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Obsah Contents

ARTIFICIAL INTELLIGENCE IN THE AGRI-FOOD INDUSTRY

Vaida BAČIULIENĖ, Valentinas NAVICKAS

Abstract

The agri-food industry faces productivity challenges due to low levels of automation and a lack of innovative solutions. Artificial intelligence can become a tool to meet these challenges. Existing artificial intelligence solutions are already inevitably changing the agri-food industry. This technology is evolving rapidly and its range of applicability is expanding. The article presents an analysis the model of Benefits, Organizational Readiness and External Pressure (BOE) application to artificial intelligence in the agri-food industry. The model constructs – farm readiness, perceived benefits, external pressure– are analyzed in the agri-food industry. Growing investment in technological innovation in the agri-food industry shows that farms are organized to adopt artificial intelligence technology, realize the benefits, and external pressures accelerate the adoption of this technology. Financial resources are often identified as a major barrier to the use of artificial intelligence on farms, but the lack of financial resources can be overcome as an alternative to new business models in the agri-food industry.

Key words:
Agri-food industry, artificial intelligence, new business models

JEL Classification Q 01, Q16, Q18 https://doi.org/10.52665/ser20220201

Introduction

The agri-food industry is complex, challenging a wide range of processes and operations, but is largely inefficient. The agri-food industry faces challenges to increase productivity, and this industry needs innovative solutions. The intensity of agriculture is low, due to the insufficient level of automation and the lack of innovative solutions. There are many stakeholders in the agri-food industry - growers, producers, trade representatives, and national policy-making corps - so it is important to set goals and challenges for sustainable solutions, and technology is one of the tools to achieve these goals. Technology is a key tool in the digitalization of agriculture, and technological tools have already been developed to monitor processes in real time, streamline interventions in agriculture and calculate reasonable costs. Technology can drive the agri-food industry to become more productive, improve the sustainability and management of agriculture. Artificial intelligence technologies can be rapidly integrated into agriculture due to their wide functional range. The cost of artificial intelligence technologies and solutions in agriculture is projected to increase from $ 1 billion USD 2020 up to 4 billion USD in 2026, reaching 25.5 percent overall annual growth rate (Markets and markets, 2021). In 2016, the European Commission launched the Digital Initiative for European Industry to strengthen the competitiveness of the European Union. Artificial intelligence is considered to be the most important moment in the digital transformation, which is why the application of artificial intelligence in the European Union has been identified as a priority for a decade. Artificial intelligence can help farmers work more accurately, efficiently and sustainably. Big data-based decisions can make decision-making easier and make farming more attractive to the younger generation.

Literature overview

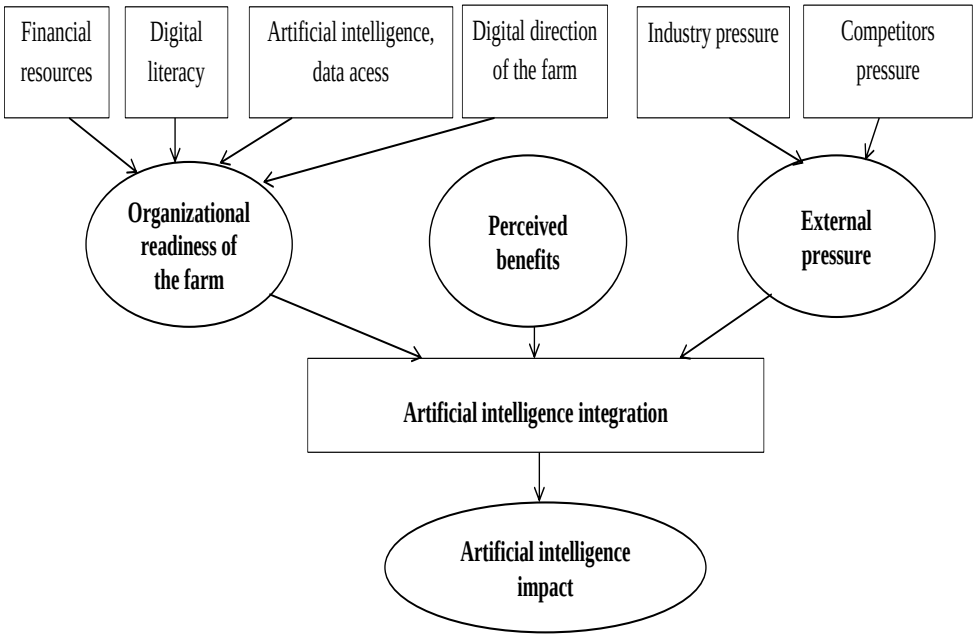
For the development of artificial intelligence, countries are developing initiatives, strategies, and guidelines for setting out how to create an artificial intelligence system that defines what constitutes artificial intelligence, but there is no consensus on how to define artificial intelligence (Brachman 2006; Nilsson, 2010; Monett and Lewis, 2018).). In the definitions

provided in the Country Strategy Papers, it is possible to single out repetitive keywords which describe artificial intelligence as *systems, autonomous (self-contained), intelligent or demonstrating intelligent suitability, ability to analyze, perform tasks, ability to learn*. Consistent with these keywords, some researchers also define artificial intelligence as information processing systems capable of correctly interpreting external data (Haenlein and Kaplan, 2019; Scotti, 2020), learning from such data (Haenlein and Kaplan, 2019), making decisions (Scotti, 2020), the flexibility to achieve specific goals or perform tasks (Haenlein and Kaplan, 2019; Wang, 2019).

Artificial intelligence in the agri-food industry offers new opportunities to gain and maintain a competitive advantage. The development of artificial intelligence technologies in the agri-food industry is leading to new business models that can compensate for the limited financial resources of farms. **The subscription business model**, with the help of artificial intelligence algorithms, gives the farmer the opportunity to test both software and hardware or mechanisms. The farmer does not acquire ownership of this software or hardware, but pays a periodic fee for its use. This business model removes barriers to testing the latest artificial intelligence solutions on the farm when the farmer lacks financial resources, leaving the option to unsubscribe if services, equipment, devices, machinery or software do not meet the farmer's expectations and needs. Feedback from farmers is also important in this model. Manufacturers of hardware or software receive feedback on their product or service through the data they collect, so they can continually improve functions; adjust processes to suit the needs of the economy (Berlin et al., 2020). **Pay-per-use business model** provides access to specific services, such as crop or soil maps. The recognition tool with an artificial intelligence algorithm records how many times the service has been used and automatically generates a bill for usage per month. The recognition tool itself is available as an online service, so the farmer does not need any additional software to use the service (Berlin et al., 2020). **Pay-per-performance business model** offers farmers to pay for the actual production, for example: a farmer no longer buys a combine but pays for a harvest over a period of time. The owner may offer the hardware or machinery on a performance basis, assuming the risk of maintaining the hardware to ensure its operation. In this type of business model, agricultural services can be offered that ensure proper soil properties or animal nutrition. Small robots or drones can also be offered according to this model (Berlin et al., 2020). When farmers purchase expensive hardware or software, they often do not use the maximum capacity of the equipment, so **the asset-sharing business model** provides the opportunity to share such equipment. Excessive capacity of equipment, machinery or software is shared to enable the acquisition of state-of-the-art solutions in the absence of equipment on the market that meets the needs of the farmer. The asset-sharing business model involves the sale of additional capacity back to the market. The sharing business model is implemented on the principle of an online platform, where artificial intelligence algorithms can determine when equipment is free and offer it to the nearest farmer (e.g., Hello Tractor app) (Berlin et al., 2020).

Although artificial intelligence enables agri-food industry players to be more productive, new business models make up for the limited financial resources, but the integration of artificial intelligence in the agri-food industry faces challenges. The Benefit, Organizational Readiness and External Pressure model is used to understand the application of artificial intelligence in the agri-food industry (Fig. 1).

Figure 1. The Benefit, Organizational Readiness and External Pressure (BOE) model in agri-food industry



1995 to understand the application of electronic data interchange) technology in small and medium-sized businesses. Later, the model was used to understand the application of various technologies, and in 2019 the BOE model has been adapted to artificial intelligence (Iacovou et al., 1995; Mehrtens, 2001; Dasgupta and Wendler, 2019). The BOE model consists of three main factors: perceived benefits, organizational readiness, and external pressures. In the agri-food industry, the constructs of the BOE model - farm organizational readiness, external pressure - are supplemented with substructures that detail the main factors.

Results and analysis

In the agri-food industry, the central axis of the application of artificial intelligence is the farm, so the organizational readiness of the farm is important. The behavior of artificial intelligence technology application on the farm is determined by financial resources, digital literacy, artificial intelligence solutions, data access and the digital direction of the farm.

Financial resources enable the farm to integrate artificial intelligence, but budget constraints may prevent investment and retraining of farm workers (Dasgupta et al. 2019).

The limited financial resources on the farm can be offset by new business models that are also based on artificial intelligence systems. In the agri-food industry the production is affected by the seasonality that determines natural conditions, so sharing business models can compensate for expensive investments in artificial intelligence systems. New business models based on artificial intelligence provide farmers with access to expensive hardware or software without acquiring ownership. Owners of agricultural equipment and machinery are connected with the help of an artificial intelligence app to farmers who do not have such machinery, and it is possible to manage e. trade, consumer analysis.

Digital literacy is important for new business models. Digital literacy not only captures the level of technological expertise, but it is important to assess the level of technology management and support for the use of

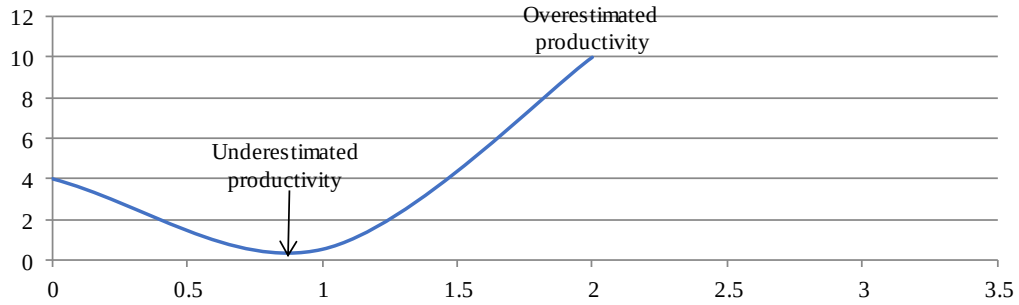
technology to achieve organizational goals (Chwelos et al., 2001). Farmers, although acquiring digital literacy, are not always inclined to adopt digital technologies, with low levels of support for the use of technology. This situation is determined by several factors - conservative approach to farming as a business, application of innovations in agriculture, lack of incentives from state institutions, uncertainty about legal regulation. A limited understanding of the possibilities of artificial intelligence does not provide a clear digital direction for the economy. In the absence of clear leadership in agri-food organizations, organizational structures are limited to the silos of the organization, i. y. the sharing of information, acting independently is avoided, so new changes are not accepted, artificial intelligence technologies is refused, thus limiting the possibility to increase efficiency on the farm. Despite these limitations, digitization is taking place and more digitized farms have enough digital data that is fragmented, unstructured. It is mistakenly believed that only accurate, organized data is one of the prerequisites for implementing artificial intelligence solutions. With the development of artificial intelligence technologies, they are enabled to systematize incomplete, fragmented data. In addition, more and more opportunities are provided by open data sets, which are mostly opened by public institutions, non-governmental organizations, and researchers (Dasgupta and Wendler, 2019).

Access to artificial intelligence solutions is important factor in assessing the application of artificial technology on a farm. One access option is to use artificial intelligence solutions that are based on open source. The availability of open source technologies facilitates their diffusion, and these technologies are free, freely available, and easy to modify. Open source projects promote the development of an artificial intelligence ecosystem. Another access option is access to complete artificial intelligence solutions. In this case, there is no need for a long period of time to realize the advantage of artificial intelligence technology. The farmer does not need to make additional investments in the development of costly systems (Dasgupta and Wendler, 2019).

External pressure comes from two levels: industry and competitors. Early application of artificial intelligence technology in agricultural processes creates a competitive advantage, which increases efficiency, production volume, creates technological improvements in processes. Competitive pressure determines whether the economy's decision to apply artificial intelligence technologies will be proactive or reactive response. At the industry level, the pressure is related to the efforts of industry associations to embed artificial intelligence technologies. At this level, the pressure is transformed into forms of cooperation, uniting public authorities, businesses - farms, artificial intelligence developers, investors, associations, e. g., connecting various Lithuanian public and private organizations, non-profit network (Lithuania Agro Space Digital Innovation Hub, digital innovation centers AgriFOOD Lithuania, EDIH4IAE.lt.). The goals of these organizations are to unite stakeholders due to the emergence of digital technology innovations, to make the agri-food industry more efficient, and to accelerate the implementation of artificial intelligence (Bačiulienė et al., 2020).

Perceived benefits determine the choice to use technology, but perceived costs reduce the likelihood of applying and integrating technology (Chwelos et al., 2001). In assessing benefits, the productivity J curve studied by researchers Brynjolfsson et al. (2018). Researchers have found that companies initially invest in artificial intelligence technologies, but economic indicators show a decline in productivity that reflects initial costs, followed by a sharp increase in productivity as it also reflects the intangible benefits accumulated in previous years. This phenomenon has been described by researchers as the productivity J curve (Fig. 2).

Figure 2. The productivity J curve

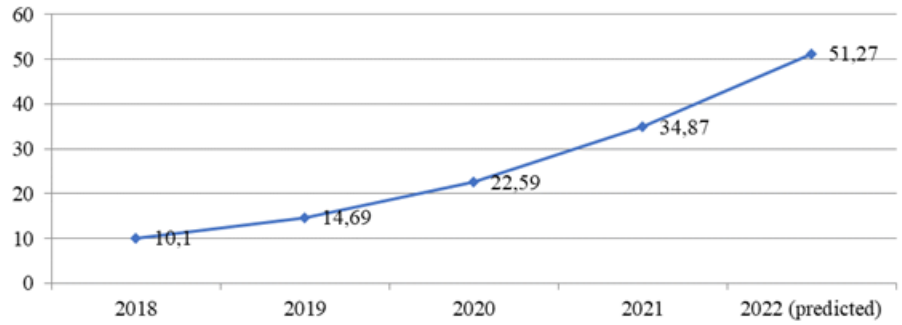


Source: own on basis of Brynjolfsson et al., 2018

Farms need time to figure out how to use artificial intelligence, which requires investment in intangible change, including rethinking the organization of production itself. After installing physical equipment, farms must create new business and farm processes, train employees, improve software if necessary, and create other intangible assets. Therefore, intangible investments related to highlighting the potential of artificial intelligence are not immediately reflected in economic indicators (Brynjolfsson et al., 2018).

Despite perceived costs of applying and integrating artificial intelligence technology, the global market value of artificial intelligence since 2018 until 2021 increased by 24.77 billion USD. The market value of artificial intelligence is forecast to increase 5 times in 2022 compared to 2018 and reach 51.27 billion USD. Since 2018, a steady increase in the market value of this technology has been observed (Fig. 3).

