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# POLAND

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ID#21920068



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## SPIS TREŚCI

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## FOREIGN DIRECT INVESTMENT IN POLAND

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CEE countries, including V4, have been long seen as attractive locations for foreign direct investment - FDI (Zimny 2017; Kersan-Skabic & Orlic 2007; Popovici 2015; Götz et al., 2018; Cieřlik 2004). Over decades following the collapse of communism and the transition to open market economies, these countries welcomed an impressive number of foreign investors. Cieřlik, (2019a) used standard panel data techniques to examine the determinants of FDI flowing to Poland in 1996–2015 from the old European Union (EU)-15 member states. Based on the knowledge-capital (KC) model and drawing on two types of capital: human and physical, gathered evidence showed that horizontal motive (market expansion) was the primary reason for undertaking FDI in Poland by multinational firms originating in old EU-15 member states. In other text Cieřlik, A. (2019b) empirically investigated reasons for inward FDI in Poland stemming from OECD in years 1996–2015. Again, relying on modified knowledge-capital model with two types of capital: human and physical he demonstrated that efficiency-seeking rather than market seeking constituted the main reason for FDI in Poland. That finding implied that pure vertically integrated model of multinational enterprise might have dominated over the pure horizontal model.

Concerning the spatial pattern of FDI distribution Dziemianowicz, et al., (2019) draw attention to the relevance of the local level and revealed that commitment of Polish entrepreneurs and the development of labour markets were the main drivers of the inflow of investment projects into *gminas*. V4 countries as traditionally very dependent on foreign capital. CEE countries since the transformation process are regarded as heavily dependent on the inflow of foreign capital in particular on FDI. Except for Poland, FDI stock represents everywhere more than 50% of the GDP (Éltető & Antalóczy 2017). This dependency is present both from the macroeconomic point of view (see “dependent economy model” by Nölke & Vliegenthart 2009) and also on regional, local level. Nordea estimates (Table 1) show an increasing number of greenfield projects in Poland over 2016-2018 with FDI accumulated stock amounting to more than 231 billion USD.

Table 1. FDI inflow and stock in Poland

Foreign Investment	Direct	2016	2017	2018
FDI Flow ( <i>million USD</i> )	Inward	15,690	9,179	11,476
FDI Stock ( <i>million USD</i> )		188,734	238,483	231,848
Number of Greenfield Investments***		311	430	440

Source: <https://www.nordeatrade.com/en/explore-new-market/poland/investment>

Experts (Nordea) see different strong and weak points in each V4 economy. Poland is praised for its growing economy; convenient central location in Europe and recently resilience even during the economic crises. Multilingual qualified labour, stable banking sector or population that does not face over-indebtedness also contribute to the country's attractiveness. Thanks to these advantages Poland was ranked by the World Bank as 27th out of 190 countries by the ease to do business in 2018. However, there are specific weak points which might deter potential investors. The labour market is claimed to be rigid, and the administrative procedures are slow (120th country for the speed of starting a business according to the World Bank). The uncertainty concerning the future euro adoption combined with as some argue political landscape may further discourage investors.

The existing law aims at attracting foreign firms and encompasses various measures. Already in 2002, the Polish Parliament passed a law stipulating that company investing in Poland can receive assistance: in Special Economic Zones (SEZ), from European Union structural funds or thanks to the creation of industrial and technological zones that enable a synergy of companies working in the same sector. In 2011, the Act Limiting Administrative Barriers for Citizens and Businesses went into effect, introducing a series of measures designed to diminish the burden of Poland's state bureaucracy. Since 1<sup>st</sup> January 2012, a company can be registered as a limited liability company in 24 hours.

Until 2018 Poland had 14 special economic zones. A new bill in 2018 stipulated that the amount of tax incentives depend on the socio-economic significance of the investment, with priority given to investments in struggling medium-sized towns. The new rules mean that SMEs will no longer need to move their operations to SEZ to attract foreign investors (hence in a way, they become "space neutral"). The changes will offer the special-economic-zone-type benefits to a number of small and medium-sized firms. The preferential conditions will be provided for a period of 10 to 15 years. The bill does not affect the arrangements already agreed in the currently operating SEZs. As explained by prime minister Morawiecki - "Each community, despite its size and particularities, every sq. kilometre out of over 312,000 stands a chance of becoming an attractive investment zone."

Other countries in the CEE region, including the Czech Republic, Hungary and Slovakia, have already introduced similar measures to meet foreign investors' expectations. Economists explain that the process of SEZ expansion can be seen as an organic development, driven by the needs of investors (Nordea, PAP/EMERGING EUROPE)

in other words, since the end of June 2018, Poland is officially a single special economic zone (<http://www.eecpoland.eu/2019/en/news/ubiquitous-zones-poland-becomes-a-single->

<sez,334657.html>). Due to the act, entrepreneurs can expect similar privileges as those that invested previously in special economic zones (e.g. tax exemptions). Although not every investor can count on support, there will be incomparably greater freedom in locating investments than before. As stressed by experts, a new act is perhaps necessary to stimulate an investment boom, but it may be insufficient. The biggest mistake would be to consider the subject of investment as "checked off" by this act and to stop creating a friendly business environment, as well as the stable, transparent and predictable legal system. One law, even the best, does not make an investment summer”.

As the National Bank of Poland (NBP) data show, at the end of 2018, Poland's net liabilities due to foreign direct investment amounted to PLN 859.1 billion. They included liabilities from shares and other forms of equity participation in the amount of PLN 653.0 billion and from debt financial instruments in the amount of PLN 206.1 billion. The highest levels of liabilities due to foreign direct investment at the end of 2018 were recorded for the Netherlands (PLN 183.4 billion), Germany (PLN 150.0 billion), Luxembourg (PLN 122.0 billion) and France (77.9 PLN billion). Entities representing manufacturing (PLN 269.5 billion, section C according to PKD), financial and insurance activities (PLN 159.2 billion, section K), wholesale and retail trade together with repair repayments were the most substantial liabilities; rides and motorcycles (PLN 125.4 billion, section G), as well as for activities related to servicing the real estate market (PLN 82.4 billion, section L) as well as professional, scientific and technical activities (PLN 57.6 billion, section M)

In 2018, net inflow to Poland from foreign direct investment amounted to PLN 50.4 billion. It was made up of reinvestments of PLN 37.8 billion in profits and capital inflow from shares and other forms of equity (PLN 11.2 billion) and from debt financial instruments in the amount of (PLN 1.4 billion). The largest inflow of foreign direct investment was recorded from the Netherlands (PLN 31.6 billion), Luxembourg (PLN 7.4 billion), Germany (PLN 6.7 billion) and Malta (PLN 6.0 billion). The most significant divestments (withdrawal of direct investors) concerned Spain (PLN -7.2 billion) and Sweden (PLN -2.5 billion). In 2018, foreign direct investment went primarily to entities dealing with manufacturing (PLN 21.5 billion, section C), as well as the trade (PLN 14.0 billion, section G). An outflow of capital was recorded in the case of entities involved in information and communication activities (PLN -5.4 billion, section J).

According to the figures provided by NBP, last updated September 2019 (mln euro), the total FDI stock in 2018, amounted to 199 789,7 euro (approx. 200 billion) whereas the FDI inflow in 2018 totalled - 11 818,1 euro (approx. 12 billion).

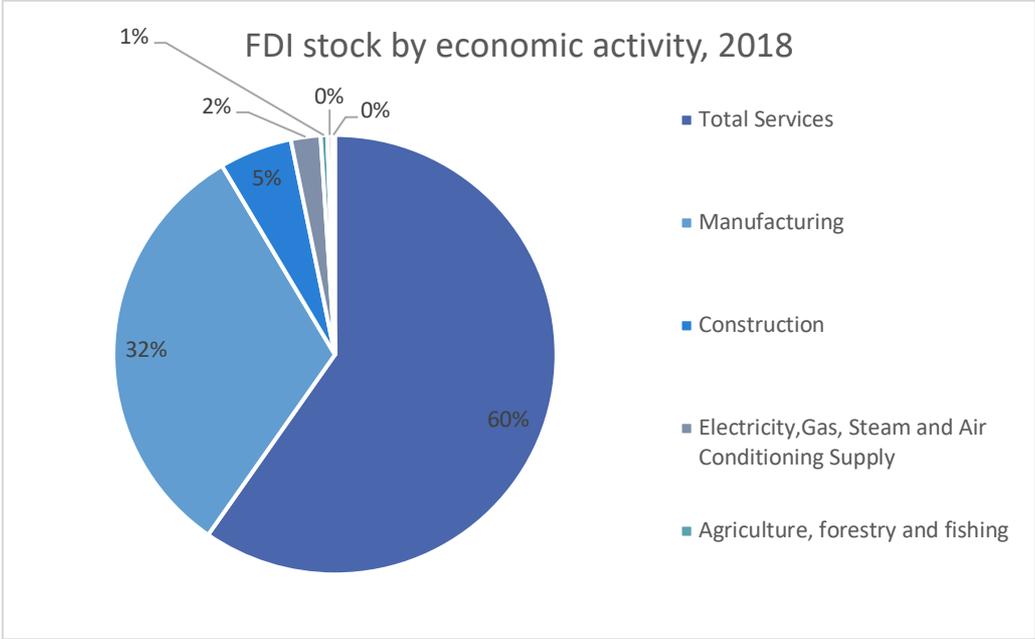
Table 2. Foreign direct investment inward position at the end of 2018 broken down by economic activity of direct investment enterprise (total activities stock, mln euro)

Total Services	117714
Manufacturing	62664
Construction	10489
Electricity, Gas, Steam and Air Conditioning Supply	4265
Agriculture, forestry and fishing	963
Mining and quarrying	655
Water Supply; Sewerage, Waste Management and Remediation Activities	422

Source: own elaboration based on NBP data

As it is presented in Table 2, direct investment enterprises are active mainly in services, manufacturing, construction, followed by sectors of electricity (with gas, steam and air conditioning supply), agriculture (with forestry and fishing), mining and quarrying, water supply (with sewerage, waste management and remediation activities).

Figure 1. FDI stock by economic activity, 2018



Source: own elaboration based on NBP data

Figure 1 shows detailed FDI composition in Poland. Services (60%) and manufacturing (32%) constitute the vast majority of the total economic activity of foreign direct investment enterprise.

Table 3. Foreign direct investment inward position at the end of 2018 broken down by manufacturing type of direct investment enterprise

Manufacture of motor vehicles, trailers, semi-trailers & other transport equipment	12 629
Manufacture of metal & machinery products, except electrical equipment	12 165
Manufacture of food products; beverages and tobacco products	11 736
Manufacture of motor vehicles, trailers and semitrailers	10 314
Total of other manufacturing	10 305
Manufacture of petroleum, chemicals, pharmaceutical products, rubber & plastic products	9 705
Manufacture of basic metals and fabricated metal products, except machinery & equipment	7 986
Manufacture of textiles, wearing apparel wood & paper products; printing & reproduction	6 124
Manufacture of wood, paper & their products; printing and reproduction of recorded media	5 404
Manufacture of rubber and plastic products	4 928
Manufacture of chemicals and chemical products	3 177
Manufacture of machinery and equipment n.e.c.	2 819
Manufacture of other transport equipment	2 315
Manufacture of basic pharmaceutical products and pharmaceutical preparations	1 510
Manufacture of air and spacecraft and related machinery	1 481

Manufacture of computer, electronic and optical products	1 360
Manufacture of textiles and wearing apparel	720
Manufacture of communication equipment and consumer electronics	639
Manufacture of instruments and appliances for measuring, testing and navigation; watches and clocks; manufacture of irradiation, electromedical and electrotherapeutic equipment	153
Manufacture of computers and peripheral equipment	140
Manufacture of coke and refined petroleum products	90

Source: own elaboration based on NBP data

Table 3 shows 21 different manufacturing type of direct investment enterprise. Three most common types are represented by the manufacture of motor vehicles (with trailers, semi-trailers & other transport equipment), manufacture of metal & machinery products (except electrical equipment and manufacture of food products (with beverages and tobacco products).

Table 4. Foreign direct investment inward position at the end of 2018 broken down by services type of direct investment enterprise

Financial and Insurance Activities	37023
Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles	29162
Real Estate Activities	19165
Professional, Scientific and Technical Activities	13406
Information and Communication	10673
Transportation and Storage	2976
Administrative and Support Service Activities	2566
Accommodation and Food Service Activities	1462
Human Health and Social Work Activities	847
Arts, Entertainment and Recreation	285

Other Service Activities	131
Education	17

Source: own elaboration based on NBP data

According to the numbers from Table 4, the vast majority of services types of the foreign direct investment enterprise are represented by financial and insurance activities, wholesale and retail trade (with the repair of motor vehicles and motorcycles) and real estate activities, professional, scientific and technical activities and finally information with communication. These five types account for almost 93% of all services type of direct investment enterprise.

