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## The Use of Information and Communication Technologies (ICT) in the Management of the TSL Industry: A Polish Example

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Patrycja Krawczyk<sup>1</sup>, Judyta Kabus<sup>2</sup>, Luiza Piersiala<sup>3</sup>

**Abstract:**

**Purpose:** The aim of the article is to analyse the use of information and communication technologies (ICT) in Polish enterprises from the TSL sector.

**Design/Methodology/Approach:** The first stage of research, based on the method of analysis and criticism of the literature, will be prepared in the area of the subject taken, including relations between the main concepts. This stage is auxiliary and constitutes a starting point for further research. The essential data source about the article's description were reports published by the Statistical Office. The method of literature analysis in terms of TSL sector as well as report analysis and own observations will be used.

**Findings:** The results of conducted analysis show that today's information and communication technologies (ICT) have revolutionized the way of working, transformed the economy and irreversible affected human activity in the information society.

**Practical Implications:** Research results may be used by TSL sector enterprises and as teaching material at higher education facilities. The article brings a number of valuable information that can be the base material and reference to further research, programs and studies. It may be useful for practitioners and analytics of transport industry to broaden applications of ICT solutions.

**Originality/value:** The results of the analysis and theoretical considerations in this article complement the current research in the field of information and communication technologies, and may become a valuable resource of knowledge and a set of specimens that can be useful in developing dissertations in the field of management.

**Keywords:** Information and communication technologies (ICT), management, transport, shipping and logistics sector (TSL), Poland.

**JEL classification:** L9, M15, R4.

**Paper Type:** Research study.

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<sup>1</sup>Faculty of Management, Czestochowa University of Technology, Poland,  
e-mail: [patrycja.krawczyk@pcz.pl](mailto:patrycja.krawczyk@pcz.pl);

<sup>2</sup>Faculty of Management, Czestochowa University of Technology, Poland,  
e-mail: [judyta.kabus@pcz.pl](mailto:judyta.kabus@pcz.pl);

<sup>3</sup>Faculty of Management, Czestochowa University of Technology, Poland,  
e-mail: [luiza.piersiala@pcz.pl](mailto:luiza.piersiala@pcz.pl);

## 1. Introduction

Information and communication theories became a major driver of the economic development of countries in a global world. Information component plays a key role in the building of competitive potential of countries and the development of international relations (Petkova *et al.*, 2019). The worldwide rapid progress of ICT in the last three decades has attracted increasing attention among many economists and researchers who have focused on studying the impact of ICT diffusion on the enterprises (Bahrini and Qaffas, 2019).

After 1989 Poland had transformed its economy from being centrally-planned to a market economy. It recovered from a severe economic slowdown in the first half of the 1990s, becoming one of the bestperforming countries in the group of post-communist economies. Following the period of political changes, enterprise restructuring and changing economic policy of the country, in particular following Poland's accession to the European Union, there was a period of economic growth primarily based on increased investments, that being foreign investments coming to Poland. The country had become an attractive investment location mainly because of low costs of labour, a wide market for products and services, and an increased internal demand (Piersiala, 2018). However, as all CEE countries is at the periphery of the EU economic core. Arendt Ł. and Garbowski devoted to the role of ICT in explaining the innovativeness of Polish enterprises (Arendt and Grabowski, 2019). The usage of ICT systems provides enterprises with many diverse advantages. A fundamental one is more efficient achievement of business objectives, systemic solutions in operations and more efficient reactions in case of emergence of various crises (Osińska and Zalewski, 2020).

The economic environment characterizes of many crisis as well as fast changes of competition's conditions create a very dynamic and not stable view of the reality where the strategies of the future development are realized. This unstable, changeable state creates the frames of transport functioning that operates the transport needs of the society. A vigorous transport industry determines the further economic development in Poland. The transport industry has a very big contribution in the branch structure of the Polish economy and what is more the role of this sector is still growing. Among the main factors that affect the evolution of transport is the development of consumerism, globalization, as well as the modernization of road infrastructure (Krawczyk and Kokot-Stepień, 2020).

These conclusions suggest the leading question, which is: What is the level of usage of ICT at TSL enterprises in Poland?

The presented issue shall be verified through the following detailed research inquiries:

- What is the significance of the TSL sector for the Polish economy?
- What is the level of use of ICT in Poland compared to other countries?

