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Diversification of Equipment in the IT Infrastructure of Enterprises in Central Pomerania in Poland

Jerzy Korczak and Dorota Janiszewska *

Faculty of Economic Sciences, Koszalin University of Technology, 75-343 Koszalin, Poland
* Correspondence: dorota.janiszewska@tu.koszalin.pl

Abstract: The IT infrastructure is the basis for the efficient and effective flow of logistic information between the individual elements of the logistical system. Therefore, the aim of this research was to assess the diversification of equipment in IT infrastructure in enterprises in Central Pomerania in Poland. The research was conducted in 2021 using the CAWI method. The research covers five categories of IT infrastructure: IT equipment, software/applications, means of communication, devices cooperating in the smart internet network and other devices. The study was conducted on a sample of 353 enterprises located in the area of Central Pomerania. The results of the conducted research indicate that the degree of use of the IT infrastructure in the analyzed enterprises varies. Taking into account the size of the enterprise, IT infrastructure is much more often used by large and medium enterprises than by small and micro enterprises. In addition, the results also show the diversification of the use of IT infrastructure depending on the business profile of the enterprise. Among the various sections of activity, IT infrastructure is most often used by enterprises from Section C (industrial processing) and from Section H (transport and warehouse management).

Keywords: IT infrastructure; enterprises; Central Pomerania in Poland

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1. Introduction

Due to the dynamic development and complexity of the business environment, competition between companies is increasing. Therefore, improving productivity, cycle times, customer service as well as responsiveness is extremely important. Information technology plays an important role in changing and improving the way businesses operate [1]. Although IT infrastructure includes various components, there is a consensus among researchers in defining it [2–5]. IT infrastructure is usually defined as shared IT resources that form the basis of communication throughout the organization, and the development and implementation of current and future business applications [6]. The company's information technology portfolio is a total investment in computer and communication technologies. The IT portfolio, therefore, includes hardware, software, telecommunications, electronically stored data, devices for collecting and representing these data, and IT service providers [7]. As emphasized by Broadbent, Weill and St. Clair [8], IT infrastructure differs from other IT investments and applications that directly execute business processes within a specific functional area or business unit because it can be shared across borders and enable better business processes.

Although IT infrastructure brings many benefits to enterprises, which include increased user productivity, faster product launch, and better customer service, as well as achieving the desired growth and competitiveness, its introduction is associated with significant financial outlays [1]. This can be a barrier for some businesses, especially small ones. The practice of using IT infrastructure indicates a diversified level of its use in the implementation of economic tasks [9]. Monitoring changes as well as diagnosis and assessment of the impact of IT infrastructure applications is crucial in the process of forecasting economic and social development at all market levels (local, regional, national, global).

Therefore, the conducted research on IT infrastructure is an attempt to answer three research questions:

- What is the level of use of elements of the IT infrastructure by economic entities in the region of Central Pomerania?
- Does the use of IT infrastructure components depend on the size of the business?
- Does the use of elements of the IT infrastructure depend on the profile of the business activity?

The rest of the article is organized as follows. Section 2 contains a literature review. Section 3 presents the methodologies of the conducted research. Section 4 discusses the results of the studies, Section 5 provides a discussion, and Section 6 summarizes the results of the studies.

2. Literature Review

The term infrastructure does not have an unambiguous definition. Descriptions and applications presented by theory and practice are multifaceted. Infrastructure is an economic category taken from the English language and means "base foundation" [10], and corresponds to the German language as basis, foundation, groundwork, foundation [11]. The dictionary of the Polish language characterizes infrastructure as devices and service institutions necessary for the proper functioning of society and production sectors of the economy (economic infrastructure includes services in the field of transport, communication, energy, etc., and social infrastructure services in the field of law, education, health care, etc.) [12]. D. F. Wood [13] in the Encyclopaedia Britannica indicates that the word infrastructure is used to describe all the amenities that an economy has, including the road, rail and port transport network, as well as vehicles and ships to use them, and that the availability of adequate infrastructure is a prerequisite for economic development. The Enciclopedia Treccani [14] sees infrastructure in general as a counterweight to the superstructure (philosophical perspective), as a structure or set of elements that constitute the supporting base or at least a basic part of other structures (technical approach), and as all installations that constitute the basis of economic development and society (economic perspective). The considerations of W. Buhr [15] concerning the first broader analyses of the meaning of the concept of infrastructure were included in the study of R. Jochimsen [16] from 1966, in which, based on the considerations of F. List [17] from 1841 and B. Malinowski [18] in 1944, he tried to create a paradigm of infrastructure, placing particular emphasis on its role in the economy. R. Jochimsen defined infrastructure as a collection of material equipment, institutions, people and all data available to economic entities, enabling business activity [19]. The division of infrastructure made by G. Bognetti [20], based on the theses of Hirschman [21], Hansen [22] and the research of Brosio and Piperno [23], divides infrastructure into basic, economic and social, and has an expansionary character. In this approach, the basic infrastructure consists of building structures that are used to perform basic tasks necessary for the existence of the state. The economic infrastructure consists of the factors of production that directly surround productive capital—mainly private capital. In turn, social infrastructure contributes to determining the living conditions of a community, including increasing the overall productivity of the social system. Similarly, J. Fourie [24], reviewing the literature, distinguishes economic infrastructure that is conducive to human economic activity, such as highways, railway lines, airports, seaports, and technical infrastructure devices from social infrastructure that serves to meet health, educational, cultural needs and needs affecting the quality of life, generally speaking. F. Kapusta [25] understands the concept of infrastructure as the technical means and institutions necessary to ensure the proper functioning of production and service activities, and to shape the desired living conditions of the population. He indicates that infrastructure is the technical means—which means that it is an indicator of economic development and standard of living, and at the same time a stimulator of all activities—and that infrastructure is also institutions that create a framework (atmosphere) for all the activities and life of the population.