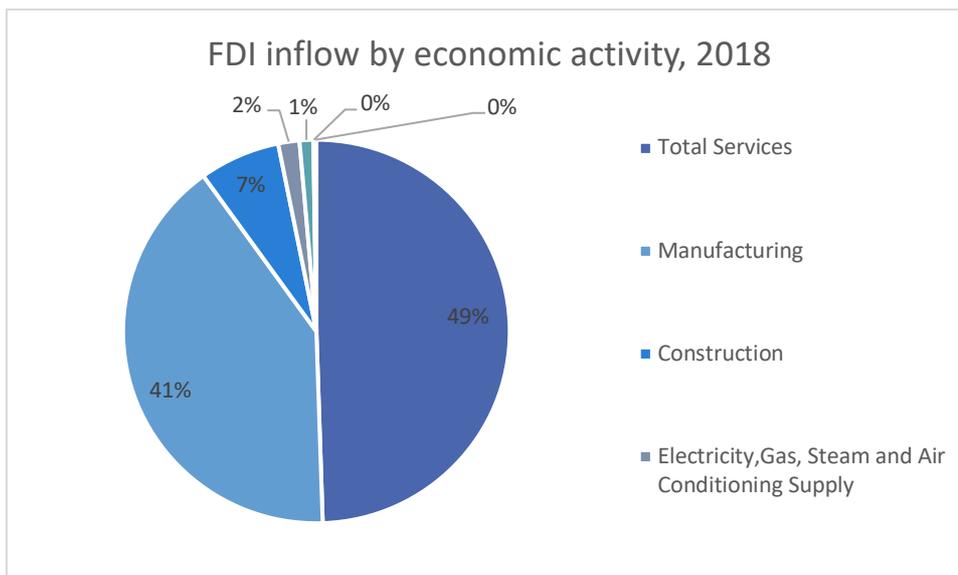
Table 5. Foreign direct investment (inflows) in Poland in 2018 broken down by economic activity of direct investment enterprise / (+) signifies capital inflows to Poland, (-) signifies the withdrawal of capital from Poland

Total Services	6 153
Manufacturing	5 047
Construction	841
Electricity, Gas, Steam and Air Conditioning Supply	221
Mining and quarrying	143
Water Supply; Sewerage, Waste Management and Remediation Activities	12
Agriculture, forestry and fishing	-19

Source: own elaboration based on NBP data

Table 5 demonstrates the capital inflows to Poland, were directed mainly to services and manufacturing. However, agriculture, forestry and fishing are showed as the only cases of withdrawal of capital from Poland in 2018.

Figure 2. FDI inflow by economic activity, 2018



Source: own elaboration based on NBP data

As demonstrated in Figure 2, total services and manufacturing made almost 90% of total FDI inflows in Poland in 2018.

Table 6. Foreign direct investment (inflows) in Poland in 2018 broken down by services type of direct investment enterprise/ (+) signifies capital inflows to Poland, (-) signifies the withdrawal of capital from Poland

Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles	3 279
Professional, Scientific and Technical Activities	1 520
Financial and Insurance Activities	727
Real Estate Activities	639
Transportation and Storage	607
Administrative and Support Service Activities	286
Accommodation and Food Service Activities	165
Arts, Entertainment and Recreation	122
Human Health and Social Work Activities	71
Other Service Activities	3

Education	-4
Information and Communication	-1 264

Source: own elaboration based on NBP data

As shown in Table 6, the vast majority of foreign direct investment (inflows) in Poland in 2018 are directed to the wholesale and retail trade (including repair of motor vehicles and motorcycles) and professional, scientific, technical activities, followed by financial and insurance activities, real estate activities and transportation with storage. These five activities signify the most relevant capital inflows to Poland. However, information and communication accounts for the most significant withdrawal of capital from Poland. Education also but to a lesser extent.

Table 7. Foreign direct investment (inflows) in Poland in 2018 broken down by manufacturing type of direct investment enterprise / (+) signifies capital inflows to Poland, (-) signifies the withdrawal of capital from Poland

Total of other manufacturing	1 249,9
Manufacture of metal & machinery products, except electrical equipment	1 193,3
Manufacture of petroleum, chemicals, pharmaceutical products, rubber & plastic products	868,5
Manufacture of motor vehicles, trailers, semi-trailers & other transport equipment	838,7
Manufacture of motor vehicles, trailers and semitrailers	680,9
Manufacture of basic metals and fabricated metal products, except machinery & equipment	650,7
Manufacture of rubber and plastic products	510,3
Manufacture of food products; beverages and tobacco products	501,4
Manufacture of textiles, wearing apparel wood & paper products; printing & reproduction	395,0
Manufacture of chemicals and chemical products	363,7
Manufacture of machinery and equipment N.E.C.	351,0

Manufacture of wood, paper & their products; printing and reproduction of recorded media	333,8
Manufacture of computer, electronic and optical products	191,6
Manufacture of other transport equipment	157,9
Manufacture of communication equipment and consumer electronics	127,7
Manufacture of air and spacecraft and related machinery	61,9
Manufacture of textiles and wearing apparel	61,2
Manufacture of computers and peripheral equipment	26,0
Manufacture of basic pharmaceutical products and pharmaceutical preparations	15,1
Manufacture of instruments and appliances for measuring, testing and navigation; watches and clocks; manufacture of irradiation, electromedical and electrotherapeutic equipment	13,8
Manufacture of coke and refined petroleum products	-20,6

Source: own elaboration based on NBP data

If we look into the foreign direct investment (inflows) in Poland in 2018 broken down by manufacturing type (Table 7) we see much more fragmented division with 20 different manufacturing type of direct investment enterprise. The largest share in inflows to Poland have a total of other manufacturing and manufacture of metal & machinery products, except electrical equipment. Manufacture of coke and refined petroleum products accounts for the only withdrawal of capital from Poland.

Table 8. Foreign direct investment inward position at the end of 2018 broken down by country and economic zone (geographically stock)

Europe	192 167
North America	4 508
Asia	3 029
Central America	147
Gulf Arabian Countries	108
Africa	9

Oceania and Polar Regions	-16
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Source: own elaboration based on NBP data

Europe holds the position of the undisputed leader as the largest source of accumulated foreign direct investment in Poland at the end of 2018 (Table 8).

Table 9. Foreign direct investment (inflows) in Poland in 2018 broken down by country and economic zone / (+) signifies capital inflows to Poland, (-) signifies the withdrawal of capital from Poland (geographically inflow 2018)

Europe	11 600
Asia	484
Oceania and Polar Regions	4
Africa	-6
South America	-8
Central America	-32
North America	-224

Source: own elaboration based on NBP data

The highest FDI inflows in Poland in 2018 were recorded from Europe and Asia. However, there has been the withdrawal of capital from Poland to North America, Central America, South America and Africa, as it is illustrated in Table 9.

Table 10. Foreign direct investment inward position at the end of 2018 broken down by country - Europe

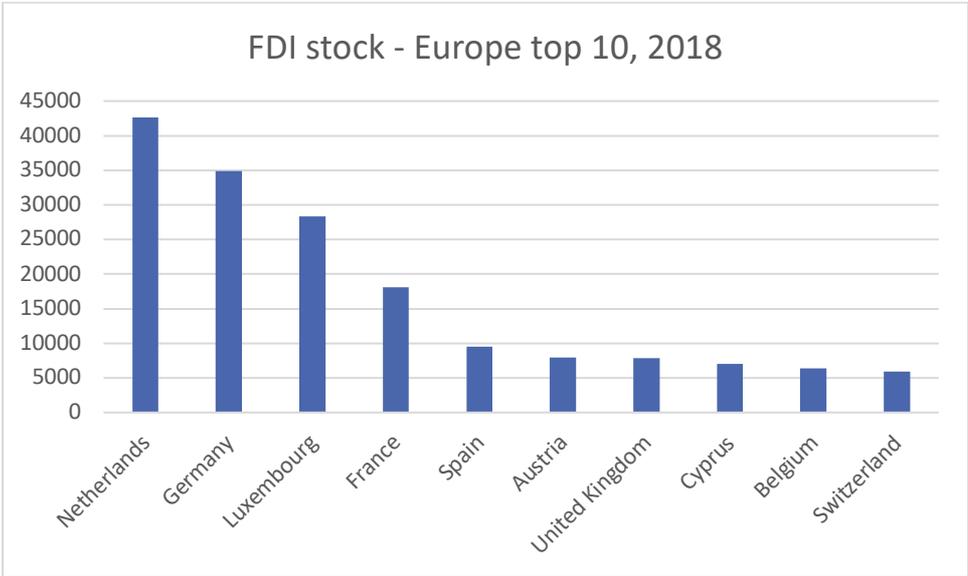
Netherlands	42643
Germany	34869
Luxembourg	28381
France	18121
Spain	9486
Austria	7963
United Kingdom	7886
Cyprus	7018
Belgium	6344

Switzerland	5913
Italy	4899
Sweden	3504
Denmark	3381
Czech Republic	1823
Malta	1788
Portugal	1629
Norway	1535
Finland	1313
Hungary	1286
Ireland	1166
Russian Federation	396
Lithuania	386
Slovakia	386
Latvia	88
Turkey	87
Liechtenstein	81
Slovenia	65
Croatia	50
Greece	41
Estonia	17
Bulgaria	10
Iceland	9
Gibraltar	5
Andorra	4
Belarus	3
Guernsey	3
Jersey	2

Source: own elaboration based on NBP data

If we analyse foreign direct investment inward position at the end of 2018 broken down by European countries (Table 10), we can see that the most influential inward position have the Netherlands, Germany, Luxembourg and France.

Figure 3. FDI stock - Europe top 10, 2018



Source: own elaboration based on NBP data

Figure 3 shows the top 10 countries with the highest inward position in Poland at the end of 2018. Following the three top of the Netherlands, Germany, and Luxembourg, we have France, Spain, Austria, United Kingdom, Cyprus, Belgium and Switzerland.

Table 11. Foreign direct investment (inflows) in Poland in 2018 broken down by country - Europe

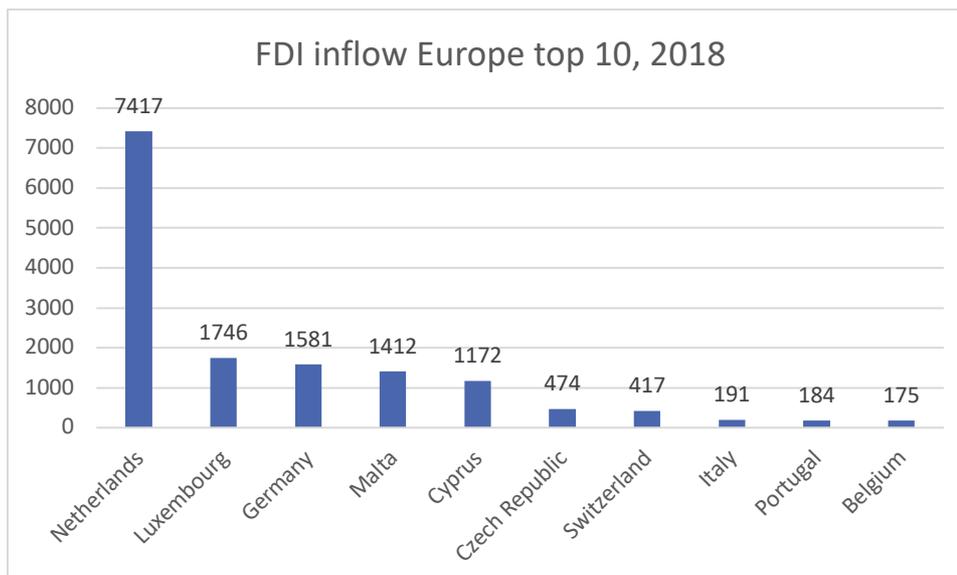
Netherlands	7417
Luxembourg	1746
Germany	1581
Malta	1412
Cyprus	1172
Czech Republic	474
Switzerland	417
Italy	191

Portugal	184
Belgium	175
Norway	153
Slovakia	139
Lithuania	106
Denmark	105
Russian Federation	38
Finland	32
Latvia	14
Belarus	8
Greece	8
Croatia	6
Liechtenstein	5
Jersey	3
Serbia	2
Andorra	2
Gibraltar	1
Bosnia and Herzegovina	1

Source: own elaboration based on NBP data

Table 11 demonstrates FDI inflows in Poland in 2018 broken down by country. Among the 26 different European countries, the Netherlands has the most significant share in FDI inflow to Poland, followed by Luxembourg and Germany.

