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Digital competences in supply chain management

Kompetencje cyfrowe w zarządzaniu łańcuchem dostaw

Abstract. The article discusses digital competences in general and their importance in supply chain management in the context of a changing, modern world. Attention was drawn to the fact that digital competences can be the key to success for an organization if used properly or they can only be an element of adaptation to changing conditions. Skills dedicated years ago to a narrow group of specialists are now available to millions of people around the world. Nowadays, we can deal with more and more issues using only the electronic way, whether we are willing to use this solution. In logistics, we can specify many technologies that can help to increase company efficiency and to build a competitive advantage. This situation confirms the importance of the described issue.

Key words: digital competences, supply chain, management, organization

Synopsis. W artykule omówiono kompetencje cyfrowe w ujęciu ogólnym oraz ich znaczenie w zarządzaniu łańcuchem dostaw w kontekście zmieniającego się nowoczesnego świata. Zwrócono uwagę na fakt, iż kompetencje cyfrowe mogą być dla organizacji kluczem do sukcesu, jeśli są odpowiednio wykorzystywane, albo też mogą stanowić jedynie element dostosowania się do zmieniających się warunków. Umiejętności przed laty dedykowane wąskiej grupie specjalistów dziś są dostępne dla milionów ludzi na świecie. W obecnych czasach coraz więcej spraw możemy załatwić, wykorzystując drogę jedynie elektroniczną. W logistyce możemy określić wiele technologii, które mogą przyczynić się do podniesienia efektywności firmy i mogą pomóc budować przewagę konkurencyjną. Taka sytuacja potwierdza ważność opisywanego zagadnienia.

Słowa kluczowe: kompetencje cyfrowe, łańcuch dostaw, zarządzanie, organizacja

Introduction

The development of digital competences is important not only because of the requirement of the times we live in. It is even a necessity resulting from the functioning of the individual in society. We will use digital competences because it will make our lives easier, which can be seen through the possibilities of shopping online, organizing meetings and making contacts, acquiring knowledge or even doing work.

The aim of the article is to present the issues of digital competences used in organizations, with particular emphasis on small and medium-sized enterprises. Particular attention was paid to assessing the level of digitization of the Polish economy and society compared to EU countries using the Digital Economy and Society Index (DESI), which presents a set of specific factors: connectivity, infrastructure level, human capital and its skills, the degree of Internet use, possibilities and scope of implementing digital technologies as well as popular and well-known digital public services. The study also indicates the importance of this issue of using digital competences in supply chain management in logistics. Data were presented using tables and drawings. The research method used in the study is a critical presentation of the literature on the subject, analysis of the data contained in the available reports. A review of the literature and analyzed data indicate that digital technologies play a very important role in the development of companies. „Digital technologies revolutionizing the way of doing business. Their implementation allows companies to expand their operating coverage, enables better management of relationships inside and outside the company, facilitates access to information and data processing and helps to use resources more efficiently (...)". The ability to use the potential of digital technologies – the competences of enterprises and people – becomes thereby a source of competitive advantage for companies and economies [Śledziewska and Włoch 2015].

The essence of digital competences

Before we explain the concept of digital competences, we must explain what competences are. According to Król [2006], these are predispositions in the field of knowledge, skills and attitudes ensuring the implementation of professional tasks at an effective and / or distinguishing level, in accordance with the standards set by the organization for a given position. According to Rostkowski [2004a], these are all employee qualities that, when challenged and developed in the work process, lead to results consistent with the company's strategic goals.

Digital competences are defined in the literature in various ways. For the purposes of the study it is assumed that they mean a harmonious set of knowledge, skills and attitudes that allow for the effective use of digital technologies in various areas of life [Analysis… 2014]. Digital competences are included in broadly understood competences in the area of ICT (Information and Communications Technology), including IT (Information Technology) and IS (Information Systems).

We treat competence as the ability to use a medium to support an area that the entity considers important or that takes a long time (i.e. is indicated by the individual as an important area of his life) [Filiciak et al. 2013].