Resuming these considerations in the systemic approach leads to the conclusion that the infrastructure system, which is part of the structure of the country (group of countries), is composed of mutually complementary subsystems: economic and social. The process approach to the infrastructure of the country (group of countries) indicates its fundamental role—enabling the implementation of processes between all entities, both in the economic and social spheres.

By logically combining infrastructure with logistics in the process of systemic thinking, we obtain a relationship appropriate to this part of the functioning of the systems, both economic and social. In the systemic approach to logistics, it should be recognized that it is an operating system that is a component of the entity (economic system) at all levels of its structure, a set of logistic elements with material and intangible potential coupled with information and decision-making streams, designed to rationalize the flows of material and intangible assets and evaluated by multiple criteria (taking into account the effectiveness of operation). In this approach, part of the logistics system is its infrastructure system consisting of two mutually complementary subsystems: economic infrastructure and social infrastructure.

In this approach, part of the logistics system is its infrastructure system, composed of three mutually complementary subsystems: technical, economic and social infrastructure. Consistent as to the criteria, and later considered as a classic approach to logistics infrastructure, its division into transport infrastructure, general infrastructure, packaging and IT infrastructure is assumed [26–31]. In this approach, the main goal of the logistics infrastructure is to create conditions for the free, continuous, safe and efficient flow of material and non-material between economic entities. Thus, the logistic infrastructure determines the flow of material and non-material flows between all entities. It enables the implementation of safe transport, storage, and protection of raw materials and materials, or the flow of information. The IT infrastructure is the basis for the efficient and effective flow of logistic information between the individual elements of the logistic system. In the course of further considerations, it was assumed that the IT infrastructure is a logically related and functionally ordered set of IT devices and means of communication equipped with appropriate software and technologies designed to transfer information between elements of the logistics system. It consists of government, local government and private information and IT systems and devices, and teleinformation systems and networks [32]. The information and IT systems and devices in logistics are a functionally related set of elements (operating systems) in which computer hardware and software were used to support the flow of information in order to manage materials, production and service production, distribution, recycling, disposal, quality, finances and human resources. On the other hand, an ICT system is a set of cooperating IT devices and software, ensuring processing and storage, as well as sending and receiving data via telecommunications networks using a terminal device appropriate for a given type of network [33].

The concept that combines the areas of information technology, communication and control is telematics [34], which adjusts these areas to the needs of the supported logistics systems through solutions integrating these areas. In this respect, the telematics infrastructure consists of telecommunications networks (fixed, mobile, satellite), a sensor network (sensors, cameras, transmitters, etc.) and information systems (hardware, software) [35]. The concept of Smart Logistics (SL) also fits into this area. The concept of SL is dynamic, allowing for a quick reaction of the micro- and macro-environment. SL are also an intelligent combination of technology, administration and human activities that allows you to predict problems and minimize their impact, coordinate resources, and eliminate communication barriers between elements of supply chains. From the point of view of the end user (recipient), the greatest values of SL are data and new services based on end devices (sensors and beacons), the access network, and back-end infrastructure [36]. The conditions for the functioning of technical and technological solutions of SL in enterprises, which are elements of IT infrastructure, indicate their decentralization, reactive operation, and the growing independence of peripheral elements [37]. SL strive for a systemic mode of

cooperation by supervising the parameters of tangible and intangible flows in the supply chain [38], integrating logistics technologies [39], using appropriate software [40], enabling the reduction of logistics costs and increasing the efficiency of transport processes [41] through, e.g., fleet location and management [42], and ensuring the security of data flow. It takes into account the territorial and object-oriented aspect of functioning [43], and allows for the mapping and assessment of gaps in processes [44], the monitoring and integration of resources using ICT, the planning and implementation of contracts, and the use of advanced enterprise management tools [45,46]. In the ideal SL model, suppliers and recipients use channels together and share distribution centers and stocks to optimize deliveries using logistics technology and specialized software [47]. When reassuming, it should be pointed out that the IT infrastructure is a nervous system that connects individual elements and subsystems of the logistic infrastructure system in terms of information flow and processing and "allows" their management.