Figure 4. FDI inflow Europe top 10, 2018



Source: own elaboration based on NBP data

Figure 4 shows the top 10 countries accounting for the highest FDI inflow in Poland at the end of 2018. The Netherlands occupies the first position, followed by Luxembourg, Germany, Malta and Cyprus.

These figures look slightly different when we account for the ultimate owner statistics as published by OECD (<https://stats.oecd.org/Index.aspx?QueryId=64220>) available data stress the fall of FDI stock in years 2017 and 2018 registered in Poland and originated truly from Europe from 176 174 mln \$ to 166 286 mln \$.

Table 12. List of main countries of origin for FDI located in Poland – in descending order as valued in 2018

ultimate owner - total inward FDI position	2017	2018
US dollars millions		
DEU: Germany	47930	45938
FRA: France	23781	23779
USA: United States	25566	23562
NLD: Netherlands	23053	20946
GBR: United Kingdom	13864	11992
ESP: Spain	11721	10647

POL: Poland	10769	9164
AUT: Austria	7723	7530
CHE: Switzerland	6308	6143
JPN: Japan	6168	5313
ITA: Italy	4916	4935
SWE: Sweden	4625	4926
DNK: Denmark	3564	3489
PRT: Portugal	2950	2904
BEL: Belgium	2961	2812
LUX: Luxembourg	2338	2351
FIN: Finland	2209	2029
CAN: Canada	2078	2004
KOR: Korea, Republic of (South Korea)	1747	1901
NOR: Norway	1669	1718
CZE: Czech Republic	1279	1557
ISR: Israel	943	984
CHN: China	848	942
IRL: Ireland	757	872
RUS: Russian Federation	991	792
AUS: Australia	424	699
SVK: Slovakia	659	677
LTU: Lithuania	293	500
IND: India	272	277
HKG: Hong Kong, China	454	276
GRC: Greece	237	227
HUN: Hungary	270	213
TUR: Turkey	112	106
LVA: Latvia	86	103
SVN: Slovenia	71	71
ISL: Iceland	39	45
MEX: Mexico	-8	15
EST: Estonia	18	15
NZL: New Zealand	4	4

CHL: Chile	1	1
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Source: OECD <https://stats.oecd.org/Index.aspx?QueryId=64220>

Companies with foreign capital are already responsible for nearly 60% of Polish exports, and over 60% of investment outlays of non-financial enterprises. Poland benefits from participation in global value chains. Although in 2019, the number of foreign projects launched by the Polish Investment and Trade Agency (PAIH) decreased, their value increased by a record of 2.9 billion euros. In 2019, foreign companies decided to locate 56 investment projects in Poland. This means a significant decrease in the number of commenced investments in comparison with the record year 2018 when there were 71 new projects. However, as PAIH representatives point out, the value of investments is crucial, and last year it increased by as much as one third in comparison with 2018, to almost three billion EUR, or about 13 billion PLN.

## INDUSTRY 4.0 IN POLAND

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As revealed by previously quoted studies, Poland has the lowest share of FDI penetration relatively to other V4 countries. It simultaneously is apparently also the weakest economy in terms of I.40 adoption – classified as hesitator / laggard (De Propriis, 2018; Castelo-Branco, et al., 2018), whereas the other V3 are at least belonging to the group of traditionalists / average club. Yet, Poland pursues the policy aiming at developing the Industry 4.0. In 2018, the Polish Platform of the Industry of the Future Foundation had been established. It is tasked with initiating the debate about the digital business transformation; disseminating best practices, and integrating shareholders (Piątek, Powstaje Fundacja Platforma Przemysłu Przyszłości – najważniejsze fakty, 2018). The Platform for the Future of Industry Foundation is to support entrepreneurs in the area of digital transformation - in terms of processes, products and business models; transformation is to be based on the use of solutions in the field of automation, artificial intelligence, ICT and related technologies. The Foundation is to transfer knowledge, train entrepreneurs and demonstrate solutions to increase the competitiveness of the industry. The platform is also to provide consulting competencies and build a support network. "coordination" appears very often in the aims of the Platform - the organization is to unite different, hitherto separate activities of companies and other entities on the market, it is to act as a "connector" of these initiatives; The Foundation is to coordinate the work of the so-called Digital Innovation Hubs, DIH. Hubs are to operate on the basis of appropriate technological infrastructure (competence centres) and provide companies with access to knowledge and technologies. The assets of the Platform will be the founding fund (grant from the State Treasury amounting to PLN 2 million) and other property obtained or acquired by it during its operation; in the years 2019-2028, about PLN 236 million from the state budget will be

allocated to the Foundation (<http://przemysl-40.pl/index.php/2018/11/08/powstaje-fundacja-platforma-przemyslu-przyszlosci-najwazniejsze-fakty>). The main goal lies in expediting the digitization and robotization of the Industry, also by adequately diagnosing the needs of the industry. Being a unique hub of research institutes, universities, SMEs, public and private bodies, the Platform assist Polish companies in acquiring the relevant technology and coordinating regulatory processes and standardization. It offers training and education (Polska Platforma Przemysłu 4.0, 26-10-2016). Platform foresees stimulating the discussion on the fourth digital revolution. It aims at collecting and disseminating knowledge and spreading and developing new business models. The platform can be regarded as a tool of modern industrial policy, element of reindustrialization strategy facilitating the digital transformation in Poland. Polish Platform borrows from the cluster concept and seems to build upon its attributes. In particular, as it stipulates the establishment of “Centra Kompetencji Przemysłu 4.0” - Centers of Competences of I4.0 in selected cities as well as Incubators of I4.0 Leaders affiliated at Polish technical universities “Inkubatory Liderów Przemysłu 4.0” (Piątek, 2018; Inkubator Liderów Przemysłu 4.0. they disseminate the information, conduct study visits in best-practice companies, conduct seminars and workshops, assure access to demonstration models, or living labs for SMEs, provide consultation and training as well as help firms in the implementation phase. All in all, the Foundation of the Polish Platform of Future Industry is supposed to act as an integrator of various activities related to digital business transformation; coupling finance, expertise and other accompanying services (BIP Rady Ministrów i Kancelarii Prezesa Rady Ministrów, 2018; Piątek 2019). It has been continuously working on developing new instruments which can assist Polish business in digital transformation. The Tool “Direction Industry 4.0” available at <https://przemyslprzyszlosci.gov.pl>, was built taking into account critical aspects of the development of the company. It enables the respondent to identify the stage of company development in several dimensions based on three pillars: Organization, Processes and Technologies. It helps to determine the current state of digital maturity of the company.

Worth mentioning is the Polish Cluster for the Internet of Things Research and Development (Polski Klaster Badań i Rozwoju Internetu Rzeczy) created in 2015, as voluntary cooperation of entrepreneurs, science entities as well as supporting institutions. Under the motto - dispersed, we are weak together we are strong, cluster work on improving the innovativeness and competitiveness in the IoT – The Internet of Things (<http://www.iofthings.pl/en/about-us/>). By facilitating the transfer of knowledge and experience among its members, the cluster aims to exploit fully the potential in the area of IoT.

In April 2018 a letter of intent was signed which stipulates setting up the Chamber of Commerce Industry 4.0 (Izba Gospodarcza Przemysłu 4.0, <http://igp4.pl>). It would be tasked with creating an atmosphere of friendly cooperation between business, science and public administration; representing interest groups before the government, drafting legislative initiatives; evaluating the reliability of the information

provided to the media and supervising information disseminated in the media; partnering with the education sector and building relations among entrepreneurs. New dedicated programme Industry 4.0 run by the Ministry of Entrepreneurship and Technology aims at developing and further buttressing the capabilities (in a set of I4.0 technologies) of Polish digital hubs (consortia of firms, clusters) with expected effects such as information campaign, demonstration practices, education, consulting and implementation assistance (Programme Industry 4.0).

These initiatives are undoubtedly essential elements for successful transformation towards I4.0, but they have to be complemented with robust business ecosystem and local industry.

Buczyńska, Frączek & Kryjom (2016) showed in an Inventory of clusters operating on the territory of Poland that there are in total 134 clusters, established between 2003 and 2015, most of them being relatively young, i.e. founded between 2011 and 2015 (60%). Location of clusters reflects the economic potential of Polish regions as 48% of clusters are located in four most developed regions (according to GDP per capita, 2013): Mazovia (13 clusters), Lower Silesia (11), Upper Poland (12) and Silesia with the highest number of 28 clusters. This suggests that most economically developed regions can offer the best environment for cluster formation and growth. Clusters represent 28 industries/specializations, according to the classification pre-defined specifically for this purpose to make the data analysis possible as the cluster coordinators originally declared a very broad range of business sectors. The most significant number of clusters are active in the following sectors: ICT, energy/renewable energy and construction, as well as in healthcare. The considerable number of clusters represent metal industry, production technologies, tourism and business services. Less than half of clusters (47%) declared having collaboration with foreign partners, and 29% confirmed participation in international networks, cluster associations and/or industry organizations. Key national clusters (krajowe klastry kluczowe - <https://www.gov.pl/web/rozwoj/krajowe-klastry-kluczowe>) have been selected based on a set of criteria aiming at supporting the best performing clusters. This idea reflects the objectives and aims of the Europe 2020 strategy and smart specialization concept promoted by the European Commission. Currently, following two rounds of calls, 16 clusters have been nominated for KKK. This distinction enables further entering into other calls of projects and applying for e.g. assistance for internationalization. These clusters represent various industry sectors such as aviation, IT, life science, construction. None, however, explicitly embodies the Industry 4.0.

In 2017, Rzeszów Technical University, together with local firms, set up an Industry 4.0 cluster (Czwarta rewolucja przemysłowa. Na Politechnice powstał Klaster Industry 4.0; Rzeszów News, 11.10.2017). In another part of the country, in the same year, the Pomerania Hub of Digital Innovations was established which is made up of ten regional companies technology institute as well as the ICT cluster Interizon. Near capital city Warsaw, the largest European living lab – Kampus Nowych Technologii has been established focusing on strategic digital areas such as: smart home, smart building, smart city and

Industry 4.0. Living Labs (LLs) are defined as user-centred, open innovation ecosystems based on systematic user co-creation approach, integrating research and innovation processes in real-life communities and settings. Some of these centres are part of the broader, EU wide initiatives directed to the new EU members namely the Smart Factories project (<https://smartfactories.eu>) and the Digital Innovation Hub (DIH) support facility (<https://ec.europa.eu/futurium/en/implementing-digitising-european-industry-actions/digital-innovation-hubs-smart-factories-new-eu>). Smart Factories is the project managed by the EC to support the European Parliament with the implementation of a network of Digital Innovation Hubs (DIH) which are supposed to act as a one-stop-shop, supporting companies in the digitization of their business.

Summing up, the Polish “digital” institutional landscape is diverse and encompasses various less or more formal initiatives such as I4.0 cluster, IoT cluster, Pomerania Hub, living-lab village, Chamber of I4.0, governmental Platform and foundation as well as dedicated 30bln PLN worth programme of the Ministry.

The interest in Industry 4.0 has been gaining popularity. It revolutionizes the production strategies of enterprises, yet it is a relatively poorly recognized scientific concept. As stated by Młody & Weinert, (2020), in contrast to the available foreign publications, the analysis shows the lack of an analogous outcome on the Polish market. Nevertheless, there is a growing body of reports dedicated to the fourth industrial revolution and digital transformation. They describe and discuss the maturity levels and readiness of Polish firms to face I4.0, as well as diagnose major threats and opportunities arising. Młody & Weinert (2020) argued that most Polish studies on I4.0 applied descriptive approach, not empirical research, which made it difficult to reach any clear conclusions.

There seems to be neither analyses touching specifically upon the application of concrete concepts, methods, and tools related to Industry 4.0, nor studies on the consequences of I4.0 implementation at the micro-, meso-, and macro-levels.

Pilot research carried out in the Czestochowa Industrial District demonstrated that for SMEs the financial resources and lack of specialized support in accessing new technologies were main problems in the implementation of digital transformation (Ingaldi & Ulewicz, 2019). The possible remedy could be the development of a platform focusing on integrating the firms’ potential in order to carry out joint actions. Firms want to become more I4.0 mature, but they often cannot afford it.

Key findings of PSI Poland: Polish production-ready for Industry 4.0? (<https://www.psi.pl/pl/blog/psi-polska-blog/post/polska-produkcja-gotowa-na-przemysl-40/>) are:

- More than half of manufacturing enterprises in Poland are familiar with the fourth industrial revolution
- Many companies have started to implement technological solutions in this area.

