

Digital Czech Republic: How we grow

Report | January 2017



Preface

Digital Czech Republic is a McKinsey & Company report that attempts to provide a holistic view of digitization in the Czech Republic. It aims to quantify – for the first time – the opportunity that digitization presents for the Czech economy. Its aspiration is to help businesses think about digitization and to offer a number of sector-specific perspectives and potential ambitions. An additional goal is to consider the role of digitization beyond business, and offer policy makers and citizens a point of departure for thinking about digitization.

The report also reflects the deep commitment of McKinsey's Prague office to Czech economic and social development. It continues the tradition of previous research, including our study on Czech economic potential (October 2015, in cooperation with the Aspen Institute and Forbes), the potential of women in Czech business (April 2012), and the state of the Czech education sector (September 2010).

Insights and aspirations for the different industry sectors of this report were developed together with our sector leaders: Wojtek Bogdan, Viktor Hanzlík, Ivan Jelíček, András Kadocska, Michal Čermák, Tomáš Karakolev, Peter Kováčik, John Leach, Michal Skalský, Daniel Svoboda, Michal Valachovič and Jiří Franta. We are also thankful to David Tan and Sergey Khon from Finalta, who provided us with unique insights on the financial segment. Moreover, we would like to thank the experts who provided their knowledge and expertise to various parts of this report. They are; Sree Ramaswamy, Henk Broeders, Somesh Khanna, Adrian Booth, Niko Mohr, Peter Peters, Rajat Agarwal, Shankar Chandrasekaran, Mukund Sridhar, Karel Dörner and Jürgen Meffert. We would like to thank our management consultants – Boris Reznicek, Marek Slobodnik, Dan Kohout, Albert Soukup and Lucie Markova – who have been working together with sector experts and contributors in writing this report.

This report is part of a series of publications on digitization across the world. Previous publications include Digital America: A tale of the haves and have-mores (published December 2015), Digital Europe: Pushing the frontier, capturing the benefits (June 2016), The economic essentials of digital strategy (March 2016), and Digital Poland: Capturing the opportunity to join leading global economies (August 2016). We would like to thank the authors of these reports for sharing their expertise and insights with us.



Michal Čermák
Expert Partner, McKinsey & Company
Prague



Dan Svoboda
Managing Partner, McKinsey & Company
Prague

About McKinsey & Company

McKinsey & Company is a global management consulting firm, deeply committed to helping institutions in the private, public, and social sectors achieve lasting success. For nine decades, our primary objective has been to serve as our clients' most trusted external adviser. With consultants in more than 100 offices in 62 countries, across industries and functions, we bring unparalleled expertise to clients anywhere in the world.

About McKinsey Prague

The Prague office of McKinsey & Company is a unique blend of talented people, innovative ideas, management excellence, and a long history of relationships with leading Czech and Slovak institutions. Since 1994, we have managed to grow into a large office with a 'small office feel', not losing our entrepreneurial roots and spirit. We regularly do pro bono work: most recently, we looked at how to radically improve the outcomes of our primary education system. Equally importantly, we are proud to have raised and developed a number of business and society leaders in the Czech Republic and Slovakia.

About Digital McKinsey

Digital McKinsey is a global organization that brings together the best of McKinsey's digital capabilities. Digital McKinsey not only advises but also builds, operates, and transfers capabilities to help our clients create value by reinventing the core of their businesses. Digital McKinsey brings together nearly 2,000 experts from across our global firm – including more than 800 developers, designers, IT architects, data engineers, agile coaches, and advanced analytics experts.

About the McKinsey Global Institute

The McKinsey Global Institute (MGI), the business and economics research arm of McKinsey, was established in 1990 to develop a deeper understanding of the evolving global economy. MGI's mission is to help leaders in the commercial, public, and social sectors develop a deeper understanding of the evolution of the global economy and to provide a fact base that contributes to decision making on critical management and policy issues.

Contents

08	In Brief
12	Reaching high: The macroeconomics of digitization
14	Introduction: Opening our eyes to the world
16	Looking up to the bar: Digitization across Europe
20	Understanding growth: Labor productivity
24	Pleasures and pains: How digitization works
30	Setting our ambitions: Productivity growth
32	Choosing your field and setting aspirations: Industry focus
34	Telecommunications
40	Retail
48	Manufacturing
56	Banking
64	Insurance
70	Utilities
76	Construction
82	Healthcare
88	Making a difference for everybody: Businesses, government and individuals
92	Companies: Achieving a successful digital transformation
94	Government: Bringing digitization to citizens
102	Individuals: Fighting for a happier life
106	Summarizing what we learned: Conclusion
110	Contributors
114	Appendix: Methodology of the macroeconomic section





In brief

As with the rest of the world, the Czech Republic is undergoing a digital transition. Its effects on the economy are not uniform – companies in different industry sectors digitize at a different pace and have to adopt their own aspirations. Meeting them will enable the Czech Republic to accelerate productivity and growth. However, digitization is the responsibility of all stakeholders – not just businesses. Policy makers and citizens will also need to do their part to accelerate digitization and ensure that it works for them.

- McKinsey’s Industry Digitization Index captures how digitization is spreading across Europe and provides a picture of companies’ digital assets, uses, and workers. The index shows that Europe’s economy is digitizing unevenly, with large variations across sectors and firms. The information and communications technology sector is at the digital frontier. Media and finance are close to the frontier, while large, traditional sectors (like construction and healthcare) lag far behind.
- The Czech Republic lags behind Western Europe in labor productivity; in nominal terms, the gap stands at 60%. Digitization is a way to narrow that gap, and indeed more digitized Czech sectors have seen more productivity growth. By embracing digitization, the Czech Republic can contribute to closing up to 19% of the productivity gap. Spread out over 10 years, this would increase Czech GDP by 1.0 – 2.1% annually.
- We propose a framework to demonstrate the effects of digitization on different sectors. The framework views the effect of digitization as a change in labor productivity resulting from four factors: (1) changing legacy product/service volumes, (2) changing costs, (3) revenue from new products/services and (4) changes in hours worked. Using these factors as a lens explains why digitization is a boon to some sectors and a curse to others.
- Digitization presents different opportunities and challenges in different sectors. Companies in each sector need to set bold aspirations to take advantage of these trends. This report discusses possible aspirations and digitization levers in eight key sectors (telecommunications, retail, manufacturing, banking, insurance, utilities, construction, and healthcare). The highest-priority levers differ from sector to sector and companies need to understand the broader implications of digitization on their competitive advantages and market conduct, and the dynamics in the broader value chain.
- Business leaders have already recognized that a digital transformation is necessary, but often struggle to ensure that they take the right approach. We provide “nine key questions” which should help them make the right decision.
- It would be a mistake to limit digitization to business. Czech policymakers need to adopt digital technologies to transform the delivery of public services. The Czech Republic ranks 92nd in the provision of online government services – just below Belarus and El Salvador. The Government can also help get Czech individuals and businesses online. Finally, it can change the way of setting regulation, adopting, for example, a more experimental approach to regulate the next Uber or Airbnb.
- Finally, individuals will need to balance the advantages and disadvantages digitization brings to their daily lives and fight to ensure that in aggregate it brings them a happier life. Digitization transforms all dimensions of our lives; our careers, our consumption habits, our entrepreneurial opportunities, the way we gather information, as well as our social and communal lives.
- Digitization is a challenge and all stakeholders will need to find new ways of doing things. The authors hope that this report will provide direction in this uncharted territory.





Reaching high: The macroeconomics of digitization

As a child needs to explore the world, our economy needs to learn about digitization – what it is, how it works, and how it influences us. Just as children contemplate adulthood, we need to look up and understand the ambitions we have for our digital age.

Introduction:

Opening our eyes to the world

Across the developed world, digitization is affecting old and new alike. The major assets of some of the world's largest companies are pieces of data – and many of the sectors they compete in did not exist only three decades ago. Even sectors that are intrinsically physical – like construction – are introducing digital technologies. Companies do so to change the way they work and change the way they engage with customers and partners. People are using technologies to transform their lives, going online to do everything from finding a job to finding love. Young people do so in astonishing numbers – 96% percent of Czechs under 24 have used the internet in the past 3 months.¹

The reason why Czech companies digitize depends on the sector they are in. Attacker banks are transforming themselves end-to-end to serve customers digitally, offering unrivalled online experiences and keeping their operations exceptionally lean. Grocery stores are going online, surpassing the service of traditional supermarkets by delivering food wherever and whenever customers want it.

It is becoming ever more important to understand what digitization is, how we can measure it, and how it affects the Czech economy, businesses, and consumers. To understand the impact of digitization in Europe and in the Czech Republic, we first looked at how digitization is understood globally, and how this can be used to understand its effects on European industry sectors. We then look at the Czech Republic, in particular how digitization can influence labor productivity and the effects digitization can have on Czech companies and Czech consumers.

¹ Český statistický úřad, (Czech Statistical Office) 2015



Looking up to the bar: Digitization across Europe

Measuring the impact of digitization in Europe

For all the progress that Europe has made to digitize its economies, consumers and societies, the adoption of digital technologies by businesses and industry sectors has been uneven. Europe therefore remains some distance behind the digital frontier formed by the ICT² sector in the vanguard and a number of other sectors with high digital intensity, including media and finance, are just behind that frontier; large traditional sectors lag far behind. Overall, Europe's digital frontier is far behind that of the United States.

Most measures of digitization in an economy tend to focus on market-oriented metrics, such as share of e-commerce, or output-oriented metrics, such as the value added by the ICT sector. While these measures are useful, they provide no indication of how the economy is assimilating digital capability across multiple sectors. For example, the ICT sector provides a view of how sectors have purchased such technologies to support their digitization, but purely measuring the ICT sector does not track the return on that investment; that is, the ability of companies to develop higher-value-added performance thanks to the diffusion of digital technologies in their workflow or in the way they conduct relationships with their customers and suppliers, for instance.

In our research, we estimate the extent to which sectors within various European countries are absorbing and deploying digital capabilities and practices. To do so, we have created an Industry Digitization Index that examines sectors across the economy through the lenses of digital assets, digital usage, and digital workers (Exhibit 1). The index gives a view across sectors of how enterprises are investing or spending on digital capabilities; how they deploy digital technologies to engage their customers, suppliers and partners, and how they digitize their internal processes, create a digitally enabled workforce, and digitize work itself.

The index uses 21 indicators to capture several ways in which companies are digitizing.³ To measure digital assets, for instance, we consider business spending on computers, software and telecom equipment, as well as the stock of ICT assets. Usage metrics include a sector's use of digital payments, digital marketing, and social technologies, as well as the use of software to manage both back-office operations and customer relationships. For the workforce, we estimate the share of workers in each sector in digital related occupations and we determine digital spending and assets on a per-worker basis.

The Industry Digitization Index shows digital penetration across sectors and the gap between the digital frontier and the rest of the economy.

² Information and communication technology

³ See the appendix of this report for a description of the indicators



Exhibit 1

The MGI Industry Digitization Index for Europe

2015 or latest available data

Relatively low digitization Relatively high digitization

● Digital disruptors within relatively less-digitized sectors

Sector	Overall digitization	Assets		Usage			Labour		Share of value added, 2013 ¹ %	Share of employment, 2015 ² %
		Digital spending	Digital asset stock	Digital transactions	Digital interactions	Digitized business processes	Digital spend per worker	Digital capital deepening		
ICT	Green	Green	Green	Green	Green	Green	Green	Green	4.5	2.7
Media	Green	Green	Green	Green	Light Green	Light Green	Light Green	Light Green	1.2	1.1
Finance and insurance	Green	Green	Green	Light Green	Light Green	Light Green	Light Green	Light Green	5.4	3.0
Professional services	Green	Green	Green	Light Green	Light Green	Light Green	Light Green	Light Green	6.3	6.0
Wholesale trade	Green	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	6.5	5.3
Advanced manufacturing	Green	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	4.4	4.2
Chemicals and pharmaceuticals	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	1.9	2.3
Utilities	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	2.3	1.0
Oil and gas	Yellow	Red	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	0.2	0.1
Basic goods manufacturing	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	8.1	7.8
Mining	Yellow	Red	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	0.8	0.4
Real estate	●	Yellow	Red	Yellow	Yellow	Yellow	Yellow	Yellow	12.1	1.0
Transportation and warehousing	●	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	5.0	5.2
Retail trade	●	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	4.4	8.8
Personal and local services	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	6.3	7.8
Government	●	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	6.5	7.1
Education	●	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	5.3	7.7
Health care	●	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	7.4	11.1
Entertainment and recreation	●	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	1.3	1.7
Hospitality	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	3.0	4.7
Agriculture	Yellow	Red	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	1.7	4.2
Construction	Red	Red	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	5.3	6.8

Cluster descriptions

- 1 Knowledge-intensive sectors that are highly digitized across most dimensions
- 2 Capital-intensive sectors with the potential to further digitize their physical assets
- 3 Service sectors with long tail of small firms having room to digitize customer transactions
- 4 B2B sectors with the potential to digitize their customer interactions
- 5 Labor-intensive sectors with the potential to provide digital tools to their workforce
- 6 Highly localized and fragmented sectors that lag across most dimensions

1 Value added as proxy for GDP; 15 countries used as proxy by EU-28.
2 EU-28.

NOTE: The level of sector digitisation measures digital assets, usage, and labour by sector. It does not refer to the intensity of digital competitive threat in a sector.

SOURCE: EU Klems; Eurostat; OECD; McKinsey Global Institute analysis

There is a significant gap between leading and laggard sectors

MGI's⁴ Industry Digitization Index for Europe indicates that there is a significant gap between digital leaders and laggards. Exhibit 1 shows the computation of the index by sector, aggregated across the 15 European countries for which we were able to collect all necessary data.

Digital laggards include asset-heavy sectors, such as manufacturing and mining, quasi-public sectors, such as health care and education, and highly localized and fragmented sectors, such as hospitality and construction. Many of these sectors lag behind the frontier in terms of digital usage and labor. The index also shows which aspects of usage and labor are especially weak; for instance, while these sectors have all tended to adopt digital payments to a degree, they lag far behind the frontier in the extent to which they have digitized their business processes and customer interactions. Sectors such as government and health care also have a long way to go in digitizing their large workforces. These laggards may focus on one or two aspects of digitization, such as digital payments or software assets, but this has proved less effective than focusing on all the dimensions represented in the index.

In manufacturing and mining, for instance, companies are deploying digital tools to engage their customers, suppliers and partners, but digital penetration in their physical assets (such as factories) remains relatively low. Sectors such as retail have also digitized their supply chains, but a long tail of small and medium-sized retailers is digitized relatively lightly. In some of these sectors, new digital firms (and existing digital giants from other sectors) are creating disruptions that may play out rapidly in the future, but for now these laggard sectors, on average, have limited digital functionality. The largest sectors in the European economy — in terms of assets, GDP contribution and employment — tend to be/are currently digital laggards and the overall European economy has a long way to go in terms of digitization. Measured against total investment stock, for instance, Europe's asset base is only 5 percent digitized. In terms of the usage of digital activities, European workplaces are only 9 percent digitized.

4 McKinsey Global Institute

Understanding growth: Labor productivity

Labor productivity in the Czech Republic is below the EU average

Improvements in productivity are the major drivers of economic growth. Understanding productivity is therefore crucial to understand how digitization affects the economy. Likewise, comparing labor productivity in the Czech Republic and across Europe helps us understand the size of the gap our economy needs to close. Labor productivity, as its name implies, is calculated as the value of goods and services (output) produced over a time period divided by units of labor (input), usually in hours worked or number of employees (full time employee equivalent). This allows us to compare countries and quantify the differences between them.

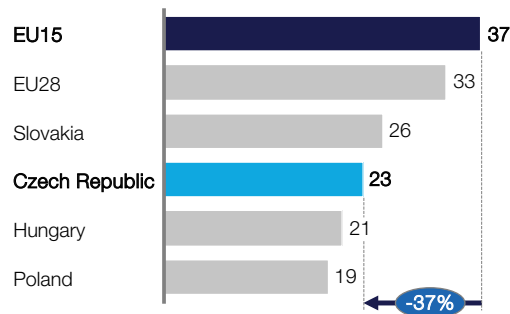
The Czech Republic clearly lags behind Western Europe in overall productivity (Exhibit 2). However, determining the size of this gap can be difficult. When reported in purchasing power terms, as is often the case, the productivity gap stands at 37%. However, in nominal productivity, a measure more suited to an open, export-oriented economy such as the Czech Republic, the gap is as high as 60% (for an explanation of the difference between productivity in nominal vs. PPP⁵ terms, see below).

5 Purchasing power parity

Exhibit 2

In PPP, Czech productivity is 37% lower than the EU15...

