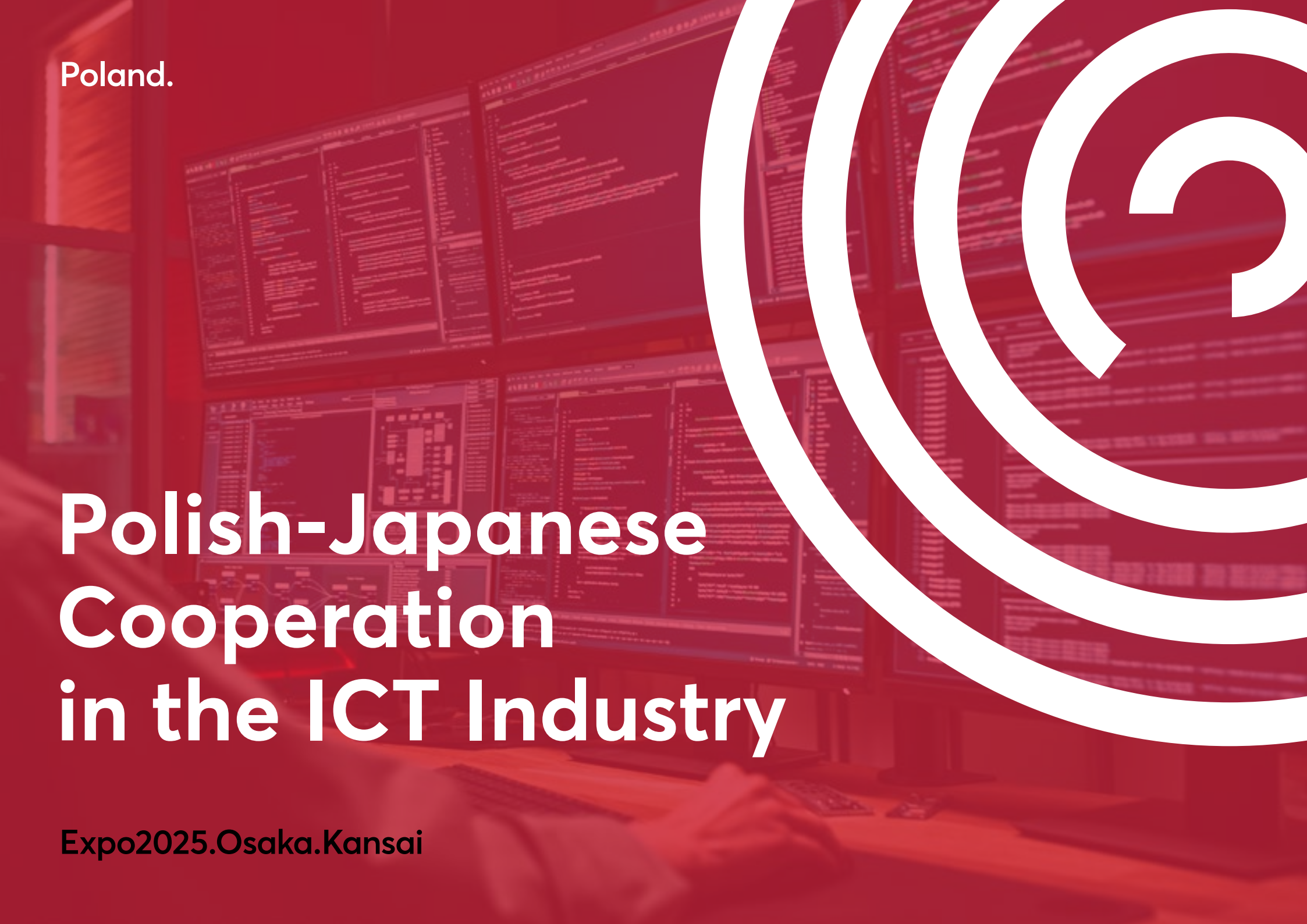

Poland.

Polish-Japanese Cooperation in the ICT Industry

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Introduction

The information and communications technology (ICT) industry is among the critical and rapidly growing sectors of modern economies. It primarily includes infrastructure, products, and services that enable information processing and electronic communication. As a result, the ICT sector combines various service and production industries. In particular, the ICT industry underpins the digital transition of economies and societies, a global trend accelerated by the COVID-19 pandemic. As digitalisation continues, exports and imports of ICT goods and services are rising. Japan and Poland are no different. At the same time, the share of ICT services exports in total services exports is almost twice as high for Poland as for Japan. Taking this perspective, the Japanese market may prove to be a promising destination for Polish exports of these services. For now, Japan is already an important partner, albeit for Polish imports of ICT services; it ranks eighth in the structure of these imports.

This chapter aims to outline the stage of development of the ICT industry in Poland and Japan, to present the sector structure in terms of the size and number of companies and employment, and to provide an overview of international trade in ICT goods and services, including bilateral trade. The chapter also presents the outcome of an analysis on the future trends of the pertinent industry and its development potential, also in the context of fostering Polish-Japanese cooperation. First, the characteristics of the ICT sector in the two countries and its importance to the pertinent economies are described. This is followed by an analysis of international trade in ICT goods and services, including key export and import destinations. Exports and imports of digitally deliverable services are also analysed

by categories defined by UNCTAD. The section on the development trends of the ICT industry and the potential for the development of Polish-Japanese cooperation analyses the development factors of the sector in the pertinent countries, followed by the development trends of the industry in Poland and Japan. The analysis of factors employs, among others, the Global Innovation Index (GII) report published by the World Intellectual Property Organization (WIPO), the IMD Digital Competitiveness Ranking compiled by the IMD World Competitiveness Centre, and the results of surveys carried out by the Japan Users Association of Information Systems (JUAS) on IT development in Japanese companies. Part three presents case studies of two companies operating in Japan, Elmodis and Widmo, as well as Sirocco Mobile, which is expanding in Poland and working with a Japanese multinational company. The case studies are based on in-depth interviews, complemented by publicly available online sources. The last section includes a directory of Polish ICT companies operating on the Japanese market or having the potential to enter this market. It includes details on production structure, export destinations, and presence on foreign markets (based on available data). The chapter is a rich source of information on ongoing and potential cooperation between Poland and Japan in the rapidly growing ICT industry, which is increasingly influencing other sectors. It considers the industry characteristics and development factors in the countries under study. It also includes real-life examples of companies, their activities, and recommendations for managers planning to expand their ICT businesses into the Japanese market.

1.Development of the ICT Industry in Poland and Japan

The analysis of the development of the ICT industry in Poland and Japan utilises statistical figures on the "Digital Economy" and country profiles published by UNCTAD, along with data from the World Bank and Eurostat. Additionally, the White Paper on Information and Communication in Japan by the Ministry of Internal Affairs and Communications (MIC), the publication of Statistics Poland entitled "Information Society in Poland in 2023," and materials from the Polish Agency for Enterprise Development (PARP) were also instrumental. Noteworthily, business classification systems used in Poland and Japan differ. In the former case, it is the statistical classification of economic activities in the European Community, NACE for short, whose Polish version and full form is the Polish Business Classification (PKD). In turn, Japan employs a system called the Japan Standard Industrial Classification (JSIC), or the Japanese Business Classification.