- What is the level of use of ICT in TSL sector compared to other industry?

The following issues related to information and communication technologies will be analysed in detail: access to computers in enterprises, access to Internet, ICT specialist, ICT training, website, social media, cloud computing, e-invoice, usage of industrial and service robots, ICT security, electronic sales, e-government, public open data, ICT investments, Digital intensity index.

The analysis shall be based upon a critical analysis of literature, branch-specific reports as well as observations of practice, own experience and thoughts.

## **2. Literature Review**

Information and communication technologies (ICT) are a tool used in many areas, including scientific research. Most scientists treat them as basic equipment and use them without even wondering about their significance for their work. Many discuss the topic of the significance of ICT from the point of view of their field of research, e. g. engineering, medicine or economy. Regarding the growing importance of ICT and the way it is transforming the world, many academicians and researchers have focused on studying the impact of ICT on economic growth at the industry level, at the national level, and at the cross-country level (Bahrini and Qaffas, 2019).

Taylor and Ciechanski writes about the transformation of polish transport companies after the year 1989. Their paper seeks to reconstruct post-1989 organisational and ownership transformations in Poland's rail-, road-, and urban-transport companies, as well as those involved in inland shipping (Taylor and Ciechanski, 2018). About the development trends of polish transport companies writes Mężyk and Zamkowowska. Their paper presents the most important factors influencing contemporary changes in transport needs, which include: the progress of globalization and integration, the development of e-commerce and logistics. We can also find there a synthetic statistical profile of transport development in Poland after 2005. They also consider the challenges for the transport industry resulting from globalization. They emphasize that, liberalization and globalization, and consequently, development and development (Mężyk and Zamkowowska, 2019). The diagnosis of the Polish TSL sector announces that it does not fully use its potential. Its development after the year 1989 was dynamic, but now it faces new challenges (Krawczyk, 2018).

Transportation plays a broad role in shaping economies. Transportation supports clusters and agglomerations, increases productivity, enhances jobs and labour market accessibility, pens new markets for businesses and enhances supply chain efficiency (Rodrigue *et al.*, 2017). The concept of transport is very wide and can be considered with many areas of the economy. Along with the systemic changes and economic transformations the transport policy has also changed.

Today, the world is developing in a multidimensional fashion. The highly developed transport infrastructure influences creating a competitive edge. Transport is the social/economic activity, which determines any and all other activities of people and businesses. Transport is characterized by an organizational/legal complexity, diversity of processes relating to movement of cargo and people, as well as a complexity of technical correlations. Transport enables the economic development of every country, foreign trading, and market integration; it ensures accessibility to different regions. Transport affects economic development, division of work, specialization of production, and it increases the reach of the market. It is decisive in terms of success of not only one economic sector but the economic success of the entire country. Transport significantly affects the Gross Domestic Product (GDP) and the development of national economy sectors (Button, 2010). Transport affects sustainable development, which refers to social, ecological, economic, spatial and functional factors, and the growth and effective functioning of the transport system allows conducting business operations.

Contemporary economic processes have been accompanied by a significant increase in mobility and higher levels of accessibility. Globalization process and international integration of economies create favourable conditions for more dynamic development. Polish economy can be considered as an interesting case study for the proposed scientific problem, as it is the biggest economy in Central Europe (Pietrzak *et al.*, 2017).

It has become common to forecast demand for transport of goods due to the increase in the main macroeconomic indicators, in particular GDP. It is done with the assumption that there is a balanced proportion between the intensity of physical production and exchange and the intensity of demand for transport. It is still worth to confront this point of view with the statistic data from the previous periods. This kind of data shows that in many cases the correlation with macroeconomic values and transport is very weak or even negative. The volume of demand for transport is affected not only by the level of physical production and exchange, but also by changes in business, location, optimization of transport and logistics processes, changes in technology and production organization, inventory management and other quantitative and qualitative factors (Burnewicz, 2017). Czech and Lewczuk explore taxonomic and econometric analysis of road transport development in Poland. The results obtained in this research show that there is an interdependence in the area of socioeconomic development in particular voivodships and the level of their road development. The higher are the economic parameters of the related position of a voivodship in the ranking, the higher is the level of road transport development (Czech and Lewczuk, 2016).

