

BUSINESS DIGITIZATION IN SLOVAKIA AND ITS IMPACT ON RURAL DEVELOPMENT

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Abstract. In this article, we examined the position of Slovak agriculture and rural businesses using the Digital Economy and Society Index (DESI), which measures a country's progress towards a digital economy and rural society in comparison to other EU countries. The Digital Economy and Society Index is an online tool for measuring the progress of EU Member States toward a digital economy and society, including rural areas. DESI combines 44 indicators (pillars) and uses a weighted criteria system to rank each country based on its digital performance. As a result, Slovakia lags the EU average in human capital, use of the Internet, and digital public services. Slovakia performs well in fast and ultra-fast broadband Internet coverage, the share of ICT professionals has increased and the number of people who have never used the Internet has decreased. Regional structures and concepts have become increasingly important in recent years, and an active and purposeful policy of integrated rural development is being developed. In strengthening regional functions, account must also be taken of the fact that farms should also be competitive on a supra-regional scale and should also contribute to improving the provision of modern rural infrastructure through their own digitalization.

Keywords: digitalization, digital enterprise, digital technologies, knowledge economy.

Introduction

The agricultural sector has several specificities compared to other sectors. Mobile access to data as well as data entry into the information system (IS) directly in the field is a common requirement for cost-effective farm management. All data from IS can be processed on a mobile platform. Digitalization is defined as vertical integration of business models in one organization implying introduction of digital technologies at all strategies: development, procurement, production, logistic and service [1]. It is the next step in the development of robotics and information technology [2]. The transition from a primitive to a digital way of life is described using roadmaps that include agricultural and industrial revolutions in four stages on a timeline [3]. The identification of new reserves for the growth of agro-industrial production will give a new impetus to the development strategy of the agro-industrial complex, one of which is the digitalization of agriculture [4]. Different four scenarios for the digitalization of the agri-food sector have been developed for Europe in 2030 [5].

They include (a) digitalization of the sector along current lines at the current pace as a baseline scenario, (b) strong digitalization of the regulatory government, (c) use of autonomous agricultural technologies, and (d) a digitalized food enterprise. The purposeful circumstances that are there have a significant impact on it. Indeed, the Industry 4.0 paradigm aims to integrate digital technologies into business processes to increase productivity levels and develop new business models [6]. It is not yet entirely clear how this change will evolve further, but what is clear is that the response to this change needs to be integrated and comprehensive, involving all stakeholders at a global level, from the public to the private sector [7]. One of the main ideas why this philosophy and therefore this concept - Industry 4.0 - has taken hold and why it has started to take hold is the expected increase in productivity, production efficiency and reduction in energy, increasing competition and pressure to reduce consumption in production in conjunction with the use of new technologies [8]. ICT tools enable the storage, processing, analysis and sharing of vast amounts of data. Digitalization and its speed of implementation in individual sectors of the national economy is also influenced by the COVID-19 pandemic that has been found to be an unfortunate accelerator when it comes to entrepreneurship and innovation as a lever of digitisation and digital transformation, with the results of an analysis of internet domain registration being a reliable indicator [9]. One of the goals of the implementation of the strategy of development of the agro-industrial complex is its digital transformation, which correlates with the national policy of accelerating the introduction of digital technologies into the economy and the social sphere [10]. The opportunity to improve the competitiveness and efficiency of the sector offered by new technologies comes together with its potential to face new economic and environmental challenges, according to [12]. The emergence of a "fourth industrial revolution", i.e. the convergence of artificial

intelligence, the Internet of Things, advanced materials, and bioengineering technologies, could accelerate socio-economic uncertainties and concerns or provide beneficial alternatives to the status quo [13]. The idea of farmers using digital infrastructure in their operations is not new, as agronomic research along these lines has existed for over 30 years [14]. The use of Geographic Information System (GIS) based on land suitability and gross value is discussed in [15].

Materials and methods

Participants in the research on the use of information and communication technologies in agricultural enterprises in Slovakia will focus on the assessment of the state of digital transformation in agriculture. The Statistical Office of the Slovak Republic collects data on the use of information and communication technologies in all key sectors. However, there is a lack of data for the agricultural sector on the use of computers, internet connectivity, use of applications or websites. For this reason, a questionnaire survey was conducted in 2016-2020 focusing on agricultural enterprises and the use of ICT resources.

