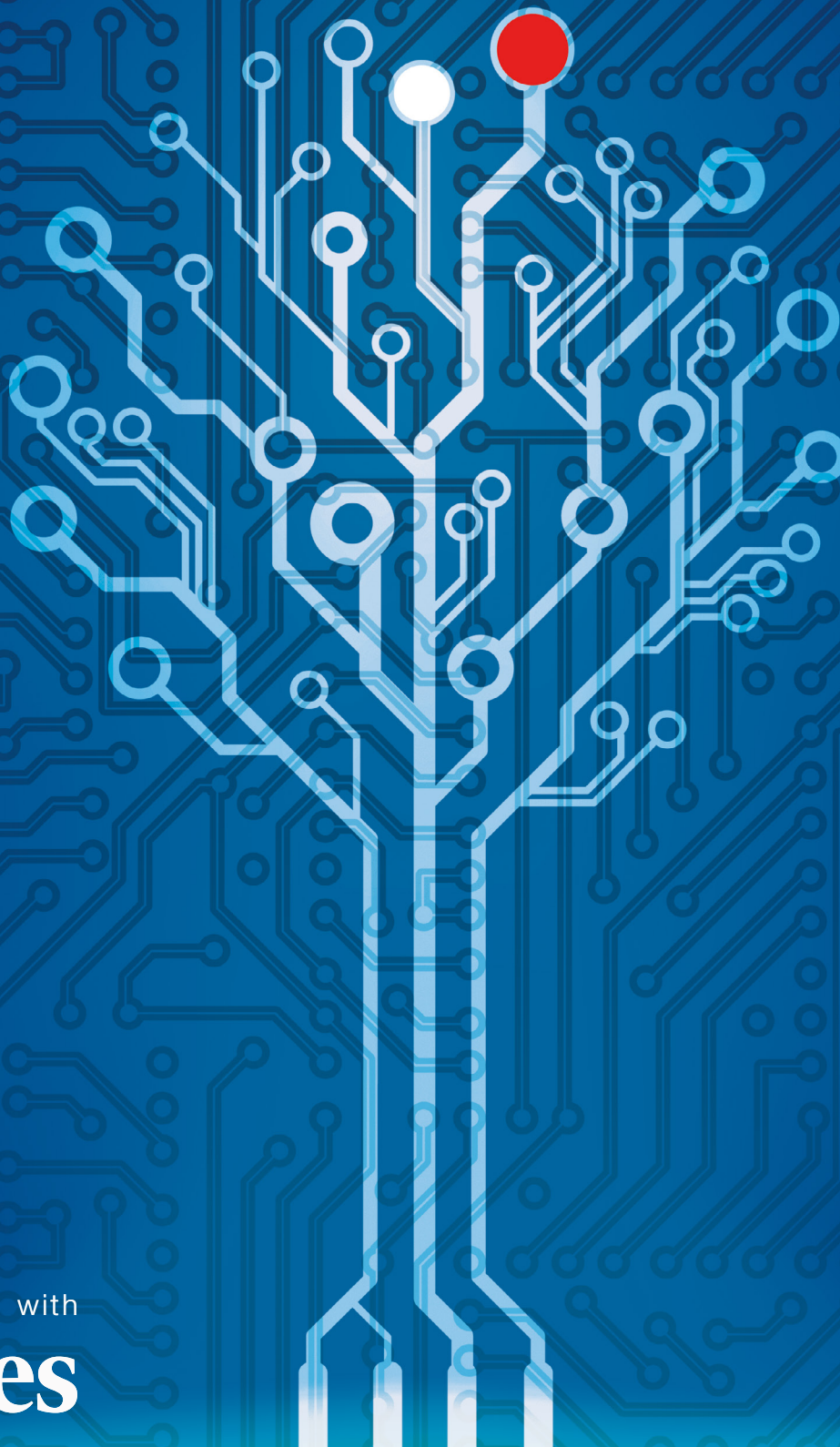


Digital Poland



In cooperation with

Forbes

Digital Poland

Capturing the opportunity
to join leading global economies

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Preface

D*igital Poland* is a McKinsey & Company report developed in cooperation with Forbes Poland. It presents Poland's position in terms of the overall digitization of the economy, gaps in the digitization of individual sectors of the economy, and key levers for closing the digital gap.

The report reflects McKinsey's deep commitment to the development of the Polish economy and the country's success on a global stage. It aims to provide a fact-based perspective on how the country can accelerate growth in the next decade thanks to digitization, elaborating on the ideas set forth in two reports published in 2015: *Poland 2025: Europe's new growth engine* and *5 opportunities for Poland*.

We would like to take this opportunity to thank Michał Broniatowski, Editor-in-Chief of Forbes Poland, for his inspiration, guidance, and cooperation. The work on this report was led by Daniel Boniecki, Senior Partner at McKinsey & Company, Wojciech Krok, Local Partner, and Wiktor Namysł, Managing

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Key industrial insights were developed by our Polish Partners and sector leaders: Łukasz Abramowicz, Wojtek Bogdan, Tomasz Jurkanis, Michał Laube, Dorota Machaj, Tomasz Marciniak, Wiktor Namysł, Marcin Purta, Dawid Rychlik, and Michael Wodzicki.

We are also grateful for the contributions made by many of our colleagues, especially Anna Padamczyk, Hanna Łukaszewska, Małgorzata Leśniewska, Robert Wielogórski, and Katarzyna Majcher.

This report also draws on a series of publications by the McKinsey Global Institute: *Digital America: A tale of the haves and have-mores* (published December 2015), *Digital Europe: Pushing the frontier, capturing the benefits* (June 2016), and *The economic essentials of digital strategy* (March 2016). We would like to thank the authors of these reports for sharing their expertise and insights with us.



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Introduction

Over the last quarter century, the Polish economy has doubled in size in terms of real GDP per capita.¹ The past success of the Polish economy has to a large extent been dependent on its well-educated yet inexpensive workforce. But the rules of the game are changing as the digitization of the world economy accelerates and the importance of competitively priced labor declines.

The world is entering a new era, hailed as the “fourth industrial revolution.” The first industrial revolution was all about steam; the second, electricity; the third, automation. The fourth industrial revolution concerns the digitization of the entire value chain, from production all the way to sales to end consumers.

Digitization is not a thing; it is a way of doing things. It is about redefining business models through the use of digital technologies. In manufacturing, for instance, online communication between different parts of the production process and the use of advanced data analytics are creating intelligent production systems that have low operating costs and can easily adapt to market needs.²

For Poland, the fourth industrial revolution is the first in which the country can fully participate – for historical reasons. The country is well positioned to take advantage of the digital revolution and join the most advanced economies around the globe.

Poland has a number of advantages in this respect. It has the fourth-largest pool of science graduates in the European Union,³ despite being only the sixth most populous country. Moreover, its digitally enabled talent pool is of a high quality – and 47%-70% more affordable than in Western Europe.⁴ Three-quarters of Polish

households have access to the Internet,⁵ and 85% of Polish Internet users aged 15-64 say they use the Internet more than five hours a week.⁶

If Poland wishes to become one of the most advanced economies in the world, it cannot treat digitization as something for the future or limit itself to supporting start-ups and technological clusters. Our analysis shows that digitization should happen at the core of the economy in order to have a meaningful impact on productivity. And the potential productivity gains from digitization in sectors such as manufacturing or mining are too great to ignore.

McKinsey analysis shows that in the next decade Poland could increase the economic value added of its entire economy by 13%-22% by means of digitization. Digitization would close the productivity gap to the most advanced Western European economies⁷ by 12%-21%, and to the EU-15⁸ by 27%-47%.

Of course, part of this growth will occur in any case if the Polish economy continues to develop at its current pace. The challenge is to achieve accelerated growth by addressing the full potential of digitization. In sectors such as retail and banking, Poland could even leapfrog Western Europe in terms of productivity.

Companies at the core of Poland’s economy can build and implement digital strategies while embedding digital technologies in their processes. In this report, we provide specific industry-level insights on how Poland can bridge the digital gap. Our aim is to supply policy makers and business leaders with a detailed fact base that will help them exploit the fourth industrial revolution to the full – and ensure the maximum benefit for the Polish economy.

What does digital mean?

At McKinsey, we use the term “digital” to mean the use of digital tools to improve productivity and contribute to economic growth. We identify four ways in which digitization can have this effect: through digitally enabled process optimization, access to a broader market space, more innovative products, and an increase in labor participation (Exhibit 1).

(1) Digitally enabled process optimization

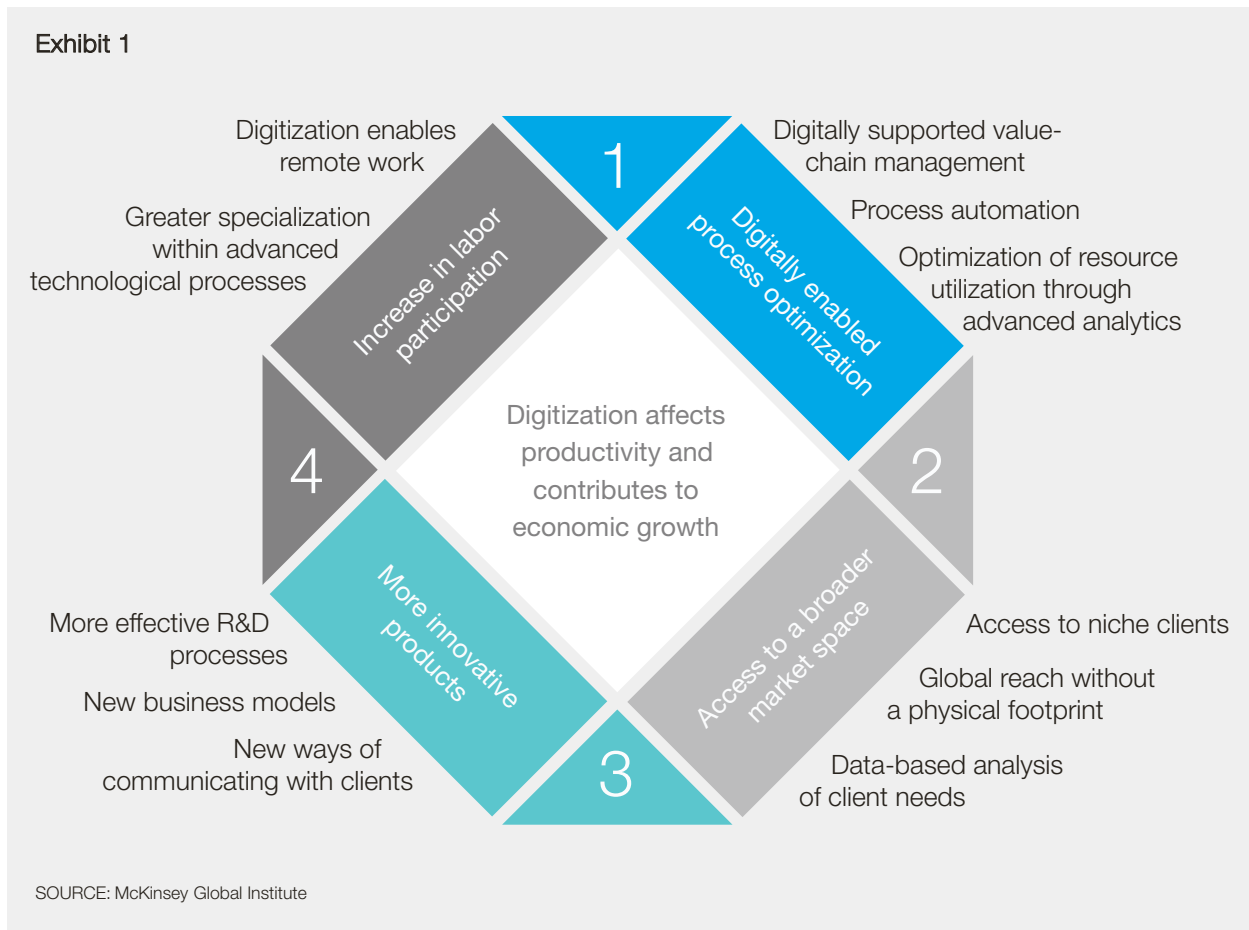
Digital tools, such as advanced analytics, can be used to optimize the amount of resources required per unit of production, thereby raising productivity. Such tools can also improve the efficiency of

processes by managing the value chain in such a way as to maximize yield. Digitization starts with reassessing the company’s processes and sometimes requires prior automation.

