. Also, a potential conflict with normative requirements is an additional perspective that could have been brought up within this survey. Within the early stage of the change initiative the team members identified the positive impact of the change on the product and engineering overall but at that time there was no fully agreeing mindset on the impact on each engineer's personal work experience settled.

Reflecting on the pilot strategy

The main aspects of risk reduction which are mentioned in the literature, enabling of learning, unfreeze organizational structures need to be considered. Reflecting the present case study, the risk reduction was achieved, as only one of the parallel-running projects was taken at risk and no negative impact on the organization was brought up.

In terms of organizational development, using active research methods, different facets need to be taken into credit. Focusing on the main questions, which were brought up, answers can be given within the limitations of the small-scale sample size. The proof is given that piloting the agile transformation was a beneficial tool. Due to the small

Table 2

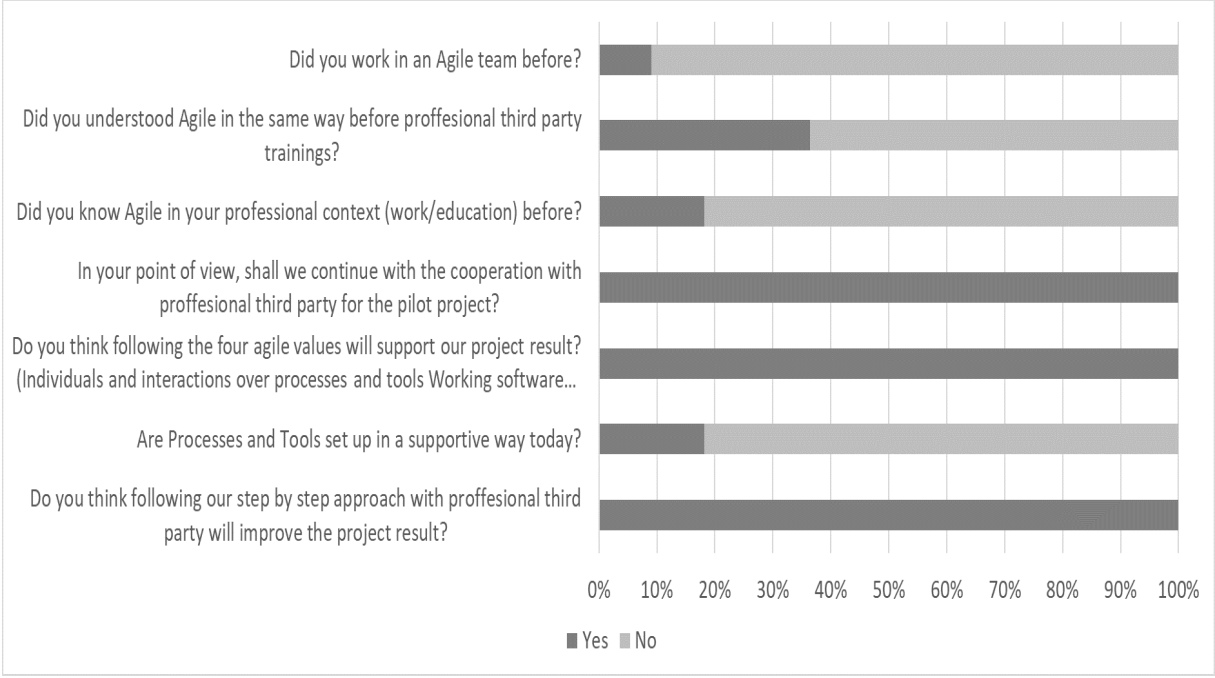
Quantitative analysis

Question	Average*	SD***	Minimum	Maximum
Do you think what you learned by now is or will be useful in your daily work?	3.55	1.29	Strongly disagree	Strongly agree
Is our pilot project positively influencing the project team members?	2.91	1.64	Strongly disagree	Strongly agree
Do you think agile may support faster time-to-market and a greater focus on our products?	4.09	0.54	Somewhat agree	Strongly agree
Do you think by adopting agile requirement management we can optimize the requirements management of our products and applications?	4.27	0.47	Somewhat agree	Strongly agree
Do you think agile may make it easier to adopt to changing requirements or environments?	4.18	0.75	Neutral	Strongly agree
Implementing an agile approach, adopted to our products/industry needs, will improve our working environment?	4.27	0.79	Neutral	Strongly agree

*Notes: *Strongly agree=5; Somewhat agree=4; Neutral=3; Somewhat disagree=2; Strongly disagree=1 **Standard Deviation*

Source: Authors' research

Figure 2
Binary question analysis



Source: Authors' research

scale of the related project team, the risk was reduced and direct feedback loops between the team, the trainer and supporting process specialists were possible.

Providing third-party support was rated very positively by the project team and in reflection of the steep learning curve within four months it can also be noticed that knowledge shall be established before going live with practices. Acceptance within the team and the organization was gained within the first months of the project. The feedback that was given during the runtime of the pilot project was tending to get far more positive over time. Based on the survey and individual feedback learning was enabled but limited to the project team. There was no learning within the broader organization, but agile within hardware-related products was understood far more positively.

Conclusion

The paper provides an insight into the reality of piloting agile within an electromobility tech company that is developing products in the scope of mechatronic systems. It has been found that utilizing pilot projects as leverage to scale up and expand the basic action research model can serve as a stable and effective backbone for implementing organizational development initiatives. This approach has a significant impact on the working style and approaches toward teamwork within the organization.