Figure 3. Market value of artificial intelligence, billion dollars

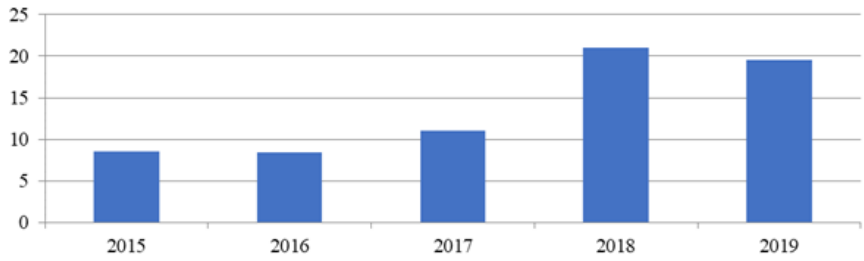


Source: Statista, 2022

Artificial intelligence technologies are also spreading in the agri-food industry. The use of this technology in the agri-food industry is increasing, start-ups are focusing on the development of artificial intelligence in this industry, and standardized solutions are increasingly being used on farms.

In the agri-food industry, investments in technological innovations in the agri-food industry also grew in the period 2015-2019 (see Fig. 4). Although in 2019 fixed decline in investment, but the industry remains strategically important and investment in technological innovation is likely to increase in the future.

Figure 4. Investment in technological innovation in the agri-food industry, billion dollars



Source: Financial Times, 2020

Conclusion

Artificial intelligence is changing the agri-food industry. The organizational readiness of the economy, perceived benefits and external pressures are important for the adoption of artificial intelligence in this industry. One of the most important factors determining the use of artificial intelligence is financial resources, but with the help of artificial intelligence technologies, the lack of financial resources can be overcome by using an alternative - new business models. The growing market value of artificial intelligence and investment in technological innovation in the agri-food industry show that farms are increasingly aware of the benefits, are organized to adopt artificial intelligence technologies, and external pressures are accelerating the use of this technology in the agri-food industry.

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Contact
Mgr. Vaida Bačiulienė
Kaunas University of Technology,
School of Economics and Business,
e-mail: vaida.baciulienė@ktu.edu

Prof. Ing. Dr. Valentinas Navickas
Social and Economic Relations Faculty,
Alexander Dubček University of Trenčin;
e-mail: valentinas.navickas@tnuni.sk

BUYING BEHAVIOR AND PLANNED OBSOLESCENCE IN THE FASHION INDUSTRY

Kamilla BAŠA, Emese SZABÓ FARKAS

Abstract

In the society of the 21st century, obsolescence as a phenomenon is all around us, it affects everyone, even if there are those who are less aware of it and do not deal with it. The aim of our study is to identify consumers' attitudes towards planned obsolescence, as well as to learn about their clothes buying habits. We conducted primary research through an online questionnaire, which was distributed using the snowball method. A total of 176 respondents participated in the research. The data analysis was carried out with the help of Microsoft Excel program. Based on our research results, the majority of respondents buy new fashion products every month or every six months. The reason for the exchange is usually that the product is no longer wearable or the customer simply wants something new. More than half of the people participating in the research fell victim to functional obsolescence as a result, but psychological obsolescence also appears. When buying new fashion products, the most important aspects are comfort and durability. On average, 34.42% of the respondents' wardrobe consists of products that are worn less often than every six months.

Key words

Buying behavior, fashion, fashion industry, fast fashion, planned obsolescence

JEL Classification: D10, L60, L67 https://doi.org/10.52665/ser20220202

Introduction

Nowadays, planned obsolescence is already common practice in manufacturing and industrial production. Professionals involved in product design downgrade the products they create in order to be competitive in a market where consumerism is one of the main goals. In the last 20 years, this process has taken on even greater dimensions, thanks to the emergence of Internet of Things, Industry 4.0, smart devices and artificial intelligence. Rapidly changing market demands for new products, new technologies and new solutions have changed the way a designer must think to develop an idea (Zallio & Berry, 2017).

It can be read from the above that the phenomenon we are investigating is present in everyday life, yet in the course of our research we came across only a few domestic scientific articles that would examine the attitude of consumers to planned obsolescence. In order to fill this gap, the aim of our research was to identify the attitude of consumers towards planned obsolescence, as well as to learn about their clothes buying habits.

Obsolescence has always played a role in the development of society, it is a process that contributed to the creation of our modern society. Thanks to extremely important innovations, our current world is at this level of development. Think of electricity or the development of transport (Reuss and Dannoritzer, 2017). In many cases, consumer needs drive innovation. New ideas, new forms, new materials and technologies pushed the existing ones out of society. The reason for this is simply that the innovations really helped humanity prosper (Dabóczi, 2012). The kind of obsolescence that is present in the 20th and 21st centuries is no longer exclusively characterized by positive returns (Miskolczi, 2021). Bisschop et al. (2022) pointed out that the concept and procedure of planned obsolescence carry conceptual ambiguity and moral ambivalence. The phenomenon carries diffuse harms, and although it is beneficial for short-term corporate profits, it undermines consumer confidence and represents a serious obstacle to environmental sustainability. However, there are also authors who draw attention to the benefits of planned obsolescence: creating jobs and profits, stimulating competition between companies, improving innovation, helping efforts to

incorporate new technologies into products, and thereby generating progress .

Nowadays, we buy, throw away, and then buy a new one. Sometimes we don't even notice it, because we are so used to shopping. How is it possible, despite the enormous technical development, that the lifespan of our products is not increasing, but decreasing? An example of this is the history of women's tights. DuPont tights at the 1939 New York World's Fair, which with 64 million units sold, carried the tagline "as strong as steel and as fine as a spider's web". The female customers loved it. It was durable and hard-wearing. Since there was no reason for women to buy new tights, the company commissioned the designers to create a less durable product (Miskolczi, 2021).

There are different types of obsolescence. Tim Cooper, head of the Sustainable Consumption and Clothing Sustainability research groups at Nottingham Trent University, grouped obsolescence based on whether the product was used due to some kind of failure or not. We know relative obsolescence and absolute obsolescence (Granberg, 1997; Cooper, 2004). Absolute obsolescence means that the given product can no longer be used in the future, because it can no longer fulfill its function. In this case, the product is usually completely worn out and is replaced with a new one (Dabóczi, 2012). Relative obsolescence, on the other hand, is much more diverse. It is considered a typical characteristic of consumer society. Relative obsolescence refers to the time at which the user sets the product out of order. Thus, relative obsolescence takes place before absolute obsolescence, so a discrepancy can be observed between the product's actual lifetime and usage time. This means that customers do not use the product until the technical end of the life span, because they perceive it to be obsolete beforehand (Fels et al., 2016).

Literature overview

According to Sproles' (1974) definition, fashion can be defined as a broad behavioral phenomenon that involves many material and non-material contexts. Fashion can be understood as both an object and a behavioral process. The fashion process can be mechanistically characterized as a process of social influence and diffusion. The fashion industry occupies a very important place in the economy, as it is one of the driving forces of economic development.

Fashion is now an industry more influenced by opinion leaders than magazines or designers, so it is accepted that those people have strenght to effect the perception of a brand (Köse & Enginkaya, 2017). According to Lam and Postle (2006), the typical supply chain problems in the textile and clothing industry are short product cycles, long production lead times, and forecasting errors for fashion items. Before the democratization of fashion, it was a common phenomenon that there was a lack of basic clothing in families, which faithfully reflected the financial situation and social hierarchy. In the 20th century, as a result of mass production, this changed radically, status differences in the field of clothing were blurred. In the 21st century, the relationship with clothing is based on one's own decision and represents the consumer's own attitude (Aranyosi, 2015). In today's fashion industry, new customs are mixed with traditional ones. This means that the fashions of old times regularly return, of course in a modernized form according to current trends. The big fashion companies define fashion colors and clothing styles every year, or even several seasons, on which they spend a significant amount of money, those consumers who love to follow fashion and want to look fashionable (Sille, 2016).

We cannot determine the duration of the fashion cycle in advance. Józsa (2016) distinguishes four stages of fashion waves:

The standing out stage: here a group of consumers buys to stand out from the rest. Production only in limited quantities.
Follow-up phase: when fashion dictators are followed by more and more consumers. Demand for the product increases.
Stage of mass fashion: the product reaches its peak of popularity in this stage. The start of mass production and sales.
Decline: the fashion dictators slowly "turn away from the product" as they are already interested in other products. This is how the product became out of fashion (Józsa, 2016).

Fast fashion includes low-priced, yet fashionable products that satisfy customers' needs for fashionable clothes through vogue capture, the launching of new designs and updating of

products at the sales terminal (Mihm, 2010; Zhou et al., 2020). These fashion products have a short life cycle (Zhou et al., 2020). According to Joy et al.'s (2012) definition, the term covers low-cost clothing collections that mimic current luxury fashion trends. Fast fashion satisfies young consumers' desires for luxury fashion, even if this comes at the expense of sustainability. Fast fashion in the fashion industry is based on psychological obsolescence, which it achieved through the emotional manipulation of consumers.

The reason for the passing of the fashion wave may be that they represent a compromise for the consumer, and for this reason they try to replace the missing fashion items from elsewhere. One explanation is that the demand for another larger, more comfortable product increases due to the increasing sense of comfort. Another explanation is that if the demand increases a lot and more and more people follow the fashion, then others turn away from it. The length of the fashion cycle can also be determined by whether the fashion satisfies a real need, as well as how well it can be coordinated with other social trends. Furthermore, whether it satisfies social norms and values, or whether it stays within the technological limits when it develops, can also contribute to the passing away of the fashion wave (Kotler and Keller, 2012). In connection with that, we would like to mention fast fashion, which greatly contributes to the short life of fashion items.

Consumer demand has increased as a result of mass production. The production of ready-to-wear clothes may have spread through the industrial revolution. When production became more expensive, it was outsourced to countries with cheaper labor. Fashionable clothing has become available to everyone, as products have become cheaper and consumer preferences have changed. The trend cycle has accelerated and shopping has become a pleasant pastime. Thus, by the 21st century, fast fashion, which plays a leading role in the fashion industry, was formed, which is closely linked to planned obsolescence in the fashion industry. The Internet is an integral part of people's lives, thanks to this the rise of fast fashion products, as companies can adapt very quickly to the current trend, and some pieces reach the catwalks on the store shelves in a very short time. The term is used for those clothing brands that can ensure this short-term delivery and always comply with the latest trends. Fast fashion gives the average consumer the opportunity to get fashionable clothes at an affordable price. These products are most often copies of high fashion (top category, designer) products. For this reason, fast fashion poses a challenge to fashion houses that introduce new collections every season (Bertalan et al., 2020; Haynes, 2022). The target market of fast fashion consists of women and men between the ages of 16 and 40, who have a medium-level income and keep up with fashion, and demand fashionable but affordable pieces. During their shopping, they buy fashion items for themselves or for other members of the family. It is not considered important to wear individual pieces for years, durability is not important, since they can get cheap seasonal pieces, so they can easily change their wardrobe at certain intervals, i.e. psychological obsolescence appears (Bertalan et al., 2020).

The subjects of our primary research, which will be presented later, are also representatives of this age group (individuals up to 40 years old). Generation Y and Z buy more low-quality, cheap, and fashionable clothes than baby boomers, who would prefer to purchase fewer number of higher quality clothes (Crewe and Davenport, 1992; Bhardwaj & Fairhurst, 2010). In the case of the younger generation, there are five factors that determine their shopping preferences: product identity, product description, external factors, deals and Internet affect (Özkan, 2017).

Among the young people of the 21st century, there is no longer the big difference between women and men when it comes to buying fashion items, as was the case in previous generations. It is a fact that women still play a bigger role in shopping in families, they are the ones who buy fashion items for themselves and for family members, but men are also interested in the topic. Today, there is no longer a significant gap between men and women when it comes to purchasing fashion items, but rather between generations and lifestyle groups. Female consumers shop much more often than men and like discount prices, while men shop less often, but then they do not particularly pay attention to the prices of products (Törőcsik, 2016).

Goal and Methodology

The aim of the research is to identify the attitude of consumers towards planned obsolescence, as well as to learn about their clothes buying habits.

During our research, we used a quantitative research method, the questionnaire survey, for which we created a questionnaire. The questionnaire was distributed electronically using the snowball method. We sent the questionnaire to fifty people, who were asked to send it to five more of their acquaintances in order to complete it. A total of 176 completed questionnaires were received. The questionnaires were filled in completely anonymously. The received electronic responses were analyzed in Microsoft Excel.

During the examination of the demographic data, we realized that the majority of our respondents were women (78.4%). We see the reason for the outstanding ratio in the fact that the topic of our research preoccupies the female respondents to a greater extent than men. 55.7% of the participants in the research have a university education, and 44.3% have a high school education. 52.8% of respondents live in cities, while 47.2% live in villages. 15.30% of the respondents have no monthly income (probably because they are still studying), 34.10% have a monthly net income of over 800 euros, 24.40% classified themselves in the category between 600-800 euros, and 26.10% have a monthly net income of less than 600 euros. 41.5% of the respondents are married, 38.6% live in a relationship, and 19.9% are single. We also considered it important to ask the participants in the research how many people they support within their families. 52.8% of the respondents are self-supporting, 15.9% take care of one person, 15.3% indicated two people, 9.7% are responsible for three others, 6.3% support four or more people.

Findings

During the research, the focus was on assessing consumer awareness, on the basis of which criteria they buy new fashion products, and how aware they are of the phenomenon of planned obsolescence in the fashion industry. The first and second questions of the questionnaire are closely related, as they deal with planned obsolescence as a phenomenon. In the first question, we asked whether the respondent knew the concept of planned obsolescence. Of the respondents, 61.9% answered no, while 38.1% answered yes. For the second question, we asked an open question, in order for the people participating in the research to express their opinions, experiences, and impressions related to the topic. We were interested in the opinion of those respondents who answered yes to the previous question, that is, they have already encountered the phenomenon of planned obsolescence. Of the positive comments, most emphasized the "necessary bad" or "necessary for economic growth and sustainability" positions. The majority of respondents see the negative side of the planned obsolescence:

"The economy is artificially controlled by planned obsolescence, which encourages consumers to buy, so companies ensure continuous profit."
"Planned obsolescence takes advantage of the vulnerability of the group that is interested in the cheaper product."
"Consumption is the driving force of our economy, but on the other hand, it produces a large amount of waste, and the problem lies in the damage to nature."
"In our stimulus-rich society, it is relatively unimaginable that something is permanent and will last forever, but the desire for new things has also strengthened among customers."

In the following, we asked the respondents how regularly they buy new fashion products. 5.7% of our respondents buy new fashion products more often than monthly, 41.5% monthly, 33.5% every six months, 11.4% annually, 5.1% every 2-3 years, and 2.8% less often, than every 3 years.

In the fourth question, we asked the respondents to choose from among the options the reason why they have not yet replaced the fashion product they have had for at least 3-4 years with a new one. For financial reasons, 1.7% of the respondents did not replace it with a new one, so we can say that money plays a role in a negligible percentage of the respondents in the research. Furthermore, 8% of those surveyed will replace their fashion products within 3-4 years. In their case, an increased interest in fashion is likely. On the other hand, 90.3% did not replace their existing fashion product, because that particular clothing or accessory can still be worn.