An effective tool used for collecting, storing, processing, sending and presenting information is information and communication technologies. Unfortunately, entrepreneurs sometimes perceive implementing modern IT solutions as a cost, and do not notice that they can be an effective tool to facilitate business management

business. High barriers in the implementation of new technologies are also high costs of necessary infrastructure and some applications, as well as security concerns data (Petryczka, 2017).

### **3. Diagnosis of the TSL Brand Situation in Poland**

Poland's accession to the EU brought numerous changes in the functioning of the Polish TSL sector. Even though certain attempts leading to market liberalisation had taken place much earlier, yet it was the accession to the EU that played a vital role in the context of changes. In Poland, the progress of the TSL industry became more harmonious and visible thanks to the opening of the borders and lifting of customs clearance.

The TSL sector is an important part of the Polish economy and the share of transport and logistics (commodities and people) in the Polish GDP is estimated on the level of approx. 11.5% (Fechner and Szyszka).

According to the LPI (Logistics Performance Index) Ranking published in 2018 by the World Bank, which assesses a given country in six areas, namely efficiency of the customs clearance process, quality of infrastructure, ease of organising shipment at competitive prices, competence of employees and businesses in the area of logistics, possibility of identifying and tracking shipments, timely delivery of shipments in compliance with the planned lead time.

According to the data presented by the Central Statistical Office of Poland (GUS) and the LPI Report, last year's economic sentiment's indicator in the Polish transport retained its progressive profile, which may testify to the optimism characterising entrepreneurs from this industry.

**Table 1.** *The Logistics Performance Index (LPI) - Poland*

Year	2018	2016	2014	2012
Ranking position	28	33	31	30
Country score	3,54	3,43	3,49	3,43
The efficiency of the clearance process by border control agencies, including customs	33	33	32	38
Quality of trade and transport-related infrastructure	35	45	46	42
Ease of arranging competitively priced shipments	12	33	24	22
Competence and quality of logistics services	29	31	33	32
Ability to track and trace consignments	31	37	27	37
Timeliness of shipments in reaching the destination within the scheduled or expected delivery time.	23	37	15	19

**Source:** *Own study based on: The World Bank, LPI Global Rankings 2018. The numbers presented in the table define the position of Poland in the ranking in terms of a given area.*

The analysis of Poland as compared to 160 other countries has shown that in 2018, the situation of the TSL sector improved as compared to the previous editions of the

Ranking. In 2018, Poland occupied the 28th place (an increase by 5 places in comparison to 2016) with the synthetic result of 3.54 (2016: 3.34). The top ten positions in the Ranking were taken by: Germany, Sweden, Belgium, Austria, Japan, the Netherlands, Singapore with scores above 4.0, as well as Denmark (3.99), Great Britain (3.99) and Finland (3.97). In the rankings from 2018 and 2016, Poland recorded an increase in all areas, which is a very positive phenomenon.

Shipping of commodities calculated in tons grew by 18.1% y/y, which is the highest growth since 2012. Escalation of the TSL sector is primarily the effect of a growing demand for transport services on the largest EU markets. On the other hand, 2019 showed a decreasing tendency in the entire industry. Experts claim that the main problem in the TSL sector are primarily aggravating payment backlogs, high labour costs and lack of qualified personnel, including lack of drivers which has been experienced acutely for a number of years. Approx. 95% Polish transport companies are companies from the SME sector which are, unfortunately, sensitive to the variability and instability of the market. This is coupled with significant competition on the domestic market and growing competition on the side of foreign transport entities. This affects the increasing number of bankruptcies. According to the Coface report, the transport industry in 2019 recorded an annual increase in the number of bankruptcy decisions of 30% (Commercial Report 2019).

#### **4. ICT – the Significance of Development of Poland in this Field**

Information and communications technology (ICT) are a very broad term, analysed from the standpoint of many areas of science. These technologies are used in all sectors of the economy, and issues related to ICT are the focus of interests of both economists as well as politicians dealing with the economy and business – both in developed as well as in developing countries. The term ICT includes all communication media, media allowing the storage of information and equipment allowing information processing. In addition, ICT also encompass a range of digital applications and complex IT systems allowing the actual implementation of higher abstraction level data processing and storage than the hardware level. It is thus correct to state that ICT are the circulatory system of the knowledge-based economy, in which the information society is of dominant significance. This significance is confirmed by relevant numbers (ITU, 2019):