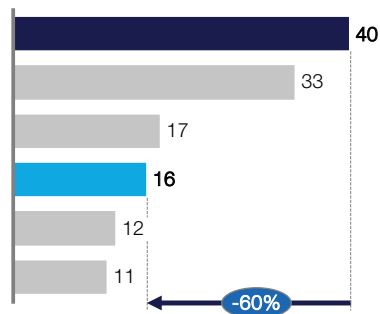
GVA per hour worked, 2013, EUR, PPP



SOURCE: Eurostat

...while the nominal value is 60% lower

GVA per hour worked, 2013, EUR



Productivity based on nominal vs. PPP gross value add

- PPP scales gross value added by price levels. These are determined independently for each country by a representative basket of goods and services.
- Since the Czech economy is export-oriented and deeply integrated in international trade, a large share of Czech production is sold on foreign markets for global prices. Those prices are nominal (based on market exchange rates), not price-level adjusted.
- Finally, when estimating the productivity gap at the end of the section, we use nominal gross value added to show what value can be created and captured by Czech companies.



27 years after the Velvet Revolution, the Czech Republic is still catching up with the West: moreover, it has lost its lead in Eastern Europe in doing so. To close the gap, the Czech Republic will need to accelerate its productivity growth.

Digitization differs across industry sectors: Sectors with a high Digital Intensity are more productive

Digitization and economic growth go hand in hand. This relationship is intuitive. When we look back to a time when people and paper travelled distances to convey messages, we intuitively recognize that today's email is more productive (it is able to offer a similar output with much less labor). Indeed, across sectors, those that are more digital – that is, those sectors that have achieved a higher score on Eurostat's Digital Intensity score⁶ – have also achieved greater productivity growth (Exhibit 3).

That is not to say that the differences in productivity between sectors can only be explained by digitization – other factors are responsible for much of the difference. The correlation holds only for productivity growth. Moreover, the growth in some Czech industry sectors – such as advanced manufacturing – cannot be explained by digitization. Instead, we need to look at other, structural factors.

Eurostat's Digital Intensity score

- On a company level, Digital Intensity reflects how many of a number of digital technologies a company uses.
- For the purpose of this analysis, the Digital Intensity of an industry is the proportion of companies ranked as having high Digital Intensity plus 50% of those ranked as medium.
- For a full list of technologies used, see the appendix to this report.

Nevertheless, when ranked by Digital Intensity, we can distinguish three clusters of sectors – High, Medium, and Low – and each is associated with a gradually lower level of average productivity growth. The difference between the top performing sectors – such as telecommunications – and the lowest performing sectors – such as construction – is almost 3 percentage points.

High Digital Intensity industry sectors

The first cluster groups sectors with the highest Digital Intensity, i.e. telecommunications, media, publishing, IT, and financial and insurance services. Digital Intensity ranges between 88% for telecommunications, to 60% for financial and insurance services. While the differences between the sectors are large, they are by far the most digitally intensive. Financial and insurance services, the least Digital Intensive sector of the High Digital Intensity cluster, is still 20 percentage points more intensive than the most Digital Intensive sector in Medium Digital Intensity cluster.

Sectors in the High Digital Intensity cluster have benefited from the rapid digitization of the past 20 years. Productivity has grown fastest in telecommunications, with a compound annual growth rate of almost 7% between 2000 and 2013. In aggregate, the cluster has enjoyed productivity growth of 4.3% on average, a full 2 percentage points higher than the average sector of the Medium Digital Intensity cluster.

Czech industry sectors in the High Digital Intensity cluster outperformed their EU15 peers both in terms of Digital Intensity (with exception of the finance, where it is equal) as well as in productivity growth (with the exception of telecommunications).

Medium Digital Intensity industry sectors

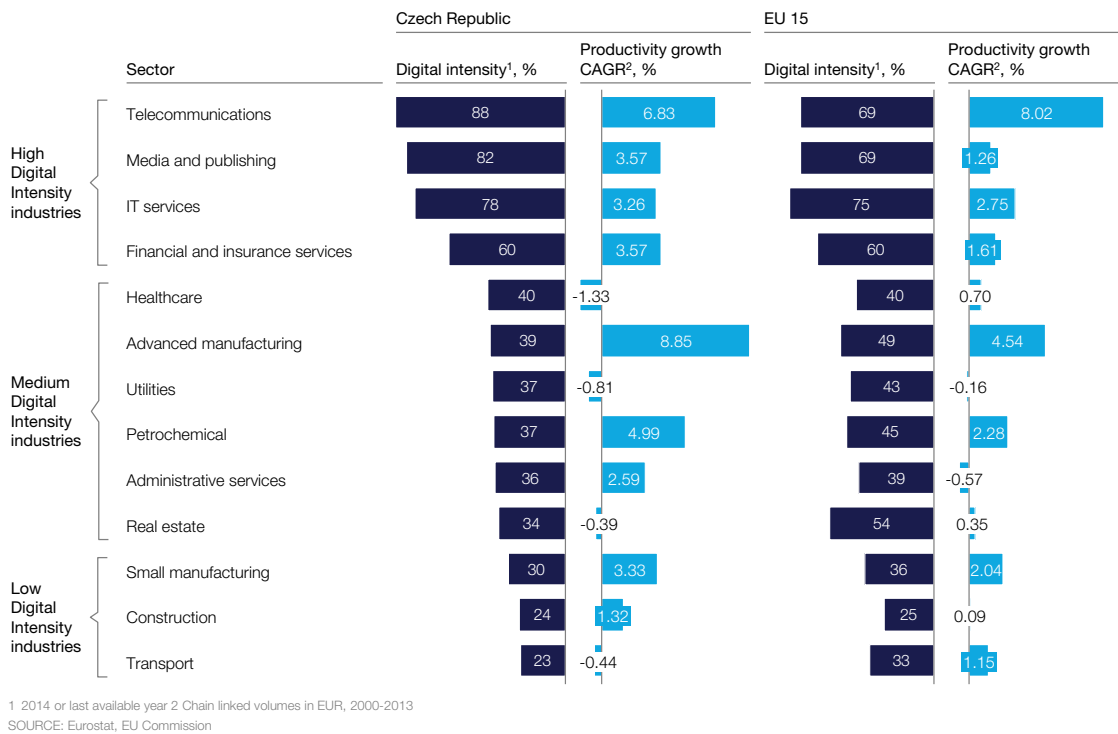
The sectors that have enjoyed only middling levels of Digital Intensity are health care, advanced manufacturing, utilities, petrochemicals, administrative services, and real estate. These sectors lag far behind the digital leaders. At between 40% and 34%, their Digital Intensity is relatively uniform, and close to the Czech average.

⁶ Eurostat - Digital Intensity score for Enterprises, 2015

Exhibit 3

Productivity growth has been highest in High Digital Intensity industries

Gross value added per hour worked



The distribution of labor productivity growth in this cluster is very uneven. Advanced manufacturing has enjoyed very high levels of productivity growth (8.8%), likely due to the inflow of capital from foreign direct investment in the early 2000s. On the other hand, health care and utilities have seen a decrease in productivity between 2000 and 2013, despite being close to the top of the cluster in terms of Digital Intensity.

In petrochemical manufacturing, administrative services, and real estate, levels of digitization are low. While petrochemical manufacturing has seen a substantial increase in productivity (partially due to increasing commodity prices), the productivity growth has been low in administrative services, and negative in real estate.

While levels of Digital Intensity in the Czech Republic are on average lower than in the EU15 by approximately 10 percentage points, the difference is particularly striking in real estate, where EU15 companies have a Digital Intensity on average 20 percentage points higher than those in the Czech Republic.

Low Digital Intensity industry sectors

Small manufacturing, construction, and transport lag behind other sectors. As in Europe, these sectors rank lowest in terms of Digital Intensity. The Digital Intensity of Czech transport is 10 percentage points lower than the EU15 average, and unlike in Western Europe, where labor productivity in transport has grown, it has fallen by 0.44% in the Czech Republic. Labor productivity growth has been low in small manufacturing, and lower still in construction.

Pleasures and pains: How digitization works

Digitization affects both businesses and consumers, but does so in different ways.

While the effect on businesses can be readily described with categories like volume, cost, and hours worked, the effect on consumers is less readily apparent. Certainly, consumers benefit from decreased prices, directly benefiting from so-called consumer surplus (indeed, consumers are often able to capture most of the surplus that digitization generates). However, consumers also benefit in other ways, which are more difficult to measure, including greater choice, a better customer experience, or simply time saved. While we focus on digitization's effect on businesses, we want to also touch upon its effect on consumers, both where it is measurable, and where it is not.

Digitization's impact on businesses is determined by its effect on four key factors

On an industry sector level, the effect of digitization is the increase in labor productivity, either as an increased economic output (gross value added) or a reduction of the number of hours worked (or, indeed, both). However, for specific businesses digitization may be a mixed bag.

To understand this better, we propose a framework based on a simple, illustrative equation. According to this equation changes in productivity from digitization are explained as the change in the price of legacy products/services multiplied by the volume of legacy product/service over hours worked, and additional revenue from new products/services over the change in hours worked.

$$\Delta \text{Productivity} = \Delta \left(\frac{\text{LegacyVolume} \times \text{LegacyPrice}}{\text{HoursWorked}} \right) + \Delta \left(\frac{\text{NewRevenue}}{\text{HoursWorked}} \right)$$

Digitization influences each driver, and different businesses are exposed to this impact in different ways. Thus, business leaders can ask themselves four questions to determine how their company will be affected by digitization.

Factor 1: How will the volumes of my current products and services change?

There are many examples of products and services that digitization has made obsolete. Some, like vinyl records, have made a stunning comeback (the Czech Republic is home to a world leader in vinyl production). However, for most products and services made obsolete by digital technologies, the market disappears completely and volumes of legacy products drop to zero.

On the other hand, digitization can help businesses reach new customers. It enables businesses to market and sell products and services globally, with little to no additional investment. Moreover, it allows businesses to use new sales and marketing channels to reach customers that they could not before.

Factor 2: How will the prices of my current products and services change?

Digitization typically exerts pressure on the prices of legacy products. As companies compete across borders, pressure on prices can increase. Falling barriers to entry allow new, digitally native competitors to enter markets for legacy products. It also allows companies to enter sectors adjacent to their own and compete with a bundled offering.

Factor 3: How much revenue can I capture from new products and services?

In many sectors, digitization has enabled completely new products and services. Businesses may be able to develop these new products, bring them to market, and thrive, or they may be left behind.

Factor 4: How will the efficiency of my business change?

Digitization usually leads to a lower overall number of hours worked, for the same amount of output. Digital banks, for example, have only a fraction of the branch employees that legacy banks have – or even none at all. While the overall demand for labor is reduced, demand for specialized work, requiring specific expertise, may increase.





Using these factors helps explain why digitization is a boon to some sectors and a curse to others

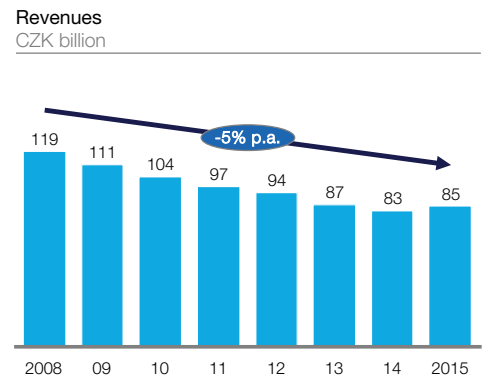
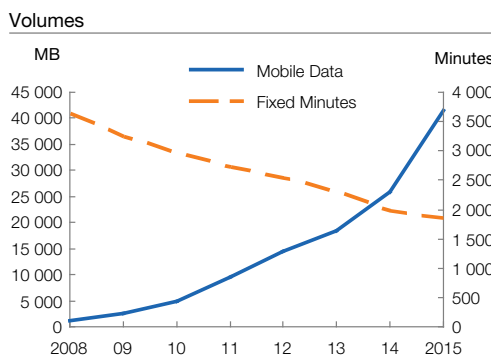
The aggregate effect of digitization is different for different companies. Businesses in some sectors may experience similar effects; a reduction in demand for a specific product, falling barriers to entry, or new production techniques. Nevertheless, the final effect of digitization is dependent on the business itself; to what extent it is able to enter new markets, successfully introduce new products, or compete against new entrants. For some, this is a boon to business, for many it is mixed blessing, and for some, digitization is a curse (Exhibit 4).

Digitization as a boon

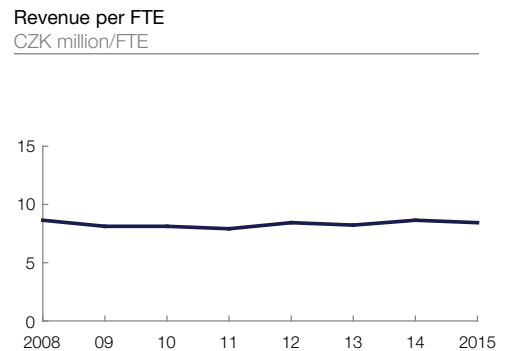
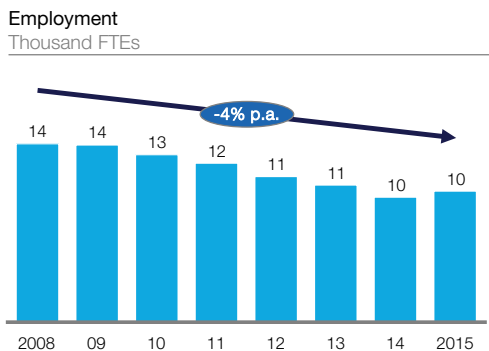
In the Czech Republic, small specialist manufacturers producing everything from hospital beds, home security systems to pencils, have become digitization's winners. They have been able to tap new markets and leverage new marketing and sales channels to offer their products to the world and succeed. At the same time, they have been able to stay competitive and limit the downside from increased competition. Finally, they have been able to tap new revenue pools, staying at the forefront of development, and offering new digitally enabled products and services.

Exhibit 4

In Czech telecommunications, revenues have fallen despite increasing mobile data volumes...



... and productivity has remained flat, as companies lowered employment levels



SOURCE: Analysys Mason, company annual reports, McKinsey analysis

Digitization as a mixed blessing

Telecommunications incumbents have seen a steady decline in demand for traditional products like landline voice services, and these revenues have only partially been offset by increased demand for new services, primarily data. The total revenues of telecom companies have thus fallen and total labor productivity has grown thanks only to a matching decrease in hours worked.

Telecoms have also ceded large parts of the market in messaging and voice services to global technology companies – like Skype or WhatsApp.

Digitization as a curse

Travel agents are seeing an erosion of their role as intermediaries between customers (Exhibit 5). Customers are increasingly turning to digitally native competitors – or indeed to travel and accommodation providers directly – to book, and administer their travel. While travel agents have recognized the importance of digitization, their response has been too little too late.

Digitization also benefits consumers, but only part of that effect is reflected in economic productivity

Consumers reap much of the increased economic output of digitization in the form of lower prices, better service, and higher quality products.

To use an extreme example, the price of mobile data in Germany has fallen from EUR 45 cents per MB to less than EUR 2 cents per MB (Exhibit 6). This resulted in a reduction in reported value added by the telecommunications sector, but significantly increased consumer surplus by enabling customers to download more data, at much lower prices.

Moreover, growing internet penetration benefited consumers in ways other than falling prices. It also gave them more choice, enabling them to search for products online, and offered them a better overall experience. Listening to music online is not only cheaper than doing so from vinyl, the choice of music to listen to is much broader, and the experience of downloading and listening to it easier.

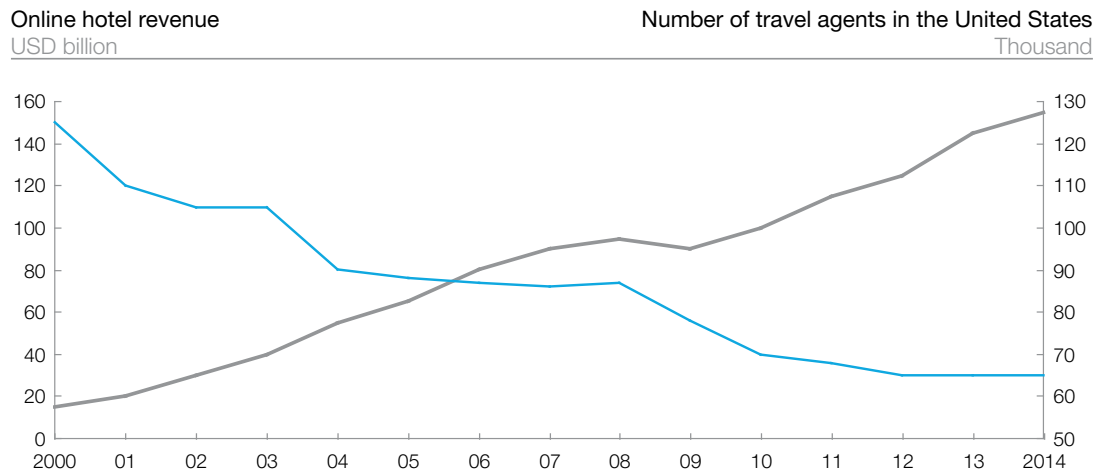
It is difficult to evaluate all benefits of this additional choice and the improved service. Another example is to think about the time that digitization has saved us. Where once we needed to visit a branch for each transaction, half of all Czechs⁷ now use internet banking for routine transactions. The aggregate time saved is substantial and certainly created value, whether this time was used for work, hobbies or time spent with family.