Digitally enabled process optimization can help Poland transform itself from an economy based to a larger extent on resources and cost-competitive labor into a competence-based economy.

(2) Access to a broader market space

Digitization can both extend the marketplace and improve a company’s market position in existing markets. It is important to understand current digital



trends, as they may cause disruptions to the customer journey. This generates both threats and opportunities for existing business.

Digitization creates new markets and facilitates companies' access to a broader market space. Digital companies can enjoy global reach, accessing niche clients around the world even without a physical footprint. Online channels extend the potential customer base and increase product accessibility.

Digitally enabled firms can also use digital tools to conduct data-based analyses of clients' needs and evaluate clients' interactions with their brands. This allows them to improve the customer experience and adjust their offerings where necessary.

From an economic perspective, access to a broader market space contributes to Poland's net exports and enables Polish businesses to compete on the basis of their product quality and service skills – rather than their financial ability to build extensive physical sales networks.

(3) More innovative products

Companies need to reassess their current processes and look for opportunities to digitize their operations. This creates space for innovation around new business models or new ways of communicating with clients. A more innovative approach can help drive productivity. At the same time, digital tools, such as big data, improve the efficiency of R&D and help translate it into innovation.

Poland has a large, high-quality talent pool. We believe the skills of this group should be directed toward innovation.

(4) Increase in labor participation

Digitization enables an increase in labor participation – for example, by means of remote working, greater specialization within advanced technological processes, and new platforms for talent development.

Competences, rather than financial resources, are the key enabler in the digital revolution. This means that Poland may be able to take advantage of this opportunity to improve its competitiveness globally and accelerate the economic growth.

The digital opportunity for Poland

In 2015 McKinsey & Company published two reports on Poland's economy: *Poland 2025: Europe's new growth engine* and *5 opportunities for Poland*. In these reports we presented the productivity gap between Poland and Western Europe. We also analyzed how Poland can close this gap and become an advanced European economy competing on a global stage. One of the levers that can help is increasing the productivity in the economy through digitization.

According to McKinsey analysis, Poland's economy is estimated to have realized 8% of

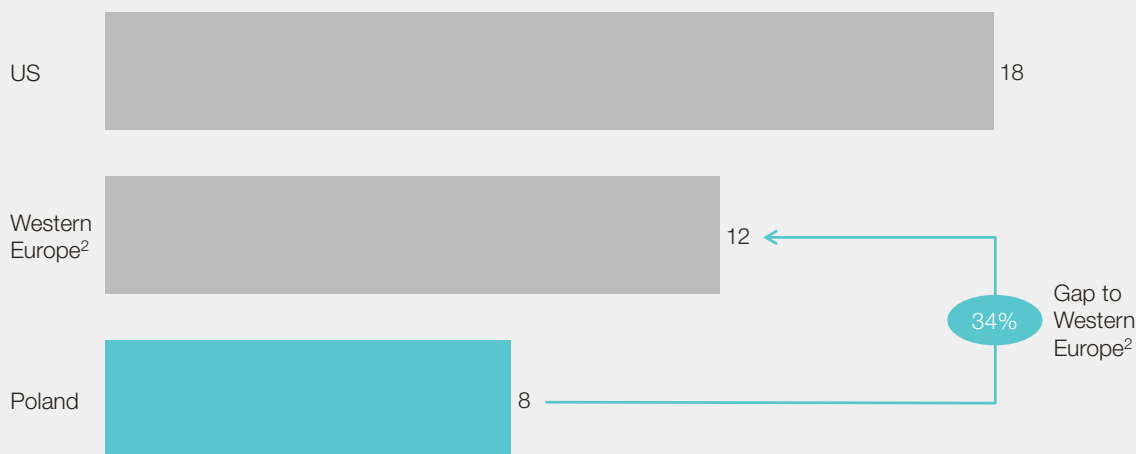
its digital potential.⁹ By comparison, Western Europe – in this report we use France, Germany, Italy, the Netherlands, Sweden, and the United Kingdom as a Western European benchmark for Poland – has realized an estimated 12% of its digital potential. Poland is thus 34% less digitized than the Western Europe benchmark (Exhibit 2).

Globally, we are still at the start of our journey to digitization. Even the United States economy has only realized 18% of its overall potential. The moment is right for Polish companies to step up

Exhibit 2

Taking the ICT sector in the US as our base (100% digitization), the overall US economy is 18% digitized, compared to 12% digitization in Western Europe in 8% and Poland. On average, Polish firms are 34% less digitized than Western European firms

Digitization Index,¹ potential captured by country (%)



¹ The Digitization Index measures the level of digitization of an economy on the basis of 21 metrics, divided into digital-supply metrics and digital-demand metrics. For details of metrics, see Exhibit 3

² Weighted average of France, Germany, Italy, the Netherlands, Sweden, and the United Kingdom. These six countries make up 60% of the population and 72% of the GDP of the EU-28

SOURCE: EU Klems; Eurostat; OECD; McKinsey analysis

Exhibit 3

About the McKinsey Digitization Index

The McKinsey Digitization Index measures how advanced a country's digitization is, based on 21 indicators of digital supply and digital demand. It shows how Poland compares with Western Europe and the USA in terms of digitization.

		Metric	Description
Digital supply	Digital asset spending	Hardware spending	Share of total expenditures spent on ICT hardware (e.g., computers, servers)
		Software and IT services spending	Share of total expenditures spent on software and IT services (e.g., enterprise resource planning software)
		Telecommunications spending	Share of total expenditures spent on telecommunications (e.g., broadband access, mobile data services)
	Digital assets stock	Hardware assets	Share of total assets made up of ICT hardware (e.g., computers, servers)
		Software assets	Share of total assets made up of software (e.g., purchased software licenses)
	Digital asset spending per worker	Hardware spending on workers	ICT hardware (e.g., computers, servers) expenditures per full-time-equivalent employee (FTE)
		Software and IT services spending per worker	Software (e.g., enterprise software licenses) and IT services expenditures per FTE
		Telecommunications spending per worker	Telecommunications (e.g., broadband access, mobile data services) expenditures per FTE
	Digital capital deepening	Hardware assets per worker	ICT hardware assets (e.g., servers, computers) per FTE
		Software assets per worker	Software assets (e.g., workers' software licenses) per FTE
Digitization of work	Use of enterprise resource planning (ERP)	Enterprises that have an ERP-software package, which they use to share information between different functional areas (e.g., accounting, planning, production, marketing)	
Digital demand	Transactions	Enterprises selling online	Annual sales realized via any computer networks (includes websites, EDI-type systems, and other means of electronic data transfer; excludes email)
		Enterprises purchasing online	Percentage of companies realizing at least 1% of purchases via computer networks (includes websites, EDI-type systems, and other means of electronic data transfer; excludes email)
	Interactions between firms, customers, and suppliers	Digital supply chain	Enterprises sending/receiving all type of information on the supply chain (e.g., inventory levels, production plans, forecasts, progress of delivery) via computer networks or via websites
		Social-media use	Enterprises using 2 or more of the following social media: social networks, enterprise's blog or microblog, multimedia content-sharing websites, wiki-based knowledge-sharing tools
		Companies with ICT very integrated into daily activities	Composite score based on McKinsey's 2015 survey on the digital capabilities of firms in Europe and the United States
		Companies with benefits from external customer-related tools	
	Companies with benefits from using social tools to work with partners		
	Processes	Companies where at least half of business is digital in nature	
		Use of enterprise resource planning (ERP)	Enterprises that have an ERP software package that they use to share information between different functional areas (e.g., accounting, planning, production, marketing)
		Use of customer relationship management (CRM)	Enterprises that use CRM software, i.e., an application used to analyze information about clients for marketing purposes

their digital efforts – and Poland is well positioned to participate in the digital revolution.

The good news is that, in terms of digital demand, Poland is already close to Western Europe, with a gap of just 16% (Exhibit 4). This means that businesses in Poland are engaging digitally with their customers, suppliers, and partners to a similar extent as firms in Western Europe, although it is still in an initial development stage. Polish firms conduct transactions online, interact according to digitally advanced communication standards, and provide online customer service.

Digital supply is the key challenge for Poland; overall the country's score on this indicator is 44% below Western Europe's. This means that firms in Poland have invested significantly less in assets and employ fewer professionals in digital jobs than Western Europe. As soon as Polish firms step up their investments in digital assets and workplaces, the country's position in terms of digital supply should start improving.

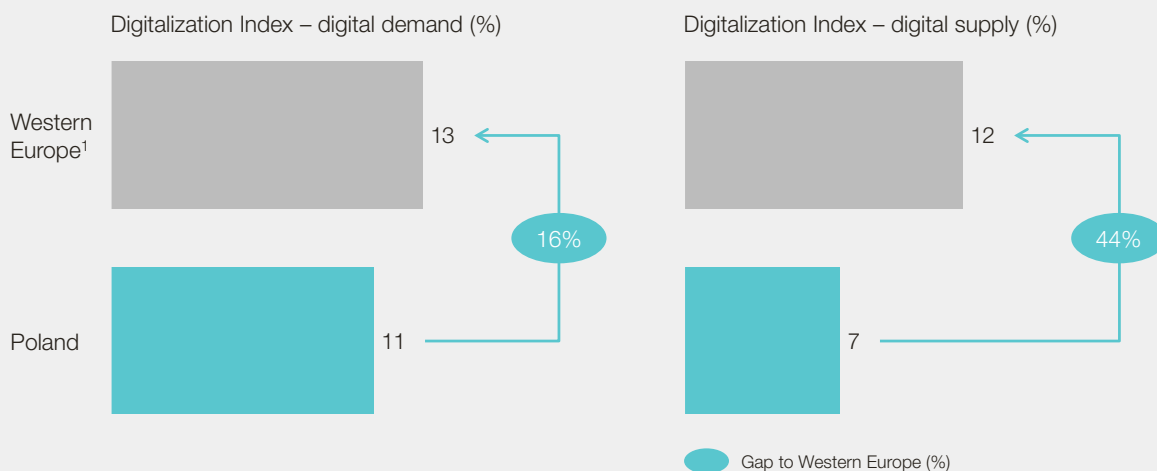
TWO SPEEDS OF DIGITIZATION

The overall gap between Poland and Western Europe averages out at 34%. But different sectors of the economy show different-sized gaps. We identify two distinct groups of sectors in terms of their speed of digitization. The first group comprises digitally advanced sectors, where the average gap is 17%. The second group consists of digitally less-advanced sectors, where the average gap is 58% (Exhibit 5).

Digitally advanced sectors contain a disproportionately large amount of foreign capital, i.e., companies with a medium to significant degree of foreign ownership. Thus, all five digitally advanced sectors have a “medium” to “significant” share of foreign capital in their companies (Exhibit 6). Firms influenced by foreign capital may benefit from importing best practices and know-how, and have established business relationships with other companies. Also, these are often the companies that have developed by employing modern technologies.