Digital competences can be considered at two levels: individual and organizational. Individual competences, understood in general, are most often defined as a combination of three elements: knowledge, skills and attitudes [European… 2008, Jasiewicz et al. 2019]. Having specific knowledge means acquiring information through learning facts, theory and practice (I know), skills are the ability to use knowledge to perform a specific task (I can), and attitudes give incentives to act (I want and I am ready). According to the Digital Information Society in Figures report [Ministry of… 2014], we define digital competences as a set of information competences covering information retrieval skills,

understanding it, as well as assessing its credibility and usefulness, as well as IT competences, which include the ability to use a computer and other electronic devices, use of Internet and the use of various types of applications and software, as well as creating digital content. Referring to the findings of the European Parliament and the Council [European Parliament… 2006] in relation to the determination of key competences in the process of lifelong learning, IT competences are one of the many key competences listed above that can guarantee the greater flexibility of the workforce, enabling it to adapt faster to changes. These are also important factors affecting innovation, competitiveness, motivation and job satisfaction, and thus the quality of work. Digital competences include the proper and critical use of information society technologies, and thus basic skills of ICT information and communication technologies [Śledziewska 2015].

Employee competences are the most valuable capital that an enterprise has. The task of personnel processes today is not only to acquire, assess and plan employee development, but above all to adapt their competences to the needs of the company and to use them in accordance with these needs [Rostkowski 2004b]. In literature, a lot of space is devoted to the study of digital (computer, media) competences among young people [ICILS 2013]. One can also find publications on gaps in the digital society [Żak 2013].

When defining competencies at the organizational level (including digital competences), we can refer to the resource theory of the enterprise, according to which organizations compete and create value using resources [Conner 1991]. Defining competences also includes the concept of so-called key competences [Hamel and Prahalad 1990], i.e. those that allow a company to gain and develop a competitive advantage. What does digital competence mean? This issue can be considered in two approaches: catalogue and relational [Analysis… 2014].
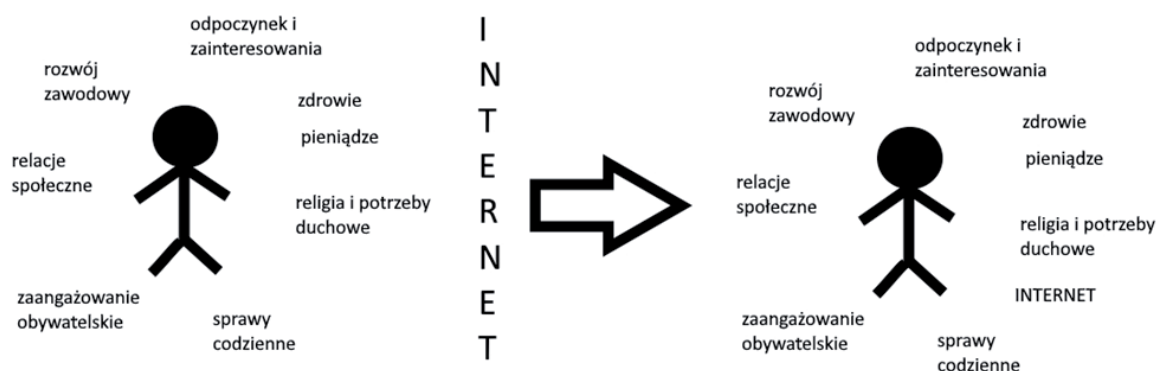
Figure 1. Nonrelational and relational digital competence model
Rysunek 1 Nierelacyjny i relacyjny model kompetencji cyfrowych
Source: [Analysis… 2014].

In terms of catalogue approach, we can interpret digital competences as certain defined elements that are acquired through education and used in life as needed. On the other hand, competence in the relational system assumes that information technologies are not so much an area as a dimension of human functioning. These two approaches are presented on Figure 2 [Analysis… 2014].

The essence of supply chain management

The supply chain is a network of organizations involved through relationships with suppliers and customers in various processes and activities that create value in the form of products and services delivered to final consumers [Christopher 1998].

Supply chain management is the management of relations with suppliers and customers and buyers in order to provide the highest value to the customer at lower costs for the entire supply chain [Christopher 1998].