- Firms have quite specific business needs and emphasised the awareness of which areas of their business activity need to be optimized
- There are various barriers to the implementation of new technologies

PSI Polska carried out market research which covered large and medium manufacturing companies. As part of the study "Readiness of manufacturing companies to implement Industry 4.0 solutions", telephone interviews with the use of CATI technology were conducted among decision-makers from 228 companies operating in four sectors: machinery and equipment, cars and transport equipment, furniture and metal products.

According to the survey, the term Industry 4.0 was known by more than half of the companies (52%). Greater knowledge of this concept was shown by large producers (62%) than the average (41%). As many as 70% of companies knowing the concept of Industry 4.0 planned or started to implement solutions that are a part of it. Large companies were the leader here because over 3/4 of them (77%) took such actions.

A relatively small percentage of implementations of advanced IT solutions does not inspire much optimism. Industry 4.0 requires advanced IT tools, of which some companies are already quite aware, but this does not always translate into real implementations and changes.

When asked about the most strategic solutions in the area of Industry 4.0, the surveyed companies reported advanced IT systems in the first place - they were indicated by 57% of the surveyed entities in general, including as many as 70% of large companies.

As the second key solution in the field of 4IR (fourth industrial revolution), companies indicated technologies enabling cooperation between people and robots. Their importance was appreciated by 52% of the surveyed, 22% of enterprises have already implemented them, and almost 1/4 planned to implement them within the next 2-3 years.

At the same time, the low position of other areas of Industry 4.0 is puzzling. 24% of respondents considered Artificial Intelligence as a strategic solution, and Big Data technologies only 8% considered it even worse in the area of implementation of these technologies - their use was declared by 1% and 4% of companies, respectively. In an era where artificial intelligence is already appearing in many aspects of our lives - for example, in our daily smartphones - it seems like neglecting this significant trend seems to be big negligence.

The declared plans to invest in new technologies may be a source of great optimism. 60% of all surveyed companies implemented or planned to implement IT systems, while large manufacturing companies more often than average declared investments in IT systems in order to optimize production (78% to 41%). The greatest motivation to implement new technologies for the surveyed companies was the willingness to increase production efficiency.

The most frequently indicated barrier in the implementation of innovative solutions was the resistance of users - over half (53%) of respondents indicated this factor as the most significant barrier in the implementation of technology. Producers also pointed to financial issues - lack of sufficient funds was ranked 2nd among obstacles.

Key findings of report Siemens / MPiIT / Kantar: Smart Industry Poland 2019 (<https://publikacje.siemens-info.com/pdf/594/Raport%20Smart%20Industry%20Polska%202019.pdf>) are:

- Most engineers believe that technical staff should take on the responsibility associated with the role of the leader of changes in manufacturing companies.
- According to the employees of small and medium-sized industrial enterprises working as engineers, it is their profession that will gain in importance and set the tone for the changes that will support their company's competitiveness on the market.

In the first half of 2019, Siemens in cooperation with the Ministry of Enterprise and Technology completed a comprehensive survey "Smart Industry Poland 2019". It was carried out by KANTAR Polska on engineers working in companies from the SME sector located in Poland. Also, the perspective of the latter - various engineers - is the axis of the research and the presented conclusions.

At present, engineers do not see any radical changes in the digital transformation at the level of individual requirements or challenges they will have to face. Engineers do not feel that the changes aimed at transformation have a significant impact on the employer's expectations for digital competences, for example. On the one hand, this may mean believing in existing competences or being able to acquire new ones easily and quickly, while on the other hand, it cannot be excluded that some engineers are not fully aware of what kind of new qualifications will be needed for a full digital transition. Already today, the profession of an engineer is inextricably linked with the expectations of a creative approach to issues and finding new solutions. 70% of engineers declare that the companies they work for are expected to submit new ideas on production technologies or the use of digital solutions and to propose product innovations. More than 60% of those surveyed say that engineers are also expected to be creative when it comes to managing communication and information within the company.

In almost half of the companies (49.5%), the management of change, initiation and implementation of innovative solutions is spontaneous and is done by people not assigned to a specific, dedicated department. However, a significant percentage (37.5%) of enterprises run specialised departments dedicated to change management and innovation implementation. This is more often the case in medium-sized companies. However, the still-dominant strategy of innovation implementation in companies is to undertake ad hoc activities dictated by current needs and implemented within the scope of current opportunities. Systemic measures were declared by only 19.5% of respondents.

Barriers to the development of Industry 4.0 are primarily related to access to adequately educated human resources. This is understandable in view of the high expectations placed on engineers in terms of interdisciplinary competences. However, more than 50% of respondents considered the current education system to be inadequate to the requirements of an innovative industry. Senior engineers are of a worse opinion, which may indicate their disappointment with the level of preparation of graduates starting their careers.

Engineers are aware of the changes taking place within their profession, which move towards leadership in organizational change. Engineers are already expected to have interdisciplinary skills. The distinguishing feature of future competences is the combination of technical skills (the acquisition of which requires a solid education), character traits (more difficult to exercise) and soft skills, which need to be learnt using different strategies than in relation to strict knowledge.

Even companies that are aware of the importance of competence and knowledge are doing a lot to internalise and retain it. This happens mainly through the training of young staff, but also through the development of formalised documentation.

Among the different competencies of an engineer, the most important were technical skills, requiring knowledge and understanding of the production process (93% of indications). Personal skills (89%), consisting of analytical thinking, problem-solving, as well as personal attributes such as readiness to learn, are not much lower down the ladder. Over 80% of respondents considered social skills related to communication and cooperation with other people, understanding their needs, leadership and establishing and maintaining business contacts to be definitely essential or somewhat important.

Key findings of report IDG/ABB: Industry 4.0 in Poland: Strategies and Leaders Missing ([https://resources.news.e.abb.com/attachments/published/26874/pl-PL/D90B088210B7/ABB\\_RAPORT\\_GOSPODARKA40.pdf](https://resources.news.e.abb.com/attachments/published/26874/pl-PL/D90B088210B7/ABB_RAPORT_GOSPODARKA40.pdf)) are:

- Polish enterprises are at the beginning of the road to Industry 4.0 - innovation and the level of process advancement are low, and only a dozen or so percent of enterprises have a plan indicating the vision and objectives of activities
- The essence of Industry 4.0 is an advanced data analysis and its use in the process of company management.

The survey "Towards the Economy 4.0", which was conducted by IDG - the publisher of Computerworld magazine - in partnership with ABB, involved 108 respondents from companies operating on the Polish market. 48% of entities originated from the SME sector, while the remaining 52% were large companies and corporations employing more than 250 employees. The most numerous were companies from the sectors of industry, production and extraction (40%), FMCG and trade (15%), telecommunications (10%) and the broadly understood public utility sector (8%).

The survey shows that only 14% of enterprises have a strategic transformation plan for measures within Economy 4.0 and have started to implement it. Almost half (48%) declare that activities related to digitalization of manufacturing processes are not supported at the enterprise strategy level, although smaller projects are carried out in this area. And what is most worrying - more than every fourth company (27%) does not intend to conduct any activities related to the broadly understood Economy 4.0.

Having a plan is essential. The conducted research shows that 19% of Polish enterprises do not intend to prepare a strategic plan at all. According to experts, a firm anchoring of activities at the level of the strategic transformation plan may determine the success of projects related to digitization and automation. At the same time, the strategy of such a transformation should clearly indicate the responsibility of specific individuals. It turns out, however, that almost every third company (30%) did not appoint a person who would be responsible for actions in the area of the changes mentioned above. Labour costs are rising, and this means that companies must pay more and more attention to production and labour efficiency, which should be supported increasingly by robotisation and automation. Although at least a few pessimistic conclusions can be drawn from the study, experts believe that the future does not have to be dark. The Polish industrial sector may follow the path of the financial or telecommunications sector. These, because they were lagging behind at the time of the transformation, have implemented the latest solutions and are today among the European leaders in terms of digitisation and accessibility of services.

Key findings of report and conference Autodesk: Industry 4.0 is Innovation (<https://www.autodesk.pl/press-releases/2019-05-10>) are:

- For most survey participants, the idea of the Fourth Industrial Revolution is an important topic
- The factor determining the competitive advantage of enterprises is, first of all, innovativeness.
- Industry 4.0 is a concept that changes the way businesses operate. It combines three elements: the real world of production machines, the virtual world and information technology. Unlike previous industrial revolutions, the current one is progressing at a much faster pace. This is because each new technology gives rise to a newer, even more, efficient one.
- Digitalization of industrial and business processes is inevitable. Polish industrial companies are facing an opportunity to dynamize their business. It is worth noting that only few conference participants asked to evaluate the degree of implementation of Industry 4.0 technology in their companies described it as high (7.9% of respondents), or above average (12.9% of respondents). The most significant number of respondents (34.7%) described the level of implementation as a medium.

- As many as 94.1% of respondents to the survey conducted during the event considered the fourth industrial revolution to be an essential topic for them.
- During the meeting, participants were asked about the opportunities that Industry 4.0 can offer to their enterprises. Almost 2/3 of respondents expect "rapid changes" and more than half "making production more flexible". In the introduction of solutions compliant with the Fourth Industrial Revolution, companies also see the possibility of revenue growth (36.6%). Nearly one in three respondents expects greater customer satisfaction and increased profitability of their operations.

How the undergoing / looming transformation affects foreign firms? The Polish Volkswagen factory will significantly increase production automation, but will also reduce employment ([https://moto.rp.pl/biznes/31391-volkswagen-poznan-wyklada-2-mld-zl-ale-szykuje-zwolnienia?utm\\_source=rp&utm\\_medium=teaser\\_redirect](https://moto.rp.pl/biznes/31391-volkswagen-poznan-wyklada-2-mld-zl-ale-szykuje-zwolnienia?utm_source=rp&utm_medium=teaser_redirect)). The German company invests PLN 2 billion in 2019 and 2020 in the expansion and modernization of plants in Wielkopolska region. VW, which is the largest producer of vans in Poland, has built a new logistics hall, will expand the welding hall and radically increase the level of automation in preparation for starting the production of a new car in mid-2020. The assembly of 450 new robots at the welding department is expected to increase the level of car body automation from the current 42 to 80 percent, as is the case at the VW Crafter factory in Września. The robotization and modernization of the plant, in particular the welding plant, will reduce the production time of the car and contribute to the reduction of costs - explains Jens Ocksen, president of Volkswagen Poznań, quoted by Rzeczpospolita (Woźniak A., 2019, [https://moto.rp.pl/biznes/31391-volkswagen-poznan-wyklada-2-mld-zl-ale-szykuje-zwolnienia?utm\\_source=rp&utm\\_medium=teaser\\_redirect](https://moto.rp.pl/biznes/31391-volkswagen-poznan-wyklada-2-mld-zl-ale-szykuje-zwolnienia?utm_source=rp&utm_medium=teaser_redirect)). Last year was record-breaking for the company; production reached 266.8 thousand cars. The maximum production capacity will not change, remaining at the current level of 750 cars a day. However, in addition to reducing costs and reducing production time, they will now allow the production of new generation cars. Their design and materials used, and therefore technological considerations, exclude the possibility of making some joints manually, so far. Another benefit from the investment is the improvement of working conditions. Thanks to automation, the company wants to reduce non-ergonomic positions significantly. VW assumes that after the investment is fully completed, the Poznań factory will operate in accordance with industry 4.0 standards. Automation at the level of 80% is to bring Poznań closer to the efficiency of other concern's plants and improve its competitiveness. At the Wolfsburg factory producing Golf, robots perform 95% car body construction work. In the Spanish Pampion, where Polo is created – 100%. So far, nearly 450 employees have been trained, especially those who have previously held the positions of manual welding and welding. In the extended welding hall, they will be operators of machines and

devices. In addition to automating production, changes will also take place in the administration. It's about using two tools - on the one hand, RPA (robotics process automation) programs that will perform repetitive, monotonous activities. On the other - the use of intelligent technology, capable of making decisions and learning. This will increase the requirements for future employee qualifications. However, the consequence of automation and digitization will be redundancies. By the end of 2020, employment in the company is expected to decrease by 750 people. Therefore, a total of PLN 15 million was planned for training and retraining by 2021. However, the company's management believes that dismissed employees should not have trouble finding a new job. According to industry representatives, growing automation is the result of, among others the need to increase production capacity, improve production flexibility or fill staff gaps. However, growing automation will require ever-higher employee qualifications. If you want to work in the automotive industry in the future, you must educate yourself better.