- It is estimated that 4.1 billion people are using the Internet in 2019, reflecting a 5.3% increase compared with 2018. The global penetration rate increased from nearly 17% in 2005 to over 53% in 2019;
- Between 2005 and 2019, the number of Internet users grew on average by 10% every year;
- In developed countries, most people are online, with close to 87% of individuals using the Internet. In the least developed countries (LDCs), on the other hand, only 19% of individuals are online in 2019. Europe is the region with the highest Internet usage rates, Africa the region with the lowest Internet usage rates;

- In all regions of the world, more men than women are using the Internet;
- The percentage of households with Internet access at home is generally correlated with a region's level of development. In all regions of the world, households are more likely to have Internet access at home than to have a computer because Internet access is also possible through other devices. In 2019 years, more households in many countries have had Internet access than computers;
- An important barrier in the uptake and effective use of the Internet is a lack of ICT skills.

At the national level, the development of innovative technologies enables a country to take higher ranking positions by the level of information and communication technology development (Brzozowska and Kabus, 2018). The assessment is carried out using a number of indicators, calculated with the respective index system and applied for analysis of problem areas in politics, as well as for monitoring of progress in the field of innovative technologies introduction (Petkova *et al.*, 2019). Factors indicating the development level in terms of ICT include the ICT Development Index (IDI), the Web Index and the Networked Readiness Index (NRI).

The ICT Development Index (IDI), has been published annually since 2009, is used to monitor and compare developments in information and communication technology (ICT) between countries and over time. In the 2017 report, Poland took 49th place (out of 176 ranked states) rising by one level as compared to the year 2016. It was, however, one of the lowest ranked European states (ITU, 2017<sup>4</sup>).

The Web Index is the first measure of the web's contribution to social, economic and political progress, studying countries across the world. Since its launch, the Web Index has become established as a reference point for governments and policymakers around the world, holding governments accountable and driving public debate. In the last full list, Poland was ranked 34th out of 85 states (WebIndex<sup>5</sup>).

The World Economic Forum's Networked Readiness Index (NRI), measures the propensity for countries to exploit the opportunities offered by information and communications technology (ICT). It is published in collaboration with INSEAD, as part of their annual Global Information Technology Report (GITR). The report is regarded as the most authoritative and comprehensive assessment of how ICT impacts the competitiveness and well-being of nations. Liderami ranking są Finlandia i Singapur. The list is led by Finland and Singapore. According to this report, Poland took 42th place out of 139 (WEF 2016 report). Poland's neighbours rank better: Germany – 15, Lithuania – 29, the Czech Republic – 36 (Weforum<sup>6</sup>).

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<sup>4</sup> <https://www.itu.int/net4/ITU-D/idi/2017/index.html>.

<sup>5</sup> <https://thewebindex.org/data/?indicator=INDEX&country=ALL>.

<sup>6</sup> <https://reports.weforum.org/global-information-technology>.

On the basis of data from the indicated reports, it must be concluded that Poland still has a lot to do in terms of information and communication technologies. A necessary condition of improved ICT development levels in Poland is support by the public administration entailing bringing legal provisions to order and designating innovative technologies as a priority within state policy.

## 5. Results

In 2019, 96.8% of enterprises used computers. The share of enterprises with access to the Internet exceeded 96%. Comparing results of the survey conducted in the EU Member States covering the year 2018, the value of this indicator in Poland was slightly lower than the EU average and a gap between Polish enterprises and European leaders amounted to 4 percentage points. The following issues related to information and communication technologies will be analyzed in detail: access to the Internet, enterprises providing portable devices to the persons employed, employees using computers in enterprises (computer with access to the Internet), enterprises that recruited or tried to recruit persons for jobs requiring ICT specialist skills, enterprises employing persons with specialist ICT skills, enterprises providing training to upgrade ICT skills, possession of website, use of social media, use of cloud computing payed services, sending electronic invoices, use of industrial and service robots, use of selected ICT security measures, incidents related to ICT security, orders via computer networks, use of e-government, use of public open data, enterprises which incurred investments on selected type of ICT equipment, classification to particular levels of digital intensity index.