⁷ Online banking penetration in the Czech Republic, Statista 2015

Exhibit 5

Since 2000, online hotel bookings have grown significantly and the number of human travel agents has decreased by half

US hotel booking revenue and number of live travel agents, 2000-14

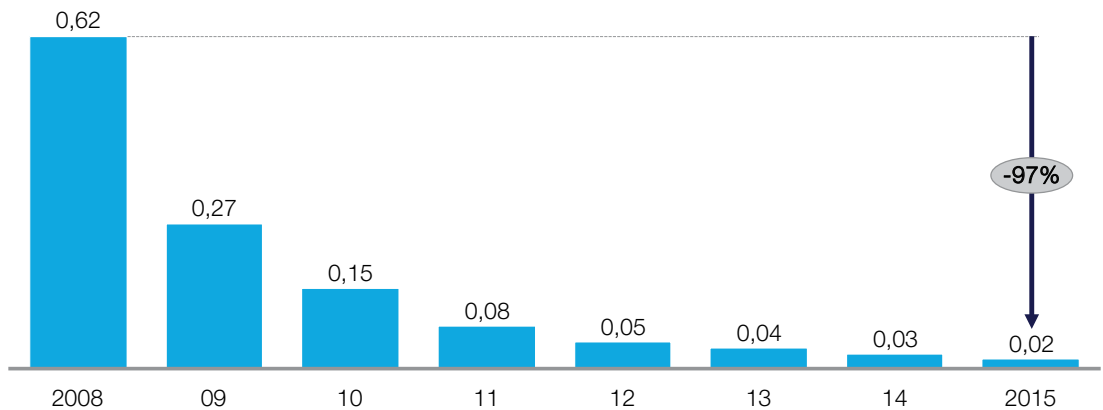


SOURCE: Phocuswright; McKinsey Global Institute analysis

Exhibit 6

The price of mobile data in the Czech Republic has fallen by 97% since 2008

Average cost of MB of mobile data, EUR



SOURCE: Analysys Mason

Setting our ambitions: Productivity growth

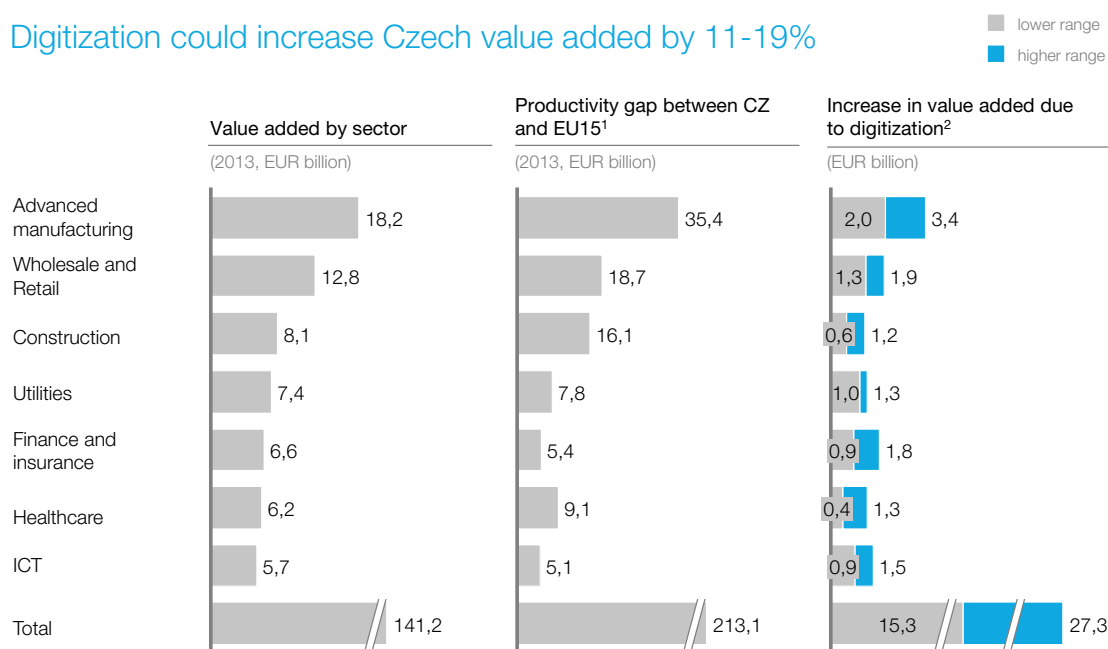
The effect of increasing Czech productivity can be estimated by comparing the output of the Czech economy as it is now with what it would have been if it had achieved the average productivity of countries in Western Europe. As it stands, the Czech economy generated approximately EUR 141 billion of gross value added in 2013. Had it achieved Western European levels of productivity, the gross value added would have totaled EUR 354 billion, suggesting a productivity gap of 213 billion (Exhibit 7).

The Czech Republic can close a portion of this gap through increased digitization. While the potential for digitization differs throughout sectors, we can estimate the potential in each to reach an aspiration for the whole economy. Covering 7 to 13% of the gap through higher digitization would amount to an increase in productivity equivalent to EUR 15 to 27 billion (CZK 405 to 729 billion). Spread out over 10 years, this would amount to an increase of 1.2 to 2.1% to the Czech Republic's GDP annually.⁸

8 Assuming the proportion of net indirect taxes to GVA continues to remain constant

Exhibit 7

Digitization could increase Czech value added by 11-19%




¹ Theoretical increase in value added if productivity level of EU15 is achieved, assuming Czech employment levels

² For sectors not shown here, we assume potential equal to the average level of the sectors shown

SOURCE: Eurostat, Expert interview, Team analysis







Choosing your field and setting aspirations: Industry focus

We have all – as young people – thought about our focus in life. Companies must do the same with digitization. Each field has its specifics and each company is different. Like people, companies thrive when they set themselves bold aspirations and work diligently to realize them – regardless of their chosen field.

Telecommunications



Starting point

Telecommunications and ICT are critical sectors for driving digitization in the country. They provide the required infrastructure, both fixed and mobile telecommunications networks, the communication devices for end-users, and they offer IT services. Even though demand for data services is growing steadily and fast, digitization transforms the entire industry value chain and creates pressure on telecom operator revenues, which have decreased by ~25% over the last 5 years, and it forces the operators to drive up investment effectiveness and FTE productivity.⁹

The Czech telecommunications and ICT industry digitization score is the highest across sectors. However, Czech telecom operators and IT services providers are still not end-to-end digitized by far. To date, they have been partially successful in digitizing selected customer journeys and upgrading digital channels (web, app, chat) with new functionalities and user interfaces. We can say that they have gone “wide” but not “deep”, yet. Telecom operators still keep a large share of internal processes in a traditional, non-digitized way and they still have a preference for internal IT development rather than external cooperation and partnerships across the broader ecosystem.

⁹ Source: Operators' annual reports

Bold aspirations

Meet customers' digital expectations

Czech telecom operators still sell and provide care for most of their services through non-digital channels (stores, call centers). That is far behind what customers expect. A McKinsey survey has shown that over 70% of people are digitally ready (segments; digital by lifestyle, digital by choice and digital by need) and almost 50% of all telecom customers would prefer end-to-end digital service. That does not correspond with the current situation, where some products are still not available online or the purchase journey is too complicated and user-unfriendly. The same is true for digital customer care, where customer behavior becomes more informal. Users of social networks do not respect standard business hours but expect immediate reaction – online behavior patterns are significantly different from offline patterns.

A Western European MVNO¹⁰ introduced a digital care customer community platform that strongly relies on social networks. Participants assist each other with service issue resolutions and queries, and receive a reward for contributing. The average response time for any question posted in the forum (available 24/7) is under 3 minutes and 95% of all questions are answered within an hour. The platform resolves 75 % of customer requests, allowing for a very lightweight cost structure of 28 internal customer care FTEs for 100,000 customers.

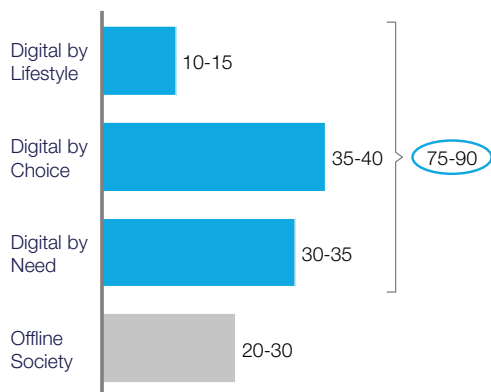
In addition to higher customer satisfaction and lower cost, there is another reason why operators should focus on building digital capabilities - industry deregulation allows new players to enter as “New digital MVNOs”. They can represent a significant threat to established players when they succeed

¹⁰ Mobile Virtual Network Operator

Exhibit 8

More than 75% of people are digitally ready...

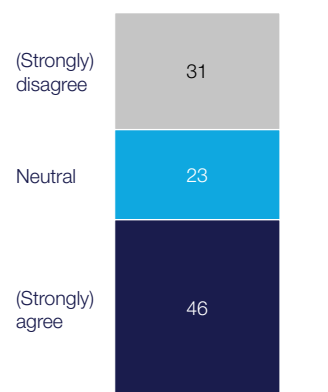
Population distribution, Percent



SOURCE: McKinsey Digital Customer Experience Survey 2015 , N = 4452 (EU), 3002 (US)

... and almost half would prefer end-to-end digital service

Share of respondents that would like to manage their relationship 100% via digital channel



in positioning themselves as “digital innovators” in the customers’ eyes and when they leverage the internet for customer acquisition and management. Another threat comes from leading international online platforms and social networks. They will be able to provide many communication services free, while offering more convenient user interfaces. We need to see how fast this change will happen, however existing telecom operators must act quickly on end-to-end digitization in order to be well positioned against these new competitors.

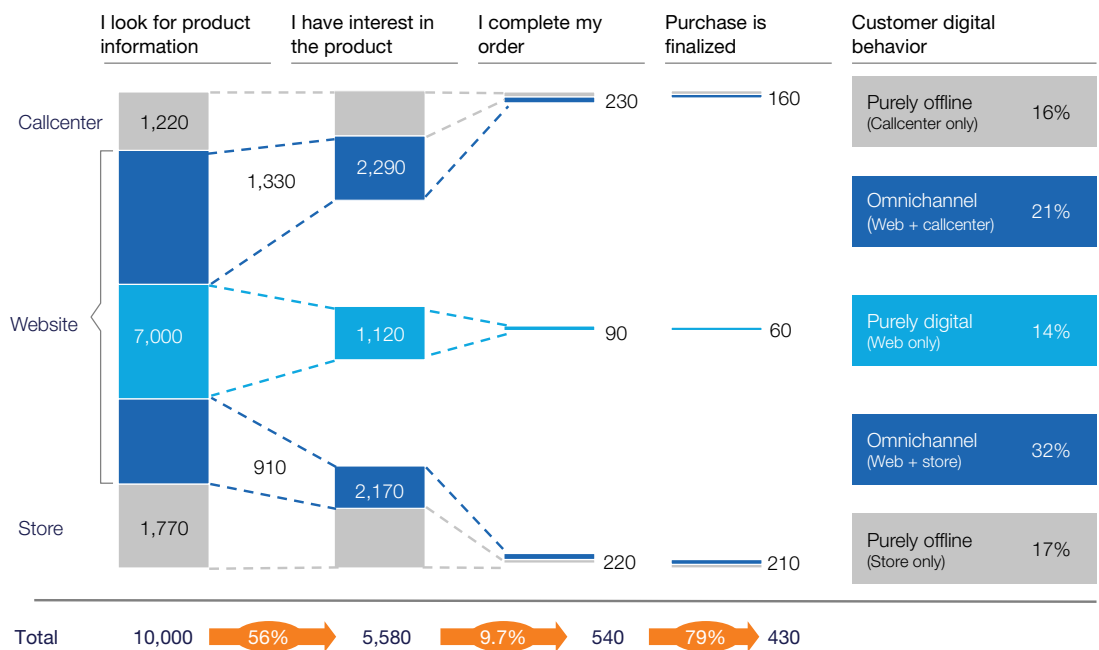
Telecom operators should radically change their organizations and operating models to promote the rapid digitization of internal processes. They can perform clean-sheet re-designs of core processes with full use of the benefits from digitization and online collaboration across employees. They should look at agile working models between business and IT in multiple areas.

Serve customers well across all channels – the magic of omnichannel

The majority of customers prefer digital and omnichannel journeys for telecom services. McKinsey research shows that more than 50% of customers prefer the omnichannel approach – communicating with operators through multiple channels. Those customers usually start online, do website research or even “mystery-shop” in the e-shop, but at some phase they stop and switch to another channel – store or call center -before they finalize a complex purchase and sign a contract with commitment. When they do so, operators should not treat them as new customers and force them to pass all the purchasing steps again. An omnichannel lead management IT application is necessary to enable operators to follow their customers. When a customer contacts a call center or store, the operator should also know about the customer’s previous behavior on

Exhibit 9

Mapping customer flows shows importance of omnichannel approach



SOURCE: McKinsey analysis, expert opinion

online and social platforms. A Western European operator introduced an omnichannel e-shop where customers can migrate their shopping basket between online and shops. It features a digital sales assistant with automatic cross-channel commissioning. Stores are equipped with self-service devices where customers can finish their online purchase while enjoying the benefits of brick-and-mortar stores, such as real device experience and immediate delivery.

Once telecom operators are able to provide this experience, they can use their customer relations and capabilities to expand their business model and become “ecosystem orchestrators”. They can introduce a platform for third parties where other providers can monetize their own apps and services.

Monetize big data with advanced analytics

Telecom operators have unique access to a variety of consumer data – including location, payment morale or mobile data usage. Additional information can be obtained from internet sources, mostly social networks. Once operators learn how to collect, analyze and use this information they can offer targeted individualized offers, smart pricing, bundled packages, product customization or cross-selling. Moreover, digitization opens the new world of the Internet of Things (IoT), including smart cars, smart homes or healthcare services, which open a new market for telecom services and solutions.

A large APAC operator launched a localized mobile reward app for its customers. The initial data (age, gender, shopping preferences, dining habits etc.) are entered by users themselves. The app then offers ads with discounts that are location and time specific (Geo-targeting) and match customers preferences. In addition, the app “learns” over time and new offers are based on previous experience and ongoing user interactions.

Clearly, the potential is huge. The operators, however, have to answer a critical question – are they able to monetize this data by developing new products and services internally or do they rather share it with third parties in some form of partnership? In other words – how can large organizations with thousands of employees react to new opportunities and challenges fast enough?



Telecommunications and ICT are at the forefront of digitization. They face a broad variety of opportunities and challenges which digitization brings. It is clear that the industry needs to transform itself rapidly in order to survive in the long term. The strategy is daunting as it is not clear where to begin, since there are many levers and they must be pulled in combination. The key challenge is how to realize such a radical change over time with the existing organization and people.

Telecom operators need to fully re-build the plane whilst flying it with passengers.