In contrast to dependent market economy (DME) literature, which argues that Central and Eastern European economies serve primarily as assembly platforms for multinational corporations and try to meet their demands, Markiewicz (2019) explains that CEE states have done much more than merely accommodating the interests of foreign investors. An analysis of the automotive sector in Poland reveals that the Polish state engaged actively in industrial policy to shape the profile of automotive production and to improve the country's position in the automotive value chain. Instead of waiting for MNCs to establish backward linkages, it nurtured the rise of a supply industry with forward linkages in the automotive value chain, thus decreasing Poland's dependence on lead MNCs. Moreover, this paper finds that while EU integration limited policy space for development, it also offered new developmental opportunities, which Polish state actors used to improve the international competitiveness of the sector.

Experts remain optimistic and predict the role of FDI / MNEs as integrators not abandoning current investment. Zbigniew Piątek, (przmeysl4.0.com, APA magazine) foresees the changing role of automatization providers due to the need of providing very complex solutions – not just selling products plus after-care but actually being an integrator – simultaneously adviser, assistance, designer etc. German firms are providers of automation (Siemens, Beckhoff Automation, Pilz, Phoenix Contact, WAGO, Weidmuller) for Polish receiving them as customers and using these solutions. Automatization and Industry 4.0 mean radically new business models – modes of organising production processes! and this has implications for international economic cooperation because it requires the ability and skills to evolve into a more complex and advanced yet agile role. Products must have certain functionalities and in fact, be part of the broader solution product service software. Risk of being replaced is low as in this are it is not common to switch to new providers that easy, usually cycles last 20-10 years. FDI and previous relations have been crucial for Polish firms, which are already embedded, highly interlinked

with German companies; all are mutually dependant, intertwined not easy to replace as the case of VW plant in Września epitomise. Interoperability remains crucial, as there are no standards universally accepted (like ISO, DIN), what matters is, however, risk of emergence of national silos.

## SURVEY RESULTS - EFFECTS OF INDUSTRY 4.0 ON FDI IN THE VISEGRAD COUNTRIES

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We have conducted 16 interviews with seven experts, five scholars and four 4 companies in December 2019 – March 2020. Our sample encompasses persons representing academia, business and public authorities; from small and large firms such as IBM, Microsoft, governmental bodies – e.g. PAIH, as well as Polish universities.

To preserve the anonymity, we coded them as “B” for Business, “A” for academia and “E” for other experts (like representatives of public authorities, governmental bodies or think-tanks).

All phone call interviews were taped, and the interviewer took notes. As stressed by Maxwell (1996) quoted by Osarenkhoe, Fjellström, Abraha, & Awuah (2018), *“the main threat to valid description, in the sense of describing what you saw and heard, is the inaccuracy or incompleteness of the data. The audio/video recording of observations and interviews, and verbatim transcription of these recordings, largely solves this problem”* (p.89). To assure confidentiality, all respondents remain anonymous.

As suggested by Miles & Huberman (1994) analysing collected data should be done in three steps starting with data reduction, followed by data display, to final conclusion-drawing and verification. First analysis began already with the transcribing the interviews. Thanks to data display, obtained information and insight were compressed to extract the appropriate conclusions and then to give the findings proper structure (Osarenkhoe, Fjellström, Abraha, & Awuah, 2018).

### 14.0 UNDERSTANDING IN THE EYES OF INTERVIEWEES

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Experts point out that although the topic of Industry 4.0 is vital, it is wrongly associated and lacks reliable information (E7). *“Industry 4.0 has recently gained media and public opinion attention but is still poorly understood. Industry 4.0 is not only about mechanisation, robotisation and automation - and this view dominates - it is about far-reaching digitisation and integration”*. As far as the definition of Industry 4.0 is concerned, there are waves. The first wave was in 2011-2015, and then the understanding of Industry 4.0 was about technology - technology dominated the concept of Industry 4.0 - cyber physical systems, increasing productivity, improving efficiency were in focus. The second wave was basically after 2017/18, when attention was focused on business models, on a holistic view, on the value-added chain; on the effects not only of production itself but also in post-production, after-sales, distribution,

marketing and so on. In fact, from 2020 we have the third wave and, as the European Commission's industrial strategy for the European Union assumes, Industry 4.0 is a mean for sustainable development; an instrument that enables sustainable economic growth while preserving environmental and demographic objectives. In other words, in successive waves, albeit in the short term, we see the evolution of the understanding of Industry 4.0 from pure technology through business models to the instrument of sustainable development.

*As put by one professor (A5) "I have been observing what has been happening in the field of Industry 4.0 for several years now, and looking at conferences, symposia and academic talks, one can conclude that there are two understandings of the term Industry 4.0. The first one is broader and identifies I4.0 with processes emerging in the wider economy (trade, sale, production) - all improvements, which de facto means that we are talking about the economy 4.0. And the second understanding of I4.0 in its strict sense draws attention to the technology, the way it is integrated with data from the market, with management data, which allows us to achieve completely different effects in the form of new products, etc."* There is a need for early diagnosis of what Industry 4.0 is in order to have a clear discussion. There is a lack of systematic terminology, and the academic world calls for a specific ontology of Industry 4.0. Scholars stress that *"Industry 4.0 is not only the technology but above all utterly new business models. Industry 4.0 turns these models "upside-down" (A1)*. New applications appear, new systems and new professions emerge, and the old ones die. It happens quickly and brutally, these turns and twists, and changes are incomparably more significant than in the past. The word Industry 4.0 does not reflect the specifics of the issue entirely, as companies build new value based on e-commerce, matchmaking platforms, using completely other business models.

Hence, the I4.0 is both the technology plus the new business models. It assumes innovation and therefore, new ways of value creation and capture. *"I.40 can be defined as a technological revolution on the scope and scale not seen before in the history of humanity. It is helpful but disruptive, with consequences difficult to predict" (A2)*. It is changing all aspects of our life, aspects of functioning our economies and societies. It promises much, but also brings challenges and threats, as it used to be before with previous revolutions. Particular structural shifting, repositioning would inevitably happen. Benefits will materialize on the micro - company level and the national level. New avenues of value creation, new products and services, new business models seem the most critical benefits.

Hence, undoubtedly, I4.0 is more than technology; it means integration and a new way of cooperation, even closer than the "just in time" idea assumes (E2). *"The debated concept of "procurement 4.0" also enforces specific standards (raising sub-suppliers)"*. Further in-depth integration and interoperability are vital. This changes the bargaining power of subcontractors and their market position. In the case of automotive, it is electromobility. This transformation is a severe reshuffle and for many companies, the need for radical re-engineering – reprofiling and discovering themselves anew (e.g. manufacturers of

internal combustion engines). To adapt to the new regime imposed by the leading corporation is not only an opportunity but also a must for existing partners is

Experts also highlight the sequential aspect of I4.0. (E4) *“First of all, I4.0 is a new technology, and it is all about using sensors, AR, or 3D. This technology affects the structure of the factory, and it can be compared to the changes introduced by the electrification. Thus, I.40 is in the first place new technology, but its application causes reconstruction of the whole cycle and production process”*. This cross-linking, the sensors' connection of devices makes the setting of the whole process adjust; consequently, the business model is modified. These initial technological changes, resulting in new models, require significant changes in human resources policy, education and training. Experience, e.g. in Germany, shows that such adjustment is time-consuming, that the introduction of I.40 requires a whole package of parallel changes.

The benefits of I4.0 are first and foremost an improvement in efficiency and the possibility to adapt the production offer to individual needs – mass customisation. The final benefits and their importance will depend on the sector and its specificity. Many manufacturers particularly value predictive maintenance. These technologies allow optimizing the production cycle by better anticipation of failures, predicting necessary overhauls, which minimizes possible downtime.

A complementary factor in the introduction of I4.0 is intangible capital, additional training, expenditures on R&D and software. Success in the implementation of I.40 requires several parallel changes in the whole package.

If we understand the I.40 narrowly in the sense of technology, this will most probably modify the central stages in the value chain, i.e. production itself. If we adopt the "business model" approach, then also the first and last stages of value-added creation will be modified.

The original definition of Klaus Schwab a few years ago sees I4.0 as a set of different technologies. This is a very capacious term for many, still too abstract. As stress by business representatives (B4) *“As life examples show, until entrepreneurs see concrete benefits, it is difficult for them to convince themselves to implement these technologies”*.

In fact, I4.0 is a physical world that merges with the digital world; as a result, entirely new processes are formed. Digital components become inextricably linked to products and services. Industry 4.0 is a breakthrough technology that transforms the market - new players emerge; others fall out.

Summing up, experts (E5) argue that *“Industry 4.0 is more than technology, it's a start for society 4.0 or even life 4.0 is a megatrend that transforms whole societies”*.

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#### I4.0 DEFINITION BOX - KEY TAKEAWAYS

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Key points of I4.0 impact on FDI in V4 in the opinion of interviewed experts (\*as interpreted by the Authors)

**Misconceptions** about the I4.0 – **the evolution of understanding** from technology allowing efficiency gains, through business models and new value creations to the critical economic and societal instrument of sustainable growth

Need for precise I4.0 related **terminology** – the ontology of I4.0

Need to **redefine** major underlying concepts; to **revise** basic measures, indices – “what the industry is”? “what the investment is?”

I4.0 as a revolution that lasts - "**evolutionary revolution**" requiring the cooperation of stakeholders (“unifying revolution”)

I4.0 as unprecedented **shift of technologies** and business models promising much **benefits but with risks** attached

I4.0 as a set of **technologies** causing significant business models changes and requiring far-reaching **interoperability and compatibility**

Implementation of I4.0 is based on technological changes **which induce modification** of business models and the whole **functioning of companies**

I4.0 understood as **the set of technologies** which indeed **disrupt and transform** markets are game-changers with scope, scale and speed of modifications being **colossal**

I4.0 is a **significant trend**, but it will **co-exist** and modify economic activity together with others, e.g. environmental trends, climate protection (development of electromobility, etc.).

I4.0 as **mega-trend** influencing the whole **life**, society 4.0. Technology **sovereignty** critical aspect and the EU needs to hammer out joint position.

#### I4.0 IMPACT ON MNES & FDI IN THE EYES OF INTERVIEWEES

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Most scholars tend to agree that “*No clear dominant strategy of MNEs can be discerned now*” (A2). Different trends coexist. On the one hand, MNE will keep the most crucial elements defining their competitive advantage at home. On the other hand, they will find it reasonable to share technology with foreign subsidiaries and with partners. Unclear remains to what extent they would do this. What would be the outcome, the balance and relation between these tendencies? An important issue that emerges is namely if these new technologies (AI, AM, RV) are in possession of few large MNEs etc., or instead in the hands of more actors, dispersed and more readily available? Crucial would become to safeguard the spillovers effect of this incoming technological solutions. It can imply huge chances of SMEs and more democratisation of productions.

Still, the contradictory opposing tendencies might coexist – R&D activities being reshored back home or new technologies further transferred and spread to foreign partners. Nevertheless, it must be noted that these reshoring processes are not only due to automatization but also caused by trade policies, protectionism, etc., As there are also other reasons why such different tendencies coexist. In general, there is no clear dominant strategy, but slightly different trends simultaneously happen.

Besides, as stressed by scholars (A2), *“FDI was always footloose – the old concept of “flying geese” presumes the risk of relocating first from Europe to Asia, now from China and India to Vietnam and Myanmar. In general, various set of costs need to be accounted for, and this is a decisive factor of where to go or whether to stay”*.

Host economies depending on FDI would value mainly the technology obtained thanks to FDI as this would translate into economic growth.

You need to combine two perspectives: MNEs and host countries. From the point of view of MNEs, they used to keep R&D at home. The competitive advantage is built on technology, recently, however, they move much of these valuable activities abroad, to source foreign talents. Hence, FDI is more and more about technology and know-how transfer. Yet from the perspectives of the host location, the question arises if receiving these modern technologies which lead to economic development can only happen thanks to FDI or are there alternative ways of acquiring technologies?

Some democratisation of production (technology application) might be expected. The key issue remains whether FDI would stay as they have been so far the key and only channels of transferring the most advanced technologies - whether they would become the single vehicle of I4.0 or may host location draw on alternative sources and channels? If yes, then the next crucial aspects would be the readiness to absorb them, to fully benefit from them and make them work for the whole economy. Hence, issues such as interoperability, similarity or maturity levels of firms would determine the chances to benefit from I4.0. We cannot forget that all these modern technologies I4.0 promise all, what constitute the classic advantages in the economy, i.e. more sale, lower costs, higher efficiency, lower waste, more production etc.

Experts agree that *“Modern digital technologies would change the profile of some firms – with emerging new purely digital technology service companies and it would allow the optimisation of production in classic brick and mortar firms”* (E1). Though, they also stress, that *You need to be careful when assessing the impact of I4.0 or digital transformation on certain investors decisions and differentiate causality from some correlations or simply coexistence of some trends*.