In order to indicate the importance of supply chain management, in which the final recipient is at the end and who is interested in the efficient functioning of logistics processes, it is worth clearly stating that such action should be thought out and focused on effective building of competitive advantage.

The functioning of logistics and the supply chain is not possible without technology. Among the most important technological factors in logistics and the supply chain, the following should be certainly mentioned [Marzantowicz 2019]: computerization, digitization, automation, robotization, virtualization. The first element belongs to those of fundamental importance, from which technological changes begin, and the remaining ones are those that may cause management to be ineffective or less effective.

In the process of supply chain management, it is important to skilfully adapt to technological changes or even the ability to create, apply and develop them. This requires appropriate managerial competence. In view of the requirement of advanced technological changes, i.e. automation or robotization, it becomes a basic competence need to combine technical skills with the so-called soft competences, such as the ability to adapt processes to the requirements of market changes and own changes [Marzantowicz 2019].

Digitization will be the dominant trend on the TSL market (transport, forwarding, logistics) in the future. As the logistics chain is changing as a result of the increasing use of internet commerce and intermediary platforms, the individual customer and his needs are in the focus of logistics companies. This change increases the possibility of new entities entering the market with competences expected by clients and also requires increasing the level of transparency of the entire supply chain and reacting to real-time deviations. Digitization is mentioned by most companies as both an opportunity and a threat. First of all, it means larger investments in data collection, analysis and management systems (Big Data), process automation (robotization) or transferring most of the activities to the cloud for easy access from anywhere [Fechner and Szyszka 2018].

Digital competence in Poland according to the Digital Economy and Society Index (DESI) ranking

Modern digital technologies can significantly affect the business. Thanks to their use, they can expand business sizes, better acquire and manage information and take care of relationships within the company and with the environment. Therefore, the ability to use digital competences of companies and people can become a source of competitive advantage for companies.

According to the DESI index developed by the European Commission, Poland does not occupy a good position. This index makes it possible to study, each year, the level of digitization of the economies and societies of European Union member states. When it comes to the ranking, we can include the following:
− connectivity,
− human capital,
− use of internet services,
− integration of digital technology,
− digital public services.

Over the past three years, Poland is on the 25th place among EU countries. Despite the fact that the numbers are getting better and better, our position does not change. From year to year we achieve an increasing percentage of the share, but it is still not enough to change the position (Figure 2).
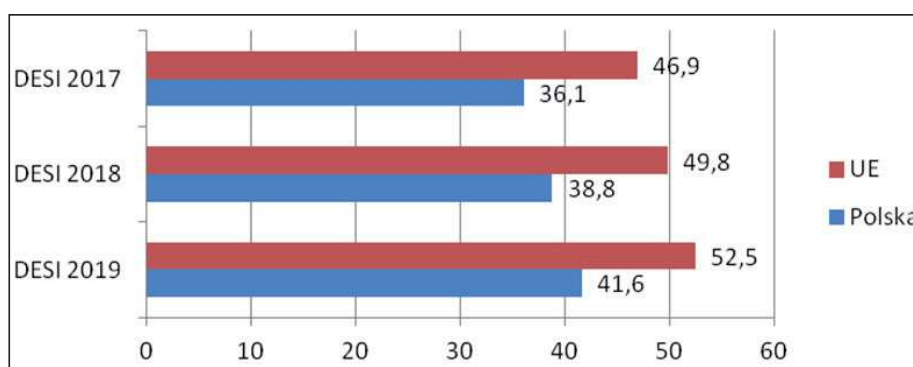
Figure 2. Ranking of the Digital Economy and Society Index
Rysunek 2. Ranking Indeksu Gospodarki Cyfrowej i Społeczeństwa

Source: [The Digital Economy… 2019].

In the further part of the study, all components of the previously mentioned ranking were thoroughly analyzed. As far as the first parameter is concerned - namely connectivity - we see diversity (Figure 3). Our position changes every year: from 43.5% in 2017 to 51.9% in 2019. However, we are still far from the parameters obtained by EU countries (by about 7% in 2019).