3. Materials and Methods

This research was carried out in 2021 in the area of Central Pomerania in Poland. The region of Central Pomerania is a peripheral region [48–50], where communal units and business entities are located at a considerable distance from regional and subregional development centers [51]. Central Pomerania has economic and social potential that can be used to build distinctive elements on its basis [52]. The surveyed region covers 15 poviats, which consist of 87 communes, including 12 urban communes, 22 urban-rural communes, 51 rural communes and 2 communes with the status of cities with poviat rights—Koszalin and Słupsk. In the years 1950–1975, the examined region was a voivodeship, and from 1975 to 1998 it was divided into two separate voivodships: Koszalińskie and Słupskie, which after 1998 constitute the eastern part of the Zachodniopomorskie voivodeship and the western part of the Pomeranian voivodship, respectively. The regional development policy based on the participatory model of selecting specializations allows for the construction of a system of regional cooperation, the key elements of which are entrepreneurs and their striving to apply innovative solutions that are part of the innovative approach to creating a competitive advantage in the region [52].

The region of Central Pomerania is diversified in terms of the structure of enterprises. Taking into account the size criterion, the region's economy is dominated by micro-enterprises. In 2018, they accounted for 96.4% of all entities. The share of enterprises employing more than 10 people and fewer than 50 in 2020 amounted to 2.8% in the population of business entities in the surveyed region. The total share of medium and large enterprises in the analyzed period was 0.7% of all entities. In 2018, in Central Pomerania, there were a total of 113.2 thousand enterprises (Table 1).

Table 1. Structure of economic entities in Central Pomerania by size, data for 2018.

Classification of Enterprises According to the Number of Employees	Number of Employees	Number of Enterprises	Share in the General Population
Big	250 and more	81	0.1%
Medium	50–249	702	0.6%
Small	10–49	3,196	2.8%
Micro	0–9	109,201	96.4%
Total	-	113,180	100%

Source: Own study based on Local Data Bank of the Central Statistical Office, 2020.

The empirical part of the study was based on a research sheet sent by e-mail to enterprises located in the region of Central Pomerania (CAWI). The CAWI study was conducted on the basis of and with the active participation of key associations and business organizations in Central Pomerania: Koszalin Chamber of Industry and Commerce, Słupsk Chamber of Industry and Commerce, Northern Chamber of Commerce—Koszalin Branch, Association of Entrepreneurs and Employers—Koszalin Branch. The study was supple-

mented with the CATI method, contacting entrepreneurs in the communes of the region. The research sample was random. The survey was conducted on a sample of 353 enterprises. The research model covers the key areas of intelligent IT infrastructure used in enterprises. The research covers five categories of IT infrastructure:

- IT equipment—server, computer, laptop and tablet,
- Software/applications—accounting, warehouse, transport, logistics, Excel, ERP, HR, tax,
- Means of communication—mobile phone, landline phone, satellite phone, mobile/radio internet, internet/landline connection,
- Other devices—barcode/barcode scanner, etc., RFID—(remote) radio identification systems, Beacon—mini Bluetooth transmitter, GPS—equipment positioning systems, Router,
- SMART—type internet compatible devices—offices (etc., printer, scanner, computer, smartphone, etc.), motion sensors, temperature sensors, industrial cameras, webcams, humidity sensors, the production process (machines, devices, etc.), transport (vehicles, control rooms, etc.), logistics (warehouses, internal roads, power supply, etc.), service cells/stations (service of machinery/equipment, repair of machinery/equipment, maintenance of technological traffic, cleaning, etc.), other cells/positions.

The attempt to systematize the determinants of SL development in enterprises [36,53] indicates the reactive action and growing independence of SL elements [37], taking control functions in the supply chain [38] and integrating logistics technologies [39] using adequate software [40]. In addition, the use of SL reduces logistic costs and increases the efficiency of transport processes [41,42], ensures the security of data flow, takes into account the territorial (spatial) and object-oriented aspect [43], and allows for the mapping and assessment of gaps in processes [44], monitoring and integration of resources using IoT [45]. Basic statistical methods were used in the analytical section.