There is no single answer as to which way I4.0 will go or what consequences Industry 4.0. will have on the behaviour of transnational corporations and their investments (A5). Global companies that have huge budgets, digital mature and aware executives and the whole stock of necessary factors can enter I4.0 immediately and colonise the entire value-added chain as pioneers. They are likely to be reluctant

to share their knowledge, their technologies because this is their competitive advantage. But there are also new hidden champions who can connect to existing chains and offer something unique in value. In fact, both tendencies coexist - sharing know-how with the willingness to keep it for themselves in order to maintain a competitive advantage. Scholars reckon, that (A5) *"From our Polish perspective, it is necessary to build the awareness among the managerial staff, to incur huge expenditures on new technologies, but also to be able to plug into the new infrastructure. Only some of the Polish companies have already made the necessary investments, have scaled up, have the right managerial staff and can operate in these realities"*. Transfer I4.0 through MNEs is undoubtedly an opportunity for Polish staff to learn about new solutions, to get used to further processes. Still, in general, I am sceptical about complete automation and replacement of people with robots. What is going on is a partial quasi or light automation, i.e. some augmentation of the employee's work (augmented) and creation of a cobot, i.e. cooperating robots.

The 21<sup>st</sup> century is a century when a fetish becomes an increase in efficiency, and I4.0 seems to give such opportunities. By the end of next year, the European Union is to work out an intra-EU regulation which concerns the obligation for companies to make data available anonymously for the need to develop databases necessary for machine learning and the development of artificial intelligence. Because only thanks to accessing to databases and the possibility of better machine learning, we can move to a higher level of Artificial Intelligence. So far, Poland is a recipient of I 4.0 solutions; we ourselves, if we only test these technologies to a small extent, e.g. thanks to projects with NCBIR, but rather do not offer much; we are a recipient and not a provider of I4.0.

In the medium term, small and medium enterprises connected so far to the networks of global leaders should not be afraid of some overturning of their position or drastic changes. In the long term, however, new models will emerge, a completely different way of functioning, value creation and a sequence of actions aimed at simplifying and integrating activities. This is a challenge for existing partners. In general, in the medium term, large companies want to provide opportunities for cooperation with small, medium-sized existing partners, but this means that huge investments are needed to change the mentality of managers and the ability to be served by appropriately qualified employees. For many small and medium-sized companies in Poland, this is a considerable difficulty; it is an obstacle that they are not able to jump over. For branches of foreign companies in Poland that deal with SSC/BPO business-related services, RPA, which will allow replacing simple activities performed by people through appropriate algorithms may be a severe threat in the long run. As representatives of the industry say, employees are not yet laid off, but no longer employed - the slowdown in employment is evident.

The only way out of this challenging situation is to focus on handling more complex, more complicated processes. In this way, the risk that the headquarters will decide to move the activity to a cheaper location or replace it with a robot decrease. Only in this way, by focusing on servicing very complex and

demanding processes, we are still able to remain an attractive location for business-related investments.

It seems that the most susceptible to digitisation are instead the last stages of the value-added chain - marketing and sales or after-sales service because it is the most natural place to implement new solutions. The production area offers the most considerable benefits in the long run but requires a substantial scale of costly investments.

Experts also draw attention to the fact that (E2) *“Under these conditions, not only new technologies but also access to databases seems to be key and will determine competitive advantage. Besides, access to capital will continue to play a role - new technologies require huge funds, and they will determine competitiveness”*. This capital intensity will also force concentration or consolidation. However, for countries such as Poland, there is a risk that it will *“become expensive before becoming rich/developed”*. Added to this is the risk of new competitors emerging, new rivals in often new areas of growing importance. However, this is also a chance for many small businesses, agile ones, to find new niches for themselves, reorient their profile.

The popularity of solutions is essential, and new technologies should spread across the market. It is in the interest of leaders to share knowledge so that network effects can occur. But this is accompanied by opposing consolidation processes; taking over functions previously outsourced, e.g. VW battery production. It is difficult to say which methods will prove to be dominant.

Contrary to appearances, robotization and digitization require staff. The need for highly qualified employees, mainly engineers, will prove even more critical. This is already visible, e.g. in Germany, where staff shortages in certain areas are a significant problem. Besides, the decision to backshoring is difficult due to the scale of involvement in a given market, often the sunk costs. This scale and scope of activity – path dependency - despite the disappearance of certain advantages do not allow to leave the given market and return to the home country. The more as that changes of international order also imply requirements regarding the country of origin (e.g. renegotiating NAFTA and the requirement of origin of components). For *Mittelstand* CEE companies, it will remain an attractive market; the risk of backshoring is small.

Despite these changes, the approach to investment evaluation will not change drastically. The number of jobs created, or the value of capital employed will continue to be assessed. When calculating possible deglobalization, there is, of course, the risk of emerging, e.g., three major global economic centres, i.e. the USA, the EU and China.

Each type of investment seems affected by the changes under the influence of I4.0 - R&D centres work differently, but also the communication channels with clients are entirely different than before (pre-sale of cars on the Internet).

Centres in time of digital transformation will probably dominate, but the growing competition between the periphery itself may be an essential phenomenon. Their situation may prove difficult due to capital shortages.

Scholars also point out that (A4) *“Crucial remains what kind of FDI have been located so far? If only these which can be easily automated, then the risk is higher”*. Most likely, however, the kind of current linkages organised along the GVC and Germany as a hub would continue, investors would not withdraw so fast, overnight, so to say.

As it seems both types of strategy will be applied as investors would share some portion of knowledge - as much as it is necessary to successfully benefit from efficiency improvements, while keeping some part of technology to themselves, to assure the unique competitive advantage.

Even if automatization and robotisation might lead to some reshoring, obtaining the same scale effects possible by investing in India and China, seems not attainable currently.

I.40 is an opportunity for new actors to appear, it is difficult to indicate whether the power of the current monopolists will be strengthened, or rather SMEs will be stronger because we have to reckon with the possibility of greater market reshuffling and the appearance of new players. As in the automotive industry, new players such as Google are entering the game alongside traditional car manufacturers.

According to expert (E4) *“Poland does not seem to be particularly exposed to reshoring/backshoring processes so far”*. The low level of robots in the Polish industry, also against the background of the V4 group, can be interpreted, in the context of certain technological backwardness, but also as an effect of the price competitiveness of Polish workers - their availability is not conducive to making investments in automation or robotization. Besides, Poland produces slightly different things. We specialize in SSC and BPO shared services centres, i.e. service offer. However, not everyone realizes that reversing this trend and returning to the country of origin is a real threat. RPA (robotic process automation), chatbots, etc. pose a risk for the functioning of SSC or BPO due to the possibility of replacing simple accounting processes, e.g. invoicing, and to a lesser extent laboratory R&D.

Yet, as stressed by scholars (A1), by developing new models of artificial intelligence (AI), Polish companies become providers of these new solutions. At the same time right from the start with the reach of a global scale, they operate as "born globals".

Industry 4.0 can be a catalyst for Polish investments abroad. The perspective is no longer about attracting inward investment but generating your own – switching from focusing on IFDI to OFDI as a source of development.

We must expect a mind-set change - perception on the world map will change Poland will not be a closed separate country, but a specific part of functioning in global conditions.

Foreign investment should be invited, somehow forced to join-venture and thus give the basis for the development of own investments, i.e. we should treat FDI as a vehicle of Industry 4.0, as a booster for domestic competitiveness.

Disproportions, imbalances will increase, and asymmetry will deepen. In fact, not only technologies matter but access to data. A common strategy of buying "start-ups", due to their attractive advanced technology, makes these strong players even more potent because the basis for competitive advantage is access to large amounts of data, they already possess. At some point, you will have to break these monopolies.

Experts highlight that (E7) *"We are dealing with a sequence of benefits. For our Polish companies, mainly manufacturing companies, these positive effects appear precisely in connection with production - the possibility of predictive maintenance, the mass customization, the chance to produce faster and more flexibly. But production is the only ¼ of the value in the value-added chain. So first the production, efficiency and effectiveness benefits appear"*.

Unfortunately, Poland is still regarded as an assembly plant, and our place in the global value-added chains is not the most attractive with classic factors still making us attractive. In essence, we do something relatively fast, efficiently, cheap and of good quality. However, if we take into account the horizontal integration within the value-added chain, the requirements of the end-user cause a certain degree of process coupling and mutual information flows, so far-reaching integration, compatibility, interoperability and data exchange become crucial. Many MNEs are implementing the policy of the information exchange. And while this coupling and this integration is advanced forwards, unfortunately, it is not yet developed backwards. Meanwhile, many countries such as Germany have a unique official strategy, but also create alliances, which are intended to encourage smaller companies to participate in this digital revolution, to involve them in this transformation. Ensuring compatibility is crucial given that small and medium-sized enterprises are the basis of European economies.

Industry 4.0 is distributed production. There are no classic factories here; we have a completely different design, product management, manufacturing, and sales.

Indeed, foreign investment will change. Until now, it has been a source of technology, employment, new jobs, and capital. Now it will all be a bit different, lighter at the same time with growing disparities. So, it is essential not to let the middle level, which is most at risk, be eliminated.

One should not be under any illusions that foreign concerns and their home countries will want the production to return to the country of origin - it is said directly in Germany, for example. At the same time, the concept of a production plant disappears; we are dealing with dispersed/distributed production. These factors force us to modify our approach to foreign direct investment.

In the eyes of interviewed experts (E3), *"for 30 years of its operation, foreign direct investment in Poland has allowed for the transfer of technology and sharing knowledge, which often took place*

*unintentionally. For example, when employees left the company, they established their own company but continued to cooperate or used the acquired know-how".* On the other hand, not only large companies but also countries are not interested in sharing a unique technology, which guarantees them a competitive advantage (e.g. they do not want to allow a resolute Polish entrepreneur to do what they do and potentially outdo the inventors). On the one hand, there is an automatic, involuntary transfer of knowledge; on the other hand, there is a tendency to block and limit this transfer. A lot will depend on the regulation.

There is an ongoing discussion on how to limit the influence of large corporations, but their lobbying and power is extensive. One must hope that this will go in the right direction, that there will be some change towards equal distribution. It is in the interest of the European Union to reduce these disparities and inequalities. However, these issues need to be put in order - the new concept requires new laws and new regulations. On the one hand, we witness actions aimed at creating national champions, on the other hand, that striving to prevent the abuse of a dominant position. There are actions promoting strong companies as a counterbalance to the American or Chinese ones, along with that of blocking the abusive monopolistic positions. The role of the state in the process of digitisation is becoming crucial. For our company to advance along GVC, this requires a bold strategic decision and educated managers, as well as an appropriate education system. The statistics are unfavourable for us. Such actions as PPP Industry platform 4.0 are needed, but it seems to be correlated with the financial preferences of the EU Funds. In essence, declarations and promised means de facto seem to be connected with these programmes.

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#### I4.0 IMPACT ON FDI BOX - KEY TAKEAWAYS

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Key points of I4.0 impact on FDI in V4 in the opinion of interviewed experts (\*as interpreted by the Authors)

There will be **no shock from one day** to another day; FDI investments will not change – they will gradually search for new concepts, implement **incremental** improvements

No bold strategic shifts of FDI expected **overnight (path dependency + scale limits)**

In **the short term and medium** time **no spectacular anticipated changes**, though, in **long term** classic business models and GVC cooperation will be **inevitably disrupted**

The **nature of changes** resulting from digital transformation is **difficult to assess**, similarly difficult to determine, are the effects of ongoing processes and tendencies often happening in opposite directions

**Contradictory trends** and **strategies of MNEs** coexist. Concentration in short-run with “winner takes the majority”, more footloose character expected.

Need to **revisit the concept of FDI** (new plants with new jobs) as the classic factory disappears, being replaced by **distributed service-oriented production**

I4.0 implies the **emergence of new actors**.

I4.0 impact on FDI – need to be **careful with causality and correlation** of some trends

The critical question that arises **are FDI the only source of I4.0**, or there are alternative ways of obtaining this and if yes, is the country capable of **absorbing** fully that potential?

What is essential is **not only the willingness to share** knowledge on the part of leaders - mother companies - but also the **desire to adopt** new technologies on the part of subsidiaries -followers.

There is a chance that Industry 4.0 will be implemented thanks to FDI, which will act a **transformation vehicle**. Due to **path dependency**, sunk costs suggest „history of investing“, and no massive relocation and closing of factories will happen. Instead, current investors would **transplant** here new modern (I4.0 related) solutions (EU certainty, broader picture)

The **risk** of investment withdrawal – backshoring is **small**, and Poland's attractiveness in general, but also against the background of V4 is high. **Interoperability, compatibility** as a must for continued cooperation (also cross-border).