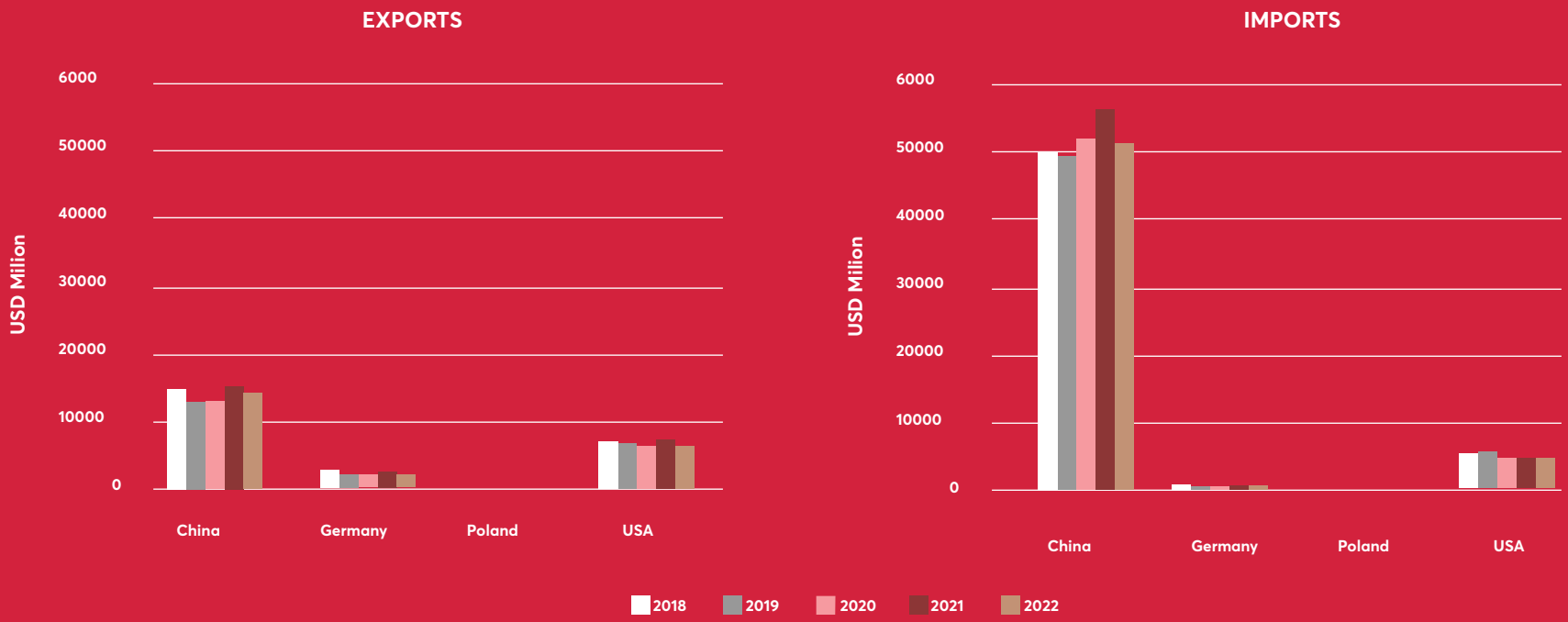
1.1 Japan

According to the Japanese government's statistical figures, in 2021, the information and communications industry's contribution to the GDP of major industries was 10.3% in real terms [MIC, 2023, p. 30]. The largest share of the industry's GDP derives from information services, research, and ICT-related services and production [MIC, 2023, p. 32].

In 2023, the share of Japan's ICT market in the global market was 5.7%, ranking Japan fourth after the US at 35.7%, the EU at 11.8% (Germany at 4.2%) and China at 11.7%, but ahead of the UK at 4.5% and India at 2.4% [Statista, 2024]. The ICT market includes, among others, equipment and devices that serve as user interfaces, communication networks (including operators and broadcasters), clouds and data centres, content services (including video and music distribution), security or artificial intelligence [MIC, 2023, p. 56].

Statistical figures on GDP by type of activity in Japan are as follows. In 2020, the service sector generated 73.1% of GDP, of which 5.1% derived from the information and communications industry [Statistics Japan, 2023, p. 30]. In 2021, employment in companies (excluding enterprises with unknown operational details, central government services, and local authorities) was 57.9 million people across estimated 5.2 million enterprises. A total of 75.6% of employees worked in companies with fewer than 10 employees. The ICT industry recorded 76,559 active companies employing nearly 2 million people, or 3.5% of the total number of employees in companies [Statistics Japan, 2023, pp. 30-32]. Total employment in the information and communications industry in 2022 was 2,720,000 people, with 71% being men [Statistics Japan, 2023, p. 128]; the largest number of jobs were created by information services, research, and ICT-related services and production [MIC, 2023, p. 39]. Noteworthily, Japan is facing severe labour shortages in the ICT sector, particularly in such areas as data analytics and cybersecurity [Imanishi, 2022].

Chart.1 Japan's exports and imports (2018-2022) based on bilateral trade flows of total ICT goods, at current prices in USD millions



Source: UNCTAD 2024, https://unctadstat.unctad.org/datacentre/dataviewer/US.IctGoodsValue.

In fiscal year 2021, research spending by ICT companies in Japan accounted for 24.2% of the total expenditure on science, research, and technology development. In recent years, the number has either declined or remained steady [MIC, 2023, p. 61].

In 2022, the share of ICT goods exports [as defined by UNCTAD, 2024] in Japan's total exports was 8.16%, while the share of ICT goods imports in total imports reached 11.27%. Chart 1 shows Japan's exports and imports from 2018 to 2022 based on bilateral trade flows of total ICT goods. In 2022, Japan's ICT goods exports, valued at USD 60.9 billion at current prices, were primarily destined for China (23%), Taiwan (the Republic of China, 16%), the United States (11%), Hong Kong (Hong Kong Special Administrative Region of the People's Republic of China, 10%), and South Korea (8%). Among European countries, it was Germany (4%) and the Netherlands (2%). Poland ranked 24th in terms of value share in Japanese exports of ICT goods. By comparison, the Czech Republic ranked 20th, Hungary 29th, and Slovakia 49th.

The imports of ICT goods (USD 101.3 billion at current prices) in 2022 came primarily from China (50%), Taiwan (21%), the United States (5%), Thailand (5%), and South Korea (4%). Among European countries, the main sources of Japanese imports of ICT goods were Germany (1%) and Ireland (0.5%). Poland ranked 26th, the Czech Republic 17th, Hungary 21st and Slovakia 44th. In 2022, the share of high-tech exports in industrial goods exports in Japan was 13% [World Bank, 2024].

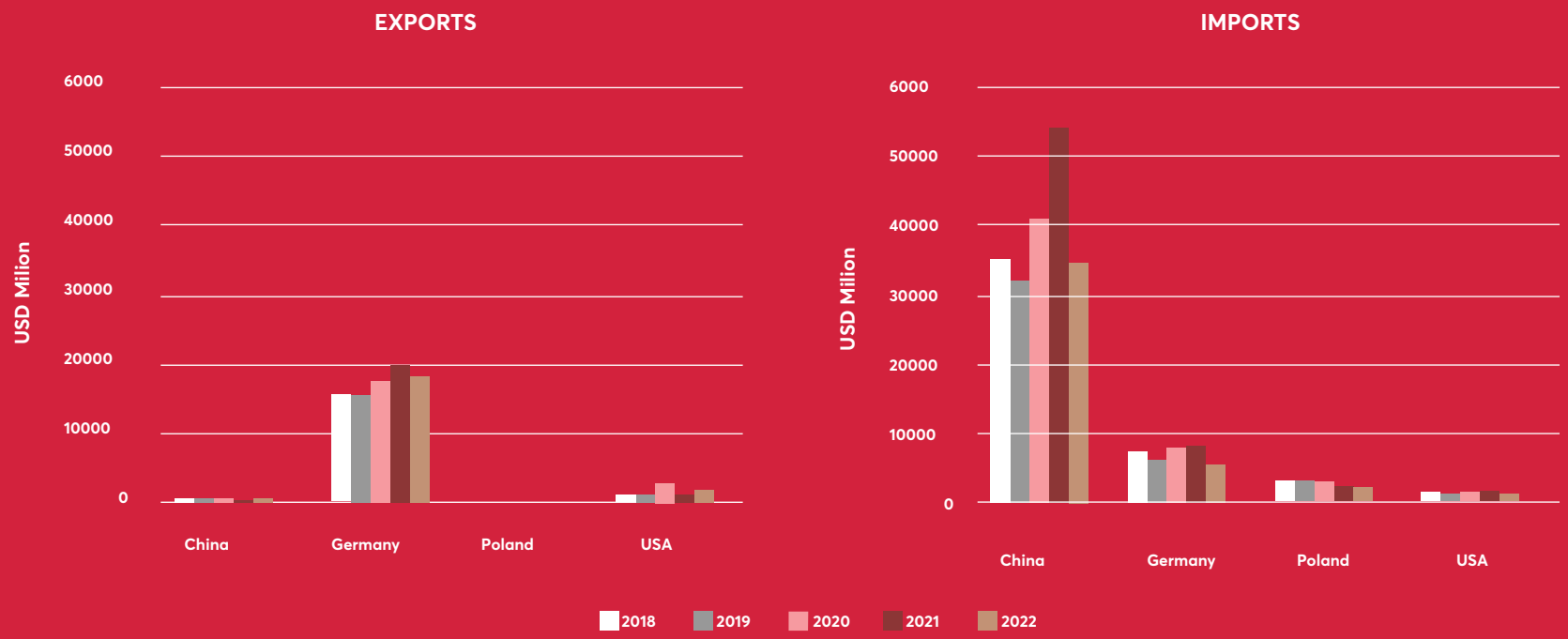
1.2 Poland

The ICT industry's contribution to Poland's GDP is estimated at 3.77% [Statista, 2023]. A comparison between the two countries is facilitated by UNCTAD data, which measures the added value of the ICT industry as a percentage share of the total added value of the business sector. In 2019, it was 5.48% for Japan and 3.16% for Poland [UNCTAD 2023a].