Table 1 presents the list of elements constituting the category of connectivity. From the components presented, it can be seen that we achieved the highest scores in the category of using mobile broadband services: from 115 in 2017 to 163 in 2019 (which gives an increase of 41.7%). As part of this element, we surpass EU countries. Also, when it comes to 4G coverage (93%) we are very close to EU results (94%). Poland's disadvantage is the coverage of fixed broadband (79% compared to 97% for the EU). According to the National Broadband Plan [2020] by the end of 2020 it is planned to:
− ensuring universal access to the Internet with a speed of at least 30 Mb/s;
− lead to the use of access services with a speed of at least 100 Mb/s by 50% of households.

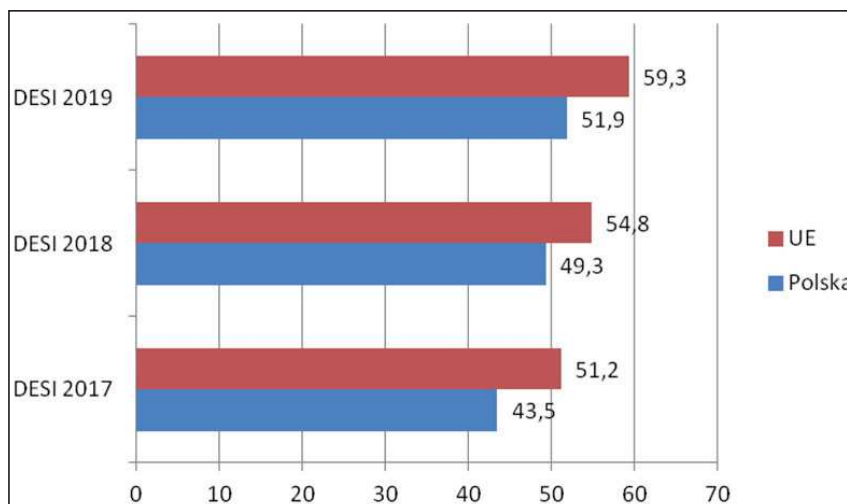It can therefore be concluded that the situation in this area will improve over time.

Figure 3. Connectivity in the DESI ranking
Rysunek 3. Komunikacja w rankingu DESI

Source: [The Digital Economy… 2019].

Table 1. Detailed characteristics of the connectivity category in the DESI ranking
Tabela 1. Szczegółowa charakterystyka kategorii komunikacji w rankingu DESI

Specification	Poland (%)			UE (%) 2019
	2017	2018	2019	
Fixed broadband coverage (% households)	81	81	79	97
Fixed broadband take-up (% households)	59	61	60	77
4G coverage (% households)	91	91	93	94
Mobile broadband take-up (Subscriptions per 100 people)	115	144	163	96
Fast broadband (NGA) coverage (% households)	61	65	66	83
Fast broadband take-up (% households)	26	32	36	41
Ultrafast broadband coverage (% households)	ND	49	54	60
Ultrafast broadband take-up (% households)	8	13	23	20
Broadband price index Score (0 to 100)	88	88	86	87

Source: [The Digital Economy… 2019].

The next analysed component of the ranking is human capital. The data are presented in Figure 4. We deviate significantly from the data characterizing the EU. Poland ranks 22nd.