To achieve the objective regarding the analysis of the DESI index, it was necessary to aggregate the data sources from the European Commission website and create the database needed for further processing [16]. The Digital Economy and Society Index (DESI) is a composite index that summarises Europe's digital performance indicators and tracks the evolution of the digital competitiveness of the European Union member states [17]. DESI consists of five core dimensions: Internet connectivity, human capital, use of Internet services, integration of digital technologies, and use of public services.

The resulting DESI value for a country is calculated as follows (values of weights determined by experts):

$$DESI = IC * 0.25 + HC * 0.25 + UIS * 0.15 + IDT * 0.20 + UPS * 0.15, \quad (1)$$

where *IC* – Internet Connection;
HC – Human Capital;
UIS – Use of Internet Services;
IDT – Integration of Digital Technologies;
UPS – Use of Public Services.

In the case of DESI, there was a slight change in the methodology in 2018. Using the MIN-MAX method, the data were recalculated to use a point scale from 0 to 100 (0 - lowest score, 100 - highest score). The survey on ICT use in enterprises is regularly conducted by the Statistical Office of the Slovak Republic [18, 19]. As these publications do not include surveys for the agricultural sector, the questions in the questionnaire were chosen so that agriculture could be compared with others. The questions (Table 1) of the questionnaire were formulated as follows:

Table 1

Questionnaire questions

A	General data on the company	-
	Do you and your employees use a computer at work?	Does your company have its own website?
B	Do you and your employees use the Internet at work?	For what purposes do you use your website?
	What type of connection do you use?	-
C	Do you use any information management tools?	For what purpose do you use e-commerce?
	Do you use e-commerce in your business?	-
D	Do you use cloud computing services?	Do you use RFID - Radio Frequency Identification?
	How do you use cloud computing services?	How do you use RFID services?
E	What percentage does expenditure on the purchase or renewal of ICT assets represent of total expenditure?	Comment on the level of agreement or disagreement with the statements on ICT.
F	Do you use social media to promote your business?	Which social media or social media tools do you use?
	Do you know the term "Precision Farming"?	Which application do you use?
G	Does your company make use of the possibilities of precision farming?	Do you use any of the mobile applications in connection with precision farming?
	Which precision farming tools do you use?	Provide your level of agreement or disagreement with the statements about precision farming.

The representativeness of the sample was verified using the Chi-square test of the goodness of fit of the comparison with the actual number of enterprises. The result of the test confirmed the representativeness of the sample. The existence of a relationship between the identification questions and the opinions was verified using the Chi-square test. The Cronbach's alpha coefficient is the most common measure of internal consistency. Descriptive statistics (mean, mode, median) were used to summarize the data obtained. MS Excel and SAS programs were used to analyse all data. The opinion questions of the questionnaire survey defined by Likert scale were verified by the reliability test. MS Excel and SAS programs were used to analyse all data.

Results and discussion

All business activities carried out by economic entities in Slovakia are subject to SK Industry 4.0 throughout the organization digitizes and integrates processes in the vertical direction from product development, through purchasing, production, logistics to services [20]. Within production, data on operations, process efficiency and quality management, as well as short-term planning, can be made available in real time, supported by augmented reality, and optimised in an integrated information system infrastructure in the processing plant.

The Digital Economy and Society Index (DESI) is an online tool for measuring the progress of EU member states towards the digital economy and society. The DESI index was first calculated in 2014 based on data from 2013. DESI combines 44 indicators (pillars) and uses a system of weighted criteria to evaluate each country based on its digital performance. It brings together a set of indicators that are in the various programs of digital countries in Europe. The indicators are not fixed, as evidenced by the adjustment of the index over the years. The index is divided into five main dimensions, which in turn consist of pillars. The DESI score ranges from 0 to 1, resp. from 0 to 100, with the higher the score, the better the country's performance.

The main dimensions of the index are the following.

- Internet connectivity – broadband infrastructure deployment and its quality.
- Human capital – the skills needed to take advantage of the opportunities offered by the digital society.
- Use of the Internet services – a variety of activities that citizens perform online.
- Integration of digital technologies – digitization of businesses and development of online commerce.
- Digital public services – digitization of public services with a focus on electronic public administration.