As estimated by Statistics Poland, the ICT sector in Poland in 2022 included 2,712 companies employing 10 people or more. A total of 91.9% of these companies provided ICT services. In contrast, more than 75% of the services offered were IT services. Employment in the ICT industry reached 318,000 people, with 87.7% working in ICT services. The IT services had the highest headcount – 79.3% [Statistics Poland, 2023c, p.23]. ICT companies account for 5% of all Polish enterprises employing at least 10 people. The total number of companies operating in the ICT industry is estimated at 100,000. Most of them are small and medium-sized enterprises (SMEs), and only 2.5% employ 10 people or more [Rutkowski, 2023, pp. 9, 15]. In 2021, sole traders constituted 26.1% of the workforce in the sector. At the same time, the industry's companies accounted for 6.7% of the total number of microenterprises in services [Skowrońska, 2023, pp. 56, 62].

In benchmarking the two countries, data from the OECD's "SDBS Structural Business Statistics (ISIC Rev. 4)" can be used as a reference. Although the data for 2020 is incomplete (as Japan's data was not published at that time), data for 2016 is available, including information on the number of companies and employees. According to these statistical figures, in 2016, there were 43,585 companies in the information and communications industry in Japan and 94,054 such companies in Poland (141,594 in 2020), and employment amounted to 1.6 million for Japan and 256,691 for Poland (302,989 in 2020) [OECD, 2024].

Chart 2. Poland's exports and imports (2018-2022) based on bilateral trade flows of total ICT goods, at current prices in USD millions



Source: UNCTAD 2024, https://unctadstat.unctad.org/datacentre/dataviewer/US.IctGoodsValue.

In Poland in 2023, ICT professionals accounted for 4.3% of total headcount, with the average for EU countries at 4.8%. Among ICT professionals, 78% of employees had a university degree, 57% belonged to the 35-74 age group, and 81% were men [Eurostat, 2024]. PAIH (the Polish Investment and Trade Agency) highlights that Poland is home to world-class developers and that Poles demonstrate high social acceptance of technological innovations. This is evidenced by Poland's third place in smartphone usage globally, the rapidly growing Revolut market, and the 90% share of contactless transactions in card payments [Polish Trade and Investment Agency].

In Poland, ICT companies were more innovative than companies in the overall economy. Between 2020 and 2022, roughly one in two companies in the industry introduced innovations (46.8%), compared to 32.2% of all the companies in Poland [Statistics Poland, 2023c, p. 23]. In 2022, R&D expenditure in the ICT sector, which increased by 40.5% compared to the previous year, accounted for 18.6% of the total gross domestic R&D expenditure [Statistics Poland, 2023c, p. 34; Statistics Poland 2023a, p. 1].

In 2022, the share of ICT goods exports [as defined by UNCTAD, 2024] in Poland's total exports was 6.47%, while the share of ICT goods imports in total imports reached 6.34%. Chart 2 shows Poland's exports and imports from 2018 to 2022, based on bilateral trade flows of total ICT goods. In 2022, the main recipients of Poland's ICT goods exports (valued at USD 22.2 billion at current prices) were Germany (23%), the Netherlands (14%), the UK (11%), France (7%), and Sweden (6%). Among trading partners in this category, Japan was ranked 42nd.

In 2022, the Polish imports of ICT goods (USD 22.7 billion at current prices) came primarily from China (43%), the Netherlands (10%), Germany (7%), Vietnam (5%) and South Korea (5%). Japan ranked 8th by value in Polish imports of ICT goods with a 2.5% share. In 2022, the share of high-tech exports in industrial goods exports in Poland was 11% [World Bank, 2024].

Table 1. Share of digitally deliverable services in the value of total services (%), 2022

	Exports		Imports	
JAPAN	Charges for the use of intellectual property, n.i.e.	27.9	Charges for the use of intellectual property, n.i.e.	13.15
	Financial services	7.14	Professional and management consulting services	10.65
	Telecommunications, computer, and information services	6.18	Telecommunications, computer, and information services	10.61
POLAND	Telecommunications, computer, and information services	14.01	Professional and management consulting services	15.23
	Professional and management consulting services	12.97	Telecommunications, computer, and information services	14.79
	Other business ervices n.i.e.	3.75	Charges for the use of intellectual property, n.i.e.	6.97

Source: UNCTAD 2023b, https://unctadstat.unctad.org/datacentre/dataviewer/US.DigitallyDeliverableServices

Table 2. . Year-on-year percentage change in the value of digitally deliverable services, 2022

	Exports		Imports	
JAPAN	Audiovisual and related services	8.2	Insurance and pension services	11.9
	Telecommunications, computer, and information services	-1	Professional and management consulting services	2.3
	Insurance and pension services	-2.9	Research and development (R&D)	1.4
POLAND	Audiovisual and related services	28.4	Audiovisual and related services	31.6
	Financial services	22.5	Insurance and pension services	27
	Telecommunications, computer, and information services	15.7	Telecommunications, computer, and information services	21.9

Source: UNCTAD 2023b https://unctadstat.unctad.org/datacentre/dataviewer/US.DigitallyDeliverableServices.

1.4 Bilateral Trade Flows of Total ICT Goods between Poland and Japan

In 2022, the share of imports from Japan in Poland's total trade was 1.5%, and exports were only 0.2% [Statistics Poland, 2023b]. Consequently, bilateral trade flows of total ICT goods between Japan and Poland are also negligible. Charts 3 through 6 show the value of trade between the countries from 2018 to 2022 by categories of ICT goods adopted by UNCTAD, i.e. computers and peripheral equipment, communication equipment, consumer electronic equipment, electronic components and miscellaneous.

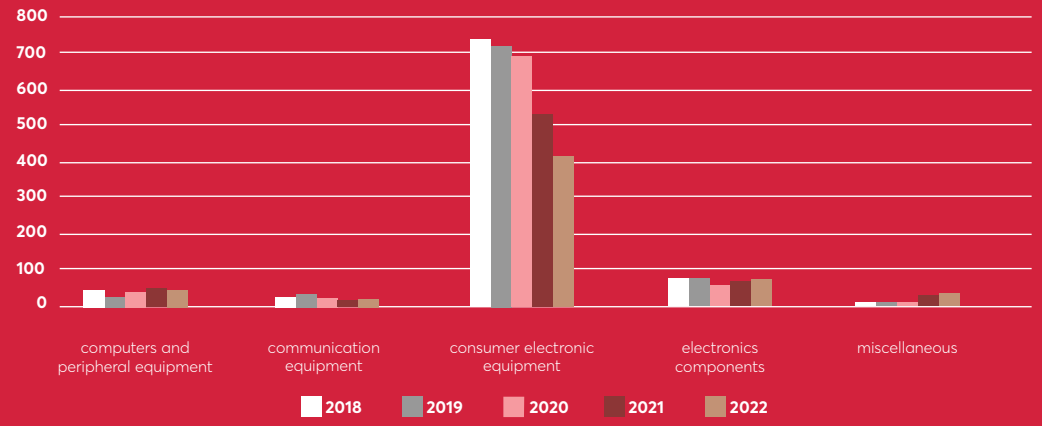
Value-wise, the largest imports from Japan to Poland were of the "consumer electronic equipment" category of goods (Chart 3). However, it exhibited a downward trend and, in 2022, accounted for 55.9% of the 2018 import value for this category. Increases in imports during the review period were observed in the "computers and peripheral equipment" and the "miscellaneous" categories.

In Japan's exports to Poland, the "consumer electronic equipment" category was also the prevailing one (Chart 4). Between 2018 and 2022, the highest export values for these products were recorded in 2020 and 2021, at USD 83 million and USD 90 million, respectively, at current prices. The "electronic components" category displayed an upward trend during the period under review.