According to the data from the ranking, the number of people using the Internet is growing, however, basic and advanced digital skills are below the EU average (Table 2). It turns out that in Poland at least basic digital skills have 46% of people, it is 4.5% more compared to 2017, and 23.9% less than in the EU. In contrast, 21% of the population has secondary digital skills, with a difference of 10.5% compared to 2017 and 47.6% compared to the EU. If companies do not hire employees with an appropriate level of digital competence, they will not implement new digital technologies. In such companies, a suf-
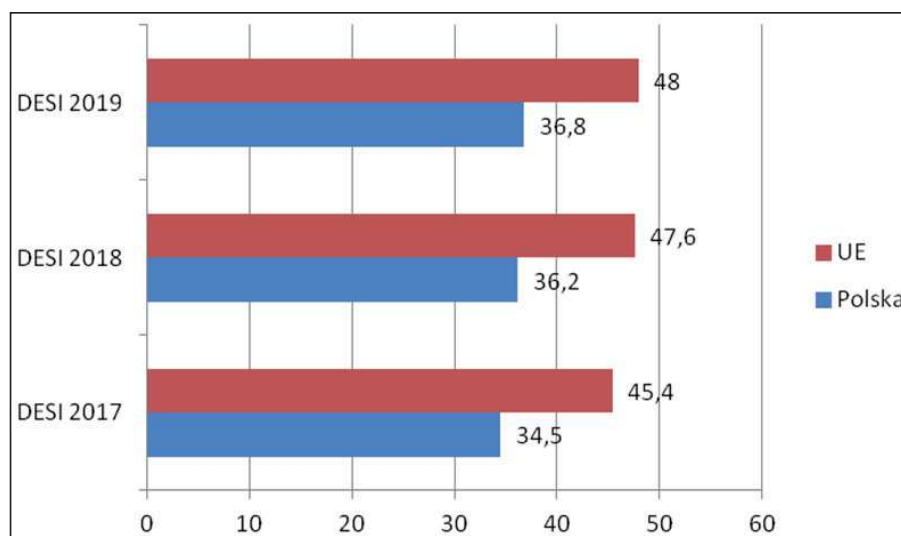
Figure 4. Human capital
Rysunek 4. Kapitał Ludzki
Source: [The Digital Economy… 2019].

ficiently high level of digital competence will not be the main required factor during the recruitment process. It may also turn out that improving qualifications in this area will not always be treated properly, i.e. that they should be constantly increased.

Table 2. Characteristics of the human capital category as part of the DESI ranking
Tabela 2. Charakterystyka kategorii kapitału ludzkiego w ramach rankingu DESI

Specification	Poland (%)			UE (%) 2019
	2017	2018	2019	
At least basic digital skills (% individuals)	44	46	46	57
Above basic digital skills (% individuals)	19	21	21	31
At least basic software skills (% individuals)	47	49	49	60
ICT specialists (% total employment)	2.6	2.7	2.8	3.7
Female ICT specialists (female employment)	0.8	0.9	0.9	1.4
ICT graduates (% graduates)	2.9	3.0	3.1	3.5

Source: [The Digital Economy… 2019].

Digital skills are part of priority axis 3 of Operational Programme Digital Poland (OP DP) for 2014–2020: "Digital competences of the society". The focus is mainly on the digital inclusion of older people, people with disabilities and people with special training needs [Index… 2019].

The next element of the ranking is presented in Figure 5, this is the use of Internet services. Poland is below the EU average, taking 24th place.

Details are presented in Table 3.

As it can be seen from the data in Table 3, Poles are active on the Internet. The most popular forms of Poles' activity are: reading news, listening to music, watching movies,
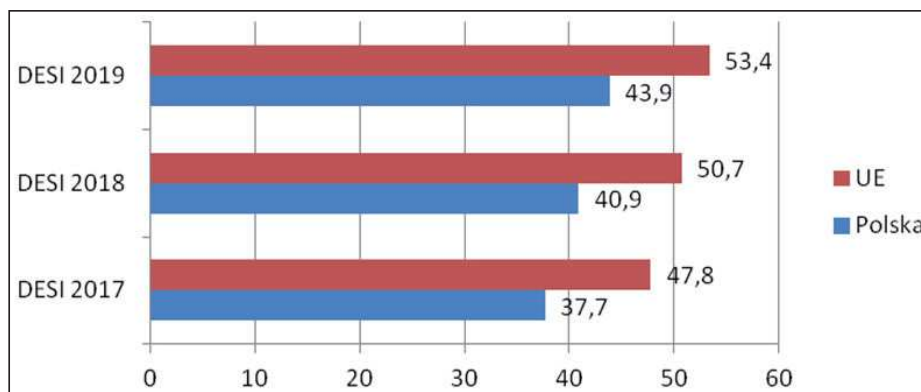
Figure 5. Position of Poland in the DESI ranking – the use of Internet services (%)
Rysunek 5. Pozycja Polski w rankingu DESI – wykorzystanie usług internetowych (%)
Source: [The Digital Economy… 2019].