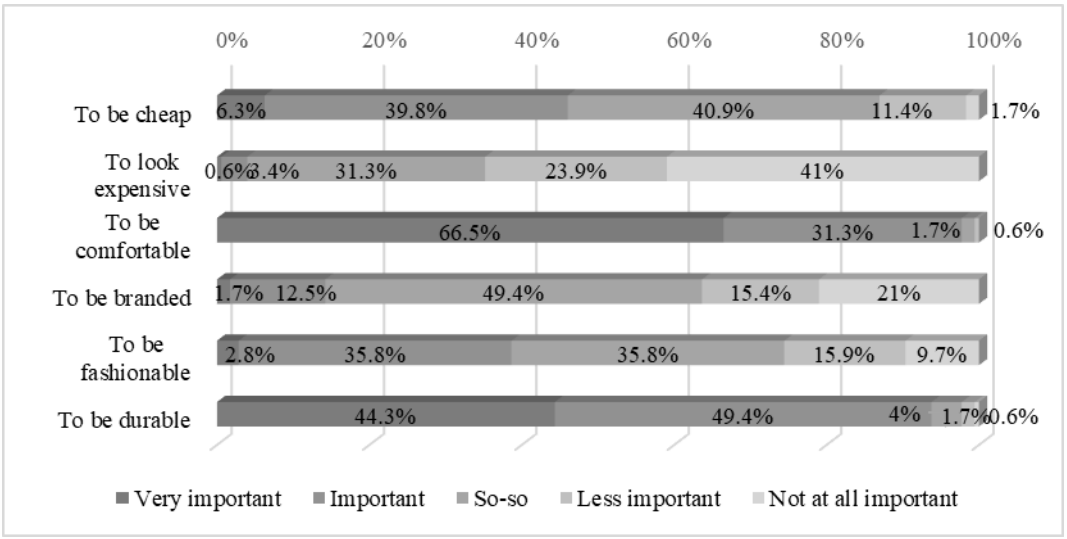
In the fifth question, we looked for the answer to what reason the respondents buy a new fashion product. 7.4% of the respondents answered that the existing fashion product would still be

suitable for wearing, but it is no longer fashionable, it is out of fashion. 51.1% indicated that the existing fashion product is no longer able to fulfill its function, it is damaged. 39.8% of the respondents indicated that there is no problem with existing fashion products, but they like new products. In the fifth question, 1.3% shared a reason that was not among the answer options, changing their wardrobe due to a change in size or style profile. Functional and psychological obsolescence appear in this part of the questionnaire. We wanted to assess which type of obsolescence is more significant among our respondents. Consumer awareness is evident here as well, just as in the previous question. It can be said that more than half of the people participating in the research fell victim to functional obsolescence. In addition, psychological obsolescence appears, which manifests itself in the demand for fashionable items, in such a way that the existing product is still wearable and can fully fulfill its function, but newer products have appeared on the market, which are more attractive to customers.

In the sixth question, we asked the respondents to rate themselves on a five-point Likert scale, according to the extent to which they consider themselves to be conscious shoppers when it comes to purchasing fashion items (clothing, shoes, bags, accessories). 13.1% of the respondents consider themselves to be fully aware customers, 38.1% consider themselves to be aware. 35.8% could not decide how conscious they are when it comes to buying fashion items, so they classified themselves in the neutral category. 9.1% of the respondents think that they are less conscious, and 4% only think that they are not conscious at all.

For the next question, we were looking for an answer to the extent to which the certain factors are important to the respondents (Fig. 1.), measured on a five-point Likert scale, when purchasing a new fashion product. Based on this, comfort and durability are the most important aspects for the respondents. The fact that the product is branded and looks expensive is only important to a small percentage of the people involved in the research.

Fig. 1. The importance of certain factors in the case of buying fashion items



Source: own processing

In the next question, we assessed what consumers do when their clothes or accessories are no longer wearable. We presented them with two alternatives. The majority of the respondents, 56.3%, marked the first option, the answer to fix it. On the other hand, 43.8% say that if a piece of clothing or accessory can no longer be worn, they replace it with a new one, because it is cheaper to buy. It is likely that those consumers who selected the first option as an answer spend more when purchasing a fashion item, and therefore try to have it repaired if necessary.

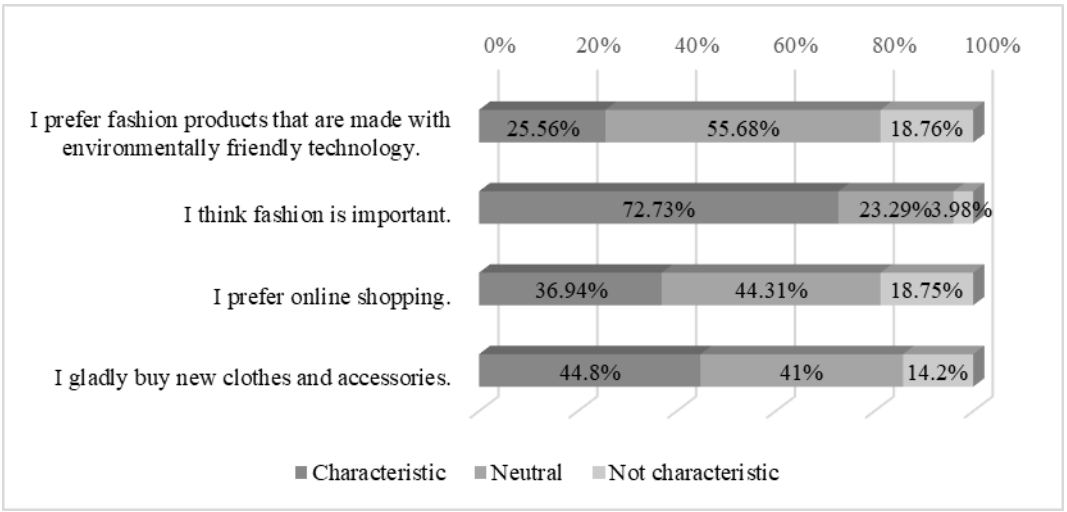
We also asked the participants in the research what happens to those fashion products that are no longer worn, but are still wearable. Most people, 48.9%, selected the option to donate, 39.8% put these items in a clothes collection container, 7.4% sell them, and 4% throw away the clothes and accessories they don't want to wear anymore.

In the following question, we were looking for the answer to whom the respondents of the questionnaire most often buy fashion items for. Most (58.5%) buy for themselves, 25.6% for their children, and 15.9% for other family members.

In the question that followed, the respondents could choose to what extent each statement was typical of them (Fig. 2.). Regarding the four different assumptions, they could decide whether they were typical, neutral, or not typical.

The figure clearly shows that the durability of the fashion item is the most important for consumers. The second largest number of responses came to the statement that says: the respondent likes to buy new clothes and accessories. This statement is very typical for 44.80%. The next statement refers to online shopping, it is typical for 36.94%. We also wanted to find out how important they consider recycled, environmentally friendly pieces to be when purchasing a fashion item. 25.56% of the respondents consider this characteristic of themselves.

Fig. 2. Degree of agreement with certain statements in the case of buying fashion items



Source: own processing

As a conclusion, it can be said that the durability of fashion items is important to the respondents, but there is also great interest in new pieces, most of them like to be able to buy new fashion items. The majority of our respondents are happy to shop online. For the participants in our research, purchasing items made with environmentally friendly technology is not a primary consideration when purchasing a fashion item.

In the next question, we focused on examining the lifespan of the product, and we asked how price and lifespan are related in the case of fashion products. Our research revealed that 40.3% of our respondents believe that more expensive clothing or accessories can be worn longer, 35.8% see no connection between price and lifespan, 23.3% could not decide, and 0.6% believes that cheaper clothing or accessories can be worn longer.

Tab. 1. Minimum, maximum, mean and standard deviation values for rarely worn fashion products

Minimum	Maximum	Mean	Standard Deviaton
0	90	34.42	22.47

Source: own processing

In the following question (Table 1.), we wanted to know what percentage of the respondent's wardrobe is made up of clothes, shoes, or accessories that they wear less often than every six months.

We also assessed how much respondents spend on average on fashion item(s) during a purchase. The majority of respondents, 48.30%, marked the amount below 50 euros, 40.30% buy between 50-100 euros, and 11.40% spend more than 100 euros on fashion items.

Discussion

The most common definition of sustainable development is the formulation in the Brundtland report published by the United Nations, which reads as follows: "a development process or organizational principle that satisfies the needs of the present without reducing the ability of future generations to meet their own needs" (Gyulai, 2013; Anyakoha, 2018). The environmentally conscious behavior of companies and consumers can be a big step forward in improving the condition of the Earth, preserving sustainability and preserving the health of future generations (Amberg, 2019). The textile and clothing industry is a resource-intensive industry. This industry is responsible for 3-10 percent of global carbon dioxide emissions and produces huge amounts of waste (de la Motte & Ostlund, 2022). Due to the increasing amount of textile waste and the increasing resource pressure, recycling has become an important aspect of the fashion and apparel industry (Riemens et al., 2021). Nowadays, textile waste recycling is a global challenge (Memon et al., 2022). According to Schoormans (2018), in the next ten years, sustainable fashion must first focus on moving from the linear to the circular economy and then on redefining the value of products. This in itself is an extremely difficult task. Not to mention that certain authors in the literature regard sustainable fashion as a concept as an oxymoron (Shotter, 2002; Henninger et al., 2016). These thoughts prompted us to deal with sustainability in the fashion industry. The aim of our study was to examine the attitude of consumers towards planned obsolescence, as well as to assess their clothes buying habits.

Conclusion

Based on our research results, the majority of respondents are not aware of the concept of planned obsolescence. Those who are familiar with the concept think of it more negatively than positively. Most of the respondents buy a new fashion product every month or every six months. Such products are most often worn for years because they have not yet been used, and the reason for the exchange is usually that the product can no longer be worn or the respondent simply wants something new. It can be concluded from this that more than half of the people participating in the research fell victim to functional obsolescence, but psychological obsolescence also appears. When purchasing new fashion products, the most important aspects were comfort and durability. The literature pays attention to the care of the product itself. This is closely related to how a consumer thinks about replacing their fashion products. Based on Fogg's (2009) model Ackermann (2018), defined nine different motivators related to product care. These are related to the product itself (financial aspects, pleasure, functionality, aesthetics), to the consumer (intrinsic motivation, rebellion against the brand policy) and to the relationship between the consumer and the product (fit with the participant’s identity, irreplaceability, shared ownership). If the product care activity is easy, then a low level of motivation is enough to act, so the care activity takes place. On the other hand, if the care of a product is difficult, a great motivation (e.g. savings in certain cases) is needed for a product care activity. In product care, internal (appearance triggers, time triggers, social triggers) and external triggers (previous care experiences, challenge-based approach) can be distinguished.

Looking at being a conscious customer, we found that the majority of respondents consider themselves more conscious, but many could not

take a position on this issue. During our research, we also discussed whether the respondents see a connection between the product's price and lifespan. According to 40.3%, there is, but according to nearly 36%, there is no connection between the two factors. The majority of respondents spend an average of less than 50 euros on the purchase of a new fashion product. The majority of our respondents are happy to shop online. This is not surprising, since thanks to the rise of e-commerce, the online space has become the primary place for buying clothes (Chen & Yang, 2020). Despite this, there are also disadvantages to buying clothes online, as customers cannot try on the clothes and check their quality (Machová et al., 2021).

In the case of a defective fashion product, 56.3% of the respondents repair it, and 43.8% prefer to replace it because they believe that buying it is cheaper than repairing it. If the product is still wearable, but the respondent no longer wants to wear or use it, then the highest percentage of respondents give it away or put it in a clothes collection container. More than half of those involved in the research most often buy fashion products for themselves, but a quarter also for their children. On average, 34.42% of the respondents' wardrobe consists of products that are worn less often than every six months. These clothes take up unnecessary space instead of being reused.

The limitation of the research was that, in our opinion, due to the choice of topic, a high proportion (78.4%) of our questionnaire was filled out by women. A possible future direction of the research could be to expand the number of answers by sending the questionnaires to men only, as well as to expand the research to an international level.

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Contact

Mgr. Kamilla Baša
Department of Management
Faculty of Economics and Informatics
J. Selye University
Bratislavská cesta 3322, 945 01 Komárno
basa.kamilla@student.ujs.sk

Bc. Emese Szabó Farkas
Department of Management
Faculty of Economics and Informatics
J. Selye University
Bratislavská cesta 3322, 945 01 Komárno
128624@student.ujs.sk

COMPUTER SKILLS OF OLDER PEOPLE: CASE OF SLOVAKIA AND FINLAND

Eva GRMANOVÁ

Abstract

In today's world, computer skills have become a necessity. However, there are differences between countries in the level of computer literacy of people in different age groups. In the long term, Finland achieves the best results in the level of computer literacy. The goal of the research study is to specify the differences in computer skills in Slovakia and Finland. The research is focused on people aged 50+. SHARE questionnaire - Survey of Health, Aging and Retirement in Europe was used to achieve the goal. The total number of observations was 2158. Chi-square (χ2) Test for Independence, Cramér's V and adjusted residuals were used to achieve the goal. Based on the methods used, we accepted the hypothesis that there is a significant association between countries (Slovakia and Finland) and computer skills. In Slovakia, there is a large share of people aged 50+ who have never used a computer. An approach by the government to promote expansion of access to the Internet, similar to Finland, could contribute to improving computer literacy in the Slovak Republic.

Key words

Computer skills, Chi-square Test of Independence, SHARE

***JEL Classification**: J24* https://doi.org/10.52665/ser20220203

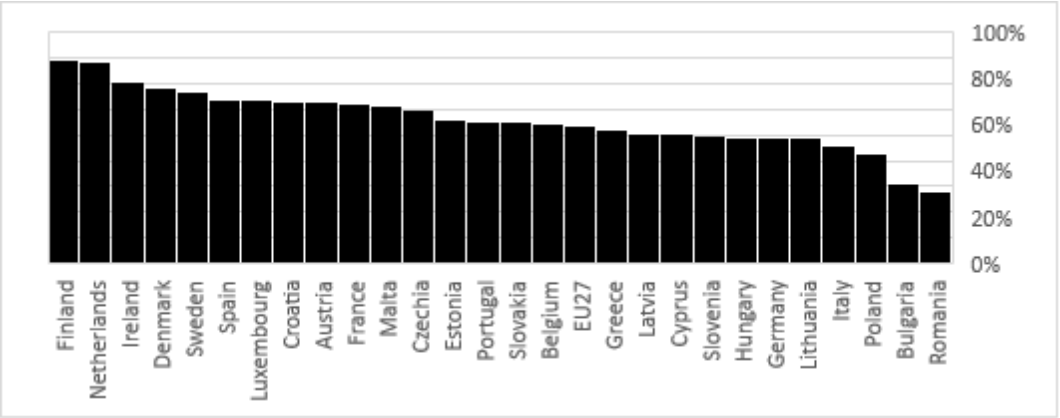
Introduction

One of the fundamental features of the current period is the spread of information technology in almost all areas. The use of computers and information technology has become a daily routine in many professions. Computer skills are a basic requirement for most employers. Due to great advances in the field of information technology, continuous expansion of computer skills has become a necessity.