Chart 5 shows the imports of the analysed categories of ICT goods from Poland to Japan. Two groups recorded almost zero values – "electronic components" and "miscellaneous". Imports of "communication equipment" and "computers and peripheral equipment" grew most intensively.

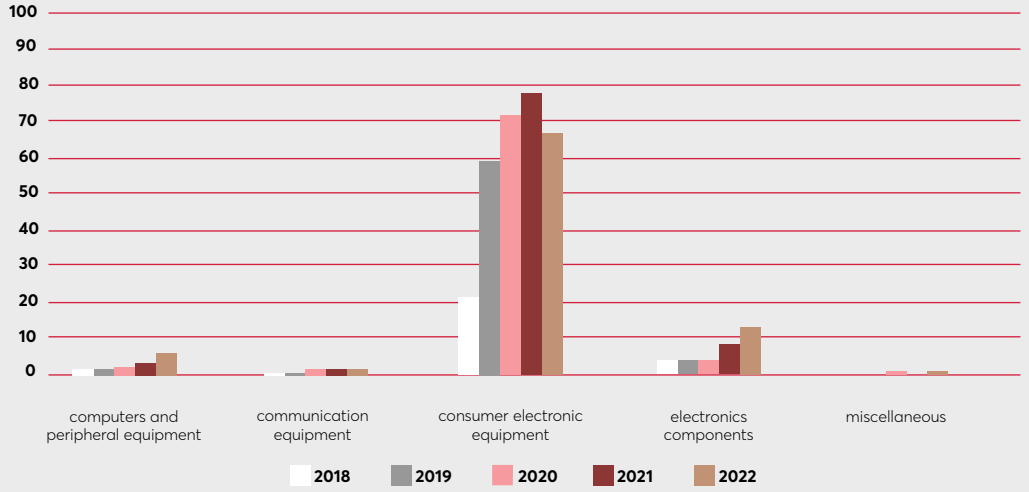
In the exports of ICT goods from Poland to Japan, the "computers and peripheral equipment" category had the highest value between 2018 and 2022 (Chart 6). In 2022, its value reached USD 16 million at current prices, more than three times the amount recorded in 2018. Another category with relatively high values was "consumer electronic equipment". In 2020 and 2021, exports of these products amounted to USD 33 million and USD 14 million, respectively, at current prices.

Chart 3. Japanese imports to Poland of ICT goods by UNCTAD category, at current prices in USD millions



Source: UNCTAD 2024, https://unctadstat.unctad.org/datacentre/dataviewer/US.IctGoodsValue.

Chart 4. Japanese Exports to Poland of ICT goods by UNCTAD category, at current prices in USD millions



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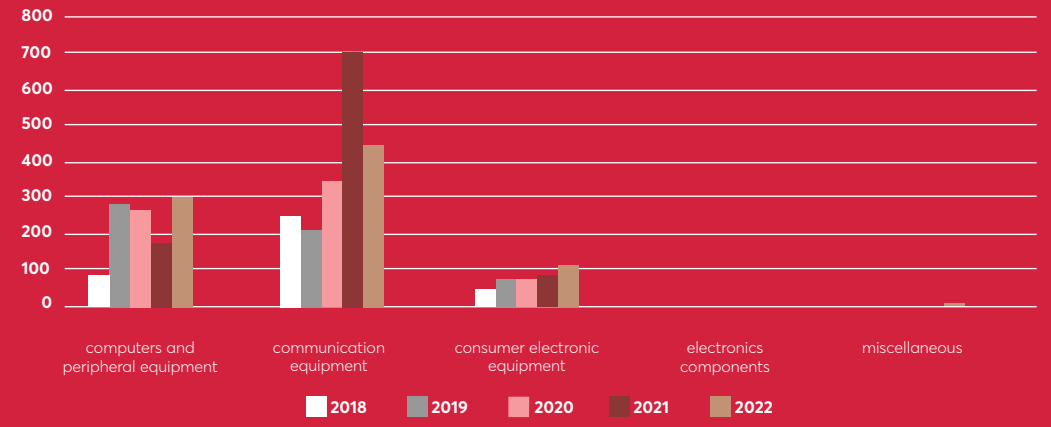

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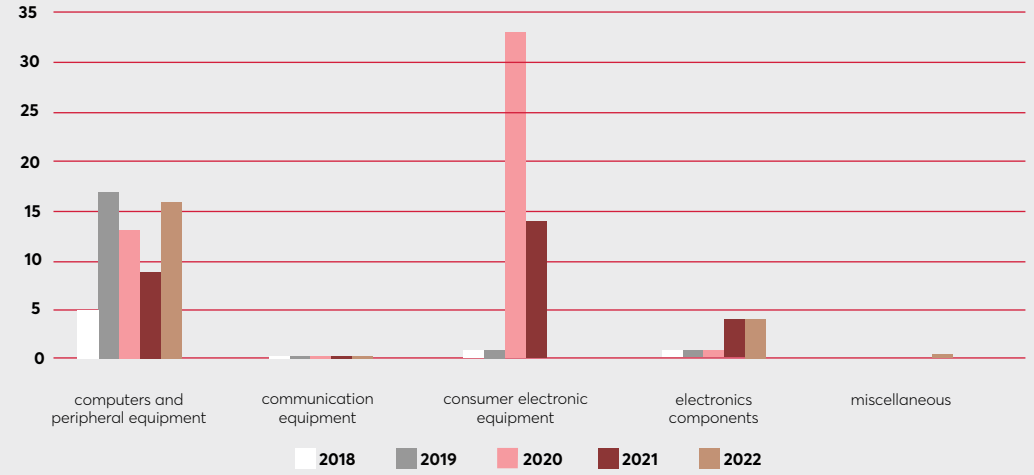


Source: UNCTAD 2024, https://unctadstat.unctad.org/datacentre/dataviewer/US.IctGoodsValue.

2. Development Trends in the ICT Industry and the Potential for Enhancing Polish-Japanese Cooperation

The development factors of the ICT industry in the two pertinent countries will be analysed first, followed by the development trends of the industry in Poland and Japan. Two main data sources, the Global Innovation Index (GII) Report published by the World Intellectual Property Organization (WIPO) and the IMD Digital Competitiveness Ranking compiled by the IMD World Competitiveness Centre, will be used in the analysis of the factors.

Table 3. The IMD 2023 Digital Competitiveness Ranking, covering 64 economies, overall digital trends and their individual factors

	Total	Knowledge	Technology	Future readiness
Poland	39 (41 in 2021)	37	44	40
Japan	32 (28 in 2021)	28	32	32

Source: UNCTAD 2023b https://unctadstat.unctad.org/datacentre/dataviewer/US.DigitallyDeliverableServices.

Although Japan ranks high in the R&D category of the GII 2023, the country faces challenges in higher education, leading to mismatches in the job market and low performance in the business environment, particularly regarding pro-entrepreneurial policies and culture. According to the GII 2023 ranking, what is also Japan's weakness is online creativity included in the creative outputs index.

Poland ranks low in the overall GII 2023 indicator for institutions, including the regulatory and business environment, particularly in terms of policies for doing business. Although Poland's strength lies in its PISA scales in reading, maths, and science, higher education is considered a weakness in its economy according to the GII 2023 ranking. Interestingly, among the strengths of the Polish economy, WIPO highlights intangible asset intensity, industrial designs by origin, creative goods exports, and generic top-level domains in online creativity.

The 2023 IMD Digital Competitiveness Ranking, which examines 64 economies and focuses on indicators related to the digital competitiveness of economies, positions Poland 39th and Japan 32nd (Table 3). The overall digital competitiveness index developed by IMD consists of three factors: knowledge, technology, and future readiness, which are further divided into specific sub-factors.

Similar to the indexes published by WIPO, Poland's strengths according to the IMD also include its high scores in the PISA international comparative study of educational competencies in mathematics (ranked 9th) and its use of robots in education and R&D (ranked 14th) examined under the knowledge factor. Highly rated are wireless broadband (4th) included in the technology factor and business agility (opportunities and threats) (15th) in future readiness. Weaknesses include starting a business (54th), intellectual property rights (54th), and communications technology (51st), all under the technology factor.