4. Results

4.1. Characteristics of the Surveyed Enterprises

The study covered 353 enterprises based in the area of Central Pomerania. The largest percentage was constituted by enterprises with headquarters in Koszalin (31.4%). The next group were enterprises based in Kołobrzeg and Sławno (5.7%). Among the surveyed enterprises, 4.2% were also based in Białogard and Sianów. Moreover, there were also enterprises based in Słupsk, Będzin, Mielno and Połczyn-Zdrój, which constituted 4.0%, 3.7% and 3.4% of enterprises, respectively. The remaining 34.3% of enterprises came from other communes in Central Pomerania.

Taking into account the size of the activity, the study included micro-enterprises employing from 0 to 9 employees, small enterprises employing from 10 to 49 employees, medium-sized enterprises employing from 50 to 249 employees and large enterprises employing 250 or more employees. Among the groups mentioned, the largest share was held by small and micro enterprises, which accounted for 36.5% and 34.0%, respectively. On the other hand, medium and large enterprises accounted for 19.8% and 9.6% of the analyzed entities, respectively.

The research also analyzed the activity profile of the surveyed enterprises. The respondents' answers show that the largest group were entities operating in the field of transport and warehouse management (13.6%), activities related to accommodation and catering services (12.2%), wholesale and retail trade (11.9%), and construction (11.0%). On the other hand, the smallest share were entrepreneurs from such sectors as: professional, scientific and technical activities (0.8%), activities in the field of administration services, and supporting activities (1.1%) as well as mining (1.1%).

4.2. The Use of IT Infrastructure Depending on the Size of the Enterprise

In order to analyze the diversification of the use of IT infrastructure depending on the size of the conducted activity, the surveyed enterprises were divided into micro, small, medium and large. Table 2 shows the percentage share of enterprises using a given type of IT infrastructure among all surveyed enterprises, depending on the size of the enterprise.

Table 2. Percentage share of enterprises using various types of IT infrastructure depending on the size of the enterprise (in%).

IT Infrastructure	The Size of the Enterprise				Total **
	In % *				
	Micro	Small	Medium	Big	
IT equipment					
Server	32.5	57.4	72.9	73.5	53.5
Computer	64.2	85.3	90.0	94.1	79.9
Laptop	76.7	74.4	62.9	85.3	73.9
Tablet	33.3	34.9	32.9	38.2	34.3
Software/Apps					
Accountants	60.0	82.2	82.9	88.2	75.4
Warehouse	34.2	55.8	71.4	82.4	54.1
Transport	20.0	43.4	62.9	76.5	42.5
Logistic	20.8	38.0	57.1	79.4	39.9
Excel	55.0	63.6	78.6	76.5	64.9
ERP	8.3	7.0	28.6	29.4	13.9
HR	28.3	55.0	57.1	73.5	48.2
Tax	35.8	44.2	48.6	67.6	44.5
Means of communication					
Mobile phone	94.2	94.6	88.6	97.1	93.5
Landline phone	39.2	63.6	70.0	70.6	57.2
Satellite telephone	1.7	4.7	5.7	5.9	4.0
Mobile/radio internet	59.2	55.8	60.0	41.2	56.4
Mobile/radio internet	56.7	75.2	77.1	82.4	70.0
Other devices					
Barcode/barcode scanner/etc.	20.0	42.6	50.0	67.6	38.8
RFID—(remote) radio frequency identification systems	2.5	9.3	17.1	29.4	10.5
Beacon—mini Bluetooth transmitter	6.7	7.8	5.7	11.8	7.4
GPS—equipment positioning systems	22.5	28.7	50.0	32.4	31.2
Router	82.5	85.3	78.6	82.4	82.7
Devices cooperating in the smart internet network					
Offices	82.5	89.9	85.7	82.4	85.8
Motion sensors	20.8	31.8	45.7	38.2	31.4
Temperature sensors	26.7	32.6	55.7	52.9	37.1
Industrial cameras	36.7	62.8	80.0	73.5	58.4
Webcams	21.7	24.0	30.0	14.7	23.5
Humidity sensors	7.5	17.1	44.3	32.4	20.7
Manufacturing process	16.7	28.7	48.6	55.9	31.2
Transport	31.7	43.4	61.4	85.3	47.0
Logistics	17.5	29.5	57.0	70.6	34.8
Cells/service stations	15.8	25.6	47.1	55.9	29.5
Other cells/positions	15.8	27.9	17.1	32.4	22.1

* % share of enterprises using a given type of infrastructure among all enterprises of a given category. ** % share of enterprises using a given type of IT infrastructure among all surveyed enterprises. Source: Own study.