Furthermore, the pilot project approach allows for the experimentation and testing of new ideas in a controlled environment, which can lead to increased buy-in from stakeholders and more successful implementation of change. It also enables the identification of potential challenges and barriers to change early on, allowing for proactive mitigation strategies to be put in place. As a result, utilizing pilot projects as leverage for organizational development can lead to long-term benefits for the organization, including increased innovation, improved performance, and a more positive organizational culture.

As limiting factors for the results, it can be identified that due to very specific boundary conditions within pilot projects, a direct transfer to other organizations can hardly be done. Within the scope of the analyzed case study the main special conditions were related to strong support by the management and organization development team, external support by specialists for Large Scale Scrum and the non-business critical project type. In concern to the generated data the small sample size of data used in this

single-case study, which was intended to reduce risk and impact on the business, is a limiting factor. Summarizing on the one hand side the limitation of a single project team as context and related to this the limited number of survey participants, and on the other hand side the very specific set-up which is not a typical agile environment, needs to be considered.

Nevertheless, gained learnings within the specific case and comparison to interpretations within existing literature can be identified and bring some additional insight to the community; pilot projects are a valuable tool to bring change to organizations. They can be established in a way that risks for the overall organization are reduced. Pilot projects can support a stepwise approach to learning and improving. The potential of a direct change success out of these factors is higher than it would be with a wider spread approach.

On the other hand, side, pilot projects are likely to not be a realistic representation of the complete organization. Due to the specific focus, support, and motivation of the team and related management a unique situation is created. Although within the observed case study no negative effects out of these boundary conditions were generated, the positive effects were artificially enlarged.

Based on current literature, it has been found that piloting is an effective strategy for learning how to mitigate risks associated with change, identifying and reducing uncertainty during the change process, and testing efficacy within a non-critical environment. Additionally, it allows for direct proof of effectiveness.

Reflecting these contradictions of piloting agile adoptions or organization development in general the transfer of knowledge and information handover, between a pilot project and the regular organization, seems to be a hidden crucial pain point of a sustainable change.

Reflecting on the pilot project team within the scope of the case study, the performed survey and the analysis of the literature the hypothesis that pilot projects are enabling tools for agile transformation is also supported. Within the pilot project the very positive up-speeding and streamlining effect of professional third-party support was underlined by most team members. Within the pilot team an understanding of agile itself was formed. This new understanding was for over more than 60% of the team a completely new way to look at the intention, values, principles and methods within working agile. Although the team members are experienced engineers, within the high-tech system development industry, providing knowledge to them by agile change professionals seems indispensable.

Reflecting a transformation of an organization, piloting seems to be path paving. If piloting includes a planned approach for organizational development, such as a plan action model, bringing knowledge, support and attention to a change, acceptance seems to be supported. Although piloting is an attractive way to get a first glance at a new topic, within a full-scale organizational transformation, it must be taken into credit, that the transition to a wider group may bring a different set of obstacles.

An up following research question might be what is changing in detail within electromobility when it comes to the product development phase and which potential further possibilities to speed up development are available. Another major question, which was brought up, is how increasing needs to be adoptive and fast within the development are influencing organizations teams and people. Reducing time for development and up speeding life cycles are already in place in other industries, such as semiconductors since a long period. Investigations could be done to find similarities and maybe derive improvements that are not yet utilized within automotive industries. In terms of organization development, the question is raised of how to ensure transfer changes out of a pilot project into a broader organization, mitigating identified risks. A potential risk is identified, providing dim evidence that the more support is provided to pilot projects, the bigger the gap to the rest of an organization might be.

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Agilna preobrazba: študija primera o zgodnji fazi sprejetja agilnega pristopa

Izvleček

Agilna preobrazba je opredeljena kot možen spodbujevalec, ki omogoča sledenje pogostim spremembam pri razvoju izdelkov. Čeprav obstajajo začetne raziskave, je empirična literatura o procesu uvajanja agilnega pristopa, zlasti o uporabi pilotnih projektov kot strategije sprememb, redka. Namen tega članka je prispevati k zapolnitvi te vrzeli s preučevanjem učinkov pilotnih projektov agilnih sprememb. Za osvetlitev pilotnih projektov je bil šest mesecev spremljan projekt v okviru razvoja mehatronskega sistema v visokotehnološki industriji. Po uvedbi članov projekta in obdobju agilnega preizkušanja je bilo izveden intervju. Intervjuvani člani ekipe prinašajo zanimive ugotovitve, saj kljub temu, da so na začetku pilotnega projekta različno razumeli agilnost, prepoznavajo agilne vrednote, načela in metode kot podporne za cikel izdelkov in še posebej za čas razvoja. Nadaljnje ugotovitve kažejo, da je strokovna podpora tretjih oseb ključni dejavnik, ki omogoča sprejetje sprememb. Prav tako se je izkazalo, da je pilotiranje kot strategija sprememb za sprejetje agilnosti podporno. Čeprav se je izkazalo, da je pilotiranje podporna strategija, so opredeljene in analizirane tudi slabosti, kot je omejena razširljivost zaradi izrednih nastavitev. Omejitveni dejavnik te študije enega primera je majhen vzorec podatkov zaradi namena pilotnega projekta, da bi omejil vpliv in tveganje za organizacijo.

Ključne besede: agilni razvoj izdelkov, organizacijska preobrazba, sprejetje agilnih rešitev, pilotni projekt, študija primera

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