Table 3. Use of Internet services
Tabela 3. Wykorzystanie usług internetowych

Specification	Poland (%)			UE (%) 2019
	2017	2018	2019	
People who never used the internet (% individuals)	22	20	18	11
Internet users (% individuals)	70	73	75	83
News (% individuals)	79	79	79	72
Music, videos and games (% internet users)	68	68	75	81
Social networks (% individuals)	60	63	64	65
Banking (% internet users)	53	52	57	64
Shopping (% internet users)	56	58	60	69
Selling online (% internet users)	21	20	18	23

Source: [The Digital Economy… 2019].

computer games and using social media. We have 18% of people who have never used the Internet (Table 3) in Poland, 18.1% less compared to 2017 and 61.1% less than EU countries. We outperform EU countries when it comes to news acquisition. Here we have 79% of people, it is more by 8.9% than in EU countries. On the Internet, we gladly use banking (57 – EU 64%) or do shopping (60% – EU 69%). The next analyzed element of the ranking is the integration of digital technology. Figure 6 shows the figures for the last 3 years. Unlike previous features, the discrepancies here are definitely bigger. In 2019, we reached the value of 24.8, which gives us 26th position, and EU countries reached the value of 41.1, which is almost twice as high.

Table 4 contains data on the detailed characteristics of digital technology integration. When it comes to details, the use of electronic information exchange is preferred by 26% of companies and it is more by 23.8% than in 2017. Its scope includes: electronic information exchange, social media, large data sets and the cloud.
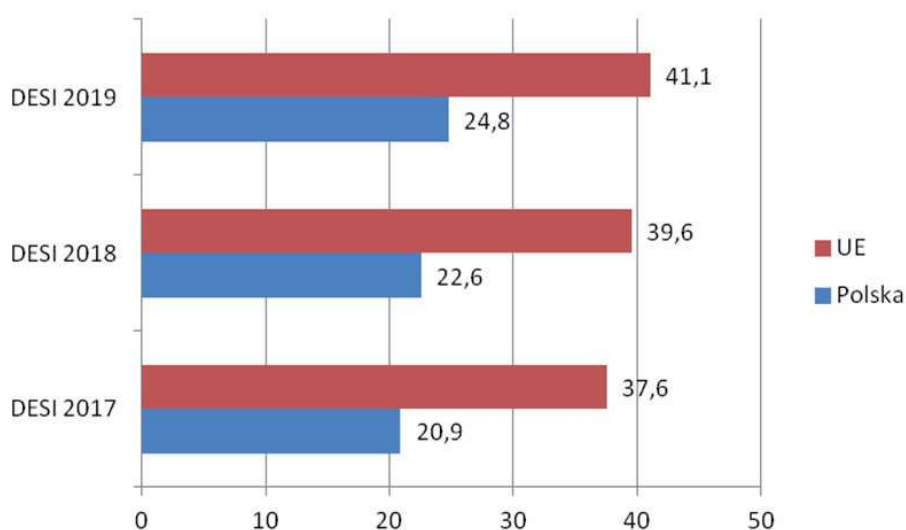
Figure 6. Integration of digital technology
Rysunek 6. Integracja technologii cyfrowych

Source: [The Digital Economy… 2019].

Table 4 Integration of digital technology
Tabela 4. Integracja technologii cyfrowych

Specification	Poland (%)			UE (%) 2019
	2017	2018	2019	
Electronic information sharing (% enterprises)	21	26	26	34
Social media (% enterprises)	9	10	10	21
Big data (% enterprises)	6	6	8	12
Cloud (% enterprises)	5	6	7	18

Source: [The Digital Economy… 2019].

There is a visible difference in relation to EU countries (a difference of 30.8%). When it comes to the use of social media by companies, here we have only 10% of companies, while in the EU the result indicates 21%, so over 100% more. Noteworthy is the use of large data sets (8% of companies) and the cloud (7% of companies). Values in EU countries are 12% and 18% respectively.