Computer skills can vary according to age. The younger generation takes the use of information technology for granted. The older generation has not “grown up” with information technology and therefore feels disadvantaged compared to the younger generation. There are also large differences in computer skills and their use between countries. Comparisons are made on the basis of various surveys. Eurostat publishes annual figures for the share of people with different levels of computer skills. Finland has long been at the top of the rankings. Fig. 1 shows individuals with basic or above basic overall digital skills (%) in EU countries. The value indicators in the Slovak Republic are above average. However, there are large differences between the level of computer skills in Slovakia and Finland.

The scientific study aims to find out the specifics of computer skills of older people in Slovakia and Finland. A deeper research of the issue will allow a closer look at where the weaknesses of the Slovak Republic lie and what are the opportunities for improvement.

Figure 1 Individuals with basic or above basic overall digital skills (%) in 2021



Source: according Eurostat (2022)

Literature overview

The digitisation of national economies is a characteristic feature of EU countries in the current period. It brings new jobs to the labour market. On the other hand, new digital skills are increasingly required of workers. Improving digital skills is becoming a priority for governmental organisations. According to Stofkova et al. (2022) this priority was also formulated by the Ministry of Education, Science, Research and Sport of the Slovak Republic.

The required computer skills vary according to the type of work performed. However, it can generally be argued that a good level of computer skills has a number of positive implications not only for the employees, but also for the labour market and companies. According to Peng (2017, p. 31) "computer skills should facilitate worker reemployment." For this reason, computer skills have an impact on employment and influence the labour market. The use of information technology can be of strategic importance. However, it is important to use computer skills creatively. Workers with higher education have an advantage in this respect. Planning and management are very important for the expansion of IT skills (Nakayama, Sutcliffe, 2004). At company level, it is, therefore, necessary that the objectives of IT skills expansion are interrelated with strategic objectives. At the same time, continuous monitoring of the skills of the company's employees is necessary (Weritz, 2022).

According to Colbert (2016, p.737) "The digital competencies of the workforce and the ways in which technology is used in the workplace will continue to develop and change." The development of digital skills will lead to improved work efficiency. However, we should not forget the negatives that the expansion of the use of information and communication technologies can bring with it. It is important to examine and try to eliminate them.

Computer skills are influenced by the possibility to use the Internet on a daily basis. The Internet allows users to acquire more and more computer knowledge. However, access to the Internet is influenced by several factors. According to Dao (2017), the basic factors include the quality of the Internet, the affordability of the Internet and the affordability of computer applications. Their accessibility also varies depending on the economic development of the country.

In addition to Internet accessibility, computer skills are also influenced by the environment at the micro-level. Wicht et al. (2021) emphasize that an enabling environment at company and community level has an important impact on ICT skills.

The computer skills of older employees are influenced by several factors. According to Augner (2022), particularly important are the relationships between, on the one hand, the level

of self-assessed computer literacy and, on the other hand, mental health, physical health and cognitive abilities. An interesting finding is that there was no significant relationship between the age and gender in the elderly. According to Vosner et al. (2012), increasing computer skills in the elderly has a positive effect of reducing feelings of loneliness. Thus, ultimately, improving computer literacy improves quality of life as well.

Older employees did not grow up with computer technology. This fact may be a disadvantage for them. According to Koegh (2009), for mature-age employees, certain specifics must be taken into account when increasing their computer skills. It is important not to use impractical training practices and to eliminate deficiencies in planning and miscommunication. The managers themselves, who are mostly of mature age, can be a hindrance too. At the same time, in ICT skills training, it is particularly important that trainers link new knowledge to the lifestyles and life needs of older employees in training (Schirmer et al., 2022).

Computer skills training may bring significant benefits to older employees. Lee et al. (2021, p. 32) state that "older workers can obtain significant benefits from job training, relative to the younger workers". Thus, we can summarize that training older employees may bring more benefits to them and the employer, and older employees may be more productive after training than younger employees. This finding is important because it points to the opportunities for increasing the productivity of older employees.

The computer skills of older employees may also influence their decision to retire. Currently, when the size of the workforce is shrinking, improving the computer skills of older employees may reduce the number of those who choose not to retire or to retire early. According to Biagi et al. (2011, p.11) "the combined effect of being skilled and using a PC at work is to reduce the probability of existing employment by 12 percentage points."

Sudden events, such as the COVID 19 pandemic, may lead to accelerating the improvement of older employees' computer skills. According to König and Seifert (2022), a large share of older employees aged 50+ in the EU28 who worked only from home reported that they had improved their computer skills. If the employees worked from home and at their usual workplace, the share of those who reported their computer skills had improved was significantly lower.

Goal and Methodology

Goal

According to Eurostat (2022), the share of employees with excellent computer skills in the Slovak Republic is lower than the share of employees with excellent computer skills in some of the most advanced EU countries. It is important to identify the specifics of these differences. As Finland has been in the top position in digital skills for a long time, we decided to identify the specifics in the level of computer skills between Slovakia and Finland. A deeper exploration of the specifics can contribute to the search for opportunities to increase computer skills in Slovakia. The goal of the research study is to specify the differences in computer skills in Slovakia and Finland. The research is focused on people aged 50+.

SHARE questionnaire - Survey of Health, Aging and Retirement in Europe Wave 8, the file sharew8_rel8-0-0_it.sav are used to achieve the goal (SHARE, 2022).

Methodology

According to Hendl (2015) when one of the variables is nominal we can use to finding association the Chi-square (χ^2) Test for Independence.

Pearson Chi-square statistic is calculated as:

$$\chi^2 = \sum_{i=1}^{R}\sum_{j=1}^{S}\frac{(f_{ij} - e_{ij})^2}{e_{ij}}, \qquad (1)$$

where *"f_{ij}* is observed frequency for contingency table category in row i and column j
e_{ij} is expected frequency for contingency table category in row i and column j on the assumption of independence." (Anderson et al., 2014, p. 312)

The requirements of Chi-square Test of Independence are:

expected count of less than 5 is in less than 20% of cells,

expected count is more than 1 (Řezanková, 2007).

Cramér's V measures the strength of association. Measure has the value from 0 to 1. Cramér's V is calculated as:

$$V = \sqrt{\frac{\chi^2}{n(m-1)}}, \qquad (2)$$

χ^2 is Chi-square statistic,

n is number of subjects.

m is $min\{R, S\}$, where R is number of rows and S is number of all columns.

Standardized adjusted residuals expressed in IBM SPSS Statistics are used to determine where the relationship is. Adjusted residuals are calculated

$$r_{ij} = \frac{f_{ij} - e_{ij}}{\sqrt{e_{ij}(1 - \frac{r_i}{N})(1 - \frac{s_j}{N})}}, \qquad (3)$$

(Agresti, 2007), where

r_i is the sum of the i-th row,
s_j is the sum of the j-th column,
N is the total number of observations.
"When H0 is true, each standardized residual has a large-sample standard normal distribution. A standardized residual having absolute value that exceeds about 2 when there are few cells or about 3 when there are many cells indicates lack of fit of H0 in that cell." (Agresti, 2007, p. 38)

Findings

At the beginning of the analysis, are present the statistics of selected variables from SHARE questionnaire and the null hypothesis are presented.
Two variables are used: Computer skills and Country.
Answer options for variable Computer skills (it_003) in the questionnaire are: "Refusal", "Don't know", "Excellent", "Very good", "Good", "Fair", "Poor" and "I never used a computer".
Selected answer options for variable Country in the questionnaire are: "Finland" and "Slovakia".
The variable Country is nominal.
Null Hypothesis H0: there is no significant association between selected country and computer skills.
Alternative Hypothesis H1: there is significant association between selected country and computer skills.
The processed answers are only from respondents who answered both questions.

In the next step, a frequency table is created (Table 1) and the expected frequencies are calculated for contingency tables (Table 2).

Table 1 Observed Frequencies

	Refusal	Don't know	Excellent	Very good	Good	Fair	Poor	I never used a computer	SUM
Finland	1	2	64	106	337	339	202	110	1161
Slovakia	0	0	16	107	251	140	134	349	997
SUM	1	2	80	213	588	479	336	459	2158

Source: own calculations in IBM SPSS Statistics based on data from Börsch-Supan et al. (2013), Gruber et al. (2014), Bergmann, Börsch-Supan (2021), Börsch-Supan (2022), Börsch-Supan, Gruber (2022), SHARE (2022)

Table 2 Expected Frequencies

	Refusal	Don't know	Excellent	Very good	Good	Fair	Poor	I never used a computer	SUM
Finland	0.54	1.08	43.04	114.59	316.34	257.70	180.77	246.94	1161
Slovakia	0.46	0.92	36.96	98.41	271.66	221.30	155.23	212.06	997
SUM	1.00	2.00	80.00	213.00	588.00	479.00	336.00	459.00	2158

Source: own calculations in IBM SPSS Statistics based on data from Börsch-Supan et al. (2013), Gruber et al. (2014), Bergmann, Börsch-Supan (2021), Börsch-Supan (2022), Börsch-Supan, Gruber (2022), SHARE (2022)

The total number of observations was 2158. The number of respondents from Slovakia was 997 (46.2%). The number of respondents from Finland was 1161 (53.8%). Table 2 shows that they have not fulfilled the requirements of Chi-square Test of Independence. Six of the all expected counts are less than 1. For this reason, we left out the two categories: "Refusal" and "Don't know". The frequency table is in Table 3. The number of observations decreased by three.

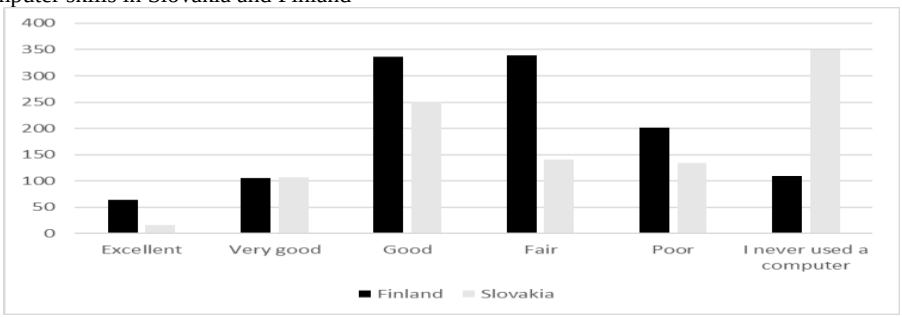
Table 3 Observed Frequencies- answers Refusal" and "Don't know" are omitted

	Excellent	Very good	Good	Fair	Poor	I never used a computer	SUM
Finland	64	106	337	339	202	110	1158
Slovakia	16	107	251	140	134	349	997
SUM	80	213	588	479	336	459	2155

Source: own calculations in IBM SPSS Statistics based on data from Börsch-Supan et al. (2013), Gruber et al. (2014), Bergmann, Börsch-Supan (2021), Börsch-Supan (2022), Börsch-Supan, Gruber (2022), SHARE (2022)

Fig. 2 shows several differences between the answers of respondents in the Slovak Republic and Finland. The biggest difference is in the category "I have never used a computer". While this answer was chosen by 23.97% of respondents in Finland, in Slovakia it was 35.0%. This fact is to the detriment of Slovakia. Another weakness appears in the category "Excellent". While in Finland this answer was chosen by 5.5%, in Slovakia it was 1.6%.

Figure 2 Computer skills in Slovakia and Finland



Source: own calculations in Microsoft Excel based on data from Börsch-Supan et al. (2013), Gruber et al. (2014), Bergmann, Börsch-Supan (2021), Börsch-Supan (2022), Börsch-Supan, Gruber (2022), SHARE (2022)

After adjusting the values, we again expressed the expected frequencies (Table 4). We determined whether the requirements of the Chi-square Test of Independence apply. The minimum expected count is 37.01. The requirement of Chi-square Test of Independence (expected count of less than 5 is in less than 20% cells) is fulfilled here.

Table 4 Expected Frequencies - answers “Refusal" and "Don't know" are omitted

	Excellent	Very good	Good	Fair	Poor	I never used a computer	SUM
Finland	42.99	114.46	315.96	257.39	180.55	246.65	1158.00
Slovakia	37.01	98.54	272.04	221.61	155.45	212.35	997.00
SUM	80.00	213.00	588.00	479.00	336.00	459.00	2155.00

Source: own calculations in IBM SPSS Statistics based on data from Börsch-Supan et al. (2013), Gruber et al. (2014), Bergmann, Börsch-Supan (2021), Börsch-Supan (2022), Börsch-Supan, Gruber (2022), SHARE (2022)

Pearson Chi squares is 251.64. Degrees of freedom (df) is 5 and p-level is 0.000. From the above, we can conclude that we reject the Null Hypothesis H0 and accept the Alternative Hypothesis H1: there is significant association between country and computer skills.

We expressed Cramér's V in the IBM SPSS program. V. Its value is 0.342. The tightness of the dependency is medium.

To determine where the relationship manifests itself, we expressed the adjusted residual in IBM SPSS. Their values are in Table 5.

Table 5 Adjusted Residual

	Excellent	Very good	Good	Fair	Poor	I never used a computer
Finland	4.8	-1.2	2.0	8.5	2.6	-14.4
Slovakia	-4.8	1.2	-2.0	-8.5	-2.6	14.4

Source: own calculations in IBM SPSS Statistics based on data from Börsch-Supan et al. (2013), Gruber et al. (2014), Bergmann, Börsch-Supan (2021), Börsch-Supan (2022), Börsch-Supan, Gruber (2022), SHARE (2022)

We will look at the table from Slovakia's point of view. The large positive residuals are for the combination: “Slovakia” and “I never used a computer”. It means that, there were more Slovaks who “Never used a computer”, than the hypothesis of independence predicts.

The large negative residuals are for combinations:

1/ “Slovakia” and “Excellent”. It means that there were fever Slovaks who have excellent computer skills, than the hypothesis of independence predicts.

2/ “Slovakia” and “Fair”,

3/ “Slovakia” and “Poor”.

evaluation, it is necessary to pay the most attention to the differences between the answers “I never used a computer” and “Excellent”.

Discussion

One of the reasons for the differences in the answers “I have never used a computer” in Slovakia and Finland is that since 2010 access to the Internet has been regarded as a fundamental right in Finland. This has also had a significant impact on access to the Internet for older people and, ultimately, on their computer skills. Therefore, the share of the elderly who have never used a computer in Finland is significantly lower. In the Slovak Republic, there is a relatively high share of the elderly who have never used a computer. According to the results from the sources used, this may have a number of negative consequences. The most important include lower adaptability of the elderly in the labour market in the Slovak Republic and lower quality of life. Similarly, the difference in the answer “Excellent” is mainly due to the fact that the process of economy digitalisation in Finland

started much earlier and with greater intensity than in the Slovak Republic.

In our opinion, the resources of a company that invests in making the Internet and computers accessible will see a very quick return and such an approach will translate into faster development of the company.