For Japan, the IMD Digital Competitiveness Ranking 2023 points to such strengths as wireless broadband (2nd) and world robots distribution (2nd), negligible software piracy (2nd) and e-participation (1st), the last three falling under the future readiness factor. Among the weaknesses are primarily indicators belonging to the knowledge factor, namely international experience (64th) and digital/technological skills (63rd). Additionally, under future readiness, in the business agility category, weaknesses include responding to business opportunities and threats (62nd), agility of companies (64th), and use of Big Data and analytics (64th).

The PARP report entitled "Perspektywy rozwoju siedemnastu branż polskiej gospo-

darki" ["Development Prospects of Seventeen Industries of the Polish Economy"] (2023) highlights the IT sector, cybersecurity, and telecommunications as areas of economic activity with the strongest impact on other sectors. The development of these areas is central for the growth of the entire economy [Worek et al., 2023, p. 16] At the same time, the agency emphasises that it is IT and cybersecurity, rather than the financial system, that now constitute the "bloodstream of the economy" [Worek et al., 2023, p. 16]. The report presents a scenario, developed by a team of experts, for the growth of the IT industry in Poland. Among the cross-industry trends most strongly affecting the sector are digitalisation, client orientation, automation and robotisation, employee orientation, internationalisation of labour markets, conscious and responsible consumption, sustainability, and energy transition. At the same time, critical factors for the industry include the availability and development of digital infrastructure, university-business cooperation, investment in R&D and innovation, increased digital security, availability and quality of human resources, investment in HR development, increased demand for IT services, and economic changes and crises [Worek et al., 2023, p. 18]. For the next five years, the scenario predicts increased investment in 5G, the development of technical education in cooperation with industry, and stronger specialisation in AI and cybersecurity. The forecast also assumes a growing number of startups, a widespread use of cloud computing and the development of international partnerships [Worek et al., 2023, p. 18].

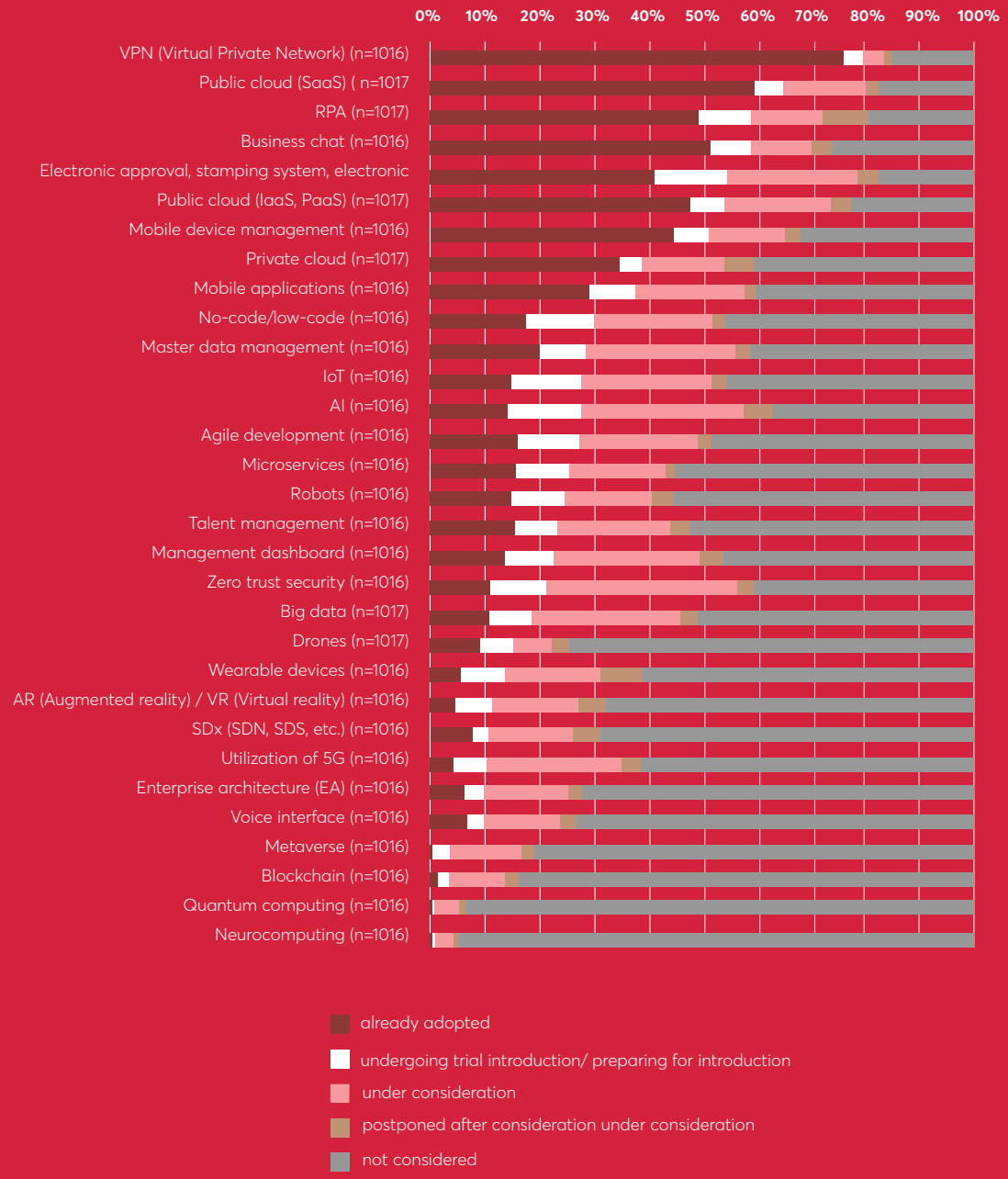
Undeniably, Poland is a key country for investors planning to build a strong presence in the CEE region. In recent years, various institutions have also supported the development of the technology ecosystem in Poland by offering,

among other things, programmes to support high-risk ventures, such as Digital Champions. The youngest "unicorn" company in the region, a startup with a capitalisation of more than USD 1 billion, is ElevenLabs, founded in 2022 and originating from Poland [Digital Champions CEE, 2024, p. 33]. Polish companies significantly increased their share in total company capitalisation from 29.81% to 38.03%, making Poland the leader in total capitalisation among CEE countries [Digital Champions CEE, 2024, p. 35].

Interestingly, Poland was ranked 23rd in the global ranking, marking its first appearance there since 2015 and standing as the only Central and Eastern European representative. Additionally, Poland secured 7th place among emerging markets in the FDI Confidence Index 2024 [Trade.gov.pl, 2024]. This achievement reflects not only the recently popular trends of nearshoring and friendshoring but also the country's significant innovative and technological potential [Trade.gov.pl, 2024; Digital Champions CEE, 2024, p. 34].

In conclusion, Poland is emerging as a leader in the ICT industry within Central and Eastern Europe, with its technological appeal validated by major investors like Google, Amazon, and Microsoft [The Polish Investment & Trade Agency, 2023]. According to PAIH, Poland stands out in Europe for its talent, key location for offshore customer experience (CX) services, dynamic development of the digital economy, and ICT market.

Recently, the Japanese business community has been working hard to effectively implement digitalisation. In response to this challenge, companies must optimise



business processes and operations. This drives demand for a range of digital services, including trust services, secure data exchange platforms, and SaaS (Software as a Service) solutions to support back-office functions. Additionally, depending on the specific industry, there is growing demand for solutions in Artificial Intelligence (AI), the Industrial Internet of Things (IIoT), sensor networks and technologies, as well as user interface (UI) and user experience (UX). A growing demand for ICT solutions, coupled with a shortage of talent, is creating opportunities for foreign companies to grow [Broeckaert, 2022, p. 3].

A valuable resource for understanding technology development trends in Japanese companies is the annual survey conducted by the Japan Users Association of Information Systems (JUAS). The JUAS surveys for 2022 and 2023 were conducted between 9 September and 27 October, targeting 4,500 companies, including those listed on the Tokyo Stock Exchange. Based on respondents' answers, the report summarises various aspects, including the current status of new technology implementation in Japanese companies (Chart 7).