Selected examples of digitization levers

Area	Sub-area	Description	Example
Customer Facing	Omnichannel presence	Customers complete their journey regardless of the channel. Switching between channels should be smooth and convenient	European telecom developed omnichannel via Web-to-shop initiative; results: +15% online conversion rate; 6% of stores closed in one year, +15 % of web-to-shop
	Product innovation	Redesign products to be simple, understandable and available online to achieve higher sales and attract new customers	WE MVNO: Current users are incentivized to acquire new users; once a new SIM is activated, the user obtains bonus points
	Digital customer interface	Design a simple, transparent and easy-to-use customer interface, features and navigate customers to use app and web	
	CRM	Rethink the customer-care process to improve up-sell and prolongation	WE MVNO introduced a digital care consumer community platform; average response is under 3 minutes; 95% of all questions are answered within an hour
Internal processes	Digital processes	Internal systems are well integrated and automated	Telecom operator introduced agile IT development across over 50% of development capabilities and application domains
	Digital HR	Interactions of people internally are simplified	WE Bank used Socialtext for internal communication and collaboration; Cut 50% meetings time; 75% email traffic decrease
	2-speed processes	IT, HR have innovation facilitated by different internal procedures	Scandinavian operator introduced Confluence wiki in software development; 30% productivity gains in SW development
Customers' data usage	Big Data	Data is collected, structured, categorized and stored securely	
	Advanced Analytics	Collected data is utilized for product development and tailored offers	
	Location data	Customer location is always known in order to make targeted offers	APAC operator: Localized mobile reward app
Adjacencies		Operator can sell services traditionally offered by banking, insurance, utilities etc.	See other sectors for adjacencies in other businesses

Retail



Starting point

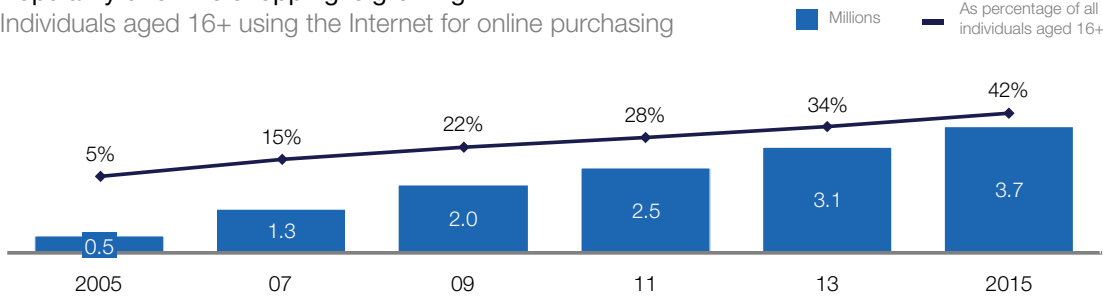
We have seen e-commerce growing quickly in the Czech Republic over the past years. For some retail goods categories, such as home electronics or mobile phones, the internet is becoming the leading channel. While in other categories, such as furnishing, clothing, and footwear, the share of e-sales is still lower, we do see very rapid growth. Two main drivers support this rapid growth of e-sales. Firstly, we see an increasing popularity of online shopping – the number of people regularly shopping online grew from 500 thousand in 2005 to 3.7 million in 2015. Secondly, we observe a high digital literacy, not just in the young generation, but also all the way up to 65 year olds (Exhibit 10).

In addition to e-commerce growth demanded by customers, we believe there are three important opportunities for digitization of the retail sector: 1) digitization of retail operations, 2) digitization of customer interfaces and the omnichannel experience, and 3) innovative services for customers enabled by digitization. Capturing these opportunities may seem “futuristic”, but in some countries it is already a reality.

Exhibit 10

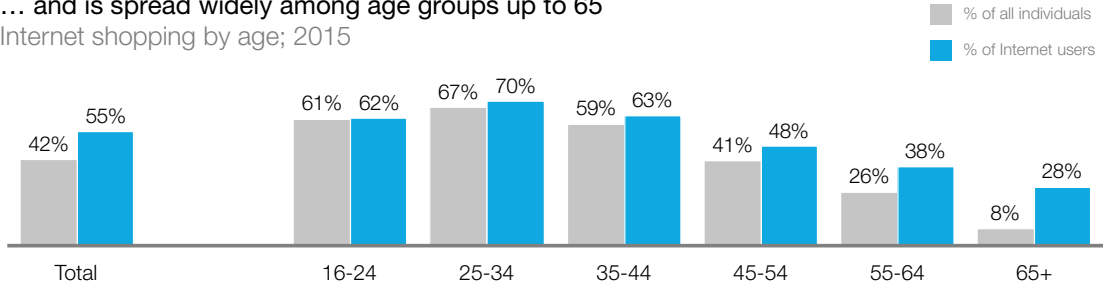
Popularity of online shopping is growing...

Individuals aged 16+ using the Internet for online purchasing



... and is spread widely among age groups up to 65

Internet shopping by age; 2015



SOURCE: Czech Statistical Office

Bold aspirations

Digitize retail operations

There are many opportunities to digitize and automate steps in retail operations, ranging from optimizing labor utilization to inventory management. Sophisticated data models and technological support for managers can help optimize labor scheduling and improve 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.

New technological solutions help make the workforce more productive. RFID¹¹ and beacons supported by the Internet of Things make it possible to track products and equipment along the supply chain. These instruments enable retailers to increase inventory turnover and process goods faster in distribution centers. This ultimately reduces inventory costs.

A new concept of the digitally enhanced retail store is emerging. Electronic shelf labels update prices real time using RFID chips, which allows dynamically changing prices based on stock levels and demand. Innovative function of RFID checkouts, where customers do not need to take their goods from shopping baskets and can make contactless payments. This optimizes workforce allocation for shelf control and checkout and improves stock control and space management.

A large American retailer uses smart shelving technology to automate pricing and product information changes. The shelves display video images of price tags that can be easily altered by computer. These tags free up employee time, as it takes more than 2 weeks to manually re-price a whole store. Additional applications could include on-demand nutritional information or video and no-motion ads.

11 Radio frequency identification

Create digital customer interfaces and an omnichannel experience

We see continuous and strong growth of online sales and no reason for a slowdown in the upcoming years. This is supported by constantly improving infrastructure (growing high-speed broadband penetration, full LTE coverage, low prices of smartphones) as well as growing customer confidence to shop online.

E-commerce sales show a stable growth of 17 percent p.a. (Exhibit 11) and currently account for 8% of total retail spending, which is similar to Western Europe¹². Having analyzed the popularity of online sales by retail category in the Czech Republic and Western Europe, we see three different groups of goods (Exhibit 12).

The first group includes high value products that are already well known by customers and can be easily presented online, e.g. mobile phones, home electronics, and Do It Yourself goods. Almost half of Czech consumers already have an experience with shopping for these goods online. In these categories, we see e-commerce changing the competitive market structure. For example, a few years ago, a large share of mobile phones was sold by operators. That is no longer the case and a combination of changing operator strategy and the fast growth of e-shops offering lower prices has led to a rapid change in the mobile phone category.

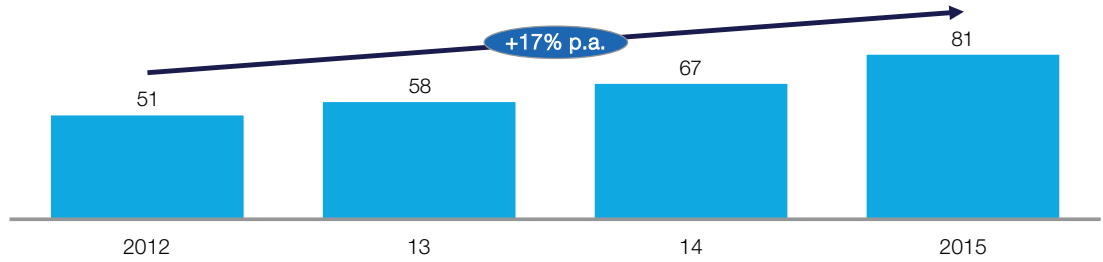
The second group of goods includes, for example, home furnishings, and clothing. One would expect traditional outlets to offer benefits as they provide real experience and trials of the goods not possible in online stores. However, we already see 30% of customers experimenting with placing online orders for some of the goods from these categories. The trend from Western Europe suggests that this group has a potential to grow the share of online sales further.

12 Statista.com, Czech Statistical Office, 2016

Exhibit 11

Total Czech E-commerce revenue shows stable growth

CZK, billion

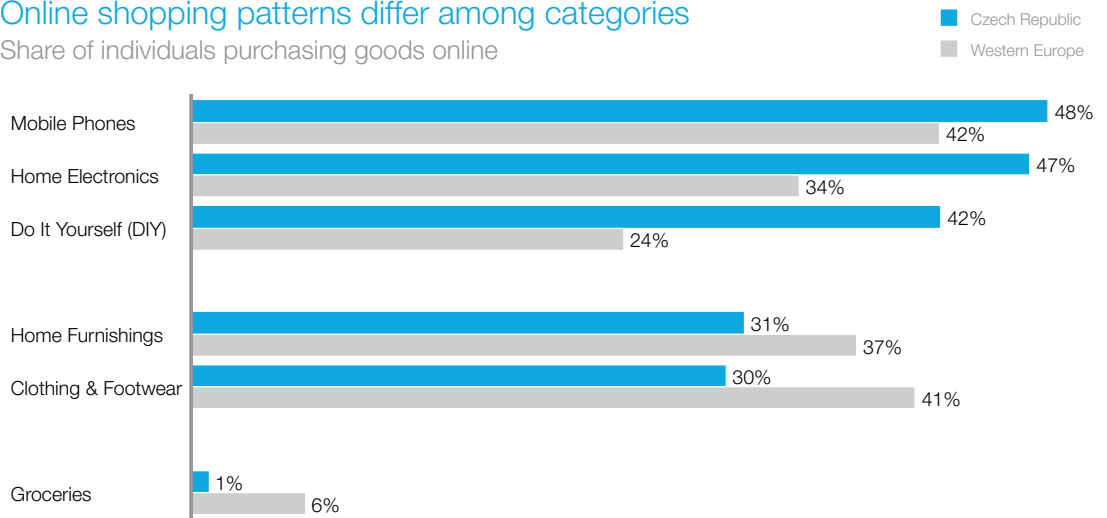


SOURCE: Heureka.cz

Exhibit 12

Online shopping patterns differ among categories

Share of individuals purchasing goods online



Question asked: Where did you make your purchase?
WE: weighted average of Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Sweden, Switzerland, UK
Total Respondents: 48223
Base: Internet users (accessing via computer, tablet or smartphone) | Answering based on a recent purchase (in select categories)

Source: The Consumer Barometer Survey 2014/15

The third group includes, for example, groceries, where the share of online sales is still very low (~1%). We believe that the main reason does not lie in low demand, but more in the insufficient availability, as most leading retailers do not offer the service and just a few innovators have recently started in the largest cities. In Western Europe, we can already see a higher share for online grocery sales and we expect this to grow in the Czech Republic when large retail chains introduce online grocery sales.

With growing online sales, retail stores will transform. The store footprint will be optimized and the retail store role and function will change over the next few years. The quality of the personal experience and the value of advice at physical stores are becoming more important for customers. For example, when buying golf clubs or a mountain bike at a brick-and-mortar store, customers look for the following benefits; they want to actually see, touch, and try out the product. In addition, they demand expert advice about

the product from the shop assistant. Therefore, brick-and-mortar stores will transform to become closer to showrooms with experienced and knowledgeable staff, able to provide value-added service in a pleasant environment. Moreover, similarly to other sectors, customers 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 and retailers will develop an omnichannel model.

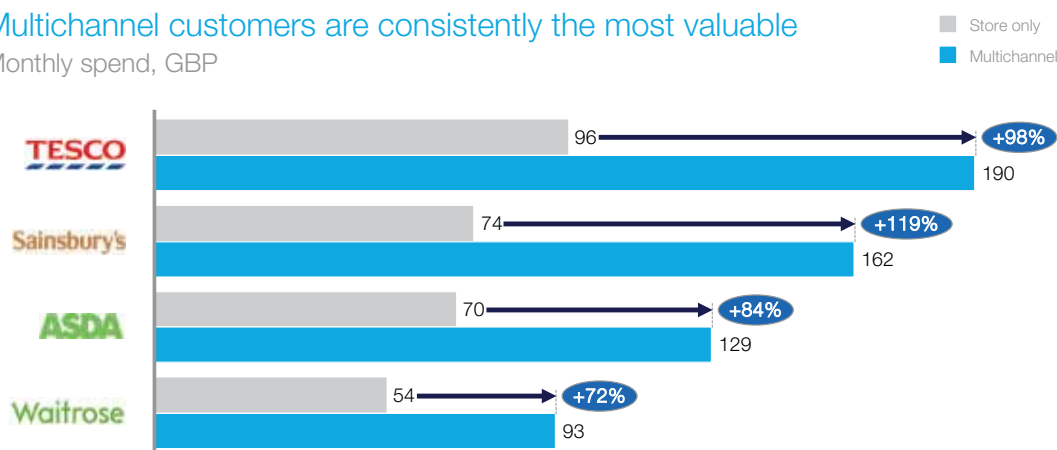
One Western European DIY¹³ store has an integrated offer across all channels. It features a large online store, free delivery and collection options, multiple payment options, including payment by installments. There is a collection of online guides, tutorials, and videos to give customers advice and ideas, and a platform for the community of users to provide suggestions, advice, and support. There are also loyalty card offers with customer benefits, promotions

13 Do It Yourself

Exhibit 13

Multichannel customers are consistently the most valuable

Monthly spend, GBP



SOURCE: UK National Retail Federation International Council, January 12th 2015

and discount coupons and personalized recommendations. Multiple mobile apps provide an enhanced customer experience – a fireplace 3D viewer, loyalty app, or even a color finder to identify and test paint colors.

In addition, a McKinsey analysis (Exhibit 13) shows that customers active in more than one channel spend twice as much money than store-only customers do. This confirms that the omnichannel approach is also important from the loyalty perspective – once a customer is satisfied with the service provided across the channels, he or she has lower motivation to switch to another retailer.

Adopt innovations faster

Once retailers digitize their operations and customer interface they can start to collect big data and develop advanced-analytics models aimed at improving their detailed understanding of customer needs and behaviors. Digitization, for example, helps to improve the in-store customer experience by measuring foot traffic for better line management. For 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 across all channels, whether in-store, online, or mobile. Loyalty card data, which include demographics and historical purchase data, can be used for digital promotions.

A luxury retailer validated consumers' decisions through education on products and brands upfront, along with the pleasure gleaned during the shopping experience. Customers learn product features via in-store “magic mirrors” and displays (RFID tags in product). Sales assistants know what the customers have purchased (online and offline) when they walk in, and offer recommendations. The company recorded a 10 percentage point higher growth rate compared to the overall luxury market.

Moreover, digitization opens new opportunities as it enables consumers and retailers to benefit from the shared economy. A lower cost of delivery can easily be achieved by using an alternative transport sharing service or fare splitting for nearby locations. Smart algorithms automatically recognize your consumption habits so that you can have your standard weekly purchase ready at your door on Saturday morning. Increased satisfaction and saved time is a clear advantage for customers, while retailers can benefit from increased customer loyalty and demand that is more predictable.



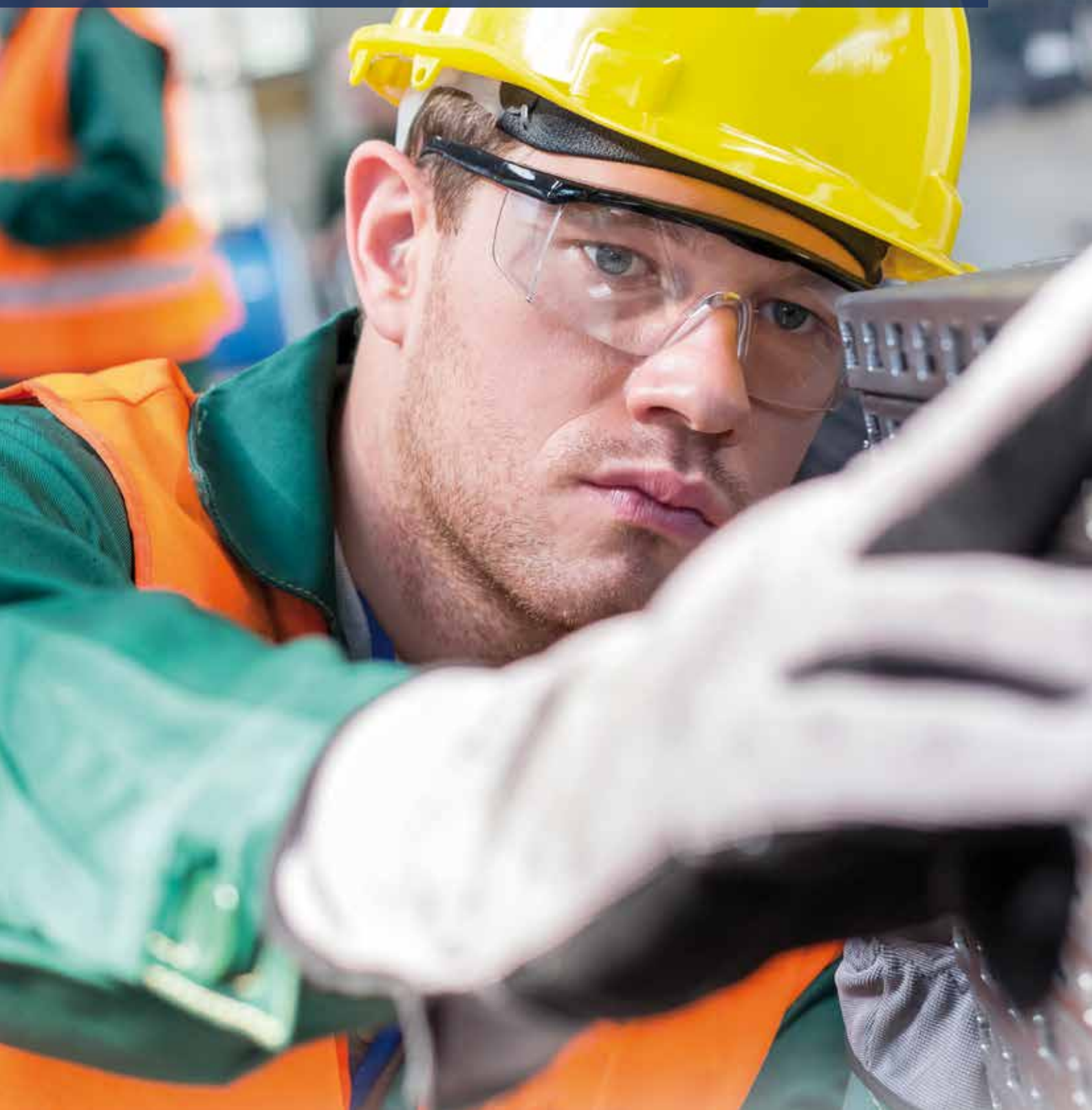
The retail sector will be shaped by several digitization trends in the coming years. The growing importance of the online channel is a clear fact that will strongly influence all the players on the market. The impact will depend on the specific retail category, but we foresee dynamic growth in most of them. The role of stores will change. They will transform into being a place that provides experience, additional services, and advice to customers. New technologies also open opportunities to collect large amounts of data that will help retailers better understand their customers and offer personalized products and services. This is in line with customers' expectations, as they yearn for a new, smoother shopping experience. Retailers that do not deliver this will stand to lose a lot.