Conclusion

The goal of the research study was to specify the differences in computer skills in Slovakia and Finland. The research was focused on people aged 50+.

SHARE questionnaire - Survey of Health, Aging and Retirement in Europe was used to achieve the goal. The total number of observations was 2158. To achieve the goal, we used Chi-square (χ^2) Test for Independence, Cramér's V and adjusted residuals. We rejected the Null Hypothesis H0 and accepted the Alternative Hypothesis H1: there is significant association between country and computer skills. The tightness of the dependence between the variables is medium. Based on the adjusted residuals, we can conclude that the large positive residuals are for the combination: "Slovakia" and "I never used a computer". It means that there were more Slovaks who never used a computer than the hypothesis of independence predicts. This fact is the result of the availability of Internet use in Finland and the result of the great pace of digitization of society.

Acknowledgments

This paper uses data from SHARE Waves 1, 2, 3, 4, 5, 6, 7, 8 and 9 (DOIs: 10.6103/SHARE.w1.800, 10.6103/SHARE.w2.800,10.6103/SHARE.w3.800,10.6103/SHARE.w4.800,10.6103/SHARE.w5.800,10.6103/SHARE.w6.800,10.6103/SHARE.w7.800,10.6103/SHARE.w8.800,10.6103/SHARE.w8ca.800,10.6103/SHARE.w9ca800), see Börsch-Supan et al. (2013) for methodological details.
The SHARE data collection has been funded by the European Commission, DG RTD through FP5 (QLK6-CT-2001-00360), FP6 (SHARE-I3: RII-CT-2006-062193, COMPARE: CIT5-CT-2005-028857, SHARELIFE: CIT4-CT-2006-028812), FP7 (SHARE-PREP: GA N°211909, SHARE-LEAP: GA N°227822, SHARE M4: GA N°261982, DASISH: GA N°283646) and Horizon 2020 (SHARE-DEV3: GA N°676536, SHARE-COHESION: GA N°870628, SERISS: GA N°654221, SSHOC: GA N°823782, SHARE-COVID19: GA N°101015924) and by DG Employment, Social Affairs & Inclusion through VS 2015/0195, VS 2016/0135, VS 2018/0285, VS 2019/0332, and VS 2020/0313. Additional funding from the German Ministry of Education and Research, the Max Planck Society for the Advancement of Science, the U.S. National Institute on Aging (U01_AG09740-13S2, P01_AG005842, P01_AG08291, P30_AG12815, R21_AG025169, Y1-AG-4553-01, IAG_BSR06-11, OGHA_04-064, HHSN271201300071C, RAG052527A) and from various national funding sources is gratefully acknowledged (see www.share-project.org).
This paper uses data from the generated easySHARE data set (DOI: 10.6103/SHARE.easy.800), see Gruber et al. (2014) for methodological details. The easySHARE release 8.0.0 is based on SHARE Waves 1, 2, 3, 4, 5, 6, 7 and 8 (DOIs: 10.6103/SHARE.w1.800,10.6103/SHARE.w2.800,10.6103/SHARE.w3.800,10.6103/SHARE.w4.800,10.6103/SHARE.w5.800,10.6103/SHARE.w6.800,10.6103/SHARE.w7.800, 10.6103/SHARE.w8.800).

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Contact

Eva Grmanová, doc. RNDr., PhD.
Faculty of Social and Economic Relations,
Dubcek University of Trencin,
Slovakia, e-mail: eva. grmanova@tnuni.sk

FINDING SPECIFIC GROUPS OF AGRICULTURAL SMES THAT USE DIGITAL TECHNOLOGIES TO MANAGE SELECTED PROCESSES

Katarína HAVIERNIKOVÁ, Monika MYNARZOVÁ, Jana SOCHUĽÁKOVÁ

Abstract

The paper presents the relevant results of research that was conducted on a current and symbolic topic that offers new perspectives and opportunities for small and medium-sized enterprises (SMEs) in the context of the 4th industrial revolution – the digital industrial revolution. This paper deals with the issue of the identification of specific groups of agricultural SMEs using digital technologies to manage selected processes. The paper's main aim is to determine if it is possible to divide the agricultural SMEs, which have implemented their processes using information technology into several characteristic groups that significantly differ by the types of processes. The fulfilment of the content of the paper is based on the research of primary data and their analysis in relation to the defined topic of the research. To achieve this goal, the cluster analysis method has been used.

Key words

Agriculture 4.0, digital technologies, industrial revolution, Industry 4.0, small and medium-sized enterprises

***JEL Classification**: L26, M15, Q12.* https://doi.org/10.52665/ser20220204

Introduction

For several years, a number of developed countries have been dealing with the onset of the so-called "4th industrial revolution", which is fundamentally changing the nature of industry, energy, trade, logistics and other parts of the economy and the entire society. The "Industry 4.0" trend is seen as a transforming force that will deeply impact agriculture. Agriculture is changing in recent years too and, in the same way as an industry, is forced to modernize its work methodologies and take advantage of opportunities offered by digital technologies (Monteleone, S. et al., 2020). The trend is building on an array of digital technologies: the Internet of Things, Big Data, Artificial Intelligence, and of digital practices: cooperation, mobility, and open innovation. They imply a transformation of the production infrastructures. They will enable both increased productivity and quality and environmental protection. But they also generate modifications in the value chain and business models with more emphasis on knowledge gathering, analysis and exchange (European Commission, 2017). The digital revolution presents not only a huge opportunity for SMEs but also a great challenge. However, to reap these benefits, businesses will need to invest in equipment, information and communication technology (ICT) and data analytics, as well as the integration of data flow across the global value chain (European Parliament, 2015).

This paper focuses on finding specific groups of agricultural SMEs using digital technologies to manage selected processes. The article is based on the main aspects of the "Agriculture 4.0" initiative; whose basic directions of implementation are the active use of various digital technologies, which are to be established for the introduction of qualitatively new approaches to the organization of the activities of agricultural enterprises. In addition, the creation of digital platforms is considered one of the approaches to improve economic, organizational, and managerial relations that take place in the process of economic activity of agricultural enterprises.

The structure of the paper is as follows. In the theoretical part, the opinions of other researchers are presented in the field. The next part defines the research goal and methodology including a description of empirical data. Then we deal with the results and short discussion on them. The final part of the paper summarizes the results of

the research in an integrated form, the limits of research and the focus of further research.

The literature on this topic suggests that the application of the principles of the 4th industrial revolution is of great importance, especially for small and medium-sized enterprises, and therefore should be widely represented in research, theory and business practice.

Literature overview

Hermann et al. (2015) point out that although Industry 4.0 is currently the top priority of many companies, research centres and universities, there is no generally accepted definition of the term. The term "Industry 4.0" became public knowledge in 2011 when an initiative with that name - an association of representatives from business, politics, and academia - promoted the idea as an approach to strengthening the competitiveness of the German manufacturing industry.

According to Perales et al. (2018), Industry 4.0 is a wide term that implies a drastic change in the way companies operate - upcoming innovations and transformations of production processes. The Internet and digitization enable the complete connection and automation of all production processes as well as the services associated with them. However, current research about Industry 4.0 is diverse, limited and clearly insufficient regarding its implementation in operational levels of the production processes (Hermann et al., 2015).

Many authors observed various aspects of enterprise processes in which Industry 4.0 finds its application. The implementation of digital technologies into the management of SMEs' processes is affected by various factors such as the organizational capabilities of SMEs (Annosi et al., 2019), the nature of the business, the size of the company, the management decision, the view of internal and external pressure (Rijswijk et al., 2019, Müller et al., 2018), and technological advancement, government policy and other.

Revolution 4.0 is at the centre of interest of small and medium-sized enterprises both in industry and agriculture. Agriculture within the agricultural supply chain faces specific challenges to enable the operational application of Industry 4.0 guidelines. The integration of Industry 4.0 and Agriculture 4.0 provides the opportunity to transform industrial agriculture into the next generation, namely "Agriculture 4.0" (Liu et al., 2020). The industry is developing much faster than agriculture (today there is talk of the so-called Industry 5.0). While Agriculture 4.0 is still limited to a few advanced companies. Regardless of the recommended industry or agriculture 4.0 for large companies, small and medium enterprises often face difficulties in such advanced development due to the continuous progress in innovation and technology (Tubis and Grzybowska, 2022). According to Rauch et al. (2020) This is primarily due to the lack of knowledge about solutions supporting Industry 4.0 and the high costs related to investments in new technologies. Mittal et al. (2018) emphasize that SMEs often do not adopt new solutions, mainly because they fear investing in bad technologies or adopting inappropriate practices.

Several studies highlight the potential of Agriculture 4.0, such as improvements in planning and management, and intelligent use of data collected through advanced technologies for sustainable growth (Braun, Colangelo and Steckel, 2018). Weersink et al. (2018) summarize the results of several studies based on the idea of Agriculture 4.0 and confirmed that the interaction of farming operations using digital information in all farm sectors and processes has brought positive changes. The fusion of precision agriculture and the Internet of farming leads to Agriculture 4.0 (or digital agriculture), which interconnects different technologies aimed at improving the yield and sustainability of crops, increasing working conditions, and the quality of production and processing (Zambon et al., 2019).

Braun et al. (2018) stress that for the agricultural sector, efficient value creation across all levels along the whole supply chain is also of great importance. The support of a digitalized and comprehensive understanding of reality enables new potential benefits for all involved partners. To achieve this, a holistic approach to digitalization is necessary.

In today's innovative environment, despite the benefits of Industry 4.0 or Agriculture 4.0 for

large enterprises, small and medium-sized enterprises often face complications in such innovative processes due to the constant development of innovation and technology (Zambon et al., 2019a). A well-organized political, legal and infrastructural overview is essential for building a business with an Industry 4.0 approach. While larger firms can get ahead through innovation processes and anticipate the potential risks of digitization to their business models, SMEs may struggle. These editorial aims to offer relevant results of research that has been carried out on this current and symbolic topic, offering new perspectives and opportunities, especially for SMEs (Zambon et al., 2019b). Policymakers should design strategies and calls for proposals to encourage SMEs to invest in these technologies and make them more competitive in the market.

Goal and Methodology

In our research, we tried to find answers to research question-related about processes, which are managed by using information technology within Slovak agricultural SMEs (RQ: Which processes do you manage by using of the information technology?). Respondents could mark the following possibilities:

PA) Accounting and finance

PB) Procurement and stock management

PC) Planning and scheduling of production

PD) Sales and customer relationship management

PE) Quality assurance and quality control

PF) Network control of production machinery and equipment

PG) Post-warranty service

PH) Managing/minimizing energy consumption.

The main goal of the paper is to find out, if is it possible to divide the SMEs, which have implemented their processes by using the information technology into several characteristic groups that significantly differ by the stated types of processes.

To achieve the stated goal a survey of 171 SMEs' opinions has been chosen and the questionnaire survey was used as a principal method. The questionnaire was created by the research team within the Vega project No. 1/0718/22 and subsequently distributed to the respondents personally, or by email.

We developed a questionnaire and distributed it to managers or owners of agricultural SMEs in eight self-governing Slovak regions (table 1).

The structure of the research sample according to their main characteristics is provided in the following tables and figures. Table 1 presents the division of respondents according to the self-governing region in which the SMEs carry out their entrepreneurial activities. A large number of SMEs belonged to the category of micro-enterprises (54.39%) and the Trenčín region (39.18%).

Table 1 Research sample according to self-governing region

Region		**BA**	**TT**	**TN**	**NR**	**ZA**	**BB**	**KE**	**PO**	**Total**
micro (0-9)	N	12	14	40	4	20	2	0	1	93
	%	7.02	8.19	23.39	2.34	11.70	1.17	0.00	0.58	**54.39**
small (10-49)	N	5	2	24	6	21	3	2	0	63
	%	2.92	1.17	14.04	3.51	12.28	1.75	1.17	0.00	**36.84**
medium (50-249)	N	3	4	3	1	3	0	1	0	15
	%	1.75	2.34	1.75	0.58	1.75	0.00	0.58	0.00	**8.77**
Total	**N**	**20**	**20**	**67**	**11**	**44**	**5**	**3**	**1**	**171**
	%	**11.70**	**11.70**	**39.18**	**6.43**	**25.73**	**2.92**	**1.75**	**0.58**	**100.00**

Source: own research, Notice: BA-Bratislava region, TT-Trnava region, TN-Trenčín region, NR-Nitra region, ZA-Žilina region, BB-Banská Bystrica region, KE-Košice region, PO-Prešov region

To evaluate the research question, the cluster analysis was used. Using cluster analysis, we divided the respondents into several characteristic groups that differ in the types of processes managed using information technology. Based on the calculation in STATISTICA application a graphical output (dendrogram) of the cluster analysis was constructed.

Findings and Discussion

The respondents' answers, indicating the options, are shown in Table 2. Most SMEs used information technology for PA) accounting and finance (149 SMEs) and PB) procurement and stock management (118 SMEs). The least SMEs used information technology for PG) Post-warranty service (27 SMEs). Accounting information as quantitative information about economic entities is useful for economic decision making and it can be used for strategic planning, management oversight, and operation oversight (Putra, 2019). For the accounting department, which records the financial movements of the business and reports the results of them, it is effective to use intelligent systems for helps to reduce human-made mistakes and the system acts faster.

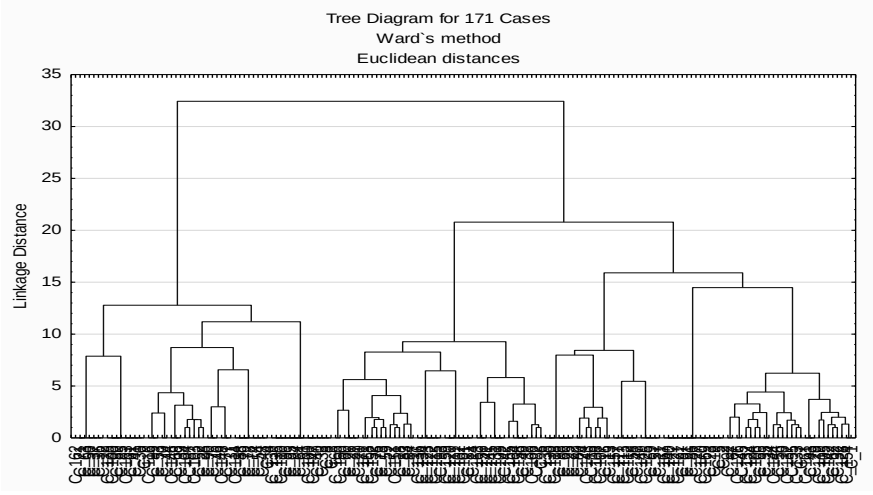
Table 2 Processes managed by using of the information technology

Process	Answer	No	Yes	Process	Answer	No	Yes
PA	**N**	22	149	**PE**	N	106	65
	%	12.87	87.13		%	61.98	38.02
PB	**N**	53	118	**PF**	N	127	44
	%	30.99	69.01		%	74.27	25.73
PC	**N**	86	85	**PG**	N	144	27
	%	50.29	49.71		%	84.21	15.79
PD	**N**	73	98	**PH**	N	133	38
	%	42.69	57.31		%	77.78	22.22

Source: own research

Many factors will affect the implementation of Industry 4.0 elements such as the size of the enterprise, the number of employees, the sector in which the enterprises do business, financial indicators such as e.g., amount of equity and liabilities, fixed assets, ways of financing (Vrchota et al., 2020). In our research, we evaluated if the size of the enterprise affects the processes managed by using informational technologies.