Though, **the service sector** may also be threatened by possible reshoring due to RPA robotics process automatisation technology

Digitization is necessary to **avoid falling out of value-added chains**, where it is easier to enter and exit.

I4.0 for Poland is an **opportunity to develop new competitive** advantages and **emergence** of Polish foreign investments - I4.0 as **competitiveness booster** and source of **OFDI**.

#### I4.0 ATTRACTIVENESS OF HOST LOCATION IN THE EYES OF INTERVIEWEES

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When asked to assess the attractiveness of Poland business representatives stress, that (B4) *“First of all, the current infrastructure or pool of human resources are not bad; it is not that the distance between Poland and other advanced countries is considerable. Compared to the world, we are not the worst”*. But they admit that in the rankings Poland is lagging behind. *“Just a few years ago there may have been impressions that we are catching up with the leaders, but for about three or four years now I have the impression that the rest have made enormous progress, leapfrogged; this distance has increased”* (B4).

In the West, digital transformation processes are being introduced faster, farther, more profound, on a larger scale, and the tendency to risk is higher. Here, yes, there are changes, but not on this scale; it is not that kind of ferment. Chasing the best will be increasingly difficult for us - for Poland.

Still, the problem is not sufficiently large scale; not sufficiently high demand for specific services, as well as awareness of the need for new solutions and low absorption capacity. Could the state help? Not necessarily, the state can only ease certain conditions when there is already a grassroots desire to act.

Such an intervention may be appropriate to mitigate risks and only facilitate decision-making but not stimulate them at the very beginning.

Poland is not permanently integrated into the global value chains, despite how it functions in the popular opinion; how it commonly appears. Our internal market is too big, and the autonomy of foreign subsidiaries is too small because they usually follow orders from HQ; they do not seem to be a vehicle for industrial transformation. This is a bit of a vicious circle we are too conservative, retrenched, too afraid, and headquarters do not outsource more ambitious tasks, and this is how it looks.

Companies admit that (B4) *"It is unknown indeed whether such a catharsis (caused by I4.0 among others) will happen, whether our region will win or lose as a result of all these changes, and how the consequences will play out - it is not known, but the average income trap is a real threat. We are too expensive in comparison to the rest in terms of traditional production, but not very advanced in other digital/future areas"*.

In Poland, the scale and scope of the changes would have to be more significant. A new generation of managers is needed on a larger scale; for now, we are talking about individual cases.

When asked whether "Are we an attractive region for FDI?" business representatives answer that (B4) *"At this basic level, yes, we are a safe country not threatened by war, other violent conflicts. Internally there are more question marks, but still, we are safe, and the stabilizer is also the European Union with its law. And then there is a set of subsequent specific cases and factors - all depends on the industry; on the particular region, on the interweaving of different factors. Czechs, Hungarians Slovaks - there is no apparent leader, and classic factors of attractiveness still matter much (number of graduates, market size)*.

As often mentioned by experts (E7) – *"The problem of Poland is the lack of scale. We have some islands of success, we have outstanding IT specialists, but these are isolated cases"*. There is no effect of scale, no mass, and there is no readiness for specific changes in society. Still, many companies and many employees remain in the comfort zone and do not feel the need to go beyond it. This is why it is so important to apply a strategy that shows a move away from linear models towards platform models, that integrate needs and opportunities and offer new value while ensuring transaction security. It is necessary to change and create a particular ecosystem that will favour Industry 4.0 and thus make the country attractive to a new kind of investors. (E7) Firstly, it is necessary to adapt the offer to the stages of development. The critical start is to raise awareness; to make the entrepreneurs aware of their needs, which will trigger their invention. Secondly, it becomes necessary to offer real help in assessing digital maturity. Thirdly, finally, it is essential to build competences, except that it is essential to look ahead, to react to new emerging challenges, to create soft and hard competencies; to offer opportunities for testing, simulation, demonstration and pilot studies. All this is key in Industry 4.0 where it is not the

product that is offered, but the whole package, including services, where information is integrated, which in some way permanently binds the partners.

In the eyes of scholars (A5) *“From the point of view of attractiveness, the smallest problem is technological issues, because technologies can be bought, changed, adapted. The biggest problem that appears in the opinion of investors is the legal environment, its stability and reliability, as well as human resources, which are slowly becoming exhausted”*. Demographic problems, which are already slowly beginning to be visible, certainly hinder and reduce the attractiveness of the location. But generally, macroeconomic factors, i.e. a stable legal framework, are the basis for attractiveness.

It is necessary to develop digital competences of the whole society. It is not about isolated cases of IT Olympic winners or outstanding computer scientists, but advanced competencies of all citizens. They will determine the possibility of participation of a given country's economy in the processes of digital transformation, which take place globally through networks of large corporations. Industry 4.0 for the Visegrad region and for Poland is, in fact, the need to come to terms with and adapt to the changes; this must not be ignored or underestimated; we must prepare ourselves very well.

According to scholars (A1) *“For the countries of the Visegrad group I4.0 could be a chance to move from the league labelled “cheap labour” to a whole new level”*.

We have technical facilities, well-educated IT staff, successes in the field of material engineering; etc. There are some excellent advantages. At the same time, it is normal that we lose wage competitiveness, but we are building competitive advantage of new quality

We have a stable operating system, robust macroeconomic conditions; we are in the EU, we do not violate intellectual property rights, we respect other international laws as standard aspects still matter (in contrast to China, for example). Thus, Poland is still attractive, infrastructure is essential, infrastructure quality is improving, we provide good schools, conditions for expats, creative class in large cities.

Polish investment attractiveness is still fine. Hard factors include now better infrastructure, railroad connections which are getting better, proper mobile telephony. But also, soft factors matter - education, schools, conditions for expats, creative class, foreign-friendly cities. The downsides as for now are the traffic jams, the lack of clean air and the lack of branding. You need to be able to sell Poland as a brand; do marketing and promote the "brand".

We need to talk not only about attracting foreign investments but in the context of Industry 4.0, to look at I4.0 as an opportunity to enter a higher level of competitiveness and development; to build new competitive advantages.

The definition and perception of investments will change - what is more important, new built the factory and number of employed people or IT orders, commissioned advanced services; specialized services rendered?

Scholars predict that (A2) *“The concentration in capital cities, large urban areas would continue regardless of FDI. Big cities would be further favoured, according to the idea that the “winner takes perhaps not all, but the majority”.* Nevertheless, smaller cities can benefit, as well. What matters are human capital, i.e. universities, infrastructure - airports and modern offices of an adequate standard. Crucial would be labour market policies and education, how to master the skills, teach and train future generation. There are examples of automation and MNEs implementing new solutions (in Poland VW and Crafter production, Bosh and IoT). On balance, whether I4.0 is threat or chance for host location would depend on how ready the country is? How it is able to draw benefits, how mature the business is, how is the absorption capability? In general, what are the conditions to benefit from I4.0 it is up to us? "Fortune favours the prepared".

According to interviewed scholars, the question we need to ask is whether (A3) *Can peripheral countries benefit from the global value chains; can they leap higher, climb up the development ladder or even leapfrog?* In fact, foreign direct investment has given Eastern Europe the chance to jump to a higher level on the industrial development path.

Silent progress was being made in Poland; officially invisible in industrial policy because it did not fit the neoliberal paradigm. In fact, however, investors were actively encouraged to open the factories, start production. Mainly fiscal reliefs were used. At the beginning there was actually no selectivity, every kind of FDI was taken on, accepted and welcome, then requirements appeared, more was expected and required.

Investors seem now to stay for good. They invest more because there is greater certainty thanks to the European Union but also due to EU programs, projects and related subsidies. Companies can simply use them; benefit from these programmes.

At the beginning of the transformation process, old production lines were transplanted, and no advanced know-how has been transferred. But unemployment was high at that moment, so none talked about technology, no one asked for it. Important was that people were employed. There was a „win-win" situation and mutual benefit.

After 2004 and shortly before the EU accession, other thinking has begun. Foreign companies started investing in knowing that they would stay here for longer, for good.

Despite the crisis (2007+) that damaged and harshly shook many companies, investors did not withdraw. There were no mass returns; they, in general, decided to stay.

It is also due to the peculiarities of the activity, of running a business; invested funds, sunk costs, now ease of obtaining grants. In fact, the history/the past decisions caused that they decided to stay.

When considering How we want to shape the future industry? Experts researchers stress that (A3) *Poland must meet required EU conditions. The participation in EU programs and projects, navigate and guide us in terms of industrial policy development. By sponsoring and promoting concrete research and*

*development activities, it set directions of innovation for the industry, shape the industrial policy evolution and economic development.*

In the eyes of some experts, (E2) *“From the point of view of a country like Poland, the biggest problems may be standards (e.g. imposed by German companies or US companies) and infrastructure, although, improving”*. The labour market seems to pose the least problems - the qualifications of Polish employees or educational standards are highly rated - PISA / AHK reports of the Polish-German Chamber of Commerce and Industry).

A whole set of factors will determine the attractiveness of the host country. The aspect of macroeconomic conditions is critical, but contrary to appearances, it should not be treated as apolitical, neutral, because. De facto this stability and macroeconomic certainty derives from the policy mix pursued. It is vital, from the point of view of a country like Poland - not the richest one, to select several significant areas of development (strategic industries) and the concentrate resources and efforts on supporting their growth. The activities of the investment promotion agency are also important, in addition to the need to promote cooperation attitudes and promote cooperation, e.g. in clusters.

Against the background of the V4 group, Poland seems to be very well positioned. The quality of human capital should be highly rated (as confirmed by the AHK investors' assessments or PISA results). The condition of the infrastructure is systematically improving. An advantage may be the lack of monocultural - the specialization of the Czech Republic, Hungary or Slovakia in the automotive sector in the light of changes (disruptive) can become a trap. A more diversified and balanced Polish economic structure would prove to be an advantage by allowing flexible adaptation to the ongoing transformations. Poland should take advantage of the country's central location to play the role of a hub. In this context, the CPK concept should be assessed very positively.

All in all, I4.0 should be an opportunity for Poland, without which it could be difficult to a breakthrough in economic development. So I4.0 can help you avoid the middle-income trap. The situation of other V4 countries can be difficult because of too much specialization and dependence on the automotive sector. Poland can build a brand and create competitive advantages, e.g. in the field of batteries for electromobility. In this approach, I4.0 is a chance for reshuffling and a new quality of competitiveness. Experts also stress that (E1) *“There are also attempts to better embed foreign investors in local economies, for instance, by locating them in clusters where the adequate benefits are also better adjusted.”*

Advanced infrastructure including the connectivity 5G, human capital (brain power), quality of the educational system as well as clusters - would matter for FDI in I4.0. Poland, as one of the most globalised/internationalised economy (6<sup>th</sup> place according to UNCTAD) due to involvement in various stages of multiple GVC is well-positioned to remain attractive for FDI.

The share of reinvested profits in total FDI (approx. 60%) suggest existing investors are not prone to leave Poland quickly due to some potential deteriorating competitive advantages (rising salaries).

However, in the eyes of business representatives (B2), tax incentives and cheaper but also very highly educated workforce – IQ, i.e. talents, still play an essential role. Access to talent counts; radical innovations are created there.

Business representative stress that (B2) *“From the point of view of the country's attractiveness, all kinds of incentives, including tax incentives, special economic zones, reliefs and investment incentives at the level of cities or municipalities are necessary. Secondly, a strong leader in a country that creates a certain ecosystem around itself is also paramount. Traditional elements remain key - access to engineers, vocational schools, universities. Legal and tax regulations are very important; transparency and stability of rules. Access to qualified staff plays an important role. It is necessary to understand the behaviour of investors to adopt their approach, their thinking so that there is no collision with the public sphere later on, and the public authority is an ally. Clusters are also worth supporting”*.

In the short term you can expect increasing concentration, but concentration around competences. In the long run, there should be some dispersion and equal distribution. i.e. these agglomerations and concentration will have a character of growing specialisation, e.g. shared services centres in Katowice or Kraków. But one should not forget about classical attractiveness factors such as infrastructure - road infrastructure, which, as it turns out, is of great importance from the point of view of even those very knowledge-intensive investors.

The advancement and maturity of Industry 4.0 among Polish companies is low. The countries of the region are ahead of us. Our firms are often subcontractors. The projects undertaken, if anything, are of "island character", carried out on a small scale as experiments.

In general, Industry 4.0 is an opportunity for the region, but it requires investment, commitment and readiness to make sacrifices. So far, the problem seems to be the lack of concrete examples and real evidence that would indicate apparent benefits of using I4.0 technology. This is the missing element, and this would facilitate the development of I4.0 in Poland by convincing about the real benefits. Demand is needed, and not just supply. Public procurement law should be modified and adapted; it is also worth changing the approach to promote a more agile approach, to reward quicker response (by relying more on MVP - minimum viable products approach).