When analyzing the first group of IT infrastructure, i.e., IT equipment, most enterprises used a computer (79.9%) and a laptop (73.9%), while a tablet (34.3%) and a server (53.5%) were definitely less frequently used. Taking into account the size of the activity and types of IT equipment, the server was most often used by large (73.5%) and medium-sized enterprises (72.9%), while micro (32.5%) and small (57.4%) enterprises used this type of equipment much less frequently. The situation is similar with regard to the use of computers, with the largest share in large (94.1%) and medium-sized (90.0%) enterprises. Moreover, large enterprises (85.3%) most often used a laptop, although a large share was also recorded in micro enterprises (76.7%), while the lowest share of this equipment was recorded in medium-sized enterprises (62.9%). Tablets were also most often used by large enterprises (38.2%), although a similar share was recorded in small enterprises (34.9%).

Taking into account the second analyzed category of IT infrastructure, i.e., software/applications, the highest shares were recorded in programming/accounting applications and Excel: 75.4% and 64.9%, respectively. On the other hand, significantly lower shares are in the field of ERP (13.9%) and logistics software/applications (39.9%). As regards the use of accounting software/applications, the highest shares were recorded in large and medium-sized enterprises (88.2% and 82.9%, respectively), and the lowest in micro-enterprises (60.0%). The situation was similar in the use of software/warehouse, transport and logistics applications—their use was dominant in large enterprises (82.4%, 76.5%, 79.4%, respectively), while it was definitely smaller in micro enterprises (34.2%, 20.0%, 20.8%, respectively). In terms of Excel, the highest values were recorded in medium-sized enterprises (78.6%), and the lowest in micro-enterprises (55.0%). The highest use of EPR occurred in large enterprises (29.4%), while definitely lower in small enterprises (7.0%). In terms of software/HR and tax applications, the largest shares were recorded in large enterprises (73.5% and 67.6%, respectively) and medium-sized ones (57.1% and 48.6%, respectively), while the lowest were in micro and small enterprises (28.3% and 35.8%, respectively).

Taking into account the next category of IT infrastructure, i.e., means of communication, the analyzed enterprises most often used a mobile phone (93.5%) and the internet/fixed-line connection (70.0%), while the least used means of communication was the satellite telephone (4.0%). In the case of mobile phones, the highest shares were recorded in large (97.1%) and small (94.6%) enterprises, and the lowest in medium-sized (88.6%) and micro enterprises (94.2%). In terms of fixed-line and satellite telephony, the largest shares were recorded in large enterprises (70.6% and 5.9%, respectively) and medium-sized enterprises (70.0% and 5.7%, respectively), while the lowest were in micro enterprises (39.2% and 1.7%, respectively). Mobile/radio internet was most often used in medium-sized enterprises (60.0%) and micro-enterprises (59.2%), and least often in large enterprises (41.2%). When analyzing the use of the internet/fixed line connection, the highest shares were recorded in large (82.4%) and medium-sized (77.1%) enterprises, while the lowest were in micro enterprises (56.7%).

Another analyzed category is other devices. Among these devices, enterprises most often used a router (82.7%), while Beacon (7.4%) and RFID (10.5%) were the least frequently used. The barcode/barcode scanner and RFID were most often used by large enterprises (67.6% and 29.4%, respectively) and medium-sized enterprises (50.0% and 17.1%, respectively), while least frequently used by micro enterprises (20.0% and 2.5%, respectively). In terms of Beacon, the highest shares were recorded in large (11.8%) and small (7.8%) enterprises, while the lowest were in medium-sized enterprises (5.7%). The highest shares in terms of the use of GPS were recorded in medium-sized (50.0%) and large (32.4%) enterprises, while the lowest were in micro-enterprises (22.5%). The router was most often used in small (85.3%) and micro (82.5%) enterprises, and least often in medium-sized enterprises (78.6%).

The last analyzed group in the field of IT infrastructure was devices cooperating in the smart internet network. In this group, the greatest number of entrepreneurs used office equipment (85.8%) and industrial cameras (58.4%), while the lowest shares were recorded in the use of humidity sensors (20.7%) and devices of other cells/stations (22.1%). Office equipment was most often used by small enterprises (89.9%) and medium-sized enterprises (85.7%), while least frequently used by large enterprises (82.4%). Taking into account motion and temperature sensors and industrial cameras, the highest shares were recorded in medium-sized (45.7%, 55.7% and 80.0%, respectively) and large enterprises (38.2%, 52.9% and 73.5%, respectively), while the lowest were in micro-enterprises (20.8%, 26.7% and 36.7%, respectively). In terms of web cameras, the largest share was recorded in medium-sized enterprises (30.0%) and small (24.0%), and the lowest in large (14.7%). Moisture sensors were most often used by medium-sized (44.3%) and large (32.4%) enterprises, while least frequently used by micro-enterprises (7.5%). The devices of the production process, transport, logistics, service cells/workstations and other cells/positions were most often

used by large enterprises (55.9%, 85.3%, 70.6%, 55.9% and 32.4%, respectively), while least frequently by micro-enterprises (16.7%, 31.7%, 17.5%, 15.8% and 15.8%, respectively).