Selected examples of digitization levers

Area	Lever	Description
Digitized retail operations	Data models	Develop data models to optimize time spent on low-value-added tasks (e.g. biometric checkouts, RFID checkouts, contactless payments, electronic shelf labels) and optimize labor scheduling and capacity planning
	RFID	Use RFID to improve inventory turnover and achieve faster processing by distribution centers
Smart data-driven business decisions for customers	Big data	Develop tools to measure foot traffic for better queue management, use technology to tailor product ranges, employ a dynamic pricing model based on real-time data and personalize promotions
Further shift from offline to online	E-commerce	Increase presence in e-commerce channel, optimize physical footprint and transform role and experience in physical stores
Omnichannel experience	Seamless switching	Enable customers to switch seamlessly between channels with no adverse impact on their shopping experience
Digitally enriched shopping experience	Assisting technology	Use technology-assisted shopping to enhance browsing, purchasing, way finding and circulation in stores and shopping malls
	Connecting online and physical	Create a virtu-real shopping environment, giving customers a personalized shopping experience
	3D printing	Allowing customers to print the desired product in store will change the supply-chain management (reduction in transportation and cost and inventory levels)
	Virtual and augmented reality	Use virtual and augmented reality to redefine how customers interact with, and experience products and brands

Manufacturing



Starting point

The application of the Internet of Things to manufacturing is changing the way data is managed; it means adding sensors to capture data, wired and wireless networks to move it around, and software to analyze, present and make decisions based on it. This, and the further advances in technology, enables completely new approaches to manufacturing, from maintenance solutions based on the accurate prediction of failures, to robots that can work side-by-side with humans, and processes that enable rapid prototyping and experimentation. Collectively, these developments are referred to as Industry 4.0, and they promise to transform how goods are made.¹⁴

Many of the technologies that enable Industry 4.0 are at a tipping point today. For example, with breakthroughs in optical head-mounted displays, augmented reality is fast becoming viable, which could transform the way workers interact with their surroundings. 3D printing is benefitting from an expanding range of materials, falling printer costs and their increased speed and precision (Exhibit 14). Robotics companies are experimenting with exoskeletons that emulate and support human physiology, which could accelerate processes that require straining manual work, and enable remote handling of dangerous goods. Falling costs of consumer-grade 3D vision systems enable manufacturers to deploy new, relatively inexpensive robots.

For the Czech Republic, manufacturing is the key sector. In 2015, it was responsible for 27% of the Czech Republic's gross value add, and for 84% of its exports by value.¹⁵ More importantly, many Czech manufacturers compete with global technological leaders, or act as their suppliers. Czech companies can no longer rely on low labor costs as their competitive advantage. They will need to invest in advanced technologies in order to keep their edge.

¹⁴ For more see Industry 4.0, "How to navigate digitization of the manufacturing sector", Digital McKinsey, 2015

¹⁵ Czech Statistical Office

Digitization in manufacturing is nothing new and manufacturers have already invested in machines that collect data and are controlled by – usually custom-made – software. However, the extent of digitization coming in Industry 4.0 is of a different magnitude. With computing power following Moore's law, and ever larger and cheaper data storage, the pace of change is exponential. In this journey, we are at a point where the curve is becoming very steep. This rapid advancement feels like a revolution. However, given that much of these speed gains are in applications that have already been used in manufacturing, the advancement can be better characterized as being more of a rapid evolution than a revolution. Much of the transformation will be enabled by equipping existing machinery with simple, cheap sensors – or indeed collecting and translating data from existing sensors – rather than embarking on major machinery upgrades. Manufacturers will need to fundamentally change the capabilities needed to succeed in manufacturing, but will be able to create new business models and enjoy significant productivity gains.

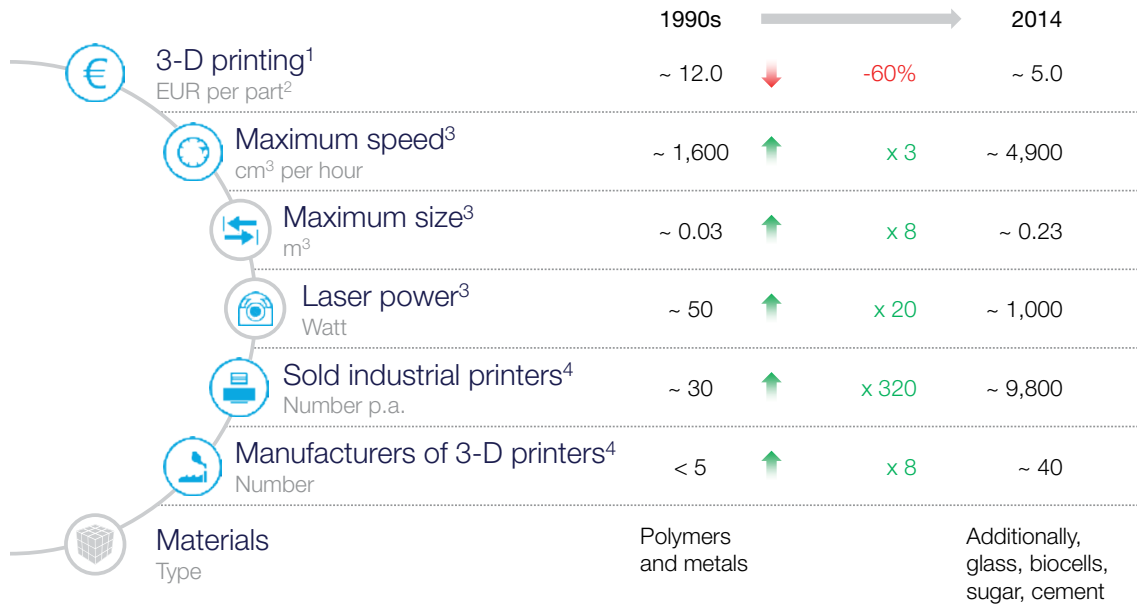
That is not to say that the transformation is without risks; there are risks associated with production downtime, cybersecurity, and quality loss, but these will do little to reduce the pace of change.

New business models enable manufacturers to exploit opportunities created by Industry 4.0. There are four main trends: In "As-a-service" models, manufacturers substitute one-off asset sales for perpetual service revenue streams. Platform business models transform manufacturers into platform providers for technology developers or brokers (e.g., creating spot markets for excess production capacity). IPR¹⁶-based business models capitalize on existing knowledge to create recurring revenue streams (such as licensing) or add-on services (like consulting). Finally, data-driven business models directly monetize collected data or the secondary insights gleaned from it.

¹⁶ Intellectual Property Rights

Exhibit 14

Significant technological advances in 3-D printing have already been achieved within the last 25 years



¹ Overall costs including energy and facilities, maintenance, labor, machinery, and materials

² Exemplary calculation for DMILS technology

³ Based on SLS Sinterstation 2000 for 1990 and 3DS sPro 230 HS for 2014; however, high dependence on exact part that is being printed

⁴ 1988 and 2012 data points for industrial AM printers

SOURCE: Wohlers Report; McKinsey

Manufacturers around the world are already successfully implementing data-driven business models. A major jet engine manufacturer has moved from selling and maintaining turbines to renting them out on the basis of engine flying hours. By collecting data from its engines, the manufacturer can use analytics to predict when maintenance is needed and perform the maintenance more efficiently. This model results in better safety and customer service, and lower costs. However, to reach for these results, the company had to develop entirely new capabilities in predictive maintenance.

New capabilities are required overall. Jobs will also change and manufacturers will need

to ensure that they can hire, train, and retain people with very different skill sets. For example, maintenance experts will need to shift from being troubleshooters and exception handlers to overseeing predictive maintenance systems, and planning and steering the process based on data-driven analysis. Manufacturers will need to hire more people to fill new job roles, such as data analysts and IT system integrators. All this, in an environment where competition for such skills will be fierce. Manufacturers that create these capabilities can use Industry 4.0 to reach the next horizon of operational effectiveness. This means eliminating inefficiencies through better use of information that today is not captured, made available, or used. Moreover, by closely

Exhibit 15

The McKinsey Digital Compass maps Industry 4.0 levers to the 8 main value drivers



¹ Maintenance, repair, and operations
SOURCE: McKinsey

integrating end-to-end operations – i.e., from the raw material to the consumer – manufacturers can reduce operating costs by over 10-25%. This is achieved by improving both machine and human efficiency, which reduces production times and increases throughput. To understand better where the potential for operational effectiveness lies, McKinsey has developed the Digital Compass (Exhibit 15), which maps Industry 4.0 levers to the eight main value drivers.

The eight value drivers comprise resources-processes, asset utilization, labor, inventories, quality, supply/demand match, time to market and service/aftersales. For each, we have identified a number of Industry 4.0 levers. For example, conserving resources and improving processes

can be done through smart energy consumption or real-time yield optimization. Maximizing asset utilization can be accomplished by making machines more flexible, and introducing predictive maintenance may be a key in this regard. By introducing rapid experimentation and simulation, companies can lower the time to market. Of course, the relative performance and impact of the particular value drivers will depend on the manufacturers and the geography.

To illustrate the potential of Industry 4.0, we describe four levers that are the most relevant for Czech manufacturers. These are digital performance management, predictive maintenance, digital quality management, and human-robot collaboration.

Bold aspirations

Digital performance management

Having a clear view of the production performance related to each manufacturing step and to each component in the manufacturing process was, until recently, an unsurmountable task.

Significant progress came with digital performance management consisting of three steps: getting the right data, connecting data collection with a data management tool, and visualizing the data. The digital performance management makes it possible to draw and maintain an accurate image of current and historical performance, compare selected lines and plants to each other, and make well informed decisions based on the generated insights. The real breakthrough is that it is now possible to get insight into all aspects of a plant's performance on a real-time basis. The performance can be analyzed using advanced analytics, yielding a new level of insight and visualization that is dynamic and customized, and which enables the most useful view to be provided for a given user.

Substantial generated value has been documented. A global food manufacturer consisting of over 40 plants and 300+ processing and packaging lines digitized its performance management. It defined and gathered KPIs across all plants such as conversion cost, waste, overall equipment effectiveness (OEE), or production volume. Data collection time was decreased from weeks to a maximum of 2 days. This initiative identified an over \$350 million opportunity. All plants and working teams were able to compare themselves against one another and share best practices. The solution was embedded within the existing performance management system. A major chemicals player was coping with oversold sites running at only ~50% OEE. Furthermore, the system in place was not trusted by the operators. A new tool allowing for digital performance management was introduced, together with training on how to use it. The results were integrated in performance huddles. There was an approximately 10-percentage point OEE increase.

Predictive maintenance

Sensors and connectivity allow manufactures to monitor production equipment in real time, which enables new approaches to maintenance that can be far more cost-effective, improving both capacity utilization and factory productivity by avoiding breakdowns. Essentially, predictive maintenance can transform the maintenance model from one of repair and replace, to predict and prevent. Importantly, with interconnected devices, it is possible to monitor the performance of all machines in a systematic way. Therefore, for example, if a downstream machine detects that the work pieces it receives are consistently off in a particular dimension, it may be an indication that the upstream equipment needs servicing. The machine can be repaired and adjusted before the factory ships defective products or the upstream machine fails.

Today, some auto manufacturers detect early signs of problems in production equipment using remote sensors collecting and reporting machinery condition data. Analysis of the resulting data enables prioritization and optimization of maintenance resources, thus saving maintenance costs (compared with regularly scheduled maintenance routines) and avoiding breakdowns that can interrupt production. One major automaker uses predictive maintenance in their press shop. The system collects data from vibration sensors on electronic equipment, together with other operating data (e.g., oil temperature and purity, currents and pressure). The data is analyzed, compared with a permissible range of values, and documented. The system was installed with relatively low effort and resulted in improved replacement schedules.

On average, predictive maintenance could reduce the maintenance costs of factory equipment by 10 to 40 percent. Additionally, better predictive maintenance can reduce equipment downtime by up to 50 percent and reduce equipment capital investment by 3 to 5 percent by extending the useful life of machinery.

Digital quality management

Digitization can bring manufacturers new insights on how to improve the quality of their products. There are three major ways in which they can do so, reflecting three sources of data. First, manufacturers can collect data from new information sources, especially computer vision. Second, they can use advanced analytics on the data they collect in the existing manufacturing processes. Finally, by combining new technologies for capturing data and specialized software, companies can track their products through production, delivery, and service.

Analytics has long been used for quality control. However, two new trends are associated with Industry 4.0. First, manufacturers have access to more data, including end-to-end datasets, with inputs from their suppliers, every part of the manufacturing process itself, and from their customers. Second, as manufacturers are becoming better at finding problems sooner and understanding them better, often, workers can detect a quality issue before it occurs, quickly identify its root cause, and rapidly move to remove it. This has resulted in increased yields, reduced rework, and increased customer satisfaction.

One European foundry created a new data-mining solution integrating hundreds of parameters, and a model able to identify those responsible for driving faulty performance. An early warning system was created to notify workers if issues were expected. The solution freed up workers' time and reduced the time it took to resolve issues from days to hours, thus increasing the productivity by 25%.

New information sources enable companies to collect data for processes where previously they were blind. Computer vision has been particularly instrumental in improving quality control. Advances in optics, image sensors, and artificial intelligence have improved precision, reliability, applicability, as well as productivity and throughput. Moreover, the market for computer vision is increasingly competitive. Demand for computer vision has

exploded as the equipment costs are dropping, devices are becoming more user friendly, and manufacturers seek to automate their factories further.

One European automaker introduced a fully automated inspection system to detect defects on car bodies. The system consists of lights, cameras, and algorithms that highlight defects on special displays for later repairs. It is able to inspect 1500 vehicles per day, with a processing time of less than 10s, and has improved defect detection by 90% over human inspection.

While the tracking and tracing of inputs and products is crucial for quality control, it remains difficult. Supply chains are fragmented and the process is often paper-based. However, new technologies for gathering data (like RFID, sensors that test moisture content) and managing it (electronic batch history records, product serialization management) can bring substantial benefits. Manufacturers can get full end-to-end visibility on the status and characteristics of everything from raw materials to the finished product. If quality issues do occur, new technologies can minimize the scope in the case of a recall.

One European pharmaceutical player implemented a global batch traceability system which enabled listing all customers and storage locations for selected batches. As a result, the tracing was sped up by up to 8000 times for some customers.

Human-robot collaboration

Robots are seeing increasing use in manufacturing. Costs are falling by 10% every year, and growth rates in industrial robots are expected to reach 12-15% by 2017. At the same time, new technologies are transforming how robots are being used. One key trend is increased human-robot collaboration, which enables robots to be deployed faster, used in a wider variety of applications and with greater effect.

Human-robot collaboration requires the robots to be designed in a way that they can work side-by-side, interact, and collaborate with humans. To do so, collaborative robots integrate safety concepts to protect workers in the case of malfunctions. Instead of requiring expert programming every time they need to change their routine, advanced collaborative robots can be told what to do, using natural gestures and verbal commands. Instead of being fixed in one place, collaborative robots can be made to circulate in the factory and help workers wherever they are needed most. Eventually, collaborative robots can learn to copy employees by simply being led through the process by the employee, the latter holding the robots “arm” and physically bringing it through the moves, instead of tediously programming it, as before.

The approach to implementing human-robot collaboration, and advanced robotics in general, can be either evolutionary or revolutionary. In the evolutionary approach, manufacturers simply improve existing processes and adapt compatible equipment. This enables faster implementation and requires less Capex. However, only by taking a revolutionary approach to re-designing existing processes can manufacturers enjoy substantial improvements, and significantly decrease Opex.