**Table 2.** *ICT usage in enterprises – statistic data*

	2015	2016	2017	2018	2019
<b>Enterprises with access to the Internet</b>					
Total	92,7	93,7	94,8		96,3
TSL sector	94,3	94,3	95,3	96,8	97,2
Highest % in 2019 (Information and communication)	98,2	99,0	99,6	99,8	99,8
<b>Enterprises with broadband access to the Internet: DSL (ADSL, SDSL, VDSL, fiberoptik network, cable television network etc.) / Mobile broadband via mobile devices</b>					
Total	-	-	-	-	85,7/75,7
TSL sector	-	-	-	-	83,8/78,8
Highest % in 2019 (Information and communication)	-	-	-	-	95,6/92,7
<b>Enterprises providing portable devices to the persons employed</b>					
Total	-	-	-	67,7	76,2
TSL sector	-	-	-	69,6	79,9
Highest % in 2019 (Repair of computer and communication equipment)	-	-	-	84,5	95,8
<b>Employees using computers in enterprises (computer with access to the Internet)</b>					
Total	43,3 (38,2)	44,0 (39,0)	45,6 (39,7)	46,1 (40,05)	47,7 (43,2)
TSL sector	-	-	-	-	46,2 (40,6)
Highest % in 2019 (Information and communication)	-	-	-	-	96,3 (95,5)
<b>Enterprises that recruited or tried to recruit persons for jobs requiring ICT specialist skills</b>					



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Total	5,4	5,3	6,0	4,5	-
TSL sector	2,4	3,0	2,9	2,6	-
Highest % in 2018 (Information and communication)	42,6	40,0	46,3	47,1	-
<b>Enterprises employing persons with specialist ICT skills</b>					
Total	-	-	-	13,2	23,5
TSL sector	-	-	-	9,0	17,7
Highest % in 2019 (Information and communication)	-	-	-	66,8	77,3
<b>Enterprises providing training to upgrade ICT skills:</b>					
<b>Training for ICT Specialists / Training for other persons employed</b>					
Total	-	-	-	6,4/1,5	-
TSL sector	-	-	-	3,1/7,9	-
Highest % in 2018 (Information and communication)	-	-	-	47,2/42,9	-
<b>Enterprises having a website</b>					
Total	65,4	67,0	66,9	66,8	70,2
TSL sector	56,0	59,3	56,9	51,7	58,0
Highest % in 2019 (Repair of computer and communication equipment)	90,3	94,0	94,6	91,5	93,1
<b>Enterprises using social media</b>					
Total	-	-	-	30,6	36,6
TSL sector	-	-	-	21,0	28,4
Highest % in 2019 (Information and communication)	-	-	-	74,1	72,0
<b>Enterprises using cloud computing payed services</b>					
Total	-	-	-	11,5	17,5
TSL sector	-	-	-	9,1	15,0
Highest % in 2019 (Information and communication)	-	-	-	44,4	53,4
<b>Enterprises sending electronic invoices (suitable for automatic processing / not suitable for automatic processing)</b>					
Total	-	-	-	18,0 / 66,1	-
TSL sector	-	-	-	16,5 / 69,1	-
Highest % in 2018 (Repair of computer and communication equipment)	-	-	-	40,3 / 93,1	-
<b>Enterprises using industrial and service robots</b>					
Total	-	-	-	-	7,5
TSL sector	-	-	-	-	5,3
Highest % in 2019 (Manufacturing)	-	-	-	-	14,7
<b>Enterprises using selected ICT security measures in 2019 (Strong password authentication / Current software updates / Backing up data and transferring it to other locations)</b>					
Total	-	-	-	76,4 / 80,8 / 57,0	-
TSL sector	-	-	-	75,2 / 79,4 / 52,4	-
Highest % in 2019 (Information and communication)	-	-	-	92,4 / 95,2 / 80,2	-
<b>Enterprises experiencing incidents related to ICT security in 2019 (Inability to use enterprise ICT resources / Data destruction or damage / Disclosure of confidential data)</b>					
Total	-	-	-	8,6 / 7,9 / 1,2	-
TSL sector	-	-	-	7,3 / 8,1 / 1,4	-
Highest % in 2019 (Information and communication)	-	-	-	15,3 / 9,6 / 2,4	-
<b>Enterprises receiving orders via computer networks</b>					
Total	12,4	11,8	14,0	15,7	-
TSL sector	7,1	5,8	13,0	11,4	-
Highest % in 2018 (Repair of computer and communication equipment)	35,8	27,0	29,6	28,3	-
<b>Enterprises using e-government</b>					
Total	93,6	94,6	95,1	95,7	-
TSL sector	94,1	95,2	96,3	96,2	-