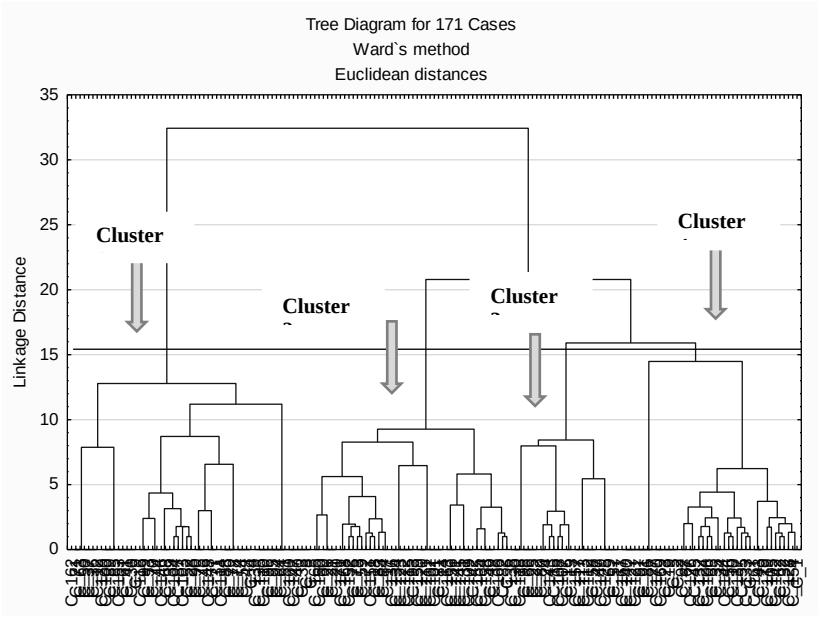
Figure1 Cluster analysis – dendrogram of processes



Source: own research

From this dendrogram, we can identify that the surveyed entrepreneurs tend to cluster into two different clusters. Subsequently, these clusters break down into 4 smaller clusters (Figure 2).

Figure 2 Cluster analysis (processes) – identification of 4 clusters



Source: own research

For the interpretation of the cluster analysis, below the graph of means (Figure 3) and the result of the analysis of variance of the 4 identified cluster s are provided (Table 3). They were generated by the K-means method, which better expresses the characteristics of the individual clusters as well as what are the averages of the individual characteristics of the studied clusters.

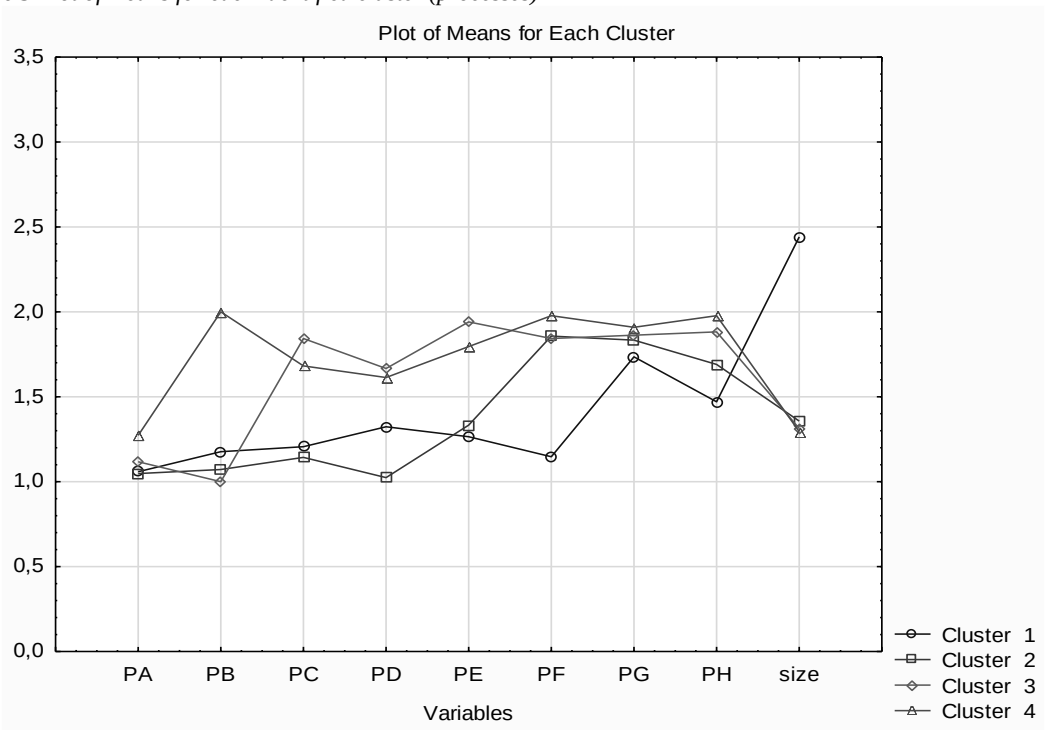
Table 3 Results of analysis of variance from the performed cluster analysis

Variable	cluster 1	cluster 2	cluster 3	cluster 4	signif. p
PA	1,11	1,00	1,25	1,11	**0,00**
PB	1,34	1,09	1,45	1,32	**0,00**
PC	1,64	1,07	1,85	1,29	**0,00**
PD	1,55	1,09	1,64	1,36	**0,00**
PE	1,82	1,30	1,78	1,50	**0,00**
PF	1,89	1,50	1,91	1,57	**0,00**
PG	1,91	1,77	1,85	1,82	0,36
PH	1,91	1,52	1,95	1,64	**0,00**
size	1,07	1,84	1,36	2,18	**0,00**

Source: own research

Figure 3 confirms the significant difference of means between the clusters for the characteristics related to the size of the enterprise. The characteristics of the clusters confirm the statement above.

Figure 3 Plot of means for each identified cluster (processes)



Source: own research

The first cluster consists of 44 enterprises (Table 4), which belong to micro-enterprises (41 enterprises) and small enterprises (3 SMEs). This cluster does not include medium enterprises. SMEs in this cluster use digital technologies mainly for managing PH processes Managing/minimizing energy consumption (1.91±0.29).

The second cluster also consists of 44 enterprises (Table 4), while the largest share is made up of enterprises from the category of small enterprises (21 SMEs). These companies, as was the case with the companies involved in the first cluster, use digital technologies especially for PH (1.52±0.51).

The third cluster consists of 55 SMEs (Table 4). The largest share is made up of enterprises belonging to the category of micro-enterprises (36), followed by small enterprises (18). There is only one enterprise from the category of medium-sized enterprises in this cluster.

The fourth cluster consists of 28 enterprises (Table 4). In terms of size category, there are 21 small enterprises, 1 micro-enterprise and 6 medium-sized enterprises in this cluster. Digitization is mainly used for PH (1.64±0.49)

Table 4 Classification of enterprises in clusters and the analysis of clusters' members - processes (output from STATISTICA)

Case No.	Cluster 1 44 cases Distance	Case No.	Cluster 2 44 cases Distance	Case No.	Cluster 3 55 cases Distance	Case No.	Cluster 4 28 cases Distance
C_6	0,55	C_2	0,43	C_1	0,51	C_20	0,43
C_13	0,50	C_5	0,38	C_3	0,32	C_34	0,46
C_14	0,32	C_7	0,44	C_4	0,35	C_38	0,37
C_30	0,28	C_11	0,54	C_8	0,32	C_49	0,37
C_31	0,50	C_15	0,46	C_9	0,36	C_58	0,53
C_36	0,37	C_18	0,55	C_10	0,50	C_67	0,46
C_54	0,35	C_19	0,46	C_12	0,38	C_73	0,46
C_63	0,37	C_21	0,43	C_16	0,52	C_80	0,42
C_65	0,47	C_22	0,28	C_17	0,49	C_83	0,54
C_79	0,35	C_23	0,41	C_28	0,41	C_84	0,38
C_87	0,39	C_24	0,54	C_29	0,44	C_86	0,32
C_88	0,35	C_25	0,38	C_32	0,48	C_97	0,40
C_89	0,43	C_26	0,35	C_33	0,36	C_105	0,56
C_90	0,45	C_27	0,38	C_37	0,56	C_106	0,59
C_91	0,43	C_35	0,49	C_39	0,42	C_107	0,59
C_92	0,49	C_45	0,40	C_40	0,36	C_108	0,57
C_94	0,27	C_47	0,48	C_41	0,39	C_111	0,32
C_95	0,31	C_55	0,45	C_42	0,41	C_115	0,36
C_96	0,35	C_57	0,53	C_43	0,57	C_119	0,48
C_99	0,44	C_60	0,47	C_44	0,43	C_126	0,47
C_102	0,36	C_66	0,45	C_46	0,46	C_129	0,38
C_103	0,53	C_69	0,40	C_48	0,33	C_130	0,42
C_109	0,35	C_72	0,49	C_50	0,40	C_138	0,37
C_116	0,41	C_81	0,38	C_51	0,34	C_149	0,47
C_121	0,44	C_82	0,44	C_52	0,45	C_152	0,50
C_122	0,31	C_98	0,45	C_53	0,38	C_164	0,39
C_123	0,35	C_101	0,42	C_56	0,46	C_168	0,39
C_127	0,40	C_112	0,46	C_59	0,51	C_171	0,39
C_128	0,44	C_113	0,39	C_61	0,36		
C_131	0,39	C_117	0,39	C_62	0,65		
C_134	0,35	C_118	0,28	C_64	0,34		
C_135	0,27	C_120	0,34	C_68	0,41		
C_136	0,35	C_124	0,39	C_70	0,45		
C_139	0,39	C_125	0,44	C_71	0,36		
C_140	0,44	C_133	0,38	C_74	0,34		
C_145	0,35	C_143	0,60	C_75	0,44		
C_146	0,41	C_144	0,48	C_76	0,55		
C_147	0,32	C_151	0,44	C_77	0,43		
C_150	0,43	C_157	0,29	C_78	0,33		
C_155	0,45	C_158	0,44	C_85	0,36		
C_160	0,32	C_159	0,34	C_93	0,41		
C_162	0,36	C_166	0,52	C_100	0,36		
C_165	0,39	C_167	0,32	C_104	0,53		
C_169	0,44	C_170	0,32	C_110	0,32		
				C_114	0,33		
				C_132	0,38		
				C_137	0,55		
				C_141	0,49		
				C_142	0,48		
				C_148	0,42		
				C_153	0,39		
				C_154	0,48		
				C_156	0,47		
				C_161	0,41		
				C_163	0,47		

Type of enterprise	Cluster 1	Type of enterprise	Cluster 2	Type of enterprise	cluster 3	Type of enterprise	cluster 4
micro	41	**micro**	15	**micro**	36	**micro**	1
small	3	**small**	21	**small**	18	**small**	21
medium	0	**medium**	8	**medium**	1	**medium**	6
Total	**44**	**Total**	**44**	**Total**	**55**	**Total**	**28**

Source: own research

Conclusion

Industry and the entire economy are undergoing fundamental changes caused by the introduction of information technology, cyber-physical systems and artificial intelligence systems into production, services, and all sectors of the economy. The impact of these changes is so fundamental that they are referred to as the 4th industrial revolution. It is necessary to respond to these trends, as they offer huge opportunities from the point of view of sustainability and increasing the productivity of production and services, and thus the demand for skilled workers. Otherwise, there is a risk of loss of competitiveness not only for companies but also for the economy as a whole, with significant impacts not only on employment and productivity but on the entire development of society.

The development of connectivity in agricultural tools is leading to significant advances in agricultural practices. They enable the development of precision agriculture and increase the transparency of the sector. However, they also face significant challenges in the key need to enable data exchange in the business ecosystem and the need to invest in new infrastructure and tools (European Commission, 2017).

The performed analysis enabled the practical implementation of the ideas developed in the "Agriculture 4.0" concept. It is capable of significantly increasing the efficiency of agricultural production and reducing the dependence of the functioning of agroecosystems on natural factors, as well as contributing to the greening of agricultural production processes.

Within this research, certain limits can be defined, which can be seen to a limited extent, although representative, the sample of respondents, or in the timing of research for a favourable phase of the economic cycle. At the same time, the research results show that the issue of may be an interesting area for further research.

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Contact

Ing. Katarína Havierniková, PhD.
Faculty of Social and Economic Relations, A. Dubček University of Trenčín
Študentská 3, 911 50 Trenčín,
Slovakia,
e-mail: katarina.haviernikova@tnuni.sk

Ing. Monika Mynarzová, Ph.D.
Faculty of Economics, VSB – Technical University of Ostrava
Sokolská třída 2416/33, 702 00 Ostrava
Czech Republic,
e-mail: monika.mynarzova@vsb.cz

Ing. Jana Sochuľáková, PhD.
Faculty of Social and Economic Relations, A. Dubček University of Trenčín
Študentská 3, 911 50 Trenčín,
Slovakia,
e-mail: jana.sochulakova@tnuni.sk

INTER-MUNICIPAL COOPERATION – A TOOL FOR SOLVING AND SATISFYING THE HETEROGENEOUS RESIDENTS NEEDS

Jana MASÁROVÁ, Martina JAKUBČINOVÁ, Filip HRŮZA, Vilém PAŘIL

Abstract

Inter-municipal cooperation is an alternative form of cooperation that enables municipalities to jointly achieve goals and interests related to a wide range of selected problems of partner municipalities. It can be seen not only as a tool for solving pressing issues of the existence and functioning of municipalities and cities, but also as a tool for improving the quality of life and services of citizens belonging to the units that are implemented. The aim of this contribution is to point out the current situation in the field of general cooperation in the Slovak Republic, as well as the perspective of interested parties on this form of cooperation. The contribution is an output of the Interreg SK-CZ project (MOSINVI 2020-2021), while its processing was based on the analysis of a questionnaire survey, which was carried out with the help of respondents included in the categories of representatives of municipalities and cities. The answers of these respondents were the basis for the creation of conclusions and recommendations.

Key words

Common municipal office; Cooperation; Local action group; Micro-region; Municipality.

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Introduction

Cooperation between cities and municipalities is one of the basic tools of the municipality. It allows to solve issues related to the growth and development of territorial administrative units. Inter-municipal cooperation is a tool to ensure, realize and evaluate the area of self-government from an economic and social point of view. It represents a basic prerequisite for meeting the heterogeneous needs of the residents of mini-municipalities. Within the application of this tool, it is necessary to emphasize the principle of efficiency and effectiveness.

There are many forms and means to implement the cooperation. Communities have a choice of several variants, which are guaranteed by the State from a legislative, institutional and financial point of view. However, the common denominator is the municipalities themselves (representatives and members of the self-government), the health and character of the self-government (the size and integrity of the self-governments), the external and internal relations of the self-governments, and the competences that belong to these self-governments.