According to JUAS (2023), the most technologically advanced sectors in Japan were finance and insurance, as well as social infrastructure (ICT, energy, distribution, and communications). In 2023, the latter emerged as the clear leader in adopting new technologies compared to other industries in Japan [JUAS, 2024]. The social infrastructure, and finance and insurance industries are dictating the pace of adopting new technologies across

the economy. It should also be noted that large companies show a significantly higher level of technology adoption compared to smaller enterprises. In 2022, the social infrastructure sector saw predominant implementation of AI, Big Data, RPA, Enterprise Architecture (EA), and Agile Development [JUAS, 2023]. In 2023, the social infrastructure sector led in implementing such technologies as public cloud (IaaS, PaaS and SaaS), management panels, Master Data Management (MDM), Big Data, electronic workflows, enterprise architecture, the Zero Trust security model, and Agile Development [JUAS, 2024, p. 211].

The 2023 JUAS survey highlighted heavy drone use in the construction and engineering sectors. However, in 2024, these industries saw the highest deployment of, among others, Augmented Reality (AR), Virtual Reality (VR), Wearable Devices, and mobile device management (MDM) [Table 4., JUAS, 2024, p. 212]. In addition, an increased uptake of generative AI among companies in general is noted as of mid-2022 [JUAS 2024, p. 228].

The 2022 survey results imply a significant focus among Japanese companies on implementing or considering the implementation of the Zero Trust security model. This trend is driven by the rise in remote work and other flexible work arrangements, and the willingness to enhance security while boosting convenience and productivity [JUAS, 2023]. Additionally, over half of the companies, particularly those with high revenues, are adopting "No-Code/Low-Code" solutions to foster business efficiency and advance digital transition [JUAS, 2023, p. 222].

The finance and insurance, and the social infrastructure industries face significant challenges in transforming their existing product and service delivery methods and also in creating new, next-generation business models. In the other industries, the review of decision-making and business processes in accounting and HR remains a common problem [JUAS, 2024, p. 222]. JUAS (2024) concludes that while the finance and insurance, and the social infrastructure sectors are leaders in adopting new technologies, they are not only addressing current issues through that, but also tackling future challenges [JUAS, 2024, p. 222].

Table 4. Adoption of new technologies by industry

New technology adoption status:	1*	2	3	4	5	6	7	8	9	10
VPN (Virtual Private Network)	**82.5**	72.5	68.4	77.8	73.7	64.1	69.6	**78.8**	73.1	69.9
Public cloud (SaaS)	64.9	63.5	59.2	62.1	57.9	48.7	**67.4**	**81.8**	62.8	59.6
RPA	57.9	58.4	50	60.8	62.1	35.9	**69.6**	63.6	53.8	33.7
Electronic approval, stamping system, electronic contract system	56.1	46.1	34.2	45.1	53.7	37.2	**60.9**	**63.6**	55.1	56
Business chat	68.4	51.7	42.1	49	42.1	38.5	**69.6**	**72.7**	50	56
Public cloud (IaaS, PaaS)	**54.4**	47.8	48.7	50.3	49.5	46.2	54.3	**72.7**	50	48.8
Mobile Device Management	**70.2**	48.3	42.1	48.4	47.4	30.8	56.5	**60.6**	44.9	39.2
No-Code/Low-Code	**38.6**	23.6	21.1	**34**	30.5	14.1	30.4	33.3	28.2	22.3
Mobile applications	40.4	29.8	23.7	33.3	20	28.2	**63**	**51.3**	33.3	25.3
Private cloud	49.1	32.6	43.4	31.4	27.4	16.7	**52.2**	**51.5**	35.9	22.3
Agile Development	24.6	15.2	13.2	26.1	17.9	11.5	**32.6**	**45.5**	17.9	27.1
IoT	**29.8**	17.4	21.1	**35.3**	6.3	3.8	2.2	24.2	11.5	10.8
Microservices/API integration	22.8	17.4	7.9	19	17.9	20.5	**56.5**	33.3	26.9	23.5
Talent management	**28.1**	**29.2**	13.2	24.8	18.9	19.2	26.1	27.3	23.1	16.9
Management dashboard	21.1	15.2	11.8	17.6	16.8	10.3	**21.7**	**42.4**	6.4	11.4
Zero Trust security	**28.1**	18	7.9	19	12.6	10.3	17.4	**30.3**	11.5	12
Language-generating AI	**12.3**	10.1	3.9	10.5	10.5	1.3	**13**	12.1	7.7	6
Robots	21.1	21.3	15.8	**30.7**	12.6	10.3	15.2	12.1	16.7	8.4

Master Data Management	22.8	16.9	17.1	18.3	21.1	23.1	**28.3**	**36.4**	5.1	9.6
AI (other than generative AI)	12.3	15.2	10.5	15.7	11.6	6.4	**23.9**	**24.2**	9	8.4
Big Data	12.3	9	13.2	13.1	7.4	9	**15.2**	**27.3**	5.1	9.6
Drones	36.8	7.3	10.5	8.5	3.2	0	8.7	**18.2**	6.4	10.8
Wearable Devices	19.3	6.2	9.2	11.1	3.2	1.3	6.5	**12.1**	9	2.4
Utilisation of 5G	14	3.4	6.6	5.2	6.3	6.4	8.7	**15.2**	14.1	9
AR (Augmented Reality)/VR (Virtual Reality)	**17.5**	6.7	7.9	**10.5**	3.2	0	4.3	9.1	7.7	4.2
Other generative AI	**7**	1.7	2.6	4.6	3.2	0	**6.5**	6.1	2.6	0.6
SDx (SDN, SDS, etc.)	8.8	10.1	3.9	**15.7**	3.2	2.6	**17.4**	9.1	11.5	4.8
Voice interface	14	2.8	7.9	9.2	5.3	6.4	**21.7**	**15.2**	11.5	4.2
Enterprise Architecture (EA)	7	7.3	3.9	11.1	7.4	5.1	**19.6**	**21.2**	3.8	4.8
Metaverse	**3.5**	1.1	0	2	0	0	0	0	**3.8**	0.6
Blockchain	**3.5**	3.4	0	2	3.2	0	**6.5**	3	2.6	3
Quantum computing	0	0	0	**0.7**	**1.1**	0	0	0	0	0
Neurocomputing	0	0	0	**0.7**	0	0	0	0	0	0

*1. Architecture and civil engineering; 2. Lifestyle-related and other production; 3. Production of basic materials; 4. Processing and assembly production; 5. Wholesale; 6. Retail and catering; 7. Finance and insurance; 8. Social infrastructure; 9. Transportation, storage and real estate; 10. Services.

Source: own elaboration based on JUAS 2024 survey, p. 212.

3. Case Studies of Polish Companies Conducting Business, Research and Investment Cooperation with Japanese Companies on the Polish and Japanese Markets

This section provides case studies of three Polish ICT companies. Two of them (3.1 and 3.2) were based on in-depth interviews conducted in Tokyo. The third one (3.3) concerns an ICT company that is now expanding in Poland and that has been working with a Japanese partner for years.

3.1 Elmodis

Business Profile:

Elmodis is a technology company based in Kraków, Poland, founded in 2015 by an experienced team of engineers. The company operates in the area of Industrial Internet of Things (IIoT) and develops solutions based on Artificial Intelligence (AI) and Machine Learning.

Elmodis "improve[s] the energy and operating efficiency of electric-powered industrial machines by offering an end-to-end hardware & software solution that enables manufacturers and end users to remotely monitor the performance of their machines in real time" [Elmodis]. Elmodis offers a hybrid solution combining hardware (Edge devices) and digital services (cloud & platform).

The company has clients and investors both in Poland (e.g., Innovation Nest Fund) and abroad (e.g. the Dutch SET Ventures fund, and Meidensha Corporation, a Japanese company).

Japan operations:

Elmodis found its way to the Japanese market through a partnership with Meidensha Corporation (Meiden), a Tokyo-based company founded in 1897 and listed on the First Section of the Tokyo Stock Exchange. Meiden manufactures and sells water treatment equipment, electronic equipment, and information equipment [Meidensha Corporation Linkedin].

Following Meiden's investment in Elmodis in December 2020 [Meidensha Corporation, 2021], the companies have also been collaborating on R&D and product customisation for the Japanese market. In July 2023, Meiden announced it received an order from Mitsui Sumitomo Insurance Co., Ltd. for an IoT-based engine analysis/ remote monitoring system. "The system was jointly developed by Meiden and Elmodis Sp. z o.o., a Polish startup in which Meiden holds a minority stake. By merging the startup's analytical and monitoring technologies that are being used in European and American pumping facilities and Meiden's knowhow in the engine business, Meiden has been able to customise the new service for use by Japanese clients" [Meidensha Corporation, 2023].