Exhibit 4

Poland is close to Western Europe in terms of digital demand (16% gap), but a long way behind in terms of digital supply (44% gap)



1 France, Germany, Italy, Netherlands, Sweden, United Kingdom
SOURCE: EU Klems; Eurostat; OECD; McKinsey analysis

Exhibit 5

In terms of digitization, Poland's economy has developed at two different speeds

Digitization gap between Poland and Western Europe,¹ (%)

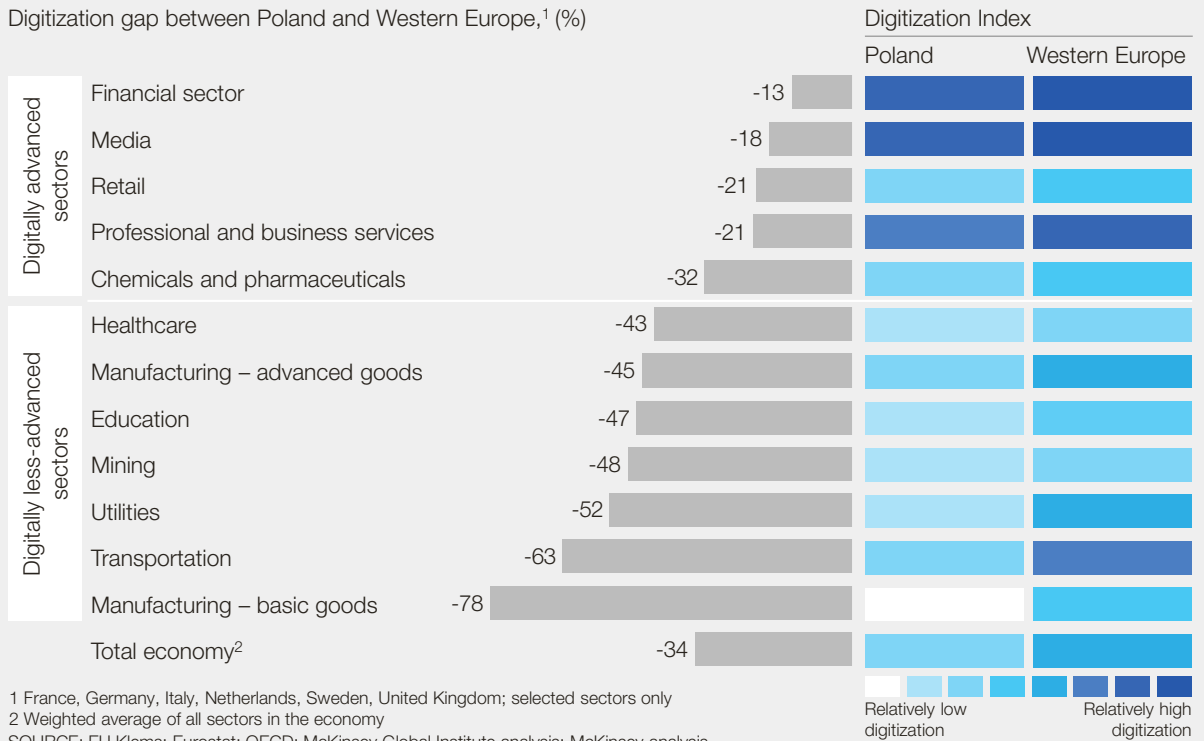


Exhibit 6

Three out of five digitally advanced sectors in Poland have a disproportionately large share of foreign ownership

Gap in digitization between Poland and Western Europe,¹ (%)

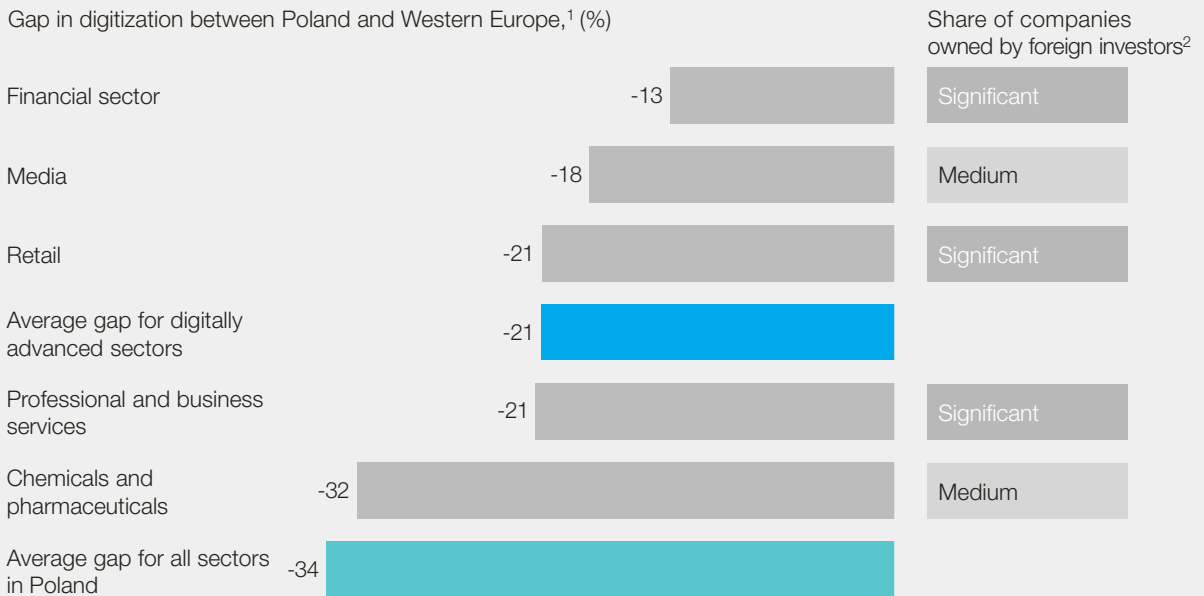
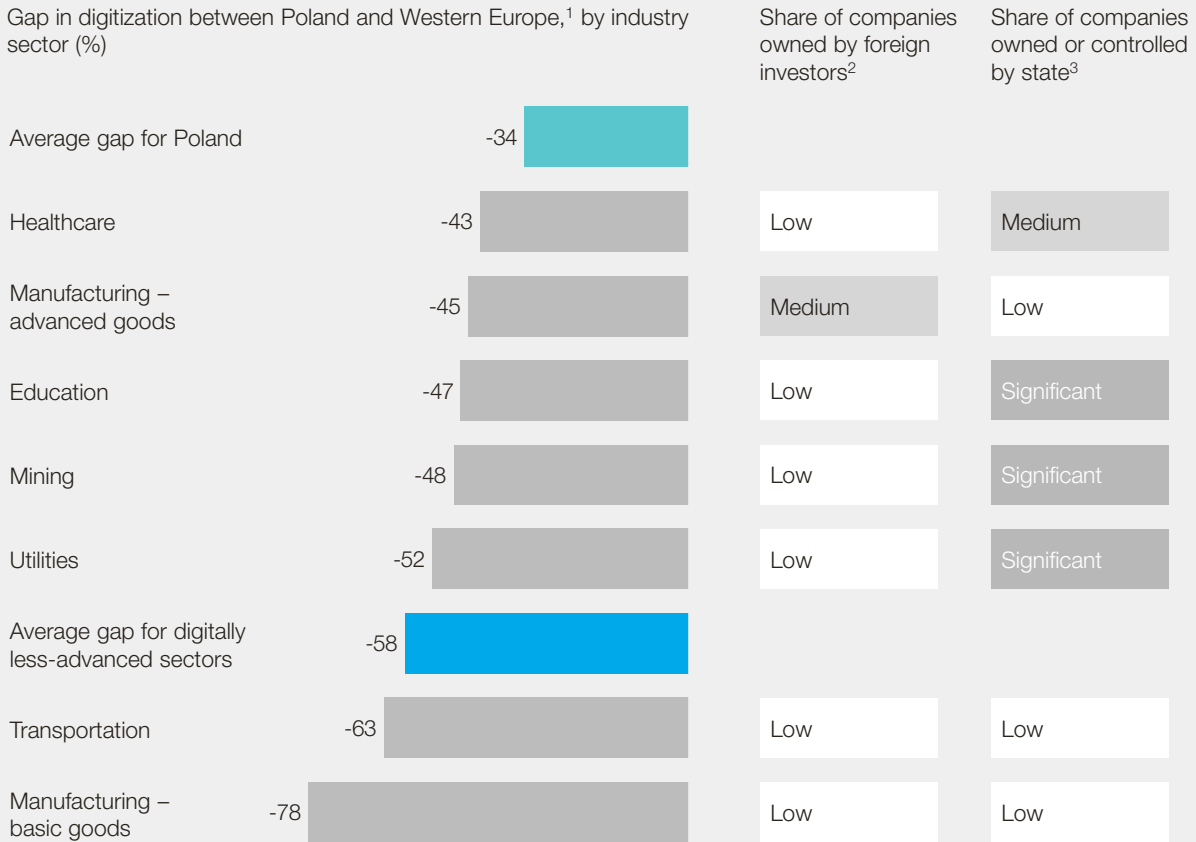


Exhibit 7

Of Poland's seven less-advanced sectors, most have disproportionately low foreign ownership, and three have disproportionately large state control



1 France, Germany, Italy, Netherlands, Sweden, United Kingdom

2 Estimated share of foreign-controlled companies in total sector revenues: significant >60%, medium 40%-60%, small <40%

3 Estimated share of state-controlled (mining, healthcare) or state-owned companies in total sector revenues: significant >60%, medium 40%-60%, small <40%

SOURCE: EU Klems; Eurostat; OECD; McKinsey analysis

In six out of the seven digitally less-advanced sectors, the share of foreign capital is low (Exhibit 7). Additionally, three of the seven sectors show a disproportionately large degree of state control. These three sectors are education, mining, and utilities – areas where the state may have a strategic interest.

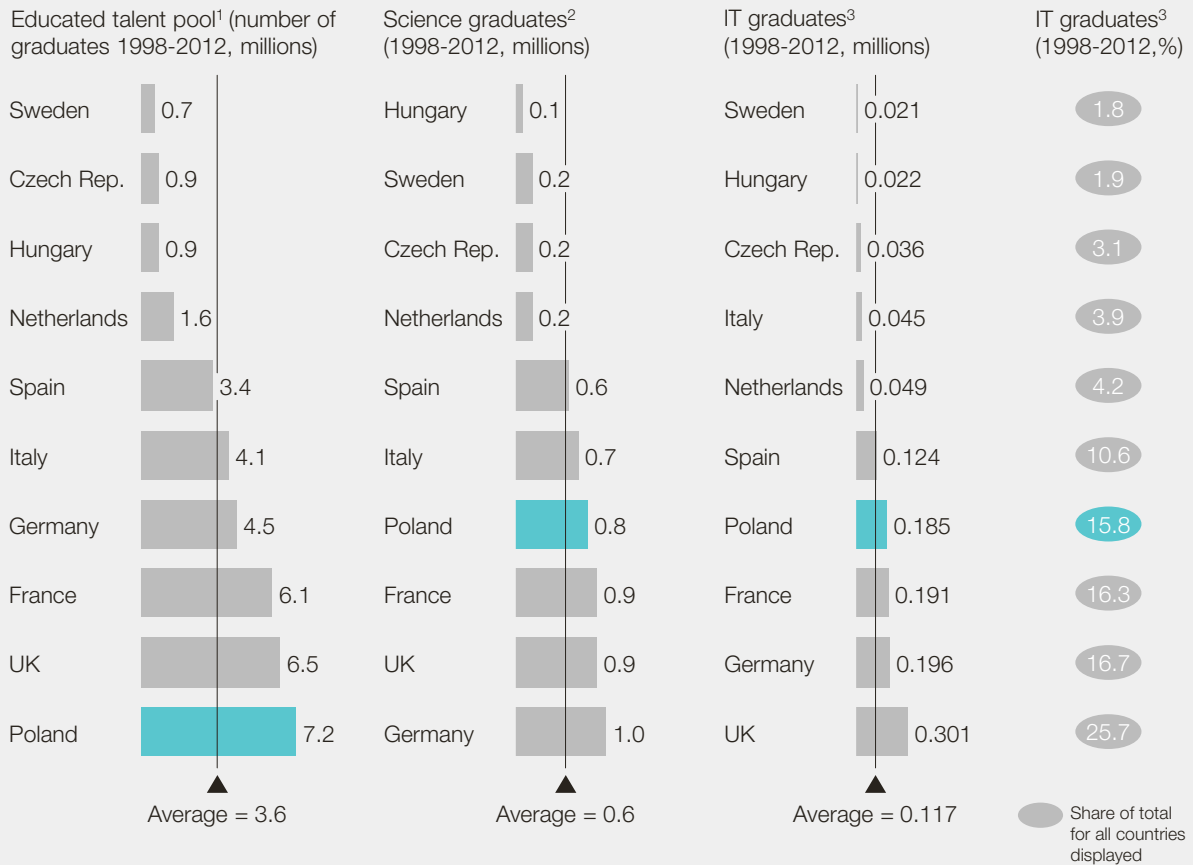
The Polish economy has thus been developing at two different speeds in terms of digitization. Digitally less-advanced sectors need to catch up, while digitally advanced sectors need targeted support to enable them to compete on global markets.

STRONG FOUNDATIONS FOR GROWTH

Despite the gap in digitization between Poland and Western Europe, Poland has strong foundations for growth in digitization. Those foundations include its sizable talent pool and its labor-cost advantage. This basis for growth could be even stronger if the country successfully optimized its graduate structure to the level seen in Germany and France, and managed to stop the leakage of talent out of the country.