4.3. The Use of IT Infrastructure Depending on the Business Profile

Among the surveyed enterprises, depending on the business profile, six dominant industries were selected and their use of IT infrastructure was analyzed. The dominant industries in the surveyed sample of enterprises were Section A—agriculture, forestry, hunting and fishing; Section C—industrial processing; Section F—Construction; Section G—wholesale and retail trade; repair of motor vehicles, including motorcycles; Section H—transport and storage; and Section I—activities related to accommodation and catering services. Enterprises from these sections accounted for 65.0% of the surveyed sample, i.e., 232 entrepreneurs. Table 3 shows the percentage share of enterprises using a given type of IT infrastructure among all surveyed enterprises—depending on the enterprise's industry.

Taking into account IT equipment, the analyzed enterprises most often used a computer (79.3% of enterprises) and a laptop (75.4% of enterprises), while a tablet (34.9%) and a server (46.6%) were used much less frequently. Taking into account the profile of activity and types of IT equipment, the server was most often used by enterprises from Sections C (79.4%) and H (62.5%), and the least frequently by enterprises from Sections F (30.8%) and G (33.3%). The computer was most often used in Section A (88.5%) and Section C (88.2%), and least often in Sections F (69.2%) and I (72.1%). The laptop was most often used in enterprises from Sections I (83.7%) and F (79.5%), while Sections G (64.3%) and A (69.2%) had the lowest share. The tablet was more often used by entrepreneurs from Sections C (47.1%) and F (41.0%).

When analyzing the category of software/IT infrastructure applications among the analyzed entrepreneurs, accounting software/applications (72.8%) and Excel (63.4%) were most often used, while ERP (11.2%) and logistics software/applications (39.2%) were used much less. Taking into account the business profile, accounting software/applications were most often used by Sections C (85.3%) and H (83.3%), and less by Sections A (61.5%) and I (65.1%). Warehouse software/applications were most often used in Sections C (97.1%) and G (64.3%), while they were used much less frequently in Sections I (34.9%) and H (56.3%). Transport software/applications were used in Sections H (83.3%) and C (82.4%), while a much smaller share was observed in Sections I (9.3%) and G (33.3%). Logistics software/applications were most often used by Sections H (68.8%) and C (61.8%), while the lowest shares were recorded in Sections I (14.0%) and A (23.1%). Excel was mainly used by entrepreneurs in Sections C (76.5%) and H (66.7%), while slightly less in Sections G (57.1%) and A (57.7%). ERP was most often used by entrepreneurs in Section C (23.5%) and Section H (18.8%). HR software/applications were most often used in Sections C (67.6%) and H (52.1%), while a much smaller share was recorded in Sections A (26.9%) and F (28.2%). Tax software/applications were most used in Sections C (47.1%) and I (46.5%), while the lowest shares were recorded in Sections F (33.3%) and G (40.5%).

Taking into account the category of means of communication, the analyzed enterprises most often used a mobile phone (94.8%) and the internet/fixed-line connection (66.4%), and definitely less frequently a satellite phone (3.9%). The mobile phone was most often used by entrepreneurs in Section G (97.6%) and Section A (96.2%), and the lowest share was recorded in Sections I (93.0%) and H (93.8%). The landline telephone was most often used in Sections H (70.8%) and C (61.8%), while definitely less often in Sections G (38.1%) and A (42.3%). The satellite phone was not used by entrepreneurs from Section I (0.0%), while the largest share was recorded in enterprises from Sections F (7.7%) and H (6.3%). The highest share in the use of mobile/radio internet was recorded in enterprises in Section H (70.8%) and Section C (64.7%), while the lowest was in Sections F (51.3%) and G (52.4%). As regards the use of the internet/fixed-line connection, the highest share was recorded in enterprises from Sections C (82.4%) and H (75.0%), and the lowest in Sections A (50.0%) and I (60.5%).

Table 3. Percentage share of enterprises using various types of IT infrastructure depending on the enterprise's industry (%).