In the Slovak Republic, it is one of the most pressing problems of the self-government environment. When it comes to the question of the size and integrity of municipalities, i.e. the residential structure of the Slovak Republic, the high level of fragmentation of local government has been encountered for a long time. Since 1993, not only the professional public has been drawing attention to this problem, but especially the representatives of these municipalities themselves. This phenomenon then causes problems regarding the existence and functionality of the given units. The units cannot fully fulfill the tasks that belong to the municipalities from the financial and personnel point of view. An alternative solution is therefore the institute of inter-municipal cooperation. Inter-municipal cooperation, as a possibility for solving the heterogeneous needs of the population of municipalities and cities, especially purposeful satisfaction of residents needs and interested parties for which the municipalities provide services, eliminates this deficiency, but does not solve it. It should also be emphasized that cooperation between municipalities and cities is not only about solving acute and unpopular issues. The goal of cooperation and partnership is to achieve a

qualitatively-quantitatively higher level of material and non-material goods.

The present state and situation of the application of the institute of inter-municipal cooperation in the SR environment are discussed in the article, the aim of which is also to identify and evaluate the issue of inter-municipal cooperation. For this purpose, available official State statistics and data obtained through self-research (questionnaire survey) were used, which were processed using selected mathematical and statistical methods. Therefore, the accepted conclusions also relate to the possible scenario of the future development of cooperation in the conditions of the Slovak Republic

Literature overview

The historical development of settlements and the related fragmentation of the settlement structure of the Slovak Republic (Klobučník et al., 2018, Jakabová, Jenčo, 2012), the transformation of public administration after 1989 (Kováčová, 2015, Machyniak, 2013) or the transfer of competences from the State to local self-government, they are only a fraction of the facts that cause serious problems for municipalities (especially small municipalities) (ÚMS, 2020, ZMOS, 2017, NKÚ, 2013). These problems are most noticeable especially in the area of securing and exercising competences. In many cases, municipal services do not correspond to the qualitative aspect, scope and interpretations of the law (Žárska, 2018).

Pursuant to Act of the Slovak Republic no. 369/1990 Coll. on the municipal establishment, the basic task of the municipality is to take care of the all-round development of the territory and the needs of the inhabitants of the given unit. Under the conditions of the Slovak Republic, 2,927 municipalities, of which 1,868 are small municipalities, are to ensure this, i.e. municipalities in the category of up to 1,000 inhabitants (ŠÚ SR, 2022). It is typical for these small municipalities that they cannot adequately ensure the growth and development of the municipality, or to provide comprehensive services for its residents. The reason is, as stated by Paulenová (SME, 2020), that "most of the income will be used for the operation of the municipality, administration and wages, but not for the services that the municipality should provide". In addition, some municipal revenues are tied to the number of inhabitants, which means that small municipalities therefore lack financial resources.

For this reason, municipalities use the possibility and opportunity represented by municipal cooperation, whether inter-municipal or cross-border. Cooperation between municipalities is carried out in the interest of better provision of public goods (material and immaterial) for the benefit of ensuring the needs of residents and further development of municipalities.

"Inter-municipal cooperation is a complex process that requires a common vision of development, appropriate structures and tools for integrated and systemic decision-making, adequate processes and management, a culture of governance, as well as leaders who are able to bring actors together and motivate them to a common effort ." (Valach et al., 2019)

According to Berenga et al. (2011, in Valach et al. 2019) inter-municipal cooperation is a general term for all jointly provided public services between municipalities that are usually, but not necessarily, neighbors.

Inter-municipal cooperation, according to Žárská (2018), means the fact that the municipality enters into such cooperation that is beneficial for the municipality and beneficial to its residents, so that it brings an increase in the quality of the provision of public services and increases the efficiency of handling financial resources.

As stated by Hasprová, Drábik and Žák (2012), small municipalities are naturally more inclined to cooperate than larger municipalities, which are able to independently provide a greater range of services. Inter-municipal cooperation is thus a classic compensation of the so-called „smallness“ of municipalities and also their inability to provide public services independently.

Bolgherini (2011, in Ježek et al., 2015) emphasizes that inter-municipal cooperation is characterized by an effort to provide better quality of public services, achieve their territorial and population optimization, reduce costs and

increase the efficiency and effectiveness of their provision.

The mainn motive of the local self-government to enter into cooperation is primarily to ensure the needs of the community and its prosperity, as well as the effort to jointly develop the territories. A prerequisite for successful cooperation in the territory is the creation of a stable core of institutions in the territory, the creation of a common vision and the direct involvement of top institutions with relevant decision-making powers (Galvasová et al., 2007).

In general, there are two basic approaches to inter-municipal cooperation, namely the top-down approach, which represents the cooperation between municipalities and cities managed by local governments (superiority of municipalities) and the bottom-up approach, which is characterized by the cooperation of municipalities on their own initiative (mainly due to the lack of financial resources).

Reasons for municipal cooperation according to Hasprova, Drábik and Žák (2012):

- problems of a homogeneous nature can be solved less expensively and without loss of autonomy,
- the resources needed to solve existing problems significantly exceed the professional and material capabilities of individual municipalities,
- the nature of the service provided (drinking water supply, wastewater treatment plant, etc.), the cultural, social or economic orientation of several municipalities demands for the need to articulate a common expression and common procedure,
- mutual communication and brainstorming support creative ideas, an atmosphere of solidarity and belonging, which undoubtedly forms a suitable basis for political and social stability in the respective area.

Based on the research that was carried out in this area, such as analysis of the micro-regions of the Slovak Republic based on centers of settlement, school attendance and employment, identified natural micro-regions in the Slovak Republic in 2005 and 2016 (Slavík et al., 2016). Based on the analysis of inter-municipal cooperation in the Nitra district and identification of positive externalities to entities and residents in given territory (Valach et al., 2019) or surveys focused on the area of inter-municipal cooperation and cross-border cooperation (Beresecká et al., 2020), it is possible to identify areas of municipal cooperation:

- advisory, consulting and methodical activities (legal, financial, technical, design, etc.),
- building technical infrastructure (water supply, sewerage, gas, roads),
- register and social care,
- local and regional culture, tourism and its information and promotion support,
- basic, specialized and retraining education,
- construction office, housing and housing construction,
- healthcare of first and second contact,
- territorial and regional planning, environmental protection,
- removal and disposal of municipal waste,
- fire protection,
- common business (common municipal business entities),
- mass suburban transport reaching the end villages,
- support of small and medium-sized businesses,
- security and fight against crime, property protection

Goal and Methodology

The aim of the submitted article is to examine, identify and evaluate the current state of inter-municipal cooperation in the Slovak Republic. The results of this issue are based on a study of the issue of cooperation between cities and municipalities within the Interreg project (carried out in 2020-2021, based on a sample of 239 respondents), which was part of the given study. When processing the results, available official State statistics and data obtained by own research (questionnaire survey) were used. These results were processed by selected mathematical and statistical methods, which were analyzed, compared, and based on synthesis and deduction, conclusions were drawn from them. A selection of the most interesting results and observations allows itself to be presented within this output.

Added value is also the conclusions adopted, which relate to the possible scenario of the future development of cooperation in the Slovak Republic, as well as the recommendations presented in the final part of this article. In addition, the article contains 2 tabular and 6 graphic illustrations.

Inter-municipal cooperation of municipalities in Slovakia

The cooperation of territorial administrative units is one of the options offered by the State as an answer to questions regarding the growth and development of municipalities. Thanks to partnership cooperation, there is understanding, inspiration, innovation, exchange of experience or sharing of problems that these units encounter (daily) in the execution of their competences.

With the gradual transfer of competences from the State administration to the local self-government, there was an increasing use of the inter-municipal cooperation institute in Slovakia (since 1989). Among the fundamental ones, we recommend the establishment of the Association of Cities and Towns of Slovakia, the creation of the first micro-regional associations or, later, local action groups and etc.

As stated by Slavík et al. (2016), the differentiation between associations according to the number of municipalities was large. The smallest regional associations consisted of around 10 municipalities, while the largest ones exceeded 100 municipalities. As a reaction to the decentralization of State competences to local governments, the first joint construction authorities began to emerge in 2002.

Gradually, new opportunities for inter-municipal cooperation were created and special-purpose associations were created, which were more specific, goal-oriented, many times connected with the creation of new joint entities (enterprises, agencies, centers), while their members were not only municipalities, but also other public administration institutions and private sector.

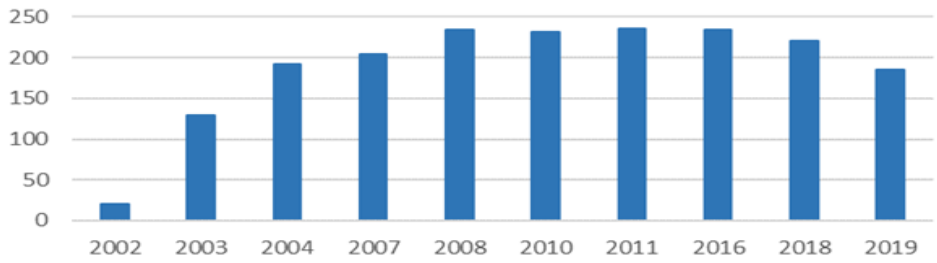
This cooperation covered a wide range of activities, from joint cultural and sports events to the elaboration of a joint sustainable development strategy. It also included a wide range of actors, which were elected representatives, professional office employees, youth, pensioners, representatives of entities and associations operating in the territory of the municipality, etc. This cooperation was carried out on the basis of a contract for the purpose of carrying out a specific task, a contract on the establishment of an association of municipalities or a contract on the establishment of a common municipal office, which is dealt with by Act of the Slovak Republic No. 369/1990 Coll. on municipal establishment.

The latter variant of cooperation - Common municipal office (CMO), is currently a frequently discussed topic. In their works, Teja, Hamalová, Nižňanský, Slavík and others deal with it, despite the fact that it began to be used in connection with the first State-decentralized competences already in January 2002, when a total of 63 competences were transferred from the state administration to local self-government. It is therefore used to solve the execution of the decentralization of competences by the local government, while there is no loss of legal sovereignty, but optimization of the performance of given tasks (Hrtánek, 2018).

When deciding the creation of a common office, the choice of criteria is very important how the individual representatives of local governments decide the advantages of such inter-municipal cooperation (Slavík et al., 2016). For this reason and in compliance with this rule, cooperation mainly affects key areas such as social services, environment, education, healthcare, infrastructure, regional development, etc. The cooperation carried out through these offices is significant with more qualitative and more qualified execution of transferred competencies from the State administration to the self-administration. The enormous increase of these offices and the subsequent stabilization, which confirms the meaning and importance of this apparatus (Figure 1), occurred in the initial years of the competences transfer. It most significantly affected smaller municipalities, which, reflecting the need to ensure the functionality of the given services, joined such cooperation. Therefore, the transfer of competences from the State to the municipalities can be considered one of the main reasons for the application of the right of municipalities to associate through the Common municipal office

(CMO). However, CMOs not only arise, but also disappear. The demise of the offices is the result of an incorrect estimate of demands and insufficient needs reflection of clients (e.g. CMO Trenčín, Modra, Viničné) as well as the ability of municipalities to ensure independent execution. In both cases, i.e. in the creation and dissolution of CMO, it is based on objective assessments and possibilities of the given partners.

Figure 1 Development of the number of Common municipal offices in the Slovak Republic



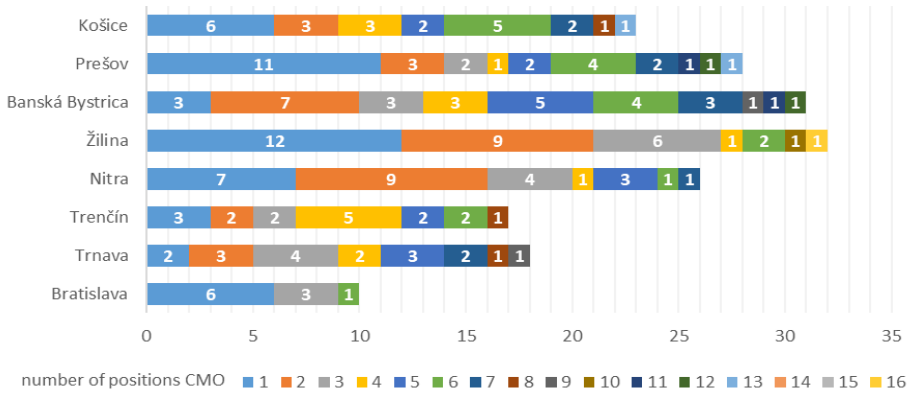
Source: MV SR (2021a)

The trend in the development of the number of these offices has been decreasing since 2016. The decrease is primarily caused by the enormous workload of administrative employees, which leads to an increase time to prepare agendas, which is met with criticism and dissatisfaction.

The latest available data on the number of CMOs, i.e. for the year 2019, which is managed by the Ministry of the Interior of the Slovak Republic, shows a decrease of 21% compared to the mentioned year. The CMO was canceled in 49 cases, and that means, the execution of transferred competences for over 4 million residents is provided by 186 CMO.

The most frequently resolved agenda that CMO carries out is the agenda of building regulations (149), nature protection (128) and local communications (112). It is interesting to note that in up to 71% of cases, there is multi-cooperation between municipalities, which cover two or more issues simultaneously within the sections and performed competences (Figure 2).

Figure 2 CMO according to the number of activities (status as of 31 December 2019)



Source: own processing according to the data of MV SR (2021a)

It is also not a rare case when, in order to satisfy the needs of their residents, municipalities have several contractual relationships, i.e. they solve the agenda through several CMOs under which they belong, e.g. construction and school office of Dunajov, Vavrečka and others. Likewise, it is not a rare case when municipalities take on the role not only of members of associated municipalities, but also in the role of main guarantor, that is, associating municipality in the area of transferred competences, e.g. municipalities of Lendak, Tešedíkovo and others.

The largest number of municipalities involved in one CMO is reported by CMO Beniakovce (Košice region - 70 municipalities), the minimum of two municipalities falling under CMO is reported in 12 cases (Table 1).