Exhibit 8

Poland has a vast digitally enabled talent pool and the fourth-largest IT graduate pool in the EU



1 University (or equivalent) graduates

2 University (or equivalent) graduates in the following technical fields: mathematics and statistics (ISC 46), Computing (ISC 48), engineering and engineering trades (ISC 52), manufacturing and processing (ISC 54), architecture and building (ISC 58)

3 University (or equivalent) graduates in computing (ISC 48)

SOURCE: OECD, "Graduates by field of education," 1998-2012

A sizable talent pool

With its 7.2 million people who graduated from university or equivalent between 1998 and 2012, Poland has the largest educated talent pool in the European Union (Exhibit 8). Some 0.8 million graduates have technical degrees, of which 185,000 are in information technology. The result is a large workforce that is "digitally enabled," i.e., able to perform digital-related jobs – the fourth-biggest such talent pool in the European Union,

after Germany, the United Kingdom, and France. Poland also boasts the fourth-biggest IT-educated talent pool in the EU.

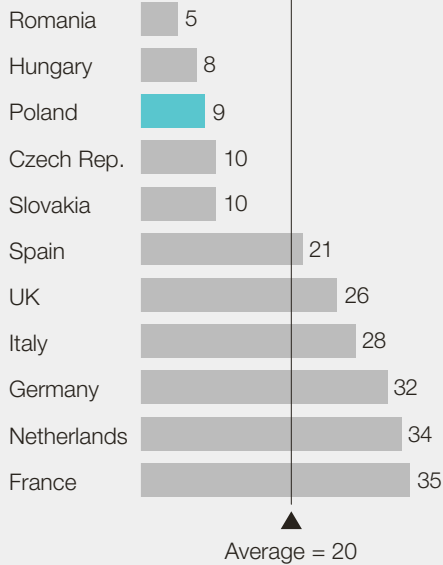
Labor-cost advantage

Poland's other key competitive advantage is the affordability of its workforce. In the ICT sector, for example, the labor cost per skilled FTE is 47%-70% lower than in the benchmark countries (Exhibit 9).

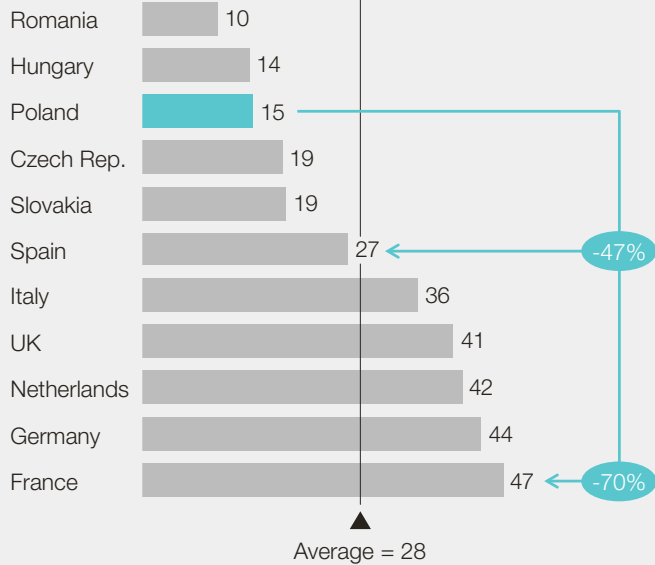
Exhibit 9

The cost of skilled workers in Poland is 47%-70% lower than in selected Western European countries

Average labor cost for economy¹
(2015,² EUR/hour)



Average labor cost for ICT field³
(2015,² EUR/hour)



Note: Sweden excluded from analysis

1 Economy defined as "Industry, construction and services (except public administration, defense, compulsory social security)"

2 2015 or latest available

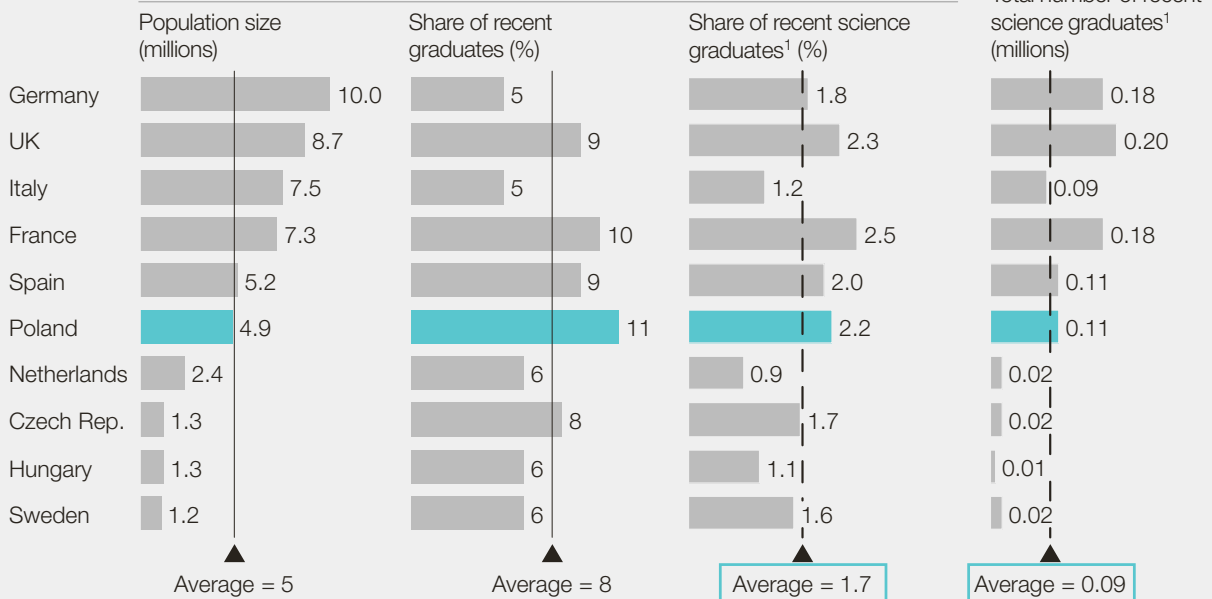
3 ICT defined as "Information and communication"

SOURCE: Eurostat, "Labour cost levels"

Exhibit 10

Poland is a leader in science degrees in Europe and has a large digitally enabled workforce – the structure of the graduate pool is also better than average

Characteristics of population 20-29 in 2014



1 University (or equivalent) graduates in the following technical fields: mathematics and statistics (EF46), computing (EF48), physical science (EF44), life science (EF42), engineering, manufacturing and construction (EF5)

SOURCE: Eurostat, "Graduates by education level, program orientation, sex and field of education"

Optimize the graduate structure

In terms of its number of university (or equivalent) graduates, Poland is one of the leaders in the EU. Some 11% of people aged 20-29 are recent graduates, and 2.2% studied science subjects (Exhibit 10). In other EU countries, such as France or the United Kingdom, the percentage of people graduating in subjects that enable them to make use of advanced digital technology is even higher (2.5% and 2.3% respectively). Poland should therefore continue to encourage young people to study science. Success here could enable Poland to become a leading European nation in this respect – as it already is with regard to its total number of university graduates.

STOP TALENT LEAKAGE

Although Poland currently has the fourth-largest digitally enabled talent pool in the EU, fewer people work in jobs that involve digital tasks than in Western Europe. According to the Digitization Index, Poland ranks 44% below Western Europe in terms of digital supply. This

reflects a significant gap between Poland and Western Europe as regards the share of digitally enabled jobs and the availability of digital tools for the workforce.

Poland also suffers from the largest cross-border leakage of well-educated active citizens in the EU. Nearly 280,000 individuals with higher education emigrated from Poland to another EU-28 or European Free Trade Association (EFTA) country after 2003 – and remained there (Exhibit 11). The leakage of digitally enabled workers increases the productivity gap, weakening the Polish economy and strengthening the economies of the countries Poland competes with.

CLOSING THE DIGITAL GAP

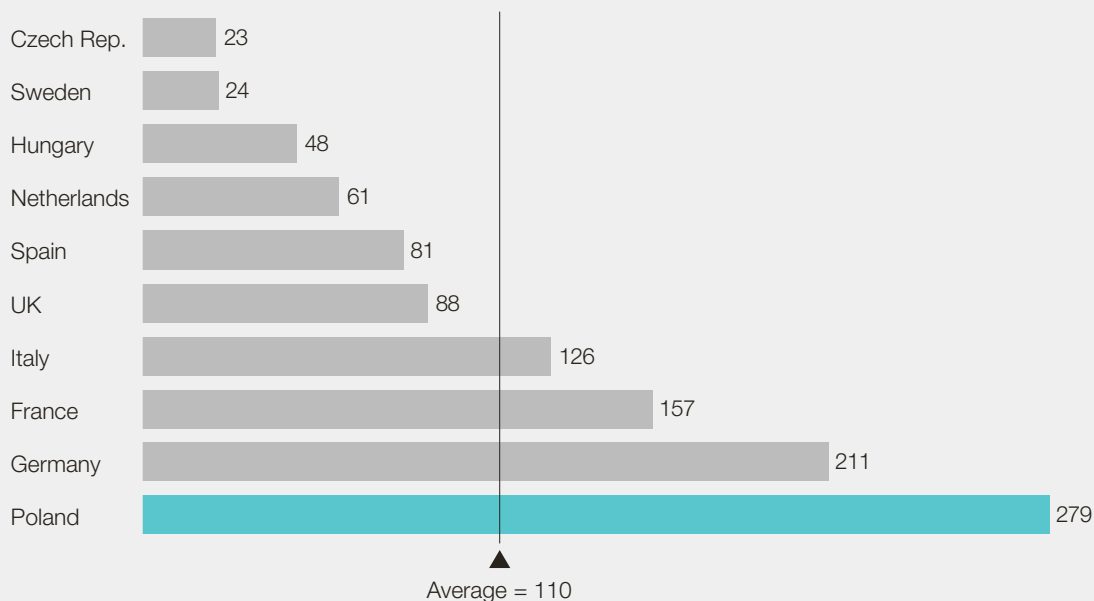
Poland lags a considerable way behind Western Europe in terms of productivity – how effectively it uses the resources at its disposal (raw materials, labor, skills, equipment, land, intellectual property, technology, management capabilities, and capital).

The Polish economy generates annually EUR 589 billion of gross value added. McKinsey analysis shows that this is 51% below what the country

Exhibit 11

Poland suffers from cross-border leakage of well-educated workers

Number of active citizens aged 15-64 with higher education living abroad¹ (2013, thousands)

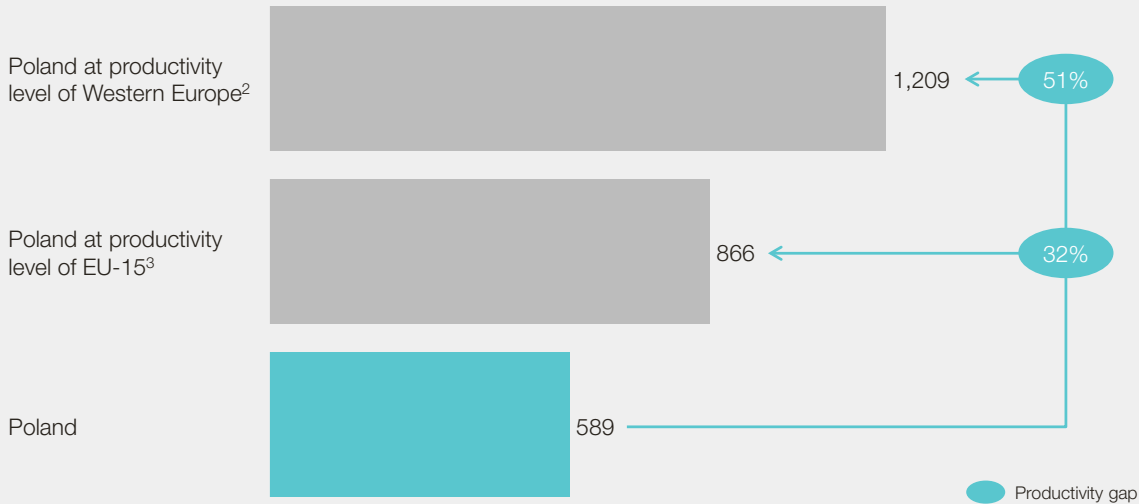


¹ Residing in an EU-28 or EFTA country other than their country of citizenship for up to ten years as of 2013
SOURCE: European Commission, "2014 Annual report on labour mobility," 2014

Exhibit 12

Poland's value added would be 51% higher if the country were as productive as Western Europe, and 32% higher if it were as productive as the EU-15

Value added, 2012¹ (EUR billion)



¹ 2012 or latest available

² Theoretical increase in value added if Poland achieved the level of productivity of Western Europe, assuming Polish employment levels. Western Europe is defined as France, Germany, Italy, Netherlands and the United Kingdom. Consistent employment data not available for Sweden

³ Theoretical increase in value added if Poland achieved the level of productivity of EU-15, assuming Polish employment levels. EU-15 is defined as countries that made up the EU between 1995 and the expansion of 2004. In the report *Poland 2025* we give the gap between Poland and the EU-15 as 35% on the basis of 2011 figures

SOURCE: Eurostat; McKinsey analysis

would achieve if it had the same level of productivity as Western Europe (Exhibit 12). Compared with the EU-15, the gap is 32%.¹⁰

The 51% productivity gap between Poland and Western Europe could be closed by increasing value added or boosting effectiveness, which can be partially fueled by digitization. McKinsey analysis shows that Poland could increase its economic value added by 13%-22% through digitization. This would narrow the productivity gap by 12%-21%, an increase in productivity equivalent to EUR 75 billion to EUR 131 billion (Exhibit 13).