Highest % in 2018 (Electricity, gas, steam and air conditioning supply / Repair of computer and communication equipment)	98,5/ 100,0	98,9/ 100,0	100,0/ 97,2	100,0/ 100,0	-
<b>Enterprises using public open data</b>					
Total	-	-	16,4	16,9	-
TSL sector	-	-	15,1	14,3	-
Highest % in 2018 (Electricity, gas, steam and air conditioning supply)	-	-	30,4	40,6	-
<b>Enterprises which incurred investments on selected type of ICT equipment in 2018 (Purchases of IT or communication goods / Purchases of IT Goods / Purchases of communication goods)</b>					
Total	-	-	-	37,5 / 34,0 / 19,0	-
TSL sector	-	-	-	34,9 / 28,5 / 21,4	-
Highest % in 2018 (Information and communication)	-	-	-	63,7 / 60,5 / 32,8	-
<b>Enterprises classified to particular levels of digital intensity index (Very low / Low / High / Very high) in % of total enterprises in a group</b>					
Total	-	-	-	56,3 / 31,3 / 11,0 / 1,5	-
TSL sector	-	-	-	68,1 / 26,4 / 4,4 / 1,1	-
Highest % in 2018 (Information and communication)	-	-	-	7,9 / 31,4 / 49,3 / 11,4	-

*Source: Own study based on: Information society in Poland Results of statistical surveys in the years 2015–2019, Statistics Poland 2019.*

The percentage of enterprises with Internet access exceeded 90%, regardless of the economic activities of the enterprise. This confirms the importance of being able to connect to the global network. In every analysed year, access to the network in the TSL companies was above the average value. The dominant position is taken up by the Information and Communication industry, where the percentage is almost at 100%. It should be emphasised that the majority of entities had mobile broadband access to the Internet. In the case of the analysed industry, such access oscillates around the average value for all companies.

Mobile device allows a mobile connection to the Internet, which allows working outside the enterprise. An employee equipped with such device has access to his e-mail or company applications. no matter where he is, this increases his performance. In 2019, more than three-quarters of all enterprises provided their employees with mobile devices. In the presented period (2018-2019), there was a 10% growth in the number of companies providing their employees with mobile devices. Repair of computer and communication equipment industry is a leader in this field.

In the year 2019, as compared to the previous year, the number of employees equipped with computers rose (by 1.6%) as did the number of employees having computers with Internet access. The level of usage of computers by employees of TSL is lower than in total. It must be stated that in 2019 the majority of employees have at their place of employment access to an Internet-connected computer: total - 47,7 (43,2), TSL brand - 46,2 (40,6), leader in this field information and communication brand 96,3 (95,5).

Between 2015 and 2019, the percentage of companies from the TSL industry which

were looking for or hiring experts from the ITC industry was low. In 2019, the average value for all companies was at 23.5% and in the case of TSL at 17.7%. The undisputed leader was information and communication, 77.3%. The situation was very similar within the scope of trainings in the area of ICT, having a website, using social media or cloud computing. Competence of people employed in enterprises must be raised constantly at a pace adapted to the changes taking place. In 2018, 6.4% of companies organized ICT training for specialists in this area, and 11.5% for other employees. In the case of TSL companies, only 3.1% decided to train for specialists and for other employees 7.9%. A company's website is an important marketing communication tool. Websites are becoming more technologically advanced and fulfil many functions. They allow e.g., placing orders and checking their status on-line, as well as putting up information on employment opportunities.

In the year 2019 over two thirds of companies had their own websites, in TSL brand 58,0 %. The use of social media refers to the company's use of internet-based applications or communication platforms to connect, create and exchange content online with clients, suppliers and partners, or within the enterprise. This communication tool can take various forms, for example: social networks, enterprise's blogs or microblogs, multimedia content sharing websites, wiki tools. The growing popularity of social media (especially among young users) has meant that they are increasingly used by businesses in the business sphere as a new communication channel. Social marketing allows you to create a group of loyal customers and quickly acquire new ones. Through communication in social media, companies encourage consumers to share ideas that they can later use in the creation or development of products and services. Increasingly, social media can be useful when recruiting employees, for example when seeking people with a narrow specialization.