Case study analysis:

According to the CEO and co-founder of Elmodis, finding a Japanese partner company is key to entering the Japanese market. Currently, Japan is among the important and strategic markets for Elmodis. The company plans to further expand its business in Japan, and is also interested in entering other countries in Asia, where Meiden is also present on numerous markets. Prior to partnering with Meiden, Elmodis perceived the Japanese market as potentially interesting but not of pivotal importance, partly due to the widespread belief that it is a very difficult market to enter. Elmodis was mainly focused on developing its business in Europe and America. In Silicon Valley, the company connected with Meiden, which was seeking innovative solutions in foreign markets through open innovation. One of the reasons why the Polish startup's technology interested the Japanese company was the challenges facing the Japanese economy, such as the decreasing number of specialists in the market, including in the maintenance and optimisation of industrial machinery, due to the ageing population. In the face of such challenges, digital technology support is of great value. In addition, the Elmodis product offering also covers energy optimisation, that is reducing energy consumption and optimising costs. This area is becoming increasingly important both in and outside Japan, as many companies actively seek to reduce CO2 emissions and monitor their carbon footprint, among other things.

Once the relationship with the key partner was established, Elmodis made several product adaptations for the Japanese market. In cooperation with Meiden, the company has modified its reporting and graphics to better suit the Japanese market. For example, numerous detailed descriptions were added to the reports in a format not commonly used in Europe, and the colour scheme and aesthetics were additionally adapted. Elmodis also made efforts to understand the essential aspects of the Japanese business culture, including by attending specialised courses. Although the primary language of communication between the companies is English, Elmodis proactively ensured proper etiquette in the relationship-building process, such as by preparing business cards.

Lessons and takeaways for managers from the case

1) The key is to find a strategic partner in Japan, particularly in such areas as sales to industry-related companies and B2B sales.

- Establishing a presence in locations where Japanese companies seeking partnerships are actively looking for potential partners (e.g., Silicon Valley) can be of help.
- Operating in sectors that may address the challenges/problems of the Japanese economy, such as the ageing population, sustainability, and digitalisation, can be of help.

2)The important role of a proactive approach to market entry in Japan.

- There may be a need to partially, at least, adapt the product to meet Japanese client specifications, which may largely differ from European or American expectations.
- Japanese companies appreciate efforts to understand and integrate key aspects of the Japanese business culture.

3)Takeaways for managers: seek a reliable partner and exercise patience.

- Be prepared for often lengthy internal project/collaboration approval processes at Japanese companies, involving product testing, for example. In turn, if the verification and internal approval process is successful, even a verbal commitment from the Japanese partner involves a high likelihood of initiating cooperation. In Japan, you can also expect strong client loyalty towards suppliers and vice versa.

3.2 Widmo

Business Profile:

WIDMO Spectral Technologies Sp. z o.o. is a company founded in 2018, with offices in Warsaw and Kraków. It is a deep-tech startup creating "subsurface tomography based on spectral ground penetrating radar and advanced analytical software (...) with Machine Learning algorithms taught on both real-world data and advanced simulations" that enables the delivery of high-quality geological information [Widmo].

The technology developed by Widmo has a number of potential applications, both in mining, as well as in other areas where subsurface information is important, such as mapping cities, where it may be of help in "infrastructure planning, utility maintenance, and emergency response" [Widmo].

Case study analysis:

Widmo is in talks with potential clients in various countries around the world, especially in Europe and America. Entering the Japanese market is appealing to the company. This is due to the market size and the numerous challenges it faces that the Polish startup's product offering could help address. For instance, one area of interest is analysing the post-event impact of earthquakes on infrastructure. Additionally, Japan's ageing population and high GDP translate to labour shortages in the construction industry, creating a demand for technological solutions. The CEO and co-founder of Widmo notes that Japanese companies often exhibit a strong understanding of the details and potential of technologies like those offered by the Polish startup, which is not always the case in other markets.

Despite the appeal of the Japanese market, Widmo also identifies obstacles such as cultural and language barriers, as well as a significantly longer sales cycle compared to Europe or America. Due to the unique characteristics of Japan, Widmo is currently viewing

it not as a potential gateway to the broader Asian market, but as a big market in its own right. The company further acknowledges that direct entry into the Japanese market can be very challenging, making it crucial to either find a local partner or be discovered by one.

In the case of Widmo, Shimizu connected with the Polish startup through open innovation thanks to its presence in a French accelerator focused on technology, heavy industry, and construction. Shimizu also visited Widmo in Poland and took part in radar testing. Additionally, another major Japanese company expressed interest in the product offering at a conference in the Netherlands, but requested that the product be sent to Japan for testing at the expense of Widmo.

Lessons and takeaways for managers from the case

1)Sometimes, it may be easier for a Polish startup to connect with a potential Japanese partner not in Poland or Japan, but in a third country, for example in Western Europe, by participating in specialised programmes or industry conferences.

2)In establishing cooperation with Japanese partners, be patient and prepare for long sales processes. On a positive note, there are substantive discussions about technology.

3)Deep tech products may require less adaptation to different markets, including Japan, potentially making them easier to sell. On the other hand, the occasional need to provide a prototype for testing by potential partners or clients can be a costly and challenging process for smaller/early-stage companies.

4)Takeaways for managers: to carefully consider the specific reasons for entering the Japanese market. If you manage to find a reliable partner, it may be very valuable. Conversely, if you lack a local partner and your goal is to expand into Asia at large, there are easier markets to start with (markets where English is more commonly used and sales processes are shorter) and where Japanese companies also have a presence.

3.3 Sirocco Mobile

Sp. z o.o.: an example of a company operating in Poland and working with Japanese partners domestically

Business Profile:

Sirocco Mobile Sp. z o.o. was founded in 2008 by Ludwik Żółtowski (CEO) and Maciej Wojtyczka (CTO), and initially specialised in Java mobile games. The company soon became a major software company with headquarters in Warsaw and development centres in Gliwice and Brussels. Currently, Sirocco Mobile employs more than 80 IT professionals who serve clients globally across various industries, including automotive, e commerce, media, ICT, and marketing [Sirocco Mobile 1].

Sirocco Mobile offers IT consulting, business analysis and UX/UI services, mobile and web application development, and AI-based solutions. After announcing the acquisition of the company by the Polish group Euvic, the group's founder and CEO Wojciech Wolny stated that "the specialisation developed within the group with Sirocco Mobile significantly strengthens our existing software development offerings, particularly in advanced business systems and mobile applications" [crn.pl, 2021]. Sirocco Mobile enhances the "Software Development pillar, which, along with the other four pillars (Body/Team Leasing, IT Infrastructure, Innovation, and Digital), forms the Euvic Group's comprehensive IT solutions for business" [inwestycje.pl, 2021].

Case study analysis:

Among its extensive portfolio of over 170 clients, Sirocco Mobile collaborates with Toyota Central Europe, a Japanese company which sells and distributes Toyota and Lexus cars in Poland, Slovakia, the Czech Republic, and Hungary. This partnership has resulted in the TMS application which has been in development since 2014 and which supports the sale of new Toyota and Lexus vehicles. "It is an SFA (Sales Force Automation) business system that uses technology to automate the sales process. TMS enables the creation of a complete sales offer for individual clients and fleets, using several advanced features, such as comparison engines, extensive product price lists with special offers, and the ability to select accessories" [Sirocco Mobile 2]. Among the main benefits of the Sirocco Mobile solution offering are data centralisation, the possibility to generate reporting data to Excel (.xlsx) and PowerBI format files for easy analysis, the digitalisation of processes (including the sales process), improved communication between headquarters and other company units, and the potential for further development with additional modules [Sirocco Mobile 2].

Lessons from the case study of Sirocco:

How the cooperation develops and what its results are has become a basis for mutual trust between the partners. Toyota Central Europe highlights Sirocco Mobile's professionalism, state-of-the-art technological knowledge, and reliability. These factors, along with the comprehensive fulfilment of expectations for the TMS application under development, have contributed to the continued advancement of the project.