Obviously, part of this growth will occur in any case if the Polish economy continues to develop at its current pace. But the challenge is to achieve accelerated growth by addressing the full potential of

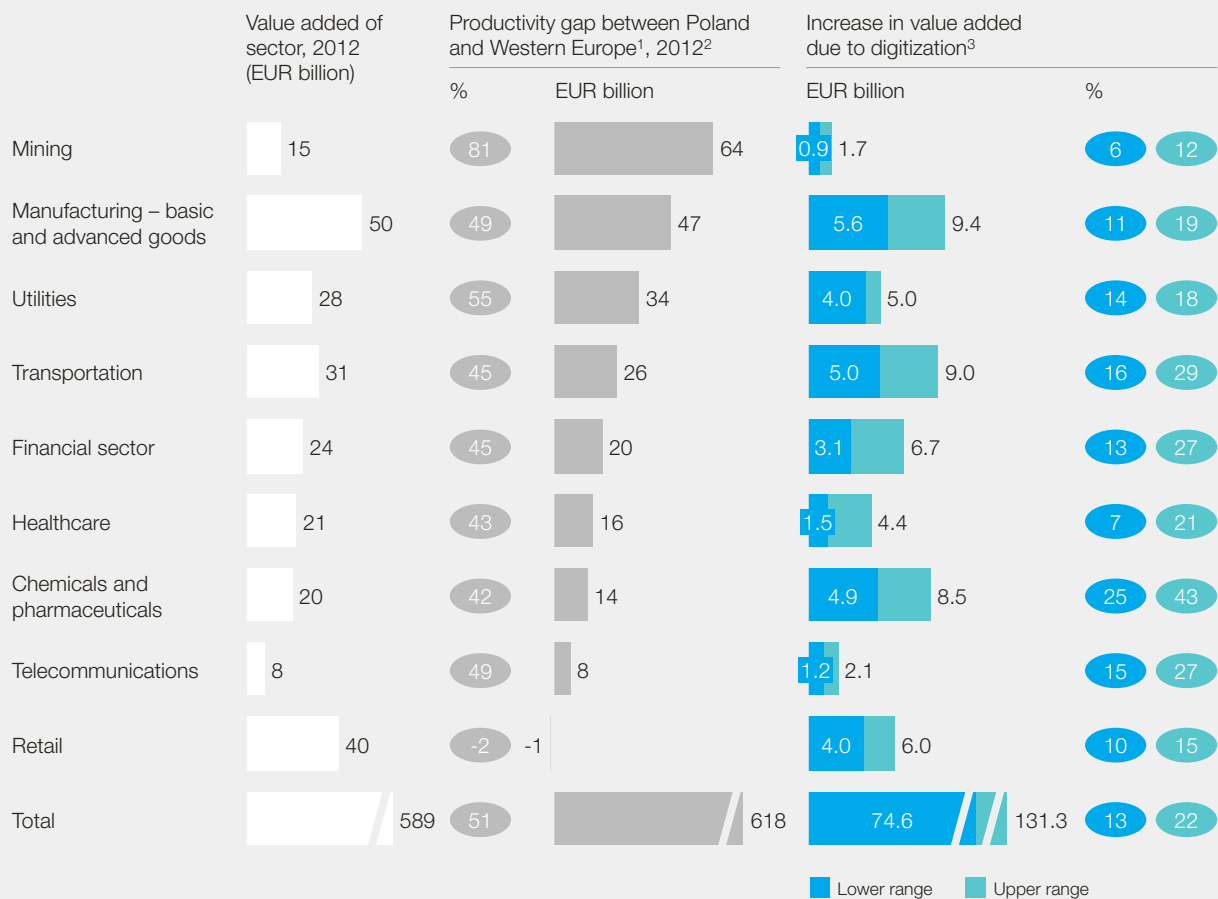
digitization. In sectors such as retail, Poland could even increase its gains over Western Europe (Exhibit 13).

According to McKinsey analysis, manufacturing, transportation, and utilities enjoy the biggest potential upside, a total of EUR 15 billion to EUR 23 billion, or 20%-31% of the overall potential. The reason for this is mainly these sectors' low starting point: all of them are in the group of digitally less-advanced sectors, with significant gaps to Western Europe in terms of digitization.

The financial sector in Poland is already well digitized. The gap between Poland and Western Europe is small here compared with other sectors, at just 13%.¹¹ Further digitization in this sector will therefore be more challenging, requiring advanced digitization levers.

Exhibit 13

Digitization could increase Poland's value added by 13%-22% over the next ten years



1 Theoretical increase in value added if productivity level of Western Europe is achieved, assuming Polish employment levels

2 2012 or latest available

3 For sectors not shown here, we assume potential equal to the average level of the sectors shown

SOURCE: Eurostat; McKinsey analysis

Crafting a digital strategy

Having examined the extent of the digital opportunity in Poland, we now turn to the pressing question of how Polish businesses can craft a robust digital strategy for themselves. Here, we draw extensively on the McKinsey framework presented in the *McKinsey Quarterly* articles “The economic essentials of digital strategy”¹² and “Competition at the digital edge: ‘Hyperscale’ businesses.”¹³

Polish firms require a clear digital strategy in order to take advantage of digitization. A digital strategy helps businesses understand what forces lie behind digital, what mechanisms drive change, and how they can address new market conditions. The McKinsey approach goes right back to the fundamentals of supply, demand, and market dynamics (Exhibit 14). This helps reveal the two primary sources of digital

transformation and disruption: the making of new markets, and the dynamics of hyperscaling platforms, such as Google or Apple. In the first, the changes in supply and demand are modest; in the second, the shifts are more extreme.

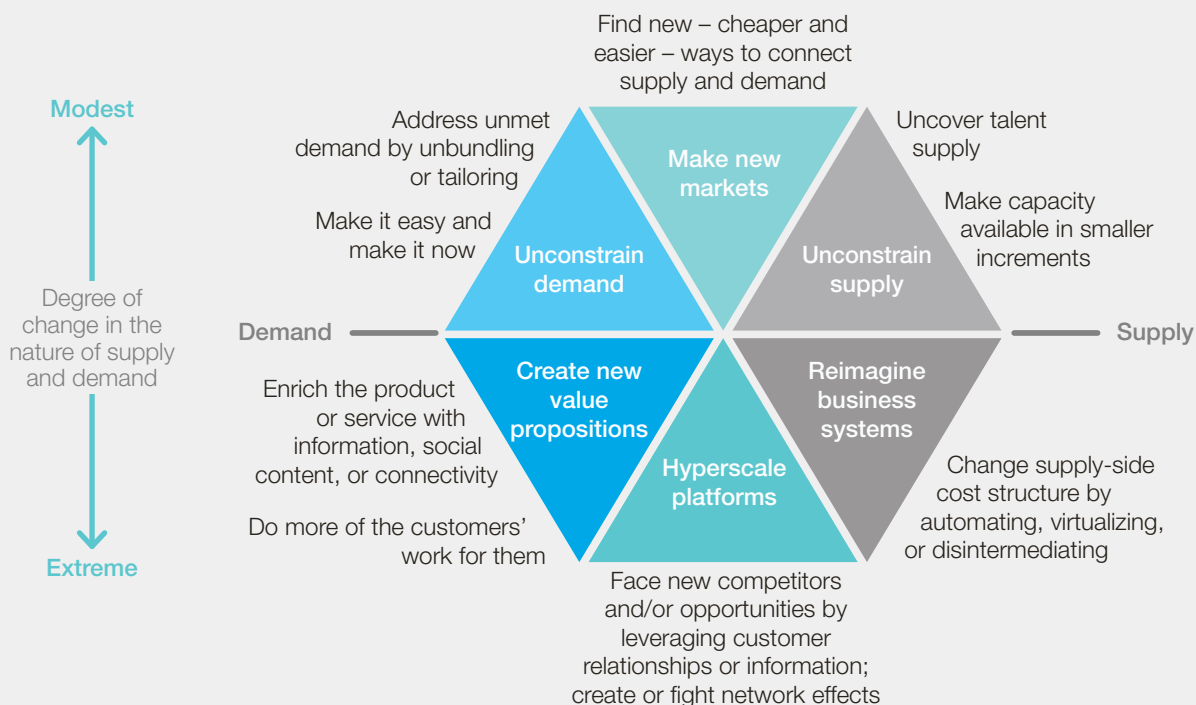
REALIGNING MARKETS

Digital technology exposes sources of supply that were previously impossible, or at least uneconomic, to provide. Digitization removes distortions in demand, giving customers more complete information and unbundling (or rebundling) aspects of products and services formerly combined (or kept separate) by necessity or convenience, or to increase profits.

This newly exposed supply, combined with newly undistorted demand, gives new market makers

Exhibit 14

Digitization can disrupt industries when it changes the nature of supply, demand, or both



SOURCE: McKinsey

an opportunity to connect consumers and customers by lowering transaction costs while reducing information asymmetry. Airbnb, for example, has not constructed new buildings; it has brought people's spare bedrooms into the market. In the process, it has uncovered consumer demand – which, as it turns out, always existed – for more variety in accommodation choices, prices, and lengths of stay. Similarly, Uber hasn't placed orders for new cars; it has brought onto the roads (and repurposed) cars that were underutilized previously, while increasing the ease of getting a ride. In both cases, although little has changed in the underlying supply and demand forces, equity-market value has shifted massively: at the time of their 2015 financing rounds, Airbnb was reported to be worth about USD 25 billion and Uber more than USD 60 billion. Airbnb and Uber may be headline-making examples, but established organizations are also unlocking markets by reducing transaction costs and connecting supply with demand.

Unmet demand and escalating expectations

Today's consumers are widely celebrated for their newly empowered behaviors. By embracing technology and connectivity, they use apps and information to find exactly what they want, where and when they want it – often for the lowest price available. As they do, they start to fulfill their own previously unmet needs and wants. Music lovers might always have preferred to buy individual songs, but until the digital age, they had to buy whole albums because that was the most valuable and cost-effective way for providers to distribute music. Now listeners pay Spotify a single subscription fee to listen to individual tracks to their hearts' content.

Similarly, with photos and images, consumers no longer have to get them developed. Instead, they process, print, and share their images instantly. They can book trips instantaneously online, thereby avoiding travel agents, and binge-watch television shows on Netflix or Amazon rather than wait a week for the next installment. In category after category, consumers are using digital technology to have it their way.

Skyrocketing customer expectations amplify the effect. Consumers have grown to expect best-in-class user experiences from all their online and mobile interactions, as well as many offline ones. Consumer

experiences with any product or service, anywhere, now shape demand in the digital world. In short, people are growing accustomed to having their needs fulfilled at places of their own choosing, on their own schedules, and often gratis. If the company cannot match that, there's a good chance another company will figure out how.