IT Infrastructure	Activity Sections						Total **
	In % *						
	A	C	F	G	H	I	
IT equipment							
Server	38.5	79.4	30.8	33.3	62.5	34.9	46.6
Computer	88.5	88.2	69.2	81.0	81.3	72.1	79.3
Laptop	69.2	73.5	79.5	64.3	79.2	83.7	75.4
Tablet	30.8	47.1	41.0	31.0	31.3	30.2	34.9
Software/Apps							
Accountants	61.5	85.3	69.2	69.0	83.3	65.1	72.8
Warehouse	61.5	97.1	64.1	64.3	56.3	34.9	61.6
Transport	53.8	82.4	41.0	33.3	83.3	9.3	50.0
Logistic	23.1	61.8	33.3	28.6	68.8	14.0	39.2
Excel	57.7	76.5	59.0	57.1	66.7	62.8	63.4
ERP	3.8	23.5	5.1	9.5	18.8	4.7	11.2
HR	26.9	67.6	28.2	40.5	52.1	44.2	44.0
Tax	46.2	47.1	33.3	40.5	45.8	46.5	43.1
Means of communication							
Mobile phone	96.2	94.1	94.9	97.6	93.8	93.0	94.8
Landline phone	42.3	61.8	46.2	38.1	70.8	55.8	53.4
Satellite telephone	3.8	2.9	7.7	2.4	6.3	0.0	3.9
Mobile/radio internet	57.7	64.7	51.3	52.4	70.8	58.1	59.5
Mobile/radio internet	50.0	82.4	64.1	61.9	75.0	60.5	66.4
Other devices							
Barcode/barcode scanner/etc.	19.2	79.4	38.5	54.8	56.3	23.3	46.1
RFID—(remote) radio frequency identification systems	7.7	26.5	5.1	7.1	14.6	0.0	9.9
Beacon—mini Bluetooth transmitter	7.7	2.9	7.7	7.1	10.4	2.3	6.5
GPS—equipment positioning systems	53.8	38.2	25.6	21.4	64.6	9.3	34.9
Router	73.1	76.5	74.4	81.0	72.9	88.4	78.0
Devices cooperating in the smart internet network							
Offices	76.9	88.2	82.1	92.9	91.7	76.7	85.3
Motion sensors	23.1	52.9	17.9	28.6	29.2	34.9	31.0
Temperature sensors	46.2	73.5	25.6	23.8	29.2	39.5	37.9
Industrial cameras	53.8	85.3	41.0	66.7	56.3	55.8	59.5
Webcams	15.4	14.7	15.4	14.3	25.0	37.2	21.1
Humidity sensors	57.7	35.3	10.3	7.1	16.7	7.0	19.4
Manufacturing process	42.3	85.3	30.8	23.8	14.6	20.9	33.6
Transport	65.4	70.6	61.5	35.7	77.1	14.0	53.0
Logistics	38.5	73.5	30.8	40.5	54.2	18.6	42.2
Cells/service stations	30.8	64.7	25.6	31.0	27.1	14.0	31.0
Other cells/positions	3.8	20.6	12.8	21.4	27.1	14.0	17.7

* % share of enterprises using a given type of infrastructure among all enterprises in a given industry. ** % share of enterprises using a given type of IT infrastructure among all surveyed enterprises. Source: Own study.

The last analyzed group in the field of IT infrastructure were devices cooperating in the smart internet network. In this group, the largest number of entrepreneurs used office equipment (85.3%) and industrial cameras (59.5%), while the lowest shares were recorded in the use of devices from other cells/stations (17.7%) and humidity sensors (19.4%). Taking into account the business profile of the analyzed enterprises, office devices (printer, scanner, etc.) were most often used in Sections G (92.9%) and H (91.7%), and least often in Sections I (76.7%) and A (76.9%). The highest share of the use of motion sensors was recorded in Sections C (52.9%) and I (34.9%), while the lowest was in Sections F (17.9%) and A (23.1%). Temperature sensors were most often used in enterprises in Sections C (73.5%) and A (46.2%), and least often in Sections G (23.8%) and F (25.6%). Industrial cameras dominated in enterprises of Sections C (85.3%) and G (66.7%), while they were much less

frequent in enterprises of Sections F (41.0%) and A (53.8%). Webcams were less used than industrial cameras, the highest share was recorded in Sections I (37.2%) and H (25.0%), and the lowest in Sections G (14.3%) and C (14.7%). Humidity sensors were most often used in Sections A (57.7%) and C (35.3%), while least frequently used in Sections I (7.0%) and G (7.1%). The production process equipment was most often used in enterprises in Section C (85.3%) and A (42.3%), and least often in Sections H (14.6%) and I (20.9%). In terms of transport equipment, the highest share was recorded in Sections H (77.1%) and C (70.6%), and the lowest in Sections I (14.0%) and G (35.7%). Logistics devices were most often used in enterprises in Sections C (73.5%) and H (54.2%), and least often in Sections I (18.6%) and F (30.8%). The highest share in the field of cellular/service station devices was recorded in enterprises from Sections C (64.7%) and G (31.0%), while the lowest was in Sections I (14.0%) and F (25.6%). The devices of other cells/positions were most often used in enterprises of Sections H (27.1%) and G (21.4%), and least often in Sections A (3.8%) and F (12.8%).