4. 4. Directory of Polish ICT companies with a presence on the Japanese market or the potential for expansion into it

No.	Company	Production structure	Exports – geographical destinations	Branch offices abroad /Other forms of foreign market presence
1	**Comarch S.A.** Kraków, Poland Founded in 1993 [Comarch 1]	A global integrator, developer of innovative IT solutions and systems [Comarch 1]	Over 100 countries worldwide [Comarch 1]	Offices in 32 countries, including Japan (Tokyo) [Comarch 1]
2	**RTB House** Warsaw, Poland Founded in 2012 [RTB 1]	Marketing technologies for leading brands and agencies [RTB 1], specialising in innovative retargeting technology based on deep learning [RTB 2]	The company operates in numerous markets globally	Offices in over 30 locations worldwide [RTB 1], including Tokyo, Japan [RTB 3]
3	**ICEYE (in, i.a., Espoo, Finland (HQ);** Warsaw, Poland Founded in 2014 (spin-off from Aalto University), ICEYE Polska registered in 2017 [Iceye 2, 4, 5, 6]	Continuous monitoring of the Earth using radar satellite imaging [Iceye 1], SAR (synthetic aperture radar) technology in microsatellites [Iceye 2]	The company operates in numerous markets globally	Offices in Finland, Poland, Spain, the United Kingdom and the United States [Iceye 1]; in Japan, ICEYE collaborates with Tokio Marine & Nichido Fire Insurance [Iceye 3]
4	**Juice** Warsaw and Wrocław, Poland Founded in 2006 [Juice 1, 2]	Comprehensive visual effects, design and sound services [Juice 1]	The company operates in numerous markets globally	Offices in Tokyo, Japan; Shanghai, China; partnership in the USA (Brand Yew)

5	**Codahead** Kraków, Poland Founded in 2015 [Codahead 1]	Deep-tech company, provider of software development solutions, specialising in artificial intelligence, hardware development, blockchain, immersive reality (XR/AR/VR), among others [Codahead 1]	The company operates in numerous markets globally, with bulk of the clients being from the European Union and the United States [Codahead 2]	Visit to Japan IT Week [Codahead 3]
6	**Vasco Electronics** Kraków, Poland, Founded in 2008 [Vasco 2]	Design, manufacture and sale of mobile translation devices [Vasco 2]	The company operates on international markets, in almost 20 countries [Vasco 1]	Main offices in Poland and the United States [Vasco 1]; presence and sales in Japan [Vasco 3, 4]
7	**Velis** Kraków, Poland a Polish company Founded in 2009 [Velis 1]	Software for Facility Management (Singu FM), Visitor Management (Singu Guestbook), Vehicle Access Control (Singu Smart Security Desk) [Velis 1]	More than 30 countries worldwide, including Poland, Hungary, Japan, the United States, Austria, etc. [Velis 1] [Velis 2]	US office (Austin, Texas) [Velis 1], foreign partnerships [Velis 3]
8	**Neoteric** Gdańsk, Poland a Polish company Founded in 2005 [Neoteric 1]	Web development, product design and AI development projects in a wide range of industries from telecom to marketing and wellness [Neoteric 2]	The company operates in numerous markets, working with international companies	
9	**Meeting15** Warsaw, Poland a Polish company Founded in 2019 [Meeting15 1]	A platform for comprehensive management of events, in both the real and the virtual world [Meeting 15 1]	The company operates in numerous international markets, handling hundreds of events in European countries. In 2021, it began operations in Japan with bold plans to expand into other Asian markets [Meeting15 1] [Meeting15 2]	A Japan office (in Tokyo) to eventually operate in the Asia-Pacific region [Meeting15 1]
10	**TenderHut** Białystok, Poland a Polish company Founded in 2010 as CodeArch [TenderHut 1]	A group with a portfolio of 15 companies in IT/ICT, legal consulting, laboratory solutions, HR, etc. [TenderHut 2]	The company operates in numerous markets globally	At least 8 foreign representative offices, including in China, Germany, Sweden, the UK and the US [TenderHut 3]. Willing to expand into the Japanese market [TenderHut 4]

11	**SKILLS & CHILL**, registered in 2014. Based in Poznań	Optimising solutions for touch-screen devices. It designs and develops applications and web portals fit for screens of various sizes. Handling and managing content resources: Enterprise Content Management.	Germany, Switzerland, the UK, France, Italy, the US and Canada
12	**Typly Sp. z o.o.**, registered in 2021. Based in Warsaw	Natural Language Processing. Advanced AI writing assistant that leverages multilingual models, e.g. GPT, ChatGPT, LLaMA.	
13	**UXMINING Sp. z o.o.,** registered in 2021. Based in Stalowa Wola	UI/UX design and user research for startups, public institutions and enterprise companies [Eastern Business Accelerator].	
14	**Movello.pl** ("DROGA DO LEPSZEGO" Foundation, Namysłów)	A Polish app supporting charity and environmental causes by promoting walking	
15	**QPER,** registered in 2023. Based in Lublin	Hyper-Convenience Retail. It consists of AI-powered micro-stores and smart vending solutions, ensuring quick and secure shopping with convenient automated payments.	
16	**Reakto Drone Services** a Polish company registered in 2023. Based in Piotrków Trybunalski	Security. Rapid response drone systems.	

17	**Gekko Photonics** a Polish technology company, founded in 2019. Based in Wrocław	Proprietary photonic (optical) solutions and their adaptation to industrial and medical applications. Precise and non-invasive measurement methods; proprietary, cost-effective and miniaturised Raman spectroscopy [Platforma Inwestora].	A global company
18	**DBR77 Robotics,** registered in 2020. Based in Toruń	Services to support the digital transition process in companies	
19	**NOT Informatyka Sp. z o.o.,** founded in 2012. Based in Warsaw	The company provides IT solutions for scientific and technological entities	Relations with entities in Belgium and Japan

Source: own elaboration based on available online sources and information provided by the Polish Chamber of Commerce and Industry in Japan (PCCIJ).

Conclusion

Information services, research, and ICT-related services and production account for the largest share of GDP generated by Japan's information and communications industry. The industry employs 3.5% of the country's total company workforce, and Japan's ICT market is well established globally. In contrast, the ICT sector in Poland is primarily developing in IT services. Most companies in this sector are SMEs, and there are nominally far more of them than ICT companies in Japan. However, Japanese ICT companies generate a much higher headcount. In recent years, R&D expenditure among companies in Poland's ICT sector has increased significantly (by 40.5% in 2022 compared to the previous year), while in Japan, research expenditure in the industry has either declined or remained steady.

The main partners of Japan's international trade in ICT goods are Asian countries. In Poland, ICT goods exports are predominantly to European countries, while imports are mainly from Asian countries. Poland's ICT services exports have a higher value than those of Japan. Domestically, the share of ICT services exports in Poland's total services exports is more than twice that of Japan. The opposite is observed for imports. Interestingly, Japan ranked 8th by value in Polish imports of ICT goods with a 2.5% share. Moreover, Poland's trade in digitally deliverable services was marked by significantly higher growth dynamics than that of Japan.

In recent years, Poland has been emerging as a leader in the ICT industry among Central and Eastern European countries. Its technological appeal is underscored by investment from international giants in the sector. In Japan, the pace at which new

technology is adopted across the economy is driven by the social infrastructure, as well as the finance and insurance industries. Transforming the existing product and service delivery methods and creating new, next-generation business models are the most significant challenges in those sectors. In the other industries, the review of decision-making and business processes in accounting and HR remains a common problem.

Cooperation of Polish and Japanese companies in the ICT industry is currently limited, but holds the potential for development. Case studies of business, research, and investment cooperation between Polish and Japanese companies, as well as of the presence of Polish companies on the Japanese market, show that finding a strategic Japanese partner is crucial for Polish companies. This is particularly important given the significant barriers and cultural differences, such as English proficiency and the length of negotiation and sales processes, between European countries and Japan. Entering the Japanese market on your own is challenging, although success can depend on such factors as the type of the product offered, the sales model, and the target customer's main industry (in the case of B2B). What is noteworthy is that valuable contacts between Polish and Japanese companies are sometimes established in third countries, such as Western European countries or the United States, where some large Japanese companies actively seek open innovation partners.

Poland.

The Polish Investment and Trade Agency

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- To enable small-and medium-sized companies to reach their full potential in exporting their products and services around the world
- To support potential investors in Poland by providing comprehensive and up-to-date information services regarding legal and tax aspects, location and human capital, as well as on the available financial incentives
- To promote 'Poland as a Brand'

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