What are the indicators of potential disruption?

- Your customers have to cross-subsidize other customers.
- Your customers have to buy the whole thing for the one bit they want.
- Your customers can't get what they want, where and when they want it.
- Your customers get a user experience that doesn't match global best practice.

When these indicators are present, so are opportunities for digital transformation and disruption.

Exposing new supply

On the supply side, digitization allows new sources to enter product and labor markets in ways that were previously harder to make available. As “software eats the world” – even in industrial markets – companies can liberate supply anywhere underutilized assets exist. Airbnb unlocked the supply of lodging. Amazon Web Services provides on-the-fly scalable infrastructure that reduces the need for peak-capacity resources. In these examples and others like them, new supply becomes accessible and gets utilized closer to its maximum rate.

What are the indicators of potential disruption as companies expose previously inaccessible sources of supply?

- Customers use the product only partially.
- Production is inelastic to price.
- Supply is utilized in a variable or unpredictable way.
- Fixed costs are high.

These indicators let attackers disrupt by pooling redundant capacity virtually, by digitizing phys-

ical resources or labor, and by tapping into the sharing economy.

Making a market between them

Any time previously unused supply can be connected with latent demand, market makers have an opportunity to come in and make a match, cutting into the market share of incumbents or taking them entirely out of the equation.

Wikipedia famously unleashed latent supply that was willing and elastic, even if unorganized, and unbundled the product so that you no longer had to buy 24 volumes of an encyclopedia when all you were interested in was one entry. Google's AdWords lowers search costs for customers and companies by providing free search for information seekers and keyword targeting for paying advertisers.

To assess the vulnerability of a given market to new kinds of market makers, one must analyze the difficulty of transactions from the customer's perspective. Indicators include the following:

- High information asymmetries between customers and suppliers
- High search costs
- Fees and layers from intermediaries
- Long lead times to complete transactions

Attackers can address these indicators through the real-time and transparent exchange of information, disintermediation, and automated transaction processing, as well as new transparency through search and comparison tools, among other approaches.

EXTREME SHIFTS

So far, we have focused on the market realignment that occurs as matchmakers connect sources of new supply with newly purified demand. More extreme shifts are characterized by the introduction of new or significantly enhanced value propositions for customers, sometimes through reimagined business systems and sometimes through hyperscale platforms at the center of entirely new value chains and ecosystems. Attacks may emerge from adjacent

markets or from companies with completely different business objectives. The result can be not only the destruction of sizable profit pools but also the emergence of new control points for value.

Established companies relying on existing barriers to entry – such as high physical-infrastructure costs or regulatory protection – will find themselves vulnerable. User demand will change regulations, companies will find collaborative uses for expensive infrastructure, or other mechanisms of disruption will come into play.

Companies must understand a number of radical underlying shifts in the forces of supply and demand specific to each industry or ecosystem. The power of branding, for example, is being eroded by the social validation of a new entrant or by consumer scorn for an incumbent. Physical assets can be virtualized, driving the marginal cost of production toward zero.

Taken as a whole, these forces blur the boundaries and definitions of industries and make more extreme outcomes a part of the strategic calculus.

New and enhanced value propositions

First, as markets evolve, customers' expectations escalate. Second, companies meet those heightened expectations with new value propositions that give people what they didn't realize they wanted, and do so in ways that defy conventional wisdom about how industries make money.

Few people, for example, could have explicitly wished to have the Internet in their pockets until advanced smartphones presented that possibility. In similar ways, many digital companies have gone beyond improving existing offerings, to provide unprecedented functionality and experiences that customers soon wanted to have. Giving consumers the ability to choose their own songs and bundle their own music had the effect of undistorting demand; enabling people to share that music with everyone via social media was an enhanced proposition that consumers never asked for but quickly grew to love once they had it.

Many of these new propositions, linking the digital and physical worlds, exploit ubiquitous connectivity

and the abundance of data. In fact, many advances in B2B business models rely on things such as remote monitoring and machine-to-machine communication to create new ways of delivering value. Customers get entirely new value propositions that augment the ones they already had.

What are the indicators of potential disruption as companies offer enhanced value propositions to deepen and advance their customers' expectations?

- Information or social media could greatly enrich your product or service.
- You offer a physical product, such as thermostats, that's not yet "connected."
- There's significant lag time between the point when customers purchase your product or service and when they receive it.
- The customer has to go and get the product – for instance, rental cars and groceries.

These factors indicate opportunities for improving the connectivity of physical devices, layering social media on top of products and services, and extending those products and services through digital features, digital or automated distribution approaches, and new delivery and distribution models.

Reimagined business systems

Delivering these new value propositions in turn requires rethinking, or reimagining, the business systems underlying them. Incumbents that have long focused on perfecting their industry value chains are often stunned to find new entrants introducing completely different ways to make money.

Over the decades, for example, hard-drive makers have labored to develop ever more efficient ways to build and sell storage. Then Amazon (among others) came along and transformed storage from a product into a service, Dropbox upped the ante by offering free online storage, and suddenly an entire industry is on shaky ground, with its value structure in upheaval.

The forces present in this zone of the framework change how value chains work, enable step-change reductions in both fixed and variable costs, and help

turn products into services. These approaches often transform the scalability of cost structures, driving marginal costs toward zero and, in economic terms, flattening the supply curve and shifting it downward.

Indicators of disruption include the following:

- Redundant value-chain activities, such as a high number of handovers or repetitive manual work
- Well-entrenched physical distribution or retail networks
- Overall industry margins that are higher than those of other industries

High margins invite entry by new participants, while value-chain redundancies set the stage for removing intermediaries and going direct to customers. Digital channels and virtualized services can substitute for or reshape physical and retail networks.

Hyperscaling platforms

Companies such as Apple and Google are blurring traditional industry definitions by spanning product categories and customer segments. Owners of such hyperscale platforms enjoy massive operating leverage from process automation, algorithms, and network effects created by the interactions of hundreds of millions, billions, or more users, customers, and devices. In specific product or service markets, platform owners often have goals that are distinct from those of traditional industry players.

Moreover, their operating leverage provides an opportunity to upsell and cross-sell products and services without human intervention, and that in turn provides considerable financial advantages. Amazon's objective in introducing the Kindle was primarily to sell books and Amazon Prime subscriptions, making it much more flexible in pricing than a rival such as Sony, whose focus was e-reader revenues. When incumbents fail to plan for potential moves by players outside their own ecosystems, they open themselves up to the fate of camera makers, which became collateral damage in the smartphone revolution.

Hyperscale platforms also create new barriers to entry, such as the information barrier.

What are the indicators that hyperscale platforms, and the dynamics they create, could bring disruption?

- Existing business models charge customers for information.
 - No single, unified, and integrated set of tools governs interactions between users and suppliers in an industry.
 - The potential for network effects is high.
-

These factors invite platform providers to lock in users and suppliers, in part by offering free access to information.

All of these forces and factors come together to provide a comprehensive road map for potential digital disruptions. Executives can use this road map to take into account everything at once: their own business, supply chain, sub-industry, and broader industry, as well as the entire ecosystem and how it interacts with other ecosystems. They can then identify the full spectrum of opportunities and threats, both easily visible and more hidden.

Sector-specific challenges and opportunities

Over the last five years, digitally advanced industries in Poland have grown 2.8 times faster on average than digitally less-advanced sectors in terms of total sales, which sends out a clear message to businesses across all sectors (Exhibit 15).

Digitization brings other advantages, too. A country's technology firms, if listed on the stock exchange, are generally valued above the overall equity market. Thus, public companies in the technology sector in both Poland and the benchmark group (France, Germany,

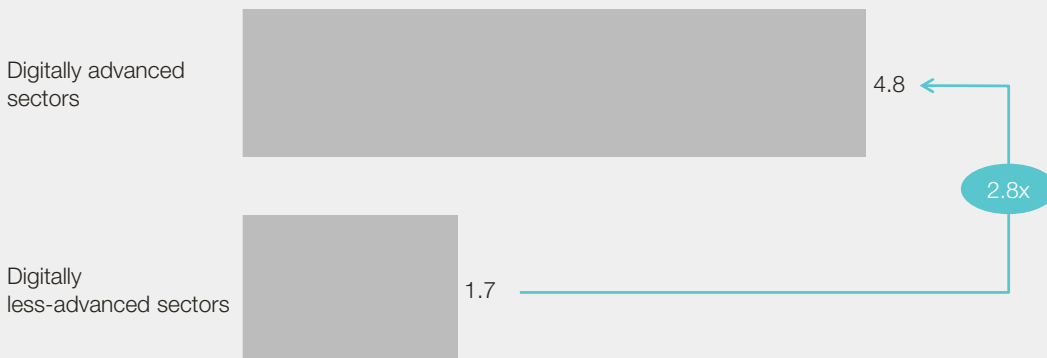
Netherlands, United Kingdom) are valued on average 14%-19% above their overall markets (Exhibit 16).

Digitization creates opportunities that can help companies move to the next level in terms of competitiveness (Exhibit 17). In this chapter, we focus on five specific sectors, discussing the levers for digitization for each. Three are digitally advanced sectors: telecommunications, retail, and financial sector; two sectors are less-advanced in terms of digitization: mining and manufacturing.

Exhibit 15

Over the last five years, digitally advanced sectors grew almost three times faster than digitally less-advanced sectors in Poland

Growth in total sales, sector averages compound annual growth rate (2010-15, %)



SOURCE: IHS World Industry Service (2016 Q2 release); McKinsey analysis

Exhibit 16

Companies in the technology sector in Poland and in a benchmark group in Europe trade at multiples 14%-19% higher than for their countries' overall markets

Difference between technology sector multiples and market multiples,¹ 2016 (%)



¹ Enterprise value divided by earnings before interest, taxes, depreciation, and amortization (EV/EBITDA) for WSE and WIG-Informatyka (Poland), Deutsche Boerse and TecDAX (Germany), FTSE and FTSE Tech (UK), AEX and AEX Tech (Netherlands), Euronext, and CAC Tech (France)

² France, Germany, Italy, Netherlands, Sweden, and United Kingdom were not included in the benchmark, as their stock exchanges do not have technology indices

SOURCE: S&P CapitalIQ, McKinsey analysis

TELECOMMUNICATIONS

Improvements in telecommunications technology have a widespread impact, not only on the telecom industry itself but also on other sectors where telecommunications represents the technological backbone for digitization. According to McKinsey analysis, further digitization of the telecom sector is expected to increase the value added of the sector by 15%-27%, or EUR 1.2 billion to EUR 2.1 billion.

Telcos can digitize in several different areas, including their customer-facing processes (sales, customer care), their internal processes (network planning, deployment, maintenance, etc.), and their commercial analytics (pricing, revenue stimulation, churn reduction, credit-risk scoring, etc.).

The digital opportunity in the first of these areas – customer-facing processes – lies in reinventing end-to-end customer journeys rather than one-off customer interactions. Telcos can build an ecosystem of digital journeys that the customer engages with continuously. This allows these companies to reduce direct customer-service costs: customers are now able to solve problems with limited human interaction, and interactions are significantly more efficient, thanks to the use of digital. The result is lower acquisition and onboarding costs, reduced call-center volumes, and higher completion rates during the onboarding process.

The digitization of internal processes represents another core lever for telcos. Businesses can use this lever to lower their corporate overhead, reduce physical documentation and mailing costs, improve their working capital (through faster collection of receivables), and optimize the impact of cross-channel marketing spend. In network infrastructure, telcos can use digital technology to offer real-time services, engage in preemptive service-quality management, and carry out advanced network optimization. Top improvement levers in the service layer of the network include early fault recognition based on digital tools, and digital management of the field force.

In commercial analytics, telcos can use advanced analytics to create algorithms for predictive churn prevention and next-product-to-buy engines.

RETAIL

In terms of productivity, the retail sector in Poland is already on a par with Western Europe. According to McKinsey analysis, however, this sector can progress even further. Over the next ten years, digitization in retail is expected to deliver an extra 10%-15% of value added in Poland, or EUR 4 billion to EUR 6 billion.