While human-robot collaboration is still in its early stages, premium German automakers are already experimenting with collaborative robots. One German premium OEM has introduced robots in one of its factories that hand over a specific engine part from load carriers to employees. It is now planning to expand into new application areas and international locations.



By introducing the Internet of Things to manufacturing, Industry 4.0 is transforming one of the key sectors of the Czech economy. Faster processing, larger storage and lower costs will mean that the speed of change will increase. Manufacturers that build the necessary capabilities will be able to create new business models and enjoy significant productivity gains. By introducing the different levers of Industry 4.0 – like digital performance management, predictive maintenance, digital quality management, and collaborative robots – Czech manufacturing can keep its edge, and remain competitive.



Banking



Starting point

Consumers around the world are quickly adopting digital banking. The trickle of a few computer savvy early adopters has grown into a flood of mainstream consumers. Incumbents have only a short period to adjust to this new reality, otherwise they risk falling behind.

If the last decade in retail banking was defined by an expansion of consumer credit, the current decade will be defined by digital. This will include rapid innovation in payments and a broader transformation in systems enabled by digital technologies. If banks fail to take action, they risk entering a path of decline similar to laggards in other sectors.

In this digital decade, revenues and profits will migrate toward banks that successfully use digital technologies to disrupt the sector. Winners create new products, automate processes, and improve regulatory compliance – all with the goal of transforming the customer experience. Companies that resist digital innovation will be punished by customers, financial markets and – sometimes – regulators. Indeed, our analysis suggests that digital laggards could see up to 35 percent of their net profit eroded, while winners may realize a profit upside of 40 percent.¹⁷

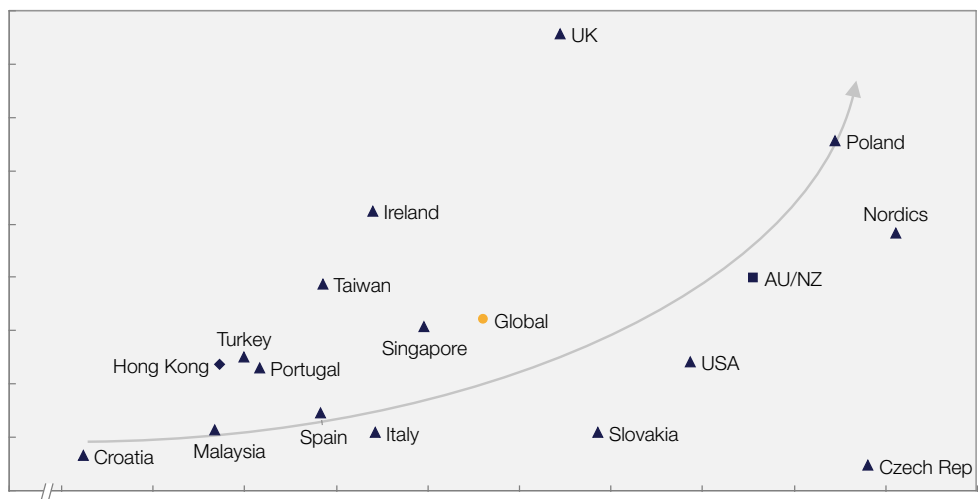
¹⁷ For more see “Strategic choices for banks in the digital age”, McKinsey, 2015

Exhibit 16 A

Despite customers’ expectations, Czech banks fail to sell products through digital channel

% sales made through a digital channel

Sales made through online or mobile channels¹ / total sales (July 2015 – June 2016)



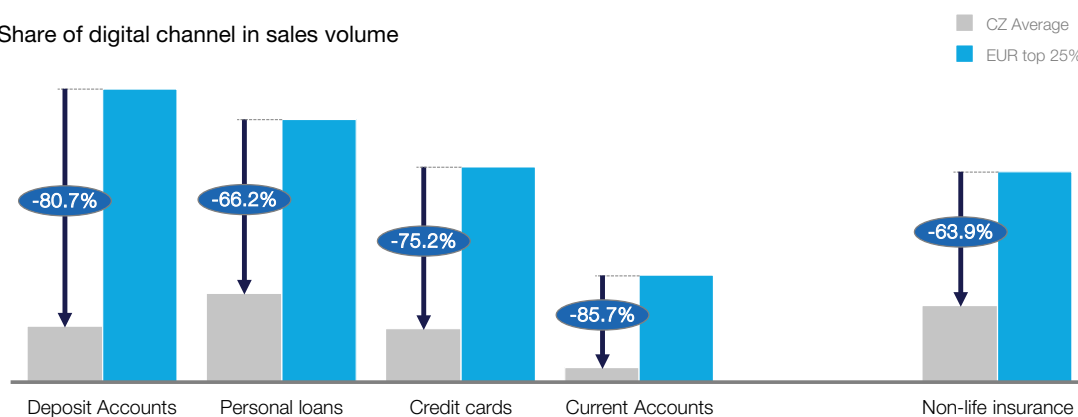
% of customers logging on to a digital channel
Customers logged onto a digital channel in 90 days to June 30th 2016 / total active customers

¹ Sale counted as 'digital' if customer completes full application in channel. Sale still counts as digital if customer has to change channel to provide ID, proof of income, or wet signature
SOURCE: Finalta

Exhibit 16 B

Czech banks are lagging behind its WE peers in terms of digital sales

Share of digital channel in sales volume



SOURCE: Finalta

We already see leading global banks investing 17-20% of their EBIT to support large-scale digital transformation. In the Czech Republic, banks were among the first sectors to embrace remote and digital channels.¹⁸ Currently, some Czech banks have managed to digitize individual parts of their business. However, Czech banks have stopped short from making fundamental changes to their operating model. This piecemeal approach has led to increasing lag in digital sales behind most developed countries. Finalta benchmarks (Exhibit 16) show that while Czech customers at the banks participating in the study are among the most

active in digital channels, sales through those channels are minor. A breakdown by products reveals a wide gap between the digital sales of Czech incumbent banks and their European peers. The gap is present across all products, no matter whether simple or complex. The large gap between customer preferences and the banks' digital capabilities is a clear call for action.

¹⁸ McKinsey Panorama, World Bank, CrunchBase, CB Insights, Merrill Lynch, Andreessen Horowitz, FFIEC

Bold aspirations

Fix the basics

Today, too many processes are still paper-based. Indeed, even simple repetitive tasks are performed manually. Conservative corporate culture in a regulated environment has created many unnecessary complexities. Simplification, resulting in straight-through processing (STP), can decrease the number of steps required. End-to-end (E2E) digitization can then boost productivity, increase customer satisfaction, streamline organizational structure, and help banks comply with regulation. Together, these approaches can create a simple and hassle-free customer experience. Customers able to move seamlessly between channels and obtain offers relevant to their needs are more valuable and sticky. A digitized bank can deliver products and services to customers at any time and place. The customers would be interacting with bank employees only when they want to. Banks would reduce their cost base, as digitization and STP dramatically reduce the amount of labor needed, resulting in significant cost reduction. Digitization would also help to streamline the organizational structure and speed up the adoption of innovative solutions, thus bringing benefits to customers and banks alike.

A European bank developed online mortgage processing with an automatic engine that enables end-to-end mortgage decision processing. E2E mortgage digitization brought four main benefits: first, it improved the customer experience and sped up the whole application process. Specifically, the final approval time was reduced from 2-3 days to 1 minute. Second, transparency was improved as customers can check the status of their application in real time. Thirdly, a 100% digital process requires less human interaction, leading to lower costs. A process that was previously more than 95% human decision-making is now more than 70% fully automated. Finally, mistakes were eliminated and decision quality improved. Automation eliminated process errors while improving both data quality and regulatory compliance. Decisions are based on a number of factors, including rules, machine-learning algorithms and collateral that is valued automatically.

Push beyond standard banking

In the past decade, the Czech banking market was growing, competition was limited and incumbents enjoyed high profitability. While incumbents are still profitable, in the face of new attackers they struggle to maintain growth. A new competition is growing from FinTechs and global online players. Last year, the number of FinTech unicorns¹⁹ has increased from 10 to 46.²⁰ An example from a neighboring country shows that even very small companies can enter segments traditionally dominated by banks and quickly gain significant market share. A FinTech platform for online currency exchange and remittance payments completely disrupted the foreign exchange market. Its faster and more convenient service – with currency spread at a 1-2 % margin, much below what the banks were offering – quickly attracted about 20 million users. As a reaction, some banks created their own platforms offering a similar service. However, the majority of banks' profit from these products was has been irreparably irredeemably lost.

Moreover, two trends put further pressure on banking revenue: Firstly, low interest rates force banks to provide cheap loans. Secondly, Czech customers became more sensitive to banking fees and increasingly request fee-free accounts. Banks will have to react to those new conditions by protecting old profit pools and developing new ones. This would require building capabilities in areas where they have historically under-invested: robust data infrastructure and analytics, flexible IT architecture and an omnichannel experience. When considering new capabilities to develop, banks should leverage the unique asset they already have – customer data. Today, most of that data still goes unused. Yet there is significant value in applying advanced analytics to identify opportunities to cross and up-sell customers. This means making data usable in real time at the point of sale and analyzing it to create targeted offers or detailed risk assessments.

¹⁹ Startups with an enterprise valuation of more than USD 900 million

²⁰ Finovate, 2015

Banks can also improve their revenue by providing services beyond banking, such as telecommunication or energy reselling. They can even aspire to become ecosystem orchestrators, like large technology and software players who seamlessly integrate products from many different providers. Banks would need to ensure that they own the single interface that customers use to manage their bills, payments, savings, telecommunications, and other services. Then, the banks could seek to integrate third party offers into this platform. By doing so, they can further improve customer satisfaction and collect even more data about their customers.

A North American FinTech created an online platform that customers use to manage multiple accounts. Customers use the company's website and app to instantly transfer money or pay bills. The company even issued its own payment card so that customers can use one card for multiple accounts. However, the platform also offers services that are more advanced. A money management tool, for example, helps customers to balance their monthly budget, reach savings goals or get insights on their spending (including information on the type of spending, the location, transaction time, and even tips). The FinTech makes money on splitting the interest margin with banks, on interchange fees, and on cross-selling third party products. After two years, and with USD 1.5 billion in annual processed transactions, the company was acquired by a major regional bank.

Become agile

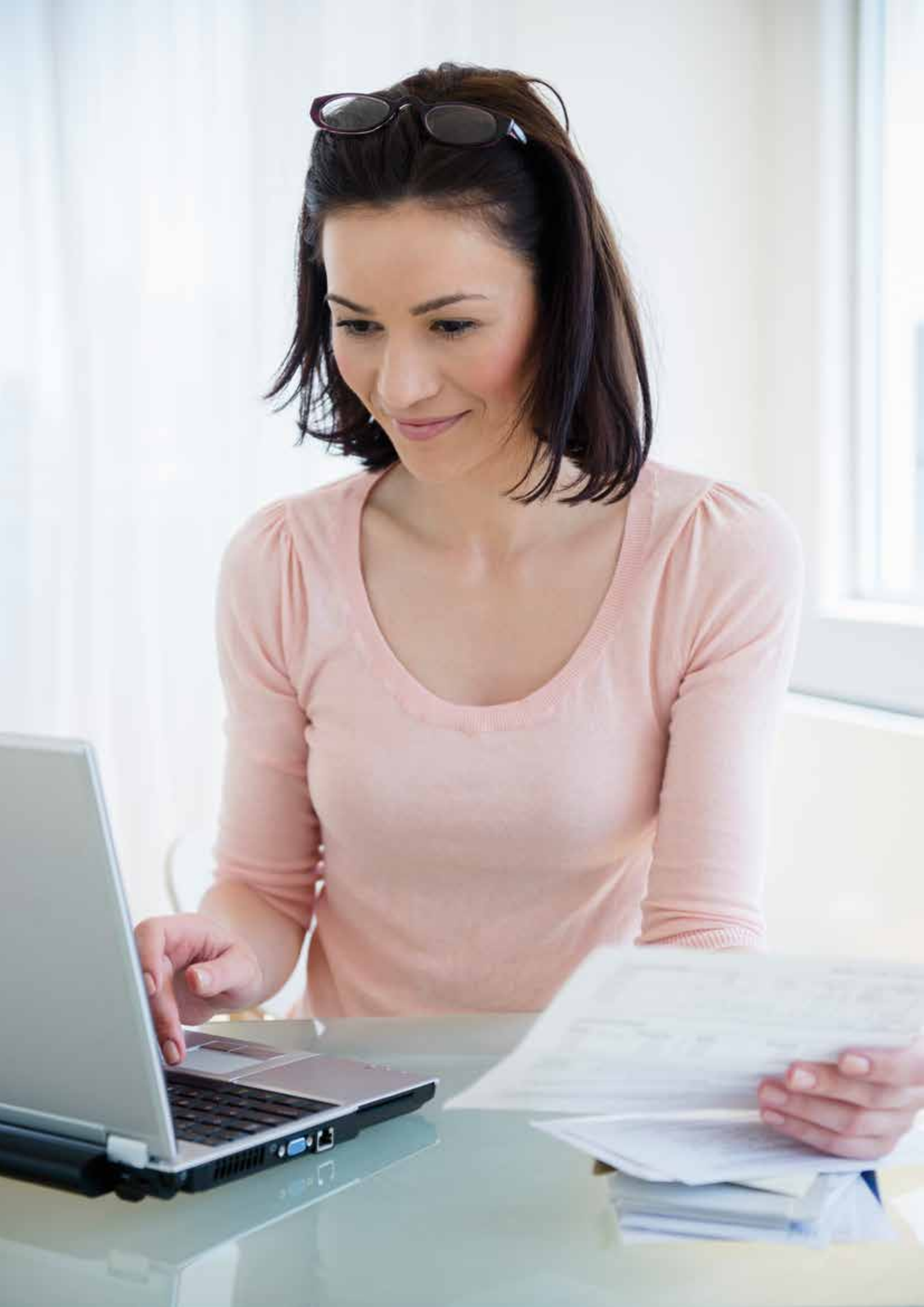
The upcoming Revised Directive on Payment Services (PSD2) may further challenge the position of incumbent banks. As banks are forced to open their payment systems to third parties, they may lose their direct relationship with customers and could end up as infrastructure providers. Even though the real impact of this deregulation is still unclear, banks could already act now. By becoming digitally agile organizations, banks would be able to quickly react to new challenges and introduce new products and services much faster than before. However, agility is not easy to combine with the current, rigid, safety-first culture and strict regulatory environment. The final aim to create an omnichannel organization with a broad range of products beyond banking and FinTech, such as time-to-market, is like sci-fi to many current banking IT and ops managers. At the same time, the data and technology required to realize this vision often already exists. What is missing is the organizational orientation and mindset to have small, cross-functional teams working together through rapid testing and improvement programs.

A large Western European bank with approximately 9 million clients successfully transformed itself into an omnichannel agile organization. It took only 9 months to design and implement several major structural changes. The bank simplified its organization structure, reducing hierarchy from 5 to 3 layers, and introduced a new company culture. Employees no longer belong to divisions and departments with hierarchical structures and no longer report to one permanent manager. Tribes and multi-disciplinary squads now perform most of the work. Squads consist of employees with various backgrounds (such as project management, IT, marketing, customer care, analysis, etc.). They are cross-functional and self-organizing teams and have end-to-end responsibility for their task. This means that they design and develop new products, as well as manage their launch and implementation. The transformation saved 30% of costs and enabled the bank to deploy 2-3 new releases per week



Digitization is rewriting the rules of how banks compete. The magnitude of change makes digitization a tough, complicated journey. Capturing the opportunities it can provide will require investment, painstaking planning, and coordinated decision making spanning across the entire bank. Incumbents that fail to grasp this complex change risk damaging franchises built over generations. Moreover, even though Czech banks have already digitized some activities, they are not the digital leaders of today.

They need to focus not on the individual projects, but on the transformation as a whole. However, they should not stop there. E2E digitization is merely a foundation on which banks can respond to growing FinTech attackers by building new integrated platforms to offer new services and products. The knowledge of their customers and their customers' behavior is a unique asset no other companies have. Banks need to learn how to use this before competitors from other sectors take over their role.