The cost of labour is becoming less, and less relevant, good infrastructure and the competence of the competent employees are becoming critical. Thus, another set of factors determines attractiveness. Perhaps a national programme for the education of digital capabilities is needed. Experts stress that (E3) *“FDI should be a tied transaction - offset so that there is a return on the acquisition of competences and intellectual participation of our entities. This also requires a change in the narrative, but it is difficult politically because it is difficult to sell a change in the perception of investment”*. They argue that *“If we*

*leave this area to the market alone, there will be further concentration, for I4.0 to be an opportunity for the periphery, the state must intervene against the dominant trend of centralisation”* although I4.0 is also an opportunity to work remotely; a chance to develop on the periphery. The technical infrastructure in Poland is at a low level, and robotisation or automation rates indicate that we are out of line with the EU average. Change requires funds. It is necessary to invest, develop vocational training, cooperation between vocational schools and universities, but also to offer legislative incentives. Horizontal and comprehensive actions are needed.

The similarity of the V4 countries means that Industry 4.0 can undoubtedly be an added value for the region, for example, in terms of research cooperation. There is a clear potential for synergies and the development of certain common areas. Similarities make it easier to act together, but the risk of rivalry is high; competition is inherent to these countries. It is worth having your own strategy and at the same time trying to cooperate, perhaps develop particular specialization inside the group.

Digitization is necessary to avoid falling out of value-added chains where it is easier to enter and exit. Attractiveness based on a cheap employee receded, infrastructure and education play a role. Labour costs are losing ground. Some occupations will remain important, but mid-level representatives are the most vulnerable to the loss of work through robotisation. An ageing population without adequate migration strategy may exacerbate the problem of access to skilled workers.

The European digital single market is, on the one hand, an attempt to protect citizens, for example, by implementing the GDPR. On the other hand, it aims at generating high growth and improve competitiveness by work on digital tax or the accessibility to data (the scale and network effects). The intentions of politicians with regard to regulation are good but very difficult to implement, and they will also define attractiveness in the I4.0 era.

Experts point out that (E4) *“State policy should be modified and adjusted accordingly. A lot has changed recently in Poland in this respect”*. Apart from the incentives and concessions for research and development (R&D), an "IP box" has been introduced which allows for the application of a reduced rate of tax on income obtained from the ownership of intellectual property rights, which is a result of research works carried out earlier and outlays on improving innovation. This is supposed to reward not only conducting research and generating new knowledge, but also its active use and commercialization in Poland.

I4.0 is a unique opportunity for the development of the periphery, and it provides an opportunity for smaller towns and cities to appear on the map of investors' interest. However, still, traditional location factors play a considerable role – airport access, highways etc.

The barriers still most frequently cited by investors are access to a suitably qualified workforce - training and lack of employees are a significant obstacle. This raises specific policy consequences - questions about the nature of migration policy and professional activation or rather stimulating automation and

robotisation. The latter is most justified as Poland is lagging behind in this respect. Also, in the context of German experience, which indicates that robotisation may harm the labour market of new employees. Though it should not adversely affect the already employed, it is rather of a complementary nature to the existing employment and not being its substitute.

The challenge is undoubtedly the infrastructure, expansion of the 5G network, but there is no clear strategy for its implementation so far. Again, examples of other countries indicate that I4.0 is being introduced slowly and requires appropriate preparation. It must be skilfully implemented; piloting and testing are essential.

There is no single universal factor determining the attractiveness, and again much will depend on the industry. I4.0 needs complementary solutions, a package of elements one of them is a wise innovation, education and science policy.

In fact, Poland performs poorly compared to the rest of the V4 in terms of readiness for I4.0. However, it is still a sizeable absorptive market offering economies of scale and located close to the industrial heart of EU Germany. Polish employees, science graduates and programmers are very highly rated.

Business representatives tend to agree that (B3) *“Classic factors such as road and transport infrastructure will continue to determine the attractiveness of a location for investment. Apart from new challenges such as data transmission capacity, 5G networks, etc., soft competencies, employee attitude, management of change become key. It is worthwhile to apply certain incentives, not necessarily financial, rather concessions, tax reliefs, preferences, support clusters”*.

What is essential is not only the willingness to share knowledge on the part of leaders - mother companies - but also the willingness to adopt new technologies on the part of subsidiaries - followers. According to experts (E5), *“As a country, Poland is still attractive. We may be losing this classic price and salary attractiveness. Still, when it comes to qualified staff, we are the leader in PISA test results or STEM graduate qualifications - this is the great strength of the region and huge potential. Our start-ups present ultra-modern technologies - they work in the field of artificial intelligence or robotics. So, when it comes to mindset, we are ready and able to really be at the forefront of high-tech countries”*.

For foreign direct investors, Poland will continue to be attractive for educational reasons, qualified human resources, but also due to its geographical location, logistical issues. Generally, what distinguishes us is, firstly, a pool of super-educated people. Secondly, a particular historically conditioned large share of the state in the economy is a bit of a relic of the past. Still, this involvement can be positively used for the benefit of the society as such stimulating demand, building awareness, nudging.

Industry 4.0 and the digital revolution is an immense opportunity, but we all need to see the importance of these changes and be prepared. We need to change our philosophy and approach to foreign investors, and a vision of how to act within the V4 group needs to be clarified. It seems that the

European Union also understands this problem and has started to work on handling it. New documents are being created, of course, from materials to implementation, a long way to go. Still, something is already happening, certain conditions are changing, and Poland is also striving to do so while chairing the Group V4 in the second half of 2020.

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#### I4.0 ATTRACTIVENESS OF LOCATION BOX - KEY TAKEAWAYS

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Key points of I4.0 impact on FDI in V4 in the opinion of interviewed experts (\*as interpreted by the Authors)

Classic FDI and **traditional factors-based attractiveness** still matter; Poland's attractiveness fine as confirmed by **reinvested** profits with **no monoculture** as an advantage

Attractiveness (also for modern I4.0 FDI) kept, mainly as it derives from **broader EU stable setting**. Though actions are needed to **safeguard the right environment** – educational policies, tailor-made incentives as well as supporting measures clusters.

Competition among peripheries – access to **capital (funds) and labour** still matter as attractiveness factors.

Attractiveness as defined by **stable and credible macroeconomic** setting and broader advanced **digital competencies** of the whole society.

Attractiveness based on a **cheap labour force receded**. Importance of costs is vanishing, **education and modern infrastructure** matter for new types of investors. **Regulations shape the attractiveness**, incl. the new law being discussed/implemented at the EU level (common digital market). These initiatives will also define **attractiveness in the I4.0 era**.

Attractiveness will be determined by the **sector of technologically strong start-ups** and a new **culture of innovation**, offering a different perspective.

The attractiveness of host location defined by its **absorptive capabilities** - demand, labour market etc.

The state might intervene but in limited extent – mainly by **raising awareness** and improving the **absorptive capacity**

Procurement and **demand-side** crucial for successful implementation of I4.0.

Poland **is lagging behind** the Visegrad region in terms of I4.0 maturity.

The I4.0 adaptation is **time-consuming**, requires a **whole package** of parallel accompanying changes. I4.0 is not introduced overnight (**evolutionary revolution**) and needs **appropriate preparation**. It must be skilfully implemented; **piloting and testing** are essential - **"fortune favours the prepared."**

Unfortunately, Polish companies seem to **get stuck in the previous industrial revolution** (70-80% accomplished 3rd IR), **not be that keen on embarking** upon the wave of digital transformation.

**HR changes, mental adjustments** among executive level is critical for the successful adaptation of I4.0 solutions.

Polish firms **need to join forces** – clusters are the right answer

Attractiveness require reaching a **certain scale**, going **outside the comfort zone**

When attracting new FDIs, we must try **to root them**, use them to develop our own companies and investments (need of **embedding, multiplying** benefits)

**V4** should grasp this opportunity and **join forces** to speak with one voice.

Poland has the lowest share of incoming FDI relatively as compared to other V4 countries. In terms of I.40, it is also regarded as hesitator / laggard, whereas the other V3 are at least classified as traditionalists or average countries.

## FINAL WORD

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Referring to our original assumptions on two-channel impact of I4.0 on FDI and based on Polish perspective, it may be argued that:

- Attractiveness apparently will still too much extent be dependent on traditional factors such as road infrastructure or cheap but qualified workforce. Nevertheless, a role for state / public authorities' engagement is expected in shaping the demand side or providing quasi-public goods (sandbox). Path dependency and history of previous successes (reinvested profits) in attracting FDI suggest no colossal changes in the short run, though, "fortune favours the prepared".
- Foreign firms would adopt both strategies in relation with foreign subsidiaries (FS) – balancing the need of sharing new technologies and knowhow (no clear pattern of behaviour can be detected now) with appropriation and modify their investing pattern but this will be an evolutionary revolution. Critical might be the readiness and absorption of Polish firms to interact. Unfortunately, many seem to be stuck in the third IR.

As we can infer from our analysis:

- The I4.0 would impact the FDI to V4 mainly by modifying the profile, HQs strategy and FSA of MNEs, reconfiguring the global production network and supply chains.
- I4.0 would also affect the attractiveness of host locations and policies conducted towards FDI in host economies as it requires necessary adjustments (readiness/maturity DESI)
- Hence, crucial becomes not only how the V4 as prospective host economies fare in terms of I4.0 readiness/competitiveness/maturity but also how ready are the home economies (source

of FDI); if they indeed consider transferring new knowledge to foreign subsidiaries and hence acting as vehicles of I4.0

It might be presumed that the impact of I4.0 on FDI flowing to V4 would depend on the absorptive capacity at macrolevel as expressed in the gap in I4.0 readiness to main investors home economies. Poland's position in 2019 edition of DESI was 25<sup>th</sup> with a score of 41,6 points; in 2020 edition – 23<sup>rd</sup> place. Three top investors, as measured by ultimate investing country (OECD) in 2018 were Germany, France and the US. Their respective DESI position / value for international DESI for outside EU countries (<https://ec.europa.eu/digital-single-market/en/news/how-digital-europe-compared-other-major-world-economies> average International DESI score 2013-2016 Switzerland 70,8, Japan 68,5 USA 66,7) might inform about the scale of differences – lagging behind.

Table 13. Estimating the possible scale / magnitude of “profoundness” of I4.0 impact on FDI  
DESI New 2020 Edition

Poland to...main FDI home	DESI DISTANCE	4. Integration of digital technology
Germany	-11	-7
France	-8	-14
Netherlands	-19	-21
United Kingdom	-15	-17
Spain	-12	-12
Austria	-10	-8
Italy	2	-3
Sweden	-21	-19
Denmark	-20	-20
<b>average distance</b>	<b>-13</b>	<b>-13</b>

As based on DESI new 2020 edition, the average distance of Poland to the home country of major investors equals 13 places, which is an improvement as compared with 2019 (gap of 15).

It might be speculated, that the more advanced the home country of the foreign investor, the higher the possibility that respective investors are digitally advanced and the that the magnitude of their “impact” would be more pronounced. Besides it could be expected that the larger the distance, the more difficult it would be for Poland to fully benefit from the I4.0 technologies transfer within FDI, yet the more beneficial would be the net gain from learning in case of sharing strategy.

According to some prominent representatives of the Polish delegation at the Davos 50<sup>th</sup> forum, it will depend on the decisions that the countries of the CEE region will take in the next few years whether we will have a chance to engage in global competition to build our own European technological hub (Pawlak, 2020). CEE countries face similar challenges and have similar economic ambitions. Therefore, they could and should join forces to stimulate the faster development of what we might call a "regional technology hub". Such cooperation can take place in many fields. First, there is a need for a common strategy to promote the region as an investment destination and attract financial investors. Secondly, interregional acceleration programmes need to be established. Thirdly, it is also worth thinking about creating favourable conditions for the development of a regional M&A market that would support the process of transforming local or regional leaders into real global champions.

Digital V4 project might pave the way for further integration in this respect (Kanownik, Kucharczyk 2020). Digital Poland, have invited counterparts from the Czech Republic, Slovakia and Hungary, representing the largest digital sector companies in these countries, to cooperate. Using the Visegrad Group formula, the Digital V4 project has been initiated. It aims to jointly create one policy supporting the development of digitisation of the countries of Visegrad region. Signatories want common voice to be heard enough in the EU arena. Digital V4 is also intended to be an advisory base for the governments of V4 countries, as well as a place for exchanging experiences. It will focus on the future of modern technologies and the direction of their development. These include the digitisation of the economy, 5G, building a strong Union through a single digital market and cyber security or the development of start-ups and small businesses.

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