If we look at a comparison of the position of Slovakia and EU over the period since the index has been measured, Slovakia has lagged well behind the EU values every year [21]. The comparison is shown in Figure 1. The best value of the DESI index was achieved by Slovakia in 2018. In contrast, the worst value was measured in the first year of measurement, i.e. in 2014. A comparison of the average value of the index of the three best countries, Slovakia, EU, and the three worst countries over the measured period also provides an interesting insight. The index value of the best countries ranges from 60 to 70. The countries that were in the top three each year were Finland, Sweden, Denmark, and the Netherlands - the order varied in some years. The index value of the worst countries ranged from 27 to 39. Each year, Greece, Romania, and Bulgaria were ranked as the worst countries. Slovakia is categorized as a lagging country, i.e. the index scores are below the EU average and the country is also developing more slowly than the EU average. Countries such as Cyprus, Italy, and Greece are in this category. The top performers, i.e. fast-developing countries, are Sweden, Denmark, Finland, Ireland, Estonia, Spain, Germany, Austria, Lithuania, and Malta.

The group of moderately developing countries includes Slovenia, Latvia, Portugal, France, Croatia, the Czech Republic, Bulgaria, Hungary, Poland, and Romania. Conquering countries are Belgium, the UK, the Netherlands, and Luxembourg. Interestingly, Italy has moved from the Medium Developing to Lagging category, with the same change for Slovakia compared to 2018 (before the change in the methodology) [22]. Malta, Denmark, Finland, Sweden, Germany, and Estonia all saw a shift to the Emerging category. The classification of EU countries into clusters is shown in Figure 2.

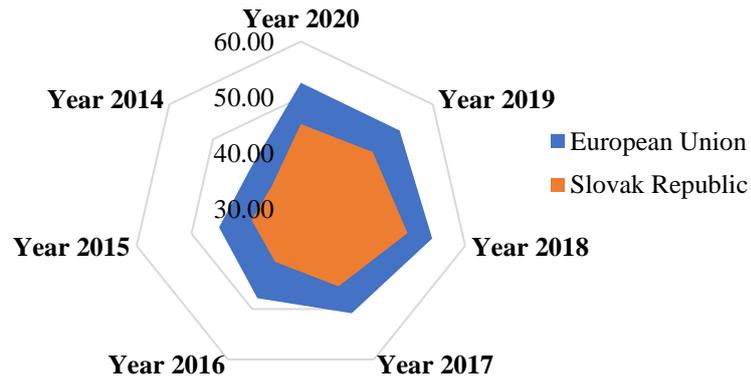


Fig. 1. Comparison of index DESI values for Slovakia and EU



Fig. 2. Country classification into groups per year 2020

Modern agribusinesses are expanding their product and service offerings to customers by providing innovative data-driven solutions as well as various integrated platform solutions [23]. According to the number of employees, the enterprises were classified into four categories, namely micro, small, medium, and large.



Fig. 3. Share of enterprises by number of employees

Large enterprises were not represented in the sample. Small enterprises accounted for the largest share (44%), and micro-enterprises for the smallest share - 23%. Based on the results of the questionnaire survey, it can be stated that all companies reported active use of computers at work, as well as the use of the Internet at work. The types of connectivity used can be classified into two main categories:

- fixed broadband – xDSL, ADSL, SDSL, cable modem, UMTS;
- mobile connections – laptops, Wi-Fi, Bluetooth.

Every business that wants to increase its visibility should have a website to ensure a stable customer base. However, based on the results of the questionnaire survey, it can be stated that 100 farms are not sufficiently aware of the importance of their website. Just over 50% of the companies in the sample have their own website. This is the lowest proportion compared to the other sections. One of the most important tools for promoting a business is its website. Since 1991, when the first website was created, more than 1.9 trillion websites have been registered to date. Their number is growing exponentially every year.

Conclusions

As mentioned in the article, innovation, and technology are becoming important factors in determining the success of a business. They provide businesses with higher growth, and competitiveness, increase efficiency and create new markets for them. The following recommendations can be drawn from the results obtained to move Slovakia towards better digitalization and integrate more information technology into agricultural enterprises. Recommendations include the use of websites, e-commerce, investment in radio-frequency identification technology, investment in the renewal and purchase of new technologies, and the presentation of agriculture through social media.

In conclusion, Slovakia's agricultural firms must adopt digitalization and information technology if they are to become more competitive, efficient, and able to capitalize on new growth opportunities. Firms in Slovakia may remain on top of trends and prosper in the long run by putting the suggestions into practice.

Author contributions

All the authors have contributed equally to creation of this article.

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