Selected examples of digitization levers

Area	Sub-area	Description	Example
Customer-facing	Opening current account	Customers pass through a smooth and quick process when applying for a new account. They can individualize the product in real-time	American bank sign-up processes can be done on iPads in 10 minutes; 25% increase in customer sign-up with 20% decrease in cost; higher customer satisfaction
	Creating payment account	Customers can join a mobile payments platform from a mobile device	A western European bank introduced a payment platform that can easily be downloaded and set up on a mobile; 20,000 downloads in 2 days
	Mortgage processing	Banks can drive down costs by digitizing and automating the process	A western European bank changed the sanctioning process to achieve 80% automation with 15-minute sanctioning time. Approval process cost decreased by 70%
	Cross-sell partnerships	Customers receive offers based on their purchase history, internet behavior or social groups they belong to	American bank provides coupons and cash-back offers credited to account when a purchase is made from a qualified merchant
	Gamification	Customers can open accounts through Facebook and “play” with the bank	UK bank had 20% lower cost of customer acquisition
Internal processes	Loan risk-assessment	Banks leverage big data to speed-up the approval process	A western European lending provider aggregates data from multiple sources. Processing time per loan application under 8 seconds, money in account under 6 minutes
	2-speed IT	Banks can have two IT teams with different aims – one robust upgrading core systems and a second agile, focused on app development	A western European bank introduced 2-speed IT for developing consumer apps, reducing development time from 1.5 years to 1.5 months

Insurance



Starting point

The insurance sector is unique in using a network of sales agents. Profit is traditionally made on complex products sold by the agents, rather than by online-only products. The key question is how to build on the current sales model whilst leveraging digital tools to make it cheaper and more effective.

In insurance, there are two tasks that, if done well, can bring substantial impact to the insurer: the digitization of the agent network and the automation of claims processing and manual agendas.

Agents trained with digital tools can sell better, whilst keeping the operating costs for issuing each policy low. Claims processing is traditionally the largest portion of operations in an insurance company; digitizing claims minimizes the complexity of the task, since the responsible department has clearly defined processes and usually represents a large share of the insurer's employees. Fraud, a constant worry on the insurer's mind, is also prevented at the stage of processing a claim. Any savings on claims payouts go directly into the profit margin, so spotting fraud more reliably through a digital tool translates 100% into increased profit.

Bold aspirations

Digitize the agent network

The agent network is here to stay. Even though digital sales have been slowly growing, high-margin products are not likely to be sold online in the foreseeable future as insurance is always rather sold than purchased, requiring a “push” from the selling agent. Only a few customers would be comfortable purchasing a life insurance policy without having the option of a long conversation with the agent, who can reassure them and clarify the details. Therefore, digitization is not here to replace the agents, but to enhance and supplement this channel.

Digitizing the agent network means two things: enabling the agents to work digitally, and leveraging digital tools to make policy issuance more efficient end-to-end, reducing the need of repetitive back-office administration. Insurance has been traditionally built on tied agents and brokers who sell the policies. Mobile devices enable the agents to see customers past purchases, tailor personalized offers, as well as show the latest market trends. All of these can be leveraged to sell more appropriate products at a time when the customer is more likely to buy them.

A good example of this is a US insurer who has completely digitized the way in which their sales agents work. Customers are now able to make appointments with their agent through a mobile app. The agents are equipped with tablets on which they can show the customers more information about the company, its values, and its products. The agents also have access to customer data, including a detailed breakdown of their needs and their financial situation. Through an app, the agents can also access a prepared contract. Follow-up communication with the customer is done by email, and many of the required documents can simply be uploaded and shared online.

Transitioning from working with a paper-filled suitcase to a network of agents that leverage digital tools is a complex process. Given that successful agents have had years of experience and success with the traditional methods, the insurer needs to work very closely with them, providing adequate support and incentives to facilitate the transition.

Having a digitally-enabled workforce simplifies automating policy issuance. Substantial resources are traditionally expended on putting policies in force, often manually underwriting many of them. The aim is to standardize these policies and process them without human interaction. A US insurer achieved a 17% compound growth rate over 5 years, with the introduction of automated processing for issued policies contributing to this growth. 50% of applications were received electronically. Out of those, half were then underwritten automatically. The average number of “touches” for all new policies was cut from 8 to 2, which led to substantial growth in the volume of new policies, while at the same time reducing the number of staff.

Automate the claims process

The second major way in which insurers are able to benefit from digitization is through automation of the claims process. Currently, most insurers have a complex process with many manual steps. When clients submit a claim, they often engage the website and the call center. After that, they send the required documentation by mail. This documentation is processed, sometimes even passed on in physical form between several departments, and after multiple actors process it, the claim is accepted or rejected. Automating even parts of this process can bring substantial savings.

The complexity of a claim process can be illustrated by standardized auto claims, comprising four stages: First Notice of Loss (FNOL), Claims Management, Loss Assessment/Repair, and Claims Settlement.

The table below is based on actual cases McKinsey has seen worldwide. It shows how an average insurer can increase their Net Promoter Score (NPS) by 10-15 percentage points, reduce claims expenses by 20-30%, and reduce payments by up to 4%. This results in an increase in customer satisfaction due to faster processing time and improved transparency. Claims expenses

are reduced by 20-30% by offering customer self-service journeys. Once-and-done processes and digitization also save time. Finally, claims payment is reduced by up to 4% by lowering the fraud rate and steering customers towards the desired settlement, be it a car repair in the partner network, or cash settlement.

Stage 1: First Notice of Loss

Current	More digitized
Customers wait 5 minutes to be connected with the claims hotline, then spend 20 minutes explaining the claim	Customers can report the claim in an online app in under 3 minutes
Even for claims reported online, manual entry is still needed	2/3 of all claims are reported online by the customers and fed into the system automatically

Stage 2: Claims Management

Current	More digitized
Only a limited number of high severity cases identified within 10 days	~65% of high severity cases identified within the first 10 days
Less than 5% of claims steered into the partner network	Over 50% of claims are steered into the partner network
Fraud analysis conducted only sporadically at specific points	Continuous fraud monitoring

Stage 3: Loss Assessment/Repair

Current	More digitized
No self-assessment of the message	Customer spends 5 minutes on damage self-assessment; speeding up the process
Customer has no transparency on the claim status Status requests account for 20% of calls in the call center	Customer has full transparency on the claim via push messages/app Status requests decreased by 50% due to app usage and messages
Several touchpoints with the claims handler, claims adjuster and repair workshop	Each party touches the claim once and passes it through to the next stage

Stage 4: Claim Settlement

Current	More digitized
Waiting for up to 20 days for processing and payout	Real-time processing and cash settlement within 2 hours
All payments are triggered manually	50% of payments are triggered and executed automatically



Given that the sales model of insurance is unlikely to change in the foreseeable future, digitization should be leveraged to make the current process more efficient. The biggest wins can be gained in the digital transformation of the sales network and subsequently in processing the policies at issuance and later when a claim is submitted. Digitization brings benefits in each area, allowing insurers to provide better service for lower costs.



Utilities



Starting point

Utilities are frequently seen as laggards in moving into digital compared to telco and banking. However, tangible opportunities to profit from digital already exist in utilities and new ones will emerge. The key challenge for the sector is to recognize the real opportunity in a sea of hype.

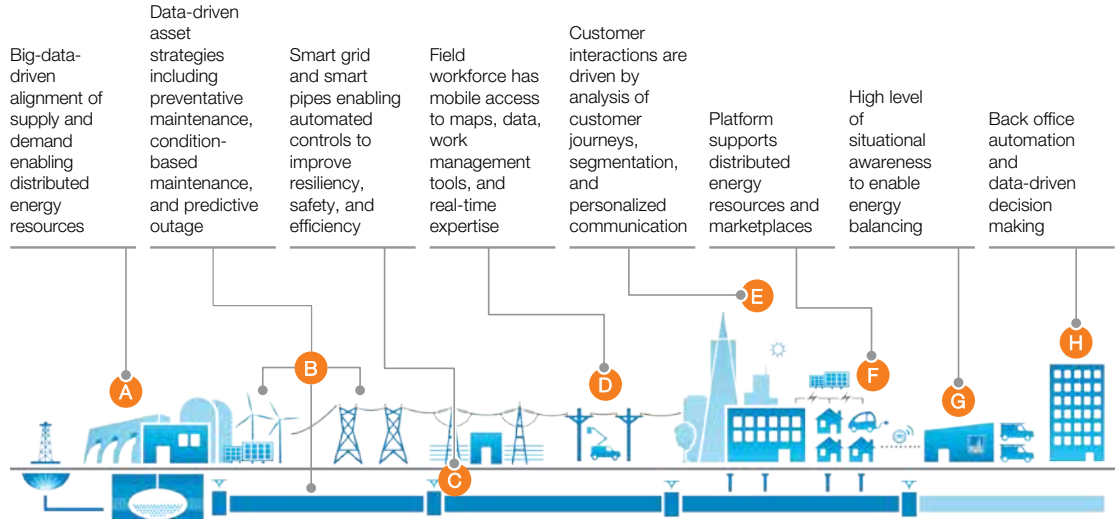
Over the past 10 years, the electric power sector has been disrupted more than most sectors. A combination of market liberalization, decline in commodity and CO2 prices, massive increase in renewables penetration – including decentralized – has threatened most of the sector’s traditional value pools. Digital is frequently portrayed as both an accelerator of the change as well as a solution

to power companies’ woes. Digitization performed correctly can indeed increase asset uptime, reduce costs and accelerate customer service – the challenge lies in recognizing which digital applications create real value for utilities (Exhibit 17).

While each case needs to be examined in depth in the context of every company, below are some of the digital applications which have either already proven their value across various geographies, or which we expect will do so in the future.

Exhibit 17

Digital utility of the future captures opportunities all along the value chain



SOURCE: McKinsey

Bold aspirations

Use data to drive grid operations

Operators are already collecting large amounts of data from their grids, as well as from their equipment, workforce, and customers. Digital leaders are distinguished by their ability to turn this data into insights and automatically act on these insights. To maximize the potential impact, utilities must strike the right balance between investing in capturing more data and investing into making the already available data actionable.

One prominent way in which utilities can use insights from data to drive decision-making are data-driven asset strategies. For example, by periodically measuring the condition of grid infrastructure – and using advanced analytics and machine learning to interpret this data – utilities can predict when an asset needs maintenance before failures occur.

Similar data-driven strategies can also be applied in the operations of generation assets – both conventional as well as renewable (primarily wind).

Grid operators can also equip their field force with new digital tools and introduce digital processes to the field force. The key advantage of newly available tools over the traditional PDA-based field-force management systems is the flexibility that allows the development of applications that are customized to the company's processes and are tailored to specific local conditions. They can show detailed information on the grid and provide knowledge and expertise relevant to the issue that workers are facing, which in turn increases field-force productivity. Advanced players are also able to change maintenance workers' schedules dynamically to focus on high-priority outages, assign a new maintenance worker if another is running late and automatically and proactively alert customers to any changes.

Digitize customer service processes

For utilities, significant opportunities exist in digitizing both the customer journey and back-end processes related to customer service, as well as improving the use of data in customer interactions.

Consumer engagement with utilities is typically of a lower frequency than with banks or telecommunication companies. At the same time, the interactions often have a high emotional intensity (e.g., delays in setting up a new power connection or insensitive handling of the debt collection process may damage the company in the eyes of a customer forever). While highly knowledgeable customer representatives will continue to be required both for service and sales, digitization can go a long way to increasing customer satisfaction by shortening waiting times, reducing errors, and improving transparency for the customer. As an example, digitization can not only accelerate and simplify data collection during the new connection process but also allow employees to share data, interact with, and monitor suppliers accurately and with minimal effort.

On the revenue generation and assurance side, utilities can use analytics to tailor communications to individual customers. For example, a European utility improved its collection process by segmenting and analyzing its 2 million customers. It used static data (e.g., contract characteristics) as well as dynamic data (e.g., 2 years data on payments and debt) to develop an early warning machine learning model to predict bad debt in B2C 3 months in advance. The model enabled it to improve new provisions for bad debt by 10-25%, launch proactive campaigns on high-risk contracts, and define separate dunning processes based on customer characteristics.

Other utilities are piloting the use of customer data for selecting the “next thing to offer” to individual customers from their growing product portfolio or in routing the customer to the customer service agent with the highest likelihood of turning the interaction into a sale.

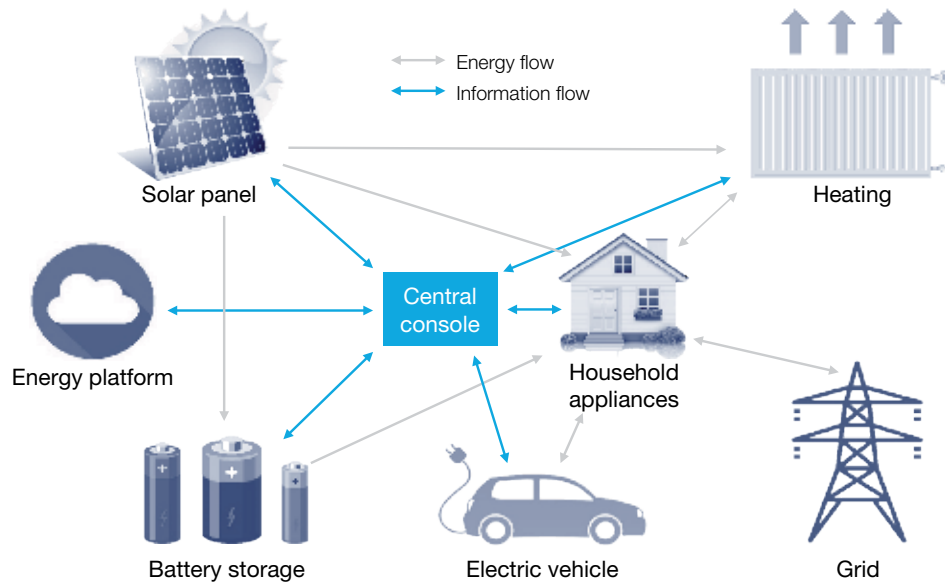
Create digital platforms for home energy management

Unlike the previous examples that have already been proven in the real world, digital energy management platforms (Exhibit 18) are still an early stage opportunity (as well as a threat) for utilities. Early adopters among customers are taking advantage of falling technology prices to outfit their homes with technologies that help them be more than just energy consumers. Technology companies and energy startups are selling solutions that control the customers' energy consumption, production, and storage.

These companies are creating platforms to manage customers' energy supply, storage, and consumption and are finding ways to monetize them. Some use these platforms to offer their own, innovative commodity products, and act as a consumers' energy retailer. Others are selling access to their platforms to third party developers. Many companies also seek to use the platform to manage customers' electricity demand and get paid to help balance the grid. One European energy startup has launched an electricity retail offering for owners of its hardware, and is offering a flat-rate tariff on electricity from the grid for customers that already produce and store it.

Exhibit 18

Central consoles collect information from appliances producing, storing and consuming electricity and connect it with energy platforms





Some European utilities have already launched strategies for entering this new business. Others have already started offering their own energy management products and services. One European utility has developed a smart thermometer able to control a home's heating, as well as other connected appliances. Four years after launch, it has already sold the device to over 10% of its customer base, and has now opened the platform to third parties.

As technologies become cheaper and with the continuing investment support from government subsidy fund,²¹ similar trends are likely to come to the Czech Republic. Local utilities have an opportunity to capture part of the potential future growth in these areas, but need advanced digital capabilities to do so.

When performed correctly, digital transformations can bring significant economic benefit for utilities. Most impact will be achieved through This includes productivity improvements, revenue gains, better network reliability and safety, enhanced customer acquisition and retention, and entry into new business areas. Leading utilities have seen significant cost reductions and double-digit bottom line improvements using a variety of digital levers.

Beyond just missing out on these opportunities, utilities also risk bearing a strategic cost for failing to attract the right digital talent. The sector may struggle to attract the top talent that drives digitization, and creates the capabilities to sustain and develop it, as even sectors that are considered digitization leaders are having problems hiring and retaining sufficient digital talent. Individual utilities that fall behind may quickly find that they have missed the train entirely.