In Poland, a lot of emphasis is placed on the development of digital technologies, even as part of programs coordinated at EU level. Poland is a member of the European High-Performance Computing Joint Undertaking and as many as four of the Polish centers have been included in the list of the global top 500 HPC (ranking of 500 non-dispersed computer systems with the highest power in the world), with the highest place – 131 [Index 2019]. Cyber security is a very important issue that needs to be addressed here.

The last of the presented characteristics is digital public services. The data presented in Figure 7 indicate that in terms of this parameter we are also in a lower position than EU countries.
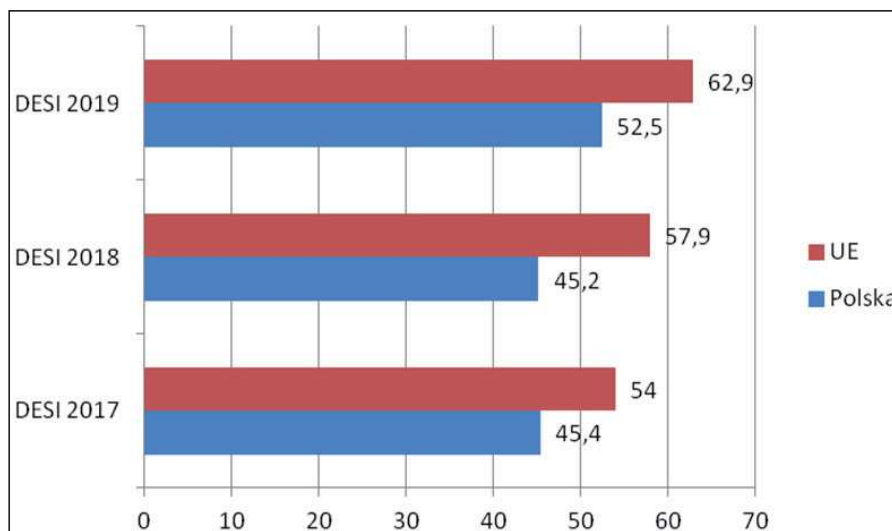
Figure 7. Digital public services
Rysunek 7. Cyfrowe usługi publiczne
Source: [The Digital Economy… 2019].

Table 5 presents the characteristics of digital public services. When it comes to public administration users, we have 49% of them, 30.6% less than in EU countries, and more by 8.8% than in 2017. The number of users increases every year what shows that these services are gaining popularity. Perhaps this proves that society is convinced to facilitate dealing with official matters.

Table 5. Characteristics of digital public services
Tabela 5. Charakterystyka cyfrowych usług publicznych

Specification	Poland (%)			UE (%) 2019
	2017	2018	2019	
e-Government users (% internet users needing to submit forms)	45	45	49	64
Online service completion Score (0 to 100)	79	81	84	87

Source: [The Digital Economy… 2019].

Easier access and more user-friendly new electronic services for citizens and businesses could lead to even greater improvements in digital public administration. It would also be worth to disseminate information about the facilities, dates or simplicity of using this type of services.

Summary

Nowadays, the best way to increase enterprise productivity and gain competitive advantage in international markets is the widespread implementation of increasingly advanced digital technologies. The use of various management methods and tools as well as techniques and technologies in connection with soft competences gives the opportunity to build flat, hierarchical management strategies which will allow at the same time to shift

the burden of responsibility for the efficiency of logistics processes from the final recipient to the entire supply chain management [Marzantowicz 2019].

Taking into consideration the analysis carried out, it is worth specifying the so-called key actions:
– conduct training in obtaining or raising digital competences pointing to the benefits of their assimilation visible in the increase in the efficiency of work performed or the growth of development potential,
– maintain progress in the digitization of public services,
– increase the availability and quality of broadband connections, while reducing the price of using the internet,
– motivate to acquire new skills, both in an organized way (training) and independently (self-study),
– ensure digital security, which means that more and more people will want to take advantage of the various amenities resulting from having digital competences.