Two perspectives exist on the digitization of retail trade: the retailer perspective and the customer perspective. From a retailer perspective, the key levers

Exhibit 17

Main digitization levers by sector

Telecommunications	Digitized customer-facing functions	Reinvent end-to-end customer journeys using digital tools	
	Digitally supported internal processes	Reduce corporate overhead by digitizing time-consuming, low-value-added tasks, including back-office processes and network infrastructure maintenance	
	Commercial analytics	Use advanced analytics to support business decisions such as pricing, revenue stimulation, churn reduction, and credit-risk scoring	
Retail	Digitized end-to-end processes	<p>Develop sophisticated data models for optimizing time spent on low-value-added tasks (e.g., biometric checkouts, RFID checkouts, contactless payments, electronic shelf labels), optimizing labor scheduling and capacity planning</p> <p>Use RFID to improve inventory turnover and achieve faster processing by distribution centers</p>	
	Smart data-driven business decisions centered on customers	<p>Develop big data and advanced analytics to support smart data-driven business decisions centered on customers (e.g., measuring foot traffic for better queue management, cutting response time by means of beacon technology)</p> <p>Use technology to tailor product ranges, employ a dynamic pricing model based on real-time data, personalize promotions, manage customer loyalty, and manage queues using beacon technology</p>	
	Further shift from offline to online	Increase presence in e-commerce channel and optimize physical footprint	
	Omnichannel presence	Enable customers to switch seamlessly between channels with no adverse impact on their shopping experience	
	A digitally enriched shopping experience	Use technology-assisted shopping to enhance browsing, purchasing, way finding, and circulation in stores and shopping malls	
		<p>Create a virtu-real shopping environment, giving customers a personalized shopping experience</p> <p>Disrupt the shopping basket with 3D printing</p> <p>Use virtual and augmented reality to redefine how customers discover, interact with, and experience products and brands</p>	
Financial sector	Digitization across value chains	Banking	<p>Digitize customer journey by, e.g., remote self-service for bank products</p> <p>Reduce sign-up barriers by digitizing customer acquisition</p> <p>Introduce solutions to automate processes (e.g., digitally enabled work flow)</p>
		Insurance	<p>Use digitization to automate processes</p> <p>Offer purely digital service across customer journey</p> <p>Enable dynamic risk calculation</p>
Mining	Digitally enabled mine planning	Leverage 3D scans of deposits for high-efficiency exploration	
	Predictive maintenance of equipment	Improve availability of equipment by using predictive models for maintenance cycles, helping to analyze real-time data from sensors installed on equipment	
	Autonomous machinery	Improve productivity and safety through autonomous machinery	
Manufacturing (basic and advanced goods)	Digitally enabled production and logistics management	<p>Leverage advanced analytics in the management cockpit for production planning and yield management</p> <p>Adopt just-in-time stock management based on predictive demand models</p>	
	Predictive maintenance with distant support	Adopt predictive maintenance and central programming for connected machines and equipment, increasing availability, and limiting failures	
	Intelligent quality assurance	Analyze the manufacturing process to eliminate root cause of flawed items	

are the digitization of end-to-end processes, smart data-driven business decisions centered around the customer, and further conversion from offline to online trade. From a customer perspective, omnichannel retail will become the rule rather than the exception, and a number of technology solutions will provide a digitally enriched shopping experience.

Retailer perspective

Digitization of end-to-end processes

The digitization of end-to-end processes may open up new possibilities for retail operations. Digitization in this sector ranges from optimizing labor utilization to inventory management. Sophisticated data models and technological support for managers can help optimize labor scheduling and hence capacity planning. For instance, a scheduling platform can embed complex data models that incorporate historical and external data, such as weather conditions. This enables managers to improve the accuracy of their predictions.

Various technological solutions help optimize workforce time allocation. Technologies such as RFID¹⁴ and beacons supported by the Internet of Things make it possible to track products and equipment along the supply chain in inventory management. They also contribute to increased turnover of inventory and faster processing by distribution centers. This ultimately leads to a reduction in inventory costs.

In a digitally enhanced retail store, electronic shelf labels can transmit prices from central servers to labels via RFID chips. Customers use RFID checkouts and make contactless payments. An alternative solution is to install advanced bar-code scanners. Not only can retailers optimize their workforce allocation for shelf control and checkout, they also can increase the efficiency of their stock control and space management.

Smart data-driven business decisions centered on the customer

Retailers can leverage digitization by developing big data and advanced-analytics models aimed at supporting smart data-driven business decisions centered around the customer. Digitization helps improve in-store customer experience by measuring foot traffic for better line management, or decreasing response time by means of beacon technology.

In the field of category management, new technology makes it possible to combine behavioral, geospatial, and demographic data to tailor an assortment to a particular store format or customer profile. By setting up a dynamic pricing model combining several data sources in real time (supply, demand, and competitor data), retailers are able to design attractive offers and, as a result, optimize value perception, build traffic, and increase conversion. They can also make personalized offers through all channels, whether in-store, online, or mobile. Loyalty card data, which include demographics and historical purchase data, can be leveraged to digitally enable the promotion mechanism.

Shift from offline to online trade

There are two consequences of the continued shift from offline to online trade.

The first is the expansion of the online market space in Poland. Poland currently still lags behind key reference markets as regards the penetration of online trade, but the e-commerce market is expected to grow over the next ten years as it catches up with benchmarks in Western Europe (Exhibit 18).

Further growth of e-commerce is fueled by two key drivers: the increasing frequency of online shopping and the growing purchasing power of consumers aged 10-34. Another consequence of increased online penetration will be the optimization of the physical footprint of stores over the next ten years due to a growing customer preference for online shopping.

Customer perspective

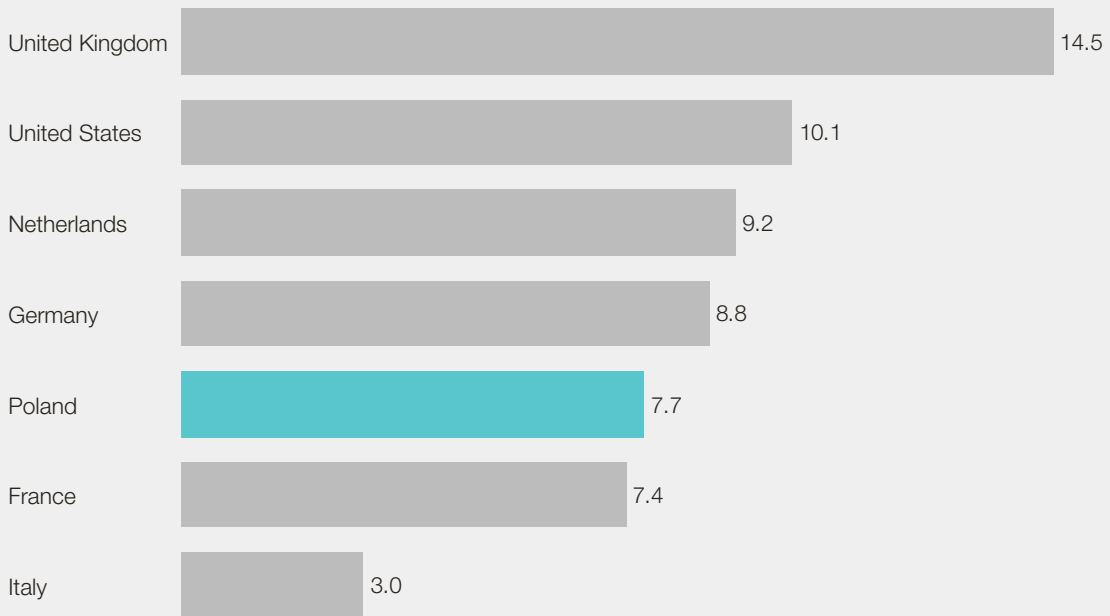
Omnichannel retail will be the rule rather than the exception

Customers increasingly expect to be able to move seamlessly between channels without having an adverse impact on their shopping experience. A single channel is no longer enough. We see bricks-and-mortar retailers trying to get online and online retailers trying to establish physical stores in a race to integrate the online and offline shopping experience for customers. Retailers need to stop thinking exclusively about where the purchase happened and instead focus on all steps of the customer journey – whatever the channel.

Exhibit 18

Penetration of e-commerce in Poland is lower than in most Western European countries

Share of e-commerce in total retail spend,¹ 2016 (%)



¹ Penetration rates based on EUR million retail value excluding sales tax, constant 2015 prices, and fixed 2015 exchange rates. Data for 2016 estimated in the fall of 2015

SOURCE: Euromonitor International

A digitally enriched shopping experience

Technology-assisted shopping will significantly enhance in-store browsing, purchasing, way finding, and circulation within stores and malls. We will see interactive digital kiosks at the place of arrival, advising shoppers on how to plan their shopping journey. There will be virtual fitting rooms with digital assistants offering an extended assortment, and interactive digital shop windows that allow customers to play and interact with products.

A number of technological solutions have the potential to revolutionize the way we shop. Some of the most revolutionary ones are: “virtu-real” shopping, virtual reality (VR) and augmented reality (AR),¹⁵ and 3D printing.

A “virtu-real” shopping environment provides customers with a personalized shopping experience that blurs the boundary between the virtual and real worlds. It can involve dynamic touch-screen LED displays that dispense scents, products that

are trending online being highlighted in physical stores, and digital shopping walls along shoppers’ circulation routes.

Virtual and augmented reality may redefine the way customers discover, interact with, and experience products and brands. For example, customers might use virtual reality to customize clothes and accessories based on their preferences when buying online or experiencing products not currently available in the store. Or they might use augmented reality in stores to explore and hunt for attractive promotions.

3D printing also could change the rules of the retail game. This technology is expected to disrupt the retail industry in two ways: by letting customers 3D print their own customized products in-store or at home (disrupting the shopping basket) and by changing the supply chain (reducing transportation, inventory levels, manufacturing, and retailing costs).

FINANCIAL SECTOR

For our purposes, two key industries in the financial sector are banking and insurance.

Banking

The Polish banking sector is already digitally advanced. Examples include online banking fully integrated with real-time CRM, omnichannel customer service (including financial products in virtual branches, customer service through social media), bancassurance (access to offers of insurance partners via the bank's online platform), partnerships between banks and mobile operators for mobile retail banking and online currency exchange platforms.

Nevertheless, McKinsey analysis shows that digitization in Poland could lead to growth of value added in the banking sector by 12%-26%, or EUR 2.5 billion to 5.4 billion, over the next ten years, setting new standards for customer service and support processes. To transform Polish financial institutions into fully digitized organizations, advanced levers will be required (such as introduction of a fully digitized online platform for all customer segments). Digitization has potential across the whole value chain, from customer acquisition to processing and service delivery – as we describe further below.

Polish consumers still lag behind Western Europeans with regard to the percentage of households with Internet access (75%¹⁶ vs. 87%¹⁷) and the percentage of smartphone users (41%¹⁸ vs. 62%¹⁹). Therefore, demand for these types of services (electronic banking) in Poland will grow as the rates increase.

Players that can follow the digitization trend stand a much better chance of improving their profitability in terms of return on expenditure (ROE)²⁰ and cost/income.²¹ In the short term, digitization may help reduce the cost base of banks, as it enables them to reduce customer service expenses, especially in the mass market. In the longer perspective, digitization would improve the quality of service (through, for example, the opportunity of testing new solutions and collecting feedback from customers almost in real time), and would result in a clear boost of competitiveness as compared with other banks and fintech companies.²² On the other hand, banks that neglect digitization may experience a worsening of their competitiveness, relative to other players in the market.

Digitally supported customer journey

From the customer's perspective, the extent of digitization of the so-called customer journey is what matters most. Online and mobile platforms broaden the range of services offered by the banks, at the same time increasing customer comfort. The examples are numerous, from the remote self-service of bank products, through discounts offered by banks' partners, matched to the customer's profile, to visualization tools (e.g., results of investment portfolio, household budget). The digital tools may also make customer relations more attractive, by offering support – e.g., in the form of webinars covering financial subjects, live calls with the virtual branch, or product assistance via chat.

Customer acquisition

Digitally supported customer acquisition is focused on reducing sign-up barriers. Digitization will significantly facilitate the account-opening process and will also enable remote access to the full product offering (applying for or purchasing products).

For products that require a risk assessment, digitized approval and onboarding are simplifying and accelerating sign-up processes (increased use of straight-through processing (STP)²³ and possibility to utilize machine learning in the already automated processes). Relevant technologies include online application, form tracking, e-signature (in Poland so far only to a limited extent), and digital image ID verification.