²¹ The "Zelená úsporám" program, managed by Ministry of the Environment of the Czech Republic

Selected examples of digitization levers

Area	Sub-area	Description	Example
Generation	Asset quality and safety	Customers complete their journey regardless of the channel. Switching between channels in smooth and convenient.	European telecom developed omnichannel via Web-to-shop initiative; results: +15% online conversion rate; 6% of stores closed in one year, +15 % of web-to-shop
	Predictive maintenance, Interactive process checklist	Redesign products to be simple, understandable and available online to achieve higher sales and attract new customers	WE MVNO: Current users are incentivized to acquire new users; once new SIM is activated, user obtains bonus points
Transmission/ Distribution	Supplier management	Supplier management tracking, live updates	
	Workforce productivity	Real-time crew management and communication Supervisor work planning (interactive maps, productivity dashboards)	Dynamic dispatching and performance management yielded a 21% increase in productivity
	Asset quality and safety	Predictive maintenance	
	Fraud reduction	Advanced analytics leak/theft detection and reporting, live incident monitoring	A fraud team realized 58% revenue (15% energy) improvement from advanced analytics in monitoring
Retail/ Customer care	Customer journeys	Omnichannel presence, Home energy audit, Live chat help, feedback	A European utility improved add-on cross-sell by 500% and contract up-sell by 10% by using analytics to make smart offers at moment of renewal
	New products	Smart home solutions, connected buildings, preventive maintenance	Smart thermometers that are able to control heating, as well as household appliances
	Internal Processes	Comprehensive CRM with history, automated cross-sell tools Credit and collection process digitization	Customer analysis to define differentiated collections process based on customer characteristics
Corporate center	Customer care	Automated back-end processes, call center with machine learning, real-time personality matching Segmentation analytics	
	Agile organization scheme	Cross-functional teams cooperation, agility, digital talent management	
	System and data architecture	2-speed IT	

Construction



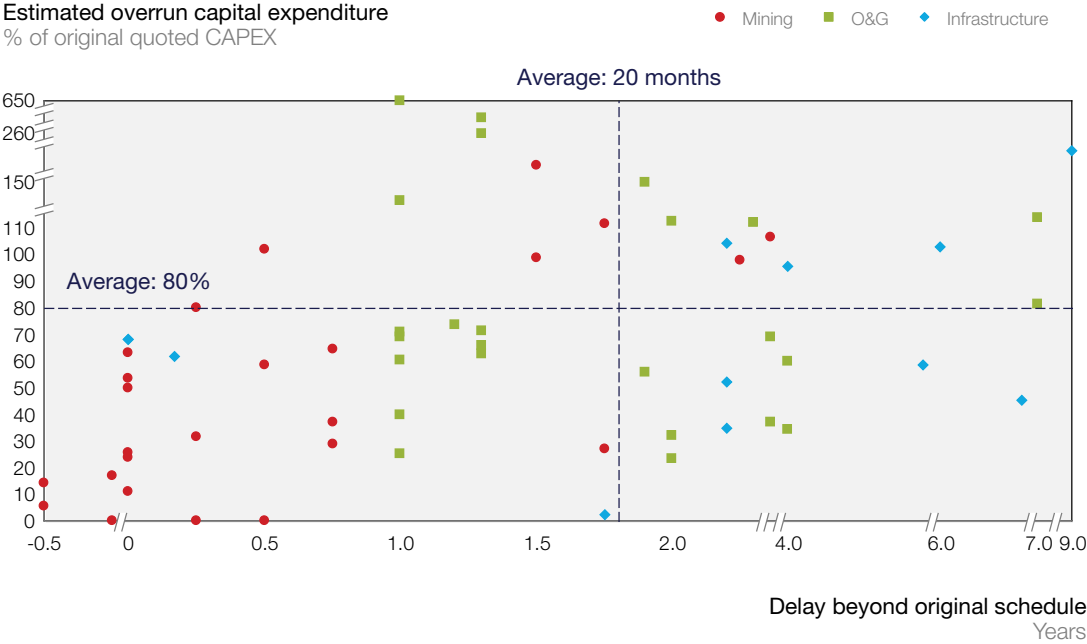
Starting point

The construction industry is ripe for disruption. Large projects across property types typically take 20 percent longer to finish than scheduled and are up to 80 percent over budget (Exhibit 19). While the construction sector has been slow to adopt process and technology innovations, there is also a continuing challenge when it comes to

fixing the basics. Project planning, for example, remains uncoordinated between the office and the field and is often done on paper. Contracts do not include incentives for risk sharing and innovation; performance management is inadequate and supply-chain practices are still unsophisticated.

Exhibit 19

Cost and schedule overruns are norm in the construction sector



SOURCE: IHS Herold Global Projects Database (Nov. 19, 2013); Companies' public annual reports; press releases

Bold aspirations

Digitization in the construction industry is not straightforward. This is because each construction site is unique; there are different geological conditions, different climate, different materials, and many other factors that vary from site to site. However, digital tools, such as 5D BIM, Digital collaboration and RFID, exist to address various challenges.

Deploy 5-D information management

5-D building information modeling can be used successfully to realize savings for large-scale projects. It is a five-dimensional representation of the physical and functional characteristics of any project. 3-D building information management (BIM) includes all standard special design parameters, including geometry, specifications, aesthetics, thermal, and acoustic properties. However, in addition to these, 5-D BIM also considers a project's cost and time component. This allows owners and contractors to identify, analyze and record the impact of changes on project costs and scheduling.

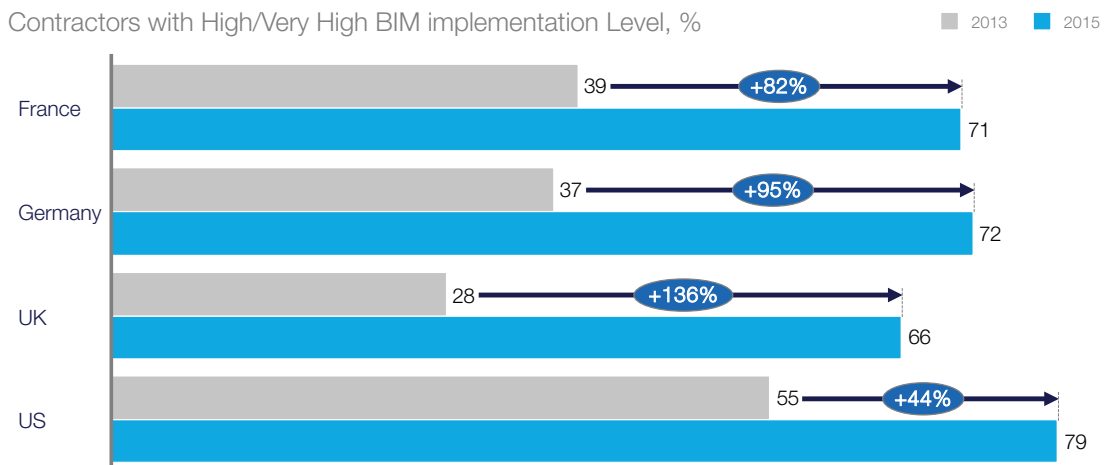
We see construction companies across the globe adopting the BIM model in last years (Exhibit 20). For example, in designing a single-exterior envelope mock-up for a US hospital 5D BIM was introduced to fully model the price and condition on the building envelope after problems were encountered in the initial modeling exercise. Issues were identified early in 45% of panels, and led to cost savings of over USD 1m.

Even 3-D BIM creates substantial savings on time and cost. For example, a hotel construction project cut their schedule by 2-3 months by reducing the time and material costs spent in steel works by pre-fabricating all the primary steel structures. An airport construction project reduced construction time by 3-5 months by improving visualization to accelerate clash detection and reduce re-work. In the case of a different airport, in Abu Dhabi, enhanced collaboration, enabled by BIM, reduced the cycle of critical RFIs²² from 28 days to 2-7 days. BIM also creates transparency in work sequences for complex interior constructions. For example, a European real estate construction project achieved 5% savings on its total cost.

²² Requests for information

Exhibit 20

Increasing global adoption of construction technologies is forcing companies to implement these technologies to remain competitive



SOURCE: McGrawHill Construction, expert interviews, team analysis

Indeed, one study found that 75 percent of those that adopted BIM reported a positive return on their investment. They also reported shorter project life cycles and savings on paperwork and material costs. Given these benefits, a number of governments, including those in Britain, Finland, and Singapore, mandate the use of BIM for public infrastructure projects.

However, proper implementation is key. Consistent use of BIM implementation by all stakeholders and a commitment from dedicated model owners allow the model to be up-to-date and fit for purpose. In projects where this was not the case, the added complexity and cost of using BIM implementations has resulted in zero-to-negative ROIs.

Use digital collaboration tools

One reason for the industry's poor productivity record is that it still relies on paper to manage processes and deliverables, such as blueprints, design drawings, procurement and supply-chain orders, equipment logs, daily progress reports and punch lists. Due to the lack of digitization, information sharing is delayed and may not be universal. Owners and contractors therefore often work from different versions of reality. The use of paper makes it difficult to capture and analyze data; this matters, because in procurement and contracting historical performance analytics can lead to better outcomes and risk management. Mismanaged paper trails also routinely spur disagreements between owners and contractors on such matters as construction progress, change orders and claims management. Finally, paper trails simply take more time.

Owners and contractors are beginning to deploy digital-collaboration and field-mobility solutions that enable them to update the design and scheduling, manage materials, track the crew, check quality through remote site inspection, update, and track contract-compliance checklists, and make performance management easier through visualized dashboards, among other advantages.

A tunnel project used collaboration tools to realize substantial savings; there were almost 600 vendors involved, so a single solution for bidding, tendering and contract management was developed. The time to generate a report was cut by 75% and document transmission time was cut by 90%. In another case, a rail project used automated workflows to save over \$110 million out of a total project value of \$5 billion.

However, the implementation of digital collaboration solutions varies; simple, first-level implementations rely on the passive use of a single building model by all contractors. Advanced, second-level collaboration entails also "editing" access rights for contractors, who can update the building model directly. This allows for a feedback loop, enabling on-the-go optimization.

Use the Internet of Things for monitoring and data capture

Factors such as the number of people, the profusion of construction equipment and the amount of work going on at the same time, mean project sites are getting denser. Sites now generate vast amounts of data, a majority of which is not captured, let alone measured and processed.

The Internet of Things is a reality in many other sectors; sensors and wireless technologies enable equipment to become "intelligent" by connecting with one another. Sensors, near-field communication (NFC) devices and other technologies can help monitor the productivity of both staff and assets. These can be used for equipment monitoring and repair, inventory management and ordering, assessing quality, monitoring energy efficiency and ensuring safety.

RFID²³ can be particularly effective for monitoring large-scale infrastructure projects (e.g., railways). In combination with RFID-reading drones, owners and contractors can keep track of inventory and measure progress to keep the project on cost and on schedule.

23 Radio frequency identification



There are many tools in construction that can be leveraged to achieve substantial benefits. Since the adoption of these innovations is still low, it might seem that widespread adoption is far off. However, companies that have adopted technologies early, and developed the expertise in using them, will be at an advantage once they become widespread.

Deployment of different technologies depends on the construction project, both in terms of the complexity and size. Implementing 5D modeling and digital collaboration is better suited to projects that are more complex. Expansive, but comparatively straightforward, infrastructure projects may use digital in different ways, focusing on RFID-tracking and drone-enabled remote oversight.

Finally, advanced capabilities are needed to capture the full potential of digital technologies. While digital can bring substantial benefits, it also increases the importance of efficient communication, cooperation and iteration in all phases of a construction project.

Selected examples of digitization levers

Sub-area	Description	Example
Higher-definition surveying and geolocation	Rapid digital mapping and estimating (for example LIDAR ²³)	Drones can be used on large infrastructure projects – such as airports and railways – to reduce site inspection costs.
5D building information modeling	In addition to a standard computer model, add dimensions of schedule and cost	Study found positive return on investment in using BIM in 75% of cases; In multiple projects had high impact on reduction of construction time European construction company saved 5% through implementing 5D BIM
Digital collaboration and mobility	Real-time updating of status of different teams and parties	Tunnel construction project had time to generate report cut by 75%, document transmission time cut by 90%
3D printing	Using large 3-D printers to rapidly build complex structures	A Chinese company was able to build 10 200-square-meter homes in 24 hours using a large 3-D printer with cement-fiber glass “ink”
Semi-autonomous building robots	Bricklaying robots able to speed up construction as well as reduce labor costs and waste	An US robotics company rents bricklaying robots that triple the speed of bricklaying, while reducing labor costs by 50%
Internet of Things	RFID tags enable effective stock management and logistics	Materials & equipment are tracked easily and their condition remotely monitored
Advanced analytics	Using advanced statistical analysis to create insights from disparate data	Oil and gas giant improved workflows to increase productivity by 20 to 25 percent

²⁴ Light detection and ranging

Healthcare



Starting point

Digital innovation in healthcare has the potential to bring a step change in care quality at a significantly lower cost. The potential is huge – a conservative estimate puts the impact of transformative, end-to-end digitization at a 6 to 10 percent productivity improvement. As in other sectors, this value stems from the power of automation, standardization, and interconnection.

Most healthcare systems, including that of the Czech Republic, face worsening talent shortages, large variations in the quality of care provided, and healthcare expenditure rising faster than GDP, driven in part by aging populations.

Investors are waking up to the fact, that unlike in other sectors, health systems have not yet captured a fraction of this potential and, although challenging, a digital revolution is possible. In the past 5 years, more than USD 18 billion in capital investment has flowed into digital health technologies globally²⁵ and more than 1,500 digital health companies are unleashing thousands of digital and mobile health applications in the health technology marketplace. Digitally savvy patients expect services to be increasingly convenient, responsive, and personalized, and healthcare is no exception. To capture the benefits, all health system stakeholders will need to re-imagine care delivery, learn lessons about the transition from other sectors, and recognize that all stakeholders have an important and specific role to play in the digital revolution.

²⁵ StartUp Health Insights, Digital Health Funding Rankings, 2015 Midyear Report

Bold aspirations

Automate manual tasks

Whether it be scheduling or repeat prescribing, many tasks can be simply and cost effectively automated, removing the chances for errors and driving improved productivity. A large proportion (some 25 percent) of clinical staff time is typically spent on collecting, recording or checking data, only 65 percent of which is relevant to patient care.

Such a simple thing as online appointment scheduling is not widely used in the Czech health system and there is huge variation in how appointments are managed both within organizations and across the system. Moving to online scheduling would both empower the patient and reduce administration activities, so that medical personnel can focus on patients, rather than paperwork. Such a shift goes in line with patient satisfaction, as it also prevents them spending hours in the waiting room.

Companies such as DocPlanner already offer simple solutions to the private sector that could be adopted more widely.

Besides the interface, another problem is encouraging adoption. This can be illustrated by the E-prescriptions system managed by the Czech drug regulator, SUKL.²⁶ Repeat prescriptions should be possible in the Czech Republic at the touch of a button; however, the majority of HC providers are not using the system. This highlights the need for the system to strengthen how existing solutions are implemented. The public authority has to ensure that there is a demand for change from clinical staff. The digital program must offer clear benefits, such as improving patient quality, but must also address a specific pain point for clinicians, providing them with the right training and incentives, as benefits may be accrued in another part of the system to the area where the change is required.

²⁶ Státní ústav pro kontrolu léčiv (State Institute for Drug Control)

Enhance connectivity

With the use of telephone, video conferencing and the internet, smart devices can fundamentally change how patients and doctors interact. Patients do not need to travel to hospitals for consultations and doctors can monitor a patient's progress remotely.

An integrated US healthcare provider with six hospitals and 150 primary locations is using remote monitoring for heart failure patients and diabetes sufferers. It is designed to help patients monitor and manage their disease independently, reduce emergency room visits and avoid hospital readmissions. Patients have a small device, connected to their phone, which monitors their heart rate, blood pressure, weight, blood sugar, peak flow, and oxygen levels on a daily basis. It also asks "yes" and "no" questions related to possible symptoms. Patients' daily health information is automatically and securely sent over the telephone line and reaches an e-health nurse in less than 30 seconds. The health data is reviewed and patients are contacted if there is an alert. The system also alerts physicians should the patient require a change in medication or in the treatment plan.

Enable patients to play a bigger role

The Czech system could make a concerted effort to help patients better access their own information and educate clinicians to better involve patients in their care decisions. Denmark, for example, has provided secure access for patients to their shared medical records, helping them make the right treatment and self-care choices, and informed decisions about which provider or even clinician will treat them. Patients are the custodians of their own data and are provided with secure access and the rights to manage their own records.

Another helpful and simple feature is an open-access provider database and ranking. Patients can check how the doctor/facility is ranked compared to others. This simple and transparent system creates value for patients and good providers, as well as insurers. Moreover, the patients feel more involved in the whole healthcare process and can actively help to improve it.

Such a system was successfully implemented in the UK, where it automated existing activities and enabled greater transparency, resulting in higher patient involvement. The system, accessible through a single website, is operated by the public health authority and provides performance information and quality rankings of HC providers, including patient feedback. But there is even more valuable content ranging from the Live Well section (tips, apps, podcast advice on losing weight, getting fit, stopping smoking, anger management, healthy eating, and mother and baby support) through online forums led by experts, to a range of different interactive tools, including widgets, slideshows, quizzes, symptom checkers, mobile apps and video walls. The positive impact is clear - 37% of users reported that it decreased their use of GP services and the savings achieved through reductions in avoidable and unnecessary consultations are EUR 60 million per year.

Introduce Electronic Medical Records

As in all health systems, there is undoubtedly a large amount of variation in the Czech health system as well. Since Czech healthcare data is not publically available, it is difficult to ascertain the extent of the challenge. However, technology can play a key role in standardizing care processes and reducing variation. Recognizing the quality and efficiency opportunity, individual providers and the system as a whole should be taking bolder steps to shift towards Electronic Medical Records (EMRs), paperless working and a standardization of care pathways.

There are known benefits from making information more transparent, including improvements in health