References

Analysis of experience and identification of good practices in the area of supporting the development of digital competences in the context of preparation of detailed rules for the implementation of the Digital Poland operational program for 2014–2020 and coordination of the thematic objective, Warsaw Institute of Economics & Digital Center, Project Poland, Warsaw.

Conner R., 1991: A historical comparison of resource-based theory and 5 schools of thouth within industrial organization economics: do we have a New thory of the firm ?, Journal of Management 17, 2, 121–154.

Christopher M., 1998: Logistic and supply chain management: Strategies for Reducing Costs and Improving Service. Financial Times – Prentice Hall, London

Filiciak M., Mazurek P., Growiec K., 2013: The use of media and social divisions. Pole`s media competences from a relational terms, Centrum Cyfrowe Projekt Polska, Warszawa, [electronic source] https://www.academia.edu/6824693/Filiciak_Miros%C5%82aw_Pawe%C5%82_Mazurek_Katarzyna_Growiec_2013_The_use_of_media_and_social_divisions._Poles_media_competences_from_a_relational_perspective_Warszawa_Centrum_Cyfrowe_Projekt_Polska [access: 05.12.2019].

Jasiewicz J., Filiciak M., Mierzecka A., Klimczuk A., 2015: The framework catalogue of digital competences, Centrum Cyfrowe Projekt, [electronic source] https://www.econstor.eu/bitstream/10419/128611/1/The_Framework_Catalogue_of_Digital_Compe.pdf [access: 05.12.2019].

Hamel G., Prahalad C.K., 1990: The Core Competence of the Corporation, Harvard Bussines Review 68, Issue 3, 79-91.

ICILS, 2013: International Computer and Information Literacy Study, The International Association for the Evaluation of Educational Achievement.

Fechner I., Szyszka G. (ed.), 2018: Logistyka w Polsce 2017 [Logistics in Poland], Biblioteka Logistyka, Poznań,

Król H., 2006: Podstawy koncepcji zarządzania zasobami ludzkimi [Basics of the concept of human resources management], [in:] H. Król, A. Ludwiczyński (eds), Zarządzanie zasobami ludzkimi [Human resources management], PWN, Warszawa.

Marzantowicz Ł. 2019: Intelligent technology in logistics and supply chain management, Kwartalnik Nauk o Przedsiębiorczości SGH, 1, 62–71

Ministry of Administration and Digitization [Ministerstwo Administracji i Cyfryzacji], 2014: Społeczeństwo informacyjne w liczbach [Information society in numbers], [electronic source] https://mac.gov.pl/files/spochoceństwo_inforamcyjne_w_liczbach.pdf [access: 20.12.2019].

National Broadband Plan [Narodowy Plan Szerokopasmowy], [electronic source] https://www.gov.pl/web/cyfryzacja/narodowy-plan-szerokopasmowy [access: 03.12.2019].

European Parliament and of the Council of 18 December 2006 on key competences for lifelong learning, [electronic source] https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:394:0010:0018:en:PDF [access: 20.12.2019].

Rostkowski T. (ed.), 2004a: Nowoczesne metody zarządzania zasobami ludzkimi [Modern methods of human resources management], Difin, Warsaw.

Rostkowski T., 2004b: Zarządzanie kompetencjami w UE [Competence management in EU], [in:] M. Juchnowicz (ed.), Standardy europejskie w zarządzaniu zasobami ludzkimi [European standards in human resource management], Poltext, Warszawa.

Śledziewska K., Woroch R., 2015: Kompetencje cyfrowe polskich małych i średnich przedsiębiorstw [Digital competences of Polish small and medium enterprises], DeLab UW Report, Warszawa.

The Digital Economy and Society Index (DESI), [electronic source] https://ec.europa.eu/digital-single-market/en/desi [access: 05.12.2019].

Żak K., 2013: Orientacja na klienta a problem wykluczenia cyfrowego [Customer orientation and the problem of digital exclusion], Zeszyty Naukowe Uniwersytetu Szczecińskiego. Finanse, Rynki finansowe, Ubezpieczenia 64, 1, 541–551.

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