They also become a tool for improving communication within the enterprise, enabling the exchange of opinions and ideas of employees. Every third enterprise in Poland in 2019 (36,6%) used at least one of the social media. TSL brand is over this -28,4%. Cloud computing is a big step from the traditional way businesses think about IT resources. It is the delivery of computing services including servers, storage, databases, networking, software, analytics, and intelligence over the Internet ("the cloud") to offer faster innovation, flexible resources, and economies of scale. In the year 2019 cloud computing services were used by 17.5% of enterprises and slightly less in TSL – 15,0.

In 2018, more than two-thirds of enterprises issued and sent electronic invoices, including not suitable for automatic processing - 66.1%, and suitable for automatic processing - 18.0%. In TSL brand it was almost the same - 69,1% and 16,5%. Repair of computer and communication equipment is the leader in this field 93,1% and 40,3%.

Industrial robots are increasingly used in various fields of the economy. In 2019,

7.5% of enterprises used robots in their operations, including industrial robots, TSL brand – 5,3%. In this area, the leader has changed to manufacturing – 14,7%.

Aware of the threats enterprises attach great importance to cyber security. With a range of security measures to choose from, they should at least minimize the risk of ICT incidents. In 2019, the percentage of enterprises using any ICT security was 80.2%. Percentage values for the analysed industry were similar. Many companies experienced incidents related to the ICT security. In this area, TSL shows values similar to the average value for all companies.

In 2018, the percentage of companies conducting on-line sale was at 15.7%. In comparison to 2017, this indicator grew by 1.7%. In the case of TSL, the indicator is slightly lower; furthermore, between 2017 and 2018, there was a drop by 1.6%. E-administration is one of the ICT opportunities that entrepreneurs use more and more willingly. Filling and sending documents online saves time, and posting information on public administration websites makes it easy to track changes in regulations. The high rate of using e-government services confirms the great interest in this activity of entrepreneur. In 2018, all the analysed entities from the generation and supply of electricity, gas, steam and hot water, repair and maintenance of computers and communication equipment made use of e-administration. Also for the TSL industry, this value was high and ranged around 96%.

In 2018, 16.9% companies made use of open public data for business purposes. The TSL industry is only slightly below these values, recording a minor drop (in 2017: 15.1% and in 2018 14.3%). Open public data were primarily used by companies from the generation and supply of electricity, gas, steam and hot water sector - 40.6% in 2018.

In 2018, over one-third of companies made outlays for the purchase of ICT equipment. The TSL industry oscillated around these values. Information and communication industry holds a dominant position.

Statistics in terms of ICT in businesses include much detailed data concerning diverse aspects of business. A synthetic indicator that tersely reflects the level of use of ICT in enterprises, taking into account various technologies, is the Digital Intensity Index proposed by Eurostat. It was created on the basis of data obtained from the ICT usage in enterprises study. The index value estimation entails assigning every enterprise to one of four digital intensity levels. A point is awarded for every condition fulfilled, with their sum describing the digital intensity index. There are four levels.

- very low 0-3,
- low 4-6,
- high 7-9,
- very high 10-12.

In the year 2018, over half of Polish businesses were included in the group spanning

very low digital intensity, with just less than a third being included in the low intensity group. Similarly, bad indicators were updated for the TSL industry.

## **6. Summary and Concluding Comments**

The performed analysis allows for answering the questions posed at the beginning of the study. It must be stated that the transport, shipping and logistics sector has a large share in generating economic value for the Polish economy. It is an important part of the Polish economy, whereas the share of transport and logistics (commodities and people) in the Polish GDP is estimated on the level of approx. 11.5%. According to the LPI Ranking, in 2018 Poland was on the 28th position (out of 160 analysed countries) with the synthetic result of 3.54 (2016: 3.34). Information and communication technologies (ICT) are the element of development for many industries. The leader is the information and communication sector, repair of computer and communication equipment electricity, gas, steam and air conditioning supply. Unfortunately, the TSL sector did not have a leading position in any of the analysed ICT areas. Based on the presented data it can be stated that it is on the average level for all sectors.

The study has certain limitations due to the data that were analysed. The analysis is based on results of studies conducted by Statistics Poland and presented in "Information Society in Poland. Results of Statistical Surveys in the Years 2015–2019." This study encompassed enterprises with ten or more employees. This means that the situation of ICT implementation in micro-enterprises was not analysed. However, such an analysis may be conducted at a later time on the basis of statistical data published by the institution. This could also be the vantage point for own research by the authors.

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