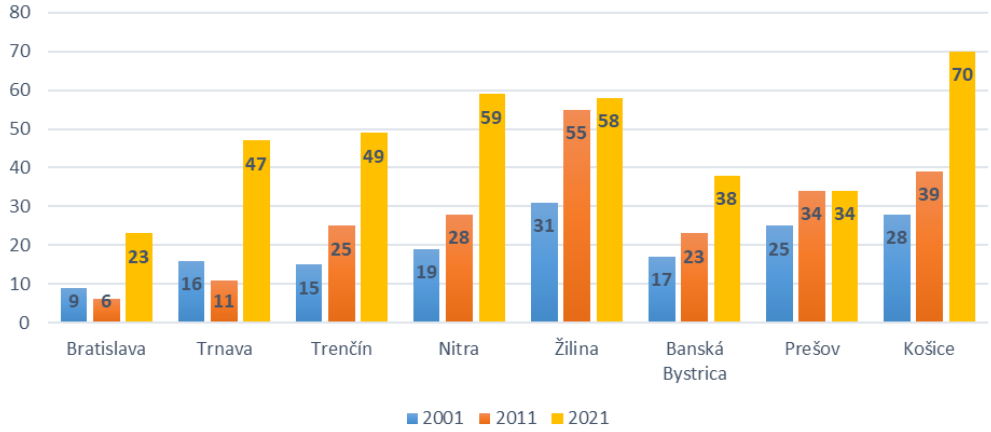
Table 1 Size of CMO in SR

Region	Municipalities			Population			Number of CMO
	Total number in SR	Total number in CMO	min. max.	Total number	Total number in CMO	min. max.	
Bratislava	89	48	2 13	719 537	168 602	7 960 32 275	10
Trnava	251	199	2 42	566 008	425 887	5 094 67 441	18
Trenčín	276	208	2 35	577 464	405 405	2 028 65 092	17
Nitra	354	352	2 48	674 306	699 808	2 714 90 304	26
Žilina	315	335	2 39	691 613	601 791	2 822 81 301	32
Banská Bystrica	516	490	4 38	625 601	545 073	2 976 70 396	31
Prešov	665	687	2 62	808 931	744 625	1 416 146 005	29
Košice	461	407	3 70	782 216	491 307	2 629 61 831	23
Σ	2927	2726	2 70	5449270	4 082 498	1 416 146 005	186

Source: own processing according to the data of MV SR (2021a)

Another used variant of cooperation between municipalities and cities includes the institute of association of a micro-regional nature, i.e. microregional associations. Microregions as a "voluntary association of municipalities" that, within the framework of the area's catchment, the principles of cohesion and the fulfillment of common goals and changes" (Labounková, Půček, Rohrerová, 2009) also underwent changes. These changes concern not only their number, but also their purpose and functionality. Since 2001, when their number was 160 (Slavík, 2016), up to 373 such apparatuses are currently recorded in this issue (MV SR, 2021b; Figure 3), which represents a 133% increase in the number of microregions.

Figure 3 Microregions of the Slovak Republic in 2001-2021



Source: own processing according to the data of Slavík a kol. (2016), Pustá (2011), MV SR (2021b)

However, many micro-regional associations do not show regular activity. The reason is the lack of funds and the lack of suitable subsidy demands that associations could use for the growth and development of the given micro-regions.

Local action groups (LAG) are the newest and also very popular form of association of municipalities. It is a form of cooperation, when municipalities, associations of municipalities, entrepreneurs, non-state non-profit organizations cooperate for the purpose of rural development, i.e. improvement of basic and citizen infrastructure, tourism and cultural activities, etc.

LAGs primarily address issues of the internal potential and development of the region in which they operate. As stated by Dragoun (2014), at the decision-making level, the ratio of representatives of the private sector (private entrepreneurs, non-profit organizations, citizens representing interest groups) must be at least half of the local partnership. The remaining, second half must be made up of representatives from the public sector. The above means that emphasis is placed on a balanced representation of partners from various socio-economic spheres representing the given territory.

The first public-private partnerships in the Slovak Republic were established in 2006. Three years later, as many as 29 of these partnerships received LAG status. Currently, this form of association is represented by 110 LAGs (Tab. 2).

Table 2 Local action groups of the Slovak Republic

Region	2007-2013	2014-2020
Bratislava	1	3
Trnava	4	12
Trenčín	4	11
Nitra	5	15
Žilina	2	10
Banská Bystrica	5	18
Prešov	4	24
Košice	4	17
Σ	29	110

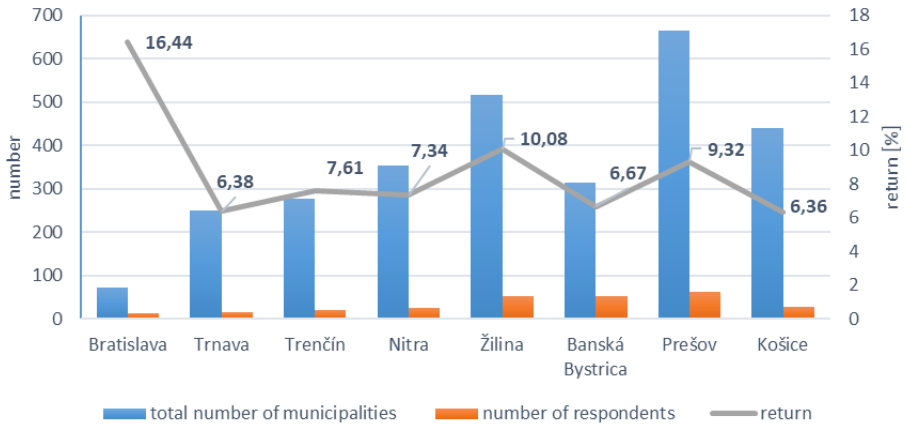
Source: own processing according to the data of Národná sieť rozvoja vidieka SR (2021)

LAGs are active in the area of stimulation of small and medium forms of business/crafts and development of civic infrastructure. A huge advantage of LAG is the support of their financing, which is characterized by support from the European Union. This financing is carried out through demands and resources of the EU - Integrated Regional Operational Program, the Ministry of Agriculture and Rural Development and the Rural Development Program of the SR 2014-2020 (a non-refundable financial contribution to finance the operational costs of LAG).

Results and findings resulting from the implemented questionnaire inquiry

The questionnaire survey was conducted in 2021, in electronic form. All 2390 representatives of the local self-government were addressed with the questionnaire. The achieved return was 10% (239 respondents, of which 223 municipalities and 13 cities - Figure 4). We attribute this result mainly to the problems and obligations that local governments had during the critical period of the pandemic crisis - COVID19. We analyzed the respondents' answers in detail and present the selection in this article.

Figure 4 Regional structure of survey respondents



Source: own questionnaire survey (2020-2021)

Most of the respondents involved in the questionnaire survey came from the Prešov region (26% of respondents), the Banská Bystrica region (22% of respondents) and the Košice region (12% of respondents). In this regard, we consider the direct proportionality of the respondents to the quantitative nature of the regions in terms of the representation of municipalities and cities to be positive. However, from the point of view of return answers, it was mainly the representatives of the municipalities and cities of the Bratislava Region who participated in this survey in the largest number (16.44% returns). The smallest return was recorded from the representatives of the municipalities of the Košice Region (6.36% returns).

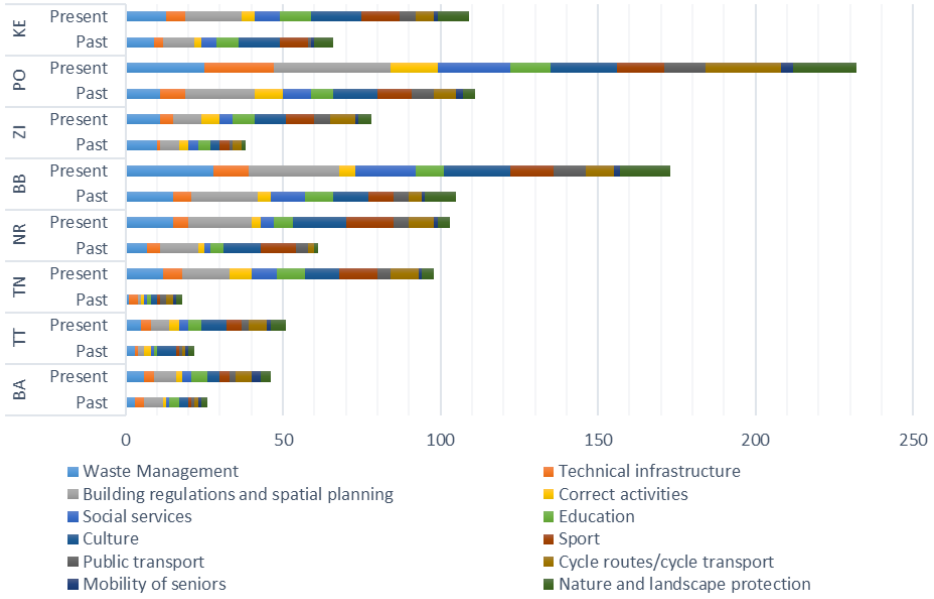
Respondents had the opportunity to comment on several questions that we consider important, but it is not possible to present all of them. Therefore, we decided to select those that are a priori related to the main idea of the contribution, namely the current state and situation in the field of inter-municipal cooperation.

The results of our survey showed that 83% of respondents are currently involved in the cooperation of municipalities and cities in Slovakia, not only within LAGs and CMOs, but also in other formal and informal cooperations. In the framework of these partnerships, the issue of construction and area planning, waste

management and culture is most often addressed (Figure 5).

The reasons for participating in the partnership are primarily saving money and increasing the quality level of services (29% of respondents), spreading the burden on local governments (10% of respondents), but also inspiring and helping each other (45% of respondents), which was mentioned in the framework of informal cooperation, LAG and contractual agreements regarding State and EU challenges.

Figure 5 Thematic areas of inter-municipal cooperation



Source: own questionnaire survey (2020-2021)

The most frequently solved areas of cooperation between municipalities and cities are issues related to construction regulations and area planning, which are solved by up to 59% of respondents (33% in the past), waste management (47% of respondents) and culture (46% of respondents) through the CMOs. The most noticeable change is the increase in the use of the phenomenon of inter-municipal cooperation occurred in the area of building cycle paths and supporting cycle transport. We calculated the increase in cooperation between cities and municipalities in this direction to the level of 275%.

A gratifying finding is also the fact that in all the areas we have chosen, there is growth, improvement and the building of new partnerships, despite the fact that several collaborations have ended.

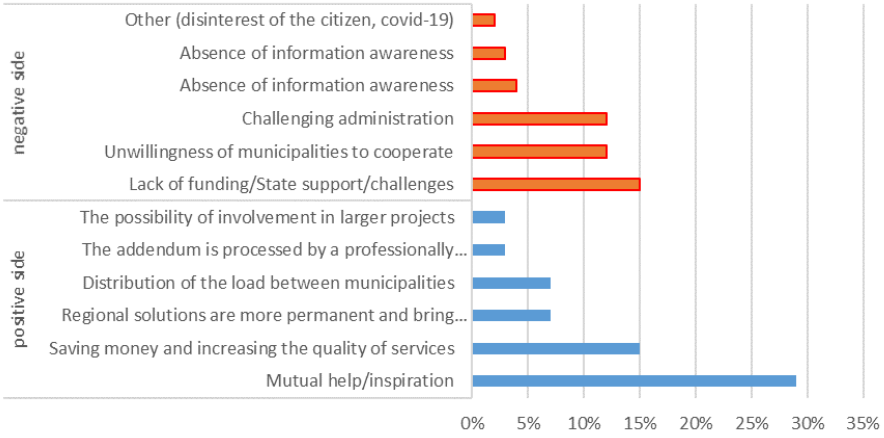
In the case of the termination of partnerships, the respondents mentioned mainly the lack of financial resources (28%), the absence of a suitable challenge (24%) and the lack of personnel capacities (17%). It is pleasing to note that the main reason is not lack of interest or bad experiences with partners, which is generally considered to be the basis of healthy and sustainable cooperation.

The assumption of the need for reliable and open partners is also confirmed by other statements of the respondents, which relate to the presonal views of the cooperation of municipalities and cities (Figure 6). Respondents representing the local self-government, highlight

benefits such as help, inspiration or learning from each other, as well as the fact that cooperation projects save financial resources and increase the quality of services that are intended for users, citizens, residents of municipalities, as well as visitors and entrepreneurs. In addition, thanks to cooperation, municipalities have more opportunities to apply for and participate in more demanding or larger projects announced either by the State or the EU.

However, not all collaborations and experiences show only positive responses. Therefore, the negative aspects of cooperation between municipalities and cities cannot be neglected. Here, lack of funds was identified as the most serious problem. Due to the lack of funds, the municipalities cannot fully implement and develop cooperation, which is also negatively contributed by the administrative complexity and the burden on the municipalities in the form of the execution of transferred functions. Negative experiences also include the approach and individuality of some partners, whose approach is not correct. Fortunately, only 12% of respondents reported this negative experience.

Figure 6 Inter-municipal cooperation through the eyes of local government representatives



Source: own questionnaire survey (2020-2021)

Despite the aforementioned negative aspects of the issue of inter-municipal cooperation, the positives of these forms of cooperation outweigh the negatives. The possibilities and the search of ways to do things well, and how to help units to grow and develop are the driving forces behind the implementation of small and large cooperation projects.

Discussion and concluding remarks

Due to the significant fragmentation of the residential structure in Slovakia, when up to 65% of municipalities have less than 1000 inhabitants, inter-municipal cooperation is very important, especially for small municipalities, and is many times understood as the only possibility to ensure the fulfillment of original and transferred competences.

Municipalities, especially the smaller ones, tend to cooperate because of the lack of financial and capacity resources. Larger municipalities, on the other hand, act as responsible and capable guarantors and partners who do not resist new challenges and collaborations.

In the Slovak Republic, municipalities and cities actively use the opportunity to associate not only in the framework of representation, such as The Association of Cities and Municipalities or the Union of Slovak Cities, but also forms that actually cover original and transferred competences, such as microregion institute (373 microregions), common municipal

office (186 CMOs) and local action group (110 LAGs).

From our own survey, focused on the cooperation of municipalities in the SR, it emerged that 83% of respondents are currently involved in any form of cooperation between municipalities within the SR. Among the most frequently mentioned areas of inter-municipal cooperation: construction regulations, area planning, waste management, culture and sports, but also cycle transport and cycle routes, which can be described as a boom of present time. Local governments have an enormous interest in continuing to maintain and build cooperation, with the aim of achieving results that can be used by their citizens in the form of material and immaterial goods. Therefore, many collaborations have a deeper and longer-term impact.

However, the financial funding is identified as one of the biggest problems. Municipalities do not have enough resources to invest in improving cooperation and projects. Municipalities most often finance cooperation from their own funds/incomes (financially less expensive projects), from grants and grant schemes (financially more expensive projects) and member contributions (financing of small and medium-cost projects).

Municipalities are aware of the benefits of inter-municipal cooperation, as well as of the potential of the partnerships, but also the fact, that it is not possible without the help and support of the State. The lack of funds for the development of local governments is still a topical issue and remains a challenge for the next period as well. Therefore, the State should support and reflect the requirements of municipalities so that they are able to operate sustainably and fulfill the functions that they are supposed to fulfill as the main guarantor.

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Contact

Jana, Masárová, Ing. PhD.
Faculty of Social and Economic Relations
Alexander Dubček University of Trenčín,
Študentská 3, Trenčín
e-mail: jana.masarova@tnuni.sk

Martina, Jakubčinová, Ing., PhD., MBA
Faculty of Social and Economic Relations
Alexander Dubček University of Trenčín,
Študentská 3, Trenčín
e-mail: martina.jakubcinova@tnuni.sk

Filip, Hrůza, Ing. Ph.D.
Public Administration Institute
Masaryk University
Lipová 41a, Brno, Czech republic
e-mail: filip.hruza@econ.muni.cz

Vilém Pařil, Ing. Ph.D.
Department of Economics Masaryk University
Lipová 41a, Brno, Czech republic
e-mail: vilem.paril@econ.muni.cz

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