The indicated differentiation in the development of the IT infrastructure of the surveyed entrepreneurs outlines the area of practical implications related to the use of smart specializations that are the core of regional competences and development opportunities. The diagnosed condition of Smart Logistics elements in the region can be an important contribution to the modeling of effective development policies, especially those promoting smart specializations.

5. Discussion

In line with the aim of the research, the diversification of IT infrastructure in enterprises in Central Pomerania in Poland was assessed. The research took into account various categories of IT infrastructure: IT equipment, software/applications, means of communication, devices cooperating in the smart internet network, and other devices. The use of IT infrastructure was also studied, taking into account the size and business profile of enterprises.

The research shows that the enterprises of Central Pomerania are characterized by different levels in terms of the use of individual elements of the IT infrastructure. In addition, enterprises usually use the basic elements of IT infrastructure, which include a computer with appropriate software, a mobile phone, a printer and a scanner, i.e., devices that can work in a network environment. This is also confirmed by the results of other researchers who, when assessing the use of elements of the IT infrastructure by SMEs in Poland under the JRC [54] (Digital Single Market) idea, indicate their preparation (e.g., through appropriate equipment with network-capable IT equipment, building architecture, IT, etc.) to carry out the tasks of supporting office operations, operational (transactional) support or managing the course of business processes [55,56].

In addition, there are also visible differences in the use of IT infrastructure depending on the size of the enterprise. The research shows that in Central Pomerania the degree of equipping an enterprise with IT infrastructure depends on the size of the enterprise—the larger the size, the greater the degree of equipment. The recorded facts are confirmed by other studies on the degree of use of IT infrastructure by Polish enterprises [57].

The research results also show that the use of IT infrastructure depends on the industry in which the company operates. It should be mentioned that in the digital economy, the distinction between production and consumption has blurred. It is based on the fact that consumers of digital services and content simultaneously become producers of resources such as data [58]. The dynamic use of the logistics infrastructure noted in the studied area makes its users produce and consume at the same time, becoming so-called prosumers. According to this approach, in Central Pomerania, IT infrastructure is more often used in industries such as industrial processing, transport and warehouse management.

Due to the important role of IT infrastructure in the functioning of enterprises of various sizes and from various industries, further research in this area should also focus on the analysis of the reasons for the diversification of its use.

6. Conclusions

The conducted analysis of the literature shows that in times of increasing competition between enterprises, equipping them with appropriate IT infrastructure is essential. This is due to the fact that IT infrastructure plays a key role in changing and improving the functioning of the enterprise. It should be emphasized that an efficient IT system should cover the collection, processing, storage, presentation and transmission of information. This is important because the main goal of the IT system functioning in the enterprise is to provide its users with access to the necessary information that will enable them to perform their daily work and make decisions. Enterprises equipped with an appropriate IT infrastructure can obtain many benefits, the main ones of which are improvements in productivity, efficiency of introducing products to the market, and customer service. Ultimately, it may increase the company's competitiveness, which is very desirable in the era of dynamic development and complexity of the business environment.

Despite the indicated importance of IT infrastructure in the efficient and effective functioning of enterprises, the conducted research indicates a large diversification in the scope of its use. In terms of the analyzed categories of IT infrastructure (IT equipment, software/applications, means of communication, devices cooperating in the smart internet network, and other devices), it was noted that the surveyed enterprises use only its basic elements. Taking IT equipment into account, the surveyed companies most often used a desktop computer (79.9%) and a laptop (79.3%). The most frequently used software in the analyzed companies were accounting systems (75.4%) and Excel (64.9%). In terms of means of communication, mainly a mobile phone (93.5%) and the internet connection (70.0%) were used. In the category of devices cooperating on the smart internet, the surveyed companies most often used a router (83.0%). In the category of other devices, the most frequently used devices were those used in offices (85.8%) and industrial cameras (58.4%). Differentiation in the use of IT infrastructure was also observed in terms of the size of enterprises. The researched enterprises were divided into micro, small, medium and large enterprises. On the basis of the obtained results, it was observed that enterprises with greater financial possibilities, i.e., large and medium-sized enterprises, are in a better situation in terms of using IT infrastructure in their operations. Moreover, differentiation in the equipment with IT infrastructure was observed by differentiating the surveyed enterprises depending on the sector. This type of infrastructure is more often used in enterprises where it is necessary, i.e., in the industrial processing industry, transport and warehouse management.

IT infrastructure involves significant financial outlays; therefore it should be adapted to the needs of the enterprise. In addition, it should also be flexible, reliable, secure and properly implemented. Only the proper implementation of the IT infrastructure can protect the enterprise from connectivity, performance and security problems that can impact the profitability of the enterprise.

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