To extend customer reach, banks can leverage online solutions that facilitate the integration of the value chain. This could include integrated partnerships with retail partners to make targeted offers to customers – for example, pop-up offers based on location data and recent search queries. It is worth noting that the first such solutions have already appeared in the Polish market.

Automation of processing

Financial institutions can support automated processing by introducing such solutions as digitally enabled work flow and automated application routing, automated risk assessment process, and real-time status updates.

Advanced analytics and machine learning are the two elements that will allow financial institutions to move from digital functionalities to digitally enabled decision making. Both these levers help banks to use generally available data (demographics, behavioral data, social-media data) for the purpose of real-time risk assessment and developing personalized product offers.

Insurance

According to McKinsey analysis, digitization has the potential to boost value added in insurance by 17%-33%, or by EUR 0.6 billion to EUR 1.2 billion over the next ten years. The key areas where digitization has potential include data processing, customer journey, and risk assessment.

Digitization of processes

Digitization supports the optimization of back-office processes. The opportunities include automation of manual activities (data entry, document management), fraud detection, or fully automated solutions (automated processing, self-service).

Customer journey

Digitization can improve customer experience, offering purely digital service across the whole insurance value chain. First, the insurance product portfolio can be presented to customers outside the traditional channel (insurance agents). Following purchase of the policy, customers can manage their product portfolio online. Claim notification, tracking the approval process and seeking help can also take place via the digital channels. Digital insurers use also the omnichannel communication model,²⁴ which includes live interaction with the insurance company in the form of video chat.

Risk management

Digitization enables dynamic risk calculation using complex algorithms, updated almost in real time. Insurers can create value added using the opportunities offered by more accurate risk assessment. This assessment can be based on telematics, which is understood as the multidisciplinary integration of telecommunication, automation, and IT.

Telematics is expected to have both a preventive and financial impact. From the prevention perspective, the new technology can motivate drivers to drive more safely and avoid dangerous routes, bypass accidents, and as a result avoid damages. It can even also automatically call for help in the event of an accident. Higher margins would be achieved through matching the level of premium to the risk assessed on the basis of new customer information, such as driving style. Each car would be telematics enabled, connected to the cloud and communicating in real time.

There are two key enablers for digitization in the insurance sector: population database and the regulation of big data.

In terms of customer acquisition, the digitization of the insurance sector is limited to a certain extent by the significant number of data points a customer must provide to purchase an insurance policy. A national database is needed, with information on individual citizens, which would significantly shorten the time to presenting the offer to the customer (e.g., extending the database of the Insurance Guarantee Fund).

Big data analytics is becoming the fundamental tool for digitization of the insurance sector. Nevertheless, it is necessary to develop sector-specific regulations that would define the range of data insurers would be able to collect.

MINING

According to McKinsey analysis, digitization can be an effective way to address the productivity issue in mining. In Poland, digitization is expected to deliver 6%-12% additional value added, or an extra EUR 0.9 billion to EUR 1.7 billion, over the next ten years.

Both globally and nationally, productivity is the critical issue in mining. According to McKinsey analysis, global mining productivity fell by 39% – a compound annual growth rate of approximately -3.9% – between 2004 and 2014.²⁵ This decline was due to increasing geological degradation and tougher mining conditions, such as deposits located deeper underground. Moreover, a lack of confidence in commodity prices and increased cost pressure resulted in greater risk aversion among investors.

Historically, the mining sector has seen less progress in innovation than other industries. As a result, mining has lagged behind other process industries such as refining and petrochemicals in terms of operations, process optimization, supply chain management, and the adoption of digital technology. For instance, less than 1% of the data collected in the mining industry is used for analysis. In the current time of low commodity prices, we are observing increased digitization efforts in the industry.

The key digitization levers in mining are digitally enabled mine planning, predictive maintenance of equipment, and autonomous machinery. These are enabled by data collection, storage, and analytics. They can help improve accuracy in identifying extraction areas, reduce labor intensity, and increase safety standards.

Digitally enabled mine planning

3D scans enable more accurate assessment of the quality and location of deposits through 3D modeling. This enables increasing efficiency of exploration over mine lifetimes.

Predictive maintenance of machines and infrastructure

Digitally enabled maintenance of mining machines and infrastructure is another key digitization lever. Predictive models of maintenance cycles help analyze real-time data from sensors that can be installed on mining equipment and infrastructure. Mining companies can use predictive maintenance to increase the availability of machinery, significantly cutting maintenance costs and improving the productivity of mines.

Autonomous machinery

The use of autonomous or remotely controlled machinery not only improves productivity by allowing continuous operation, it also raises safety standards. For example, digitally enabled drilling increases the available drilling time per shift and improves drilling and blasting accuracy. Real-time assessment of the mined ore body using digital tools provides information about key ore parameters such as hardness and fineness, which in turn enables more accurate processing. Autonomous haulage reduces costs, as

fewer workers are involved. Safety improves, thanks to taking people out of the most dangerous parts of the mine, employing shut-down protocols and sensors that are more sensitive than human drivers, and improving planning and control. Where accidents do occur, workforce-tracking systems make it possible to accurately identify the location of miners.

MANUFACTURING OF BASIC AND ADVANCED GOODS

According to McKinsey analysis, over the next ten years digitization is estimated to increase value added in the manufacturing of basic and advanced goods in Poland by 11%-19%, or EUR 5.6 billion to EUR 9.4 billion.

We break down the manufacturing sector in Poland into two segments: firms with labor-intensive production processes that have yet to be automated, and firms whose processes are already automated and can now be digitized.

The first group of firms should be aware that their labor-cost advantage is gradually evaporating. For them to remain competitive in local and global markets, automation may be inevitable. Although there is no digitization without prior automation, Poland might be able to leapfrog economies dominated by automated manufacturing by increasing its levels of automation and introducing digitization at the same time.

The second group of firms are those that already have automated production lines. These companies can now optimize their manufacturing processes further still by digitizing their operations.

The key digitization levers for the Polish manufacturing sector are digitally enabled production and logistics management, predictive maintenance with remote support, and intelligent quality assurance.

Digitally enabled production and logistics management

Digitization can help manufacturers predict demand and build resource-based transparency. Currently, managers have an overview of historical results based on the output figures for their plants. Implementing a management cockpit supported by advanced analytics can help manufacturers move from output-based transparency to resource-based transparency of process and results. This will enable them to make

reliable short-term predictions. Additionally, advanced analytics can help firms make demand predictions on a store-by-store basis, with the granularity of the analysis providing a high degree of precision. Thanks to digitally enabled control of machinery, production lines can operate with greater flexibility and increased ability to offer product customization.

The prevailing approach in today's manufacturing is customer-pulled one-piece flow, where customer demand translates into the production plan. Firms can evolve this approach to digitally enabled production planning, leveraging advanced analytics to manage yield.

Just-in-time stock management based on predictive models for demand has the potential to replace the current approach of overstocking. Optimizing inventory means less working capital is required and higher margins are achievable.

Predictive maintenance

Another digitization lever is predictive maintenance with remote support. Connecting up all your machines and equipment enables central control and programming. The availability of production lines improves, fewer failures occur, and ultimately throughput increases.

Intelligent quality assurance

Leveraging digitization in quality assurance is another effective way to boost productivity. The current approach to quality assurance focuses on eliminating flawed items from batches. Intelligent quality assurance, by contrast, focuses on analyzing the manufacturing process to eliminate the root cause of flawed items. Once the root cause is found and eliminated from the process, the flaw in question no longer occurs – and productivity goes up.

Conclusions

As we concluded in our *Poland 2025: Europe's new growth engine* report in 2014, Poland has come to a developmental threshold after 25 years of outstanding economic growth. The country is still only halfway along the road to complete success. If Poland has the ambition of becoming one of the most advanced economies, it should take full advantage of the first industrial revolution it can fully participate in – the digital revolution.

The good news for Poland is that, in Europe and globally, this revolution is only starting, and Poland is well positioned to take advantage of it. Based on the size and quality of its talent pool and affordability of highly educated and digitally enabled professionals, Poland can create an advanced and digitized economy.

To get there, Poland needs to digitize the core of the economy. Companies in utilities, transportation, manufacturing, and other sectors should start or

accelerate their digital transformations in order to catch up with the Western European benchmark in terms of productivity and advancement. Some, like retail and financial services, are already at the forefront of the digital revolution and should continue their efforts.

In this report, we discussed specific levers that can help companies fully embrace a digital opportunity and move to the next level in terms of competitiveness.

This requires urgent action on both the company level and the country level. Poland needs a concerted nationwide effort, with the joint participation of the key stakeholders: business, government, and academia.

The challenges are many, but so are the country's strengths. Poles stand before a historical opportunity to use the full potential of the digital revolution and realize the country's ambitions to be in the economic premier league.

Endnotes

- 1 *Poland 2025: Europe's new growth engine*, McKinsey & Company, 2015
- 2 *Industry 4.0: How to navigate the digitization of the manufacturing sector*, McKinsey & Company, 2015
- 3 OECD: Graduates by field of education, 1998-2012; graduates of tertiary education between 1998-2012 in the following technical fields: mathematics and statistics (ISC 46), computing (ISC 48), engineering and engineering trades (ISC 52), manufacturing and processing (ISC 54), architecture and building (ISC 58)
- 4 Based on an analysis of the average labor cost in the information and communications technology (ICT) sector
- 5 GUS, *Spoleczeństwo informacyjne w Polsce*, 2015
- 6 McKinsey Digital Consumer Poland 2016 Survey, McKinsey survey, 2016
- 7 France, Germany, Italy, the Netherlands, and the United Kingdom
- 8 The countries that made up the EU between 1995 and the expansion of 2004, i.e., Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom
- 9 To put a percentage value on the extent to which countries have realized their digital potential, we take the ICT sector in the United States as our basis and assume that this sector is 100% digitized. We then compare countries' level of digitization with this basis
- 10 In *Poland 2025* we give the productivity gap between Poland and EU-15 as 35% as of 2011. The 51% gap given here is between Poland and our representative group of Western European economies: France, Germany, Italy, the Netherlands, and the UK
- 11 Sector digitization gaps between Poland and Western Europe were shown in Exhibit 5
- 12 Angus Dawson, Martin Hirt, and Jay Scanlan, "The economic essentials of digital strategy," *McKinsey Quarterly*, March 2016, McKinsey.com
- 13 Michael Chui and James Manyika, "Competition at the digital edge: 'Hyperscale' businesses," *McKinsey Quarterly*, March 2015, McKinsey.com
- 14 Radio-frequency identification: a technology used to track objects tagged with chips, using electromagnetic fields
- 15 Virtual reality (VR) is a computer technology that replicates an environment, real or imagined, and simulates a user's physical presence and environment to allow for user interaction. Virtual realities artificially create sensory experiences, which can include sight, touch, hearing, and smell. Augmented reality (AR) is a live direct or indirect view of a physical, real-world environment whose elements are augmented by computer-generated sensory input, such as sound, video, graphics, or GPS data
- 16 Share of households with Internet access. Eurostat, Information society statistics – households and individuals, data for 2014
- 17 Share of households with Internet access; average for France, Germany, Italy, Netherlands, Sweden, and the United Kingdom. Eurostat, Information society statistics – households and individuals, data for 2014
- 18 Smartphone penetration in the population aged 18 and above. Pew Research, Spring 2015 Global Attitudes survey
- 19 Smartphone penetration in the population aged 18 and above; average for France, Germany, Italy, Spain, United Kingdom. Pew Research, Spring 2015 Global Attitudes survey
- 20 ROE in the Polish banking sector has been falling recently, from an average of 13% in 2008-11 to 9% in 2012-15. This compares with 0.3% in 2008-11 and 2% in 2012-15 in Western Europe. It should, however, be noted that compared with Western Europe, the Polish banking sector still offers attractive profitability. European Central Bank, Eurostat
- 21 Cost-to-income ratio
- 22 "Fintech" – financial technology – refers to firms that leverage technology to make financial services more accessible and efficient. Fintech companies may be involved in areas such as loans, mobile payments, money transfers, and even fund-raising
- 23 Automated business processes
- 24 Communication with clients through several closely integrated channels, providing a consistent cross-channel experience
- 25 Mining Productivity Index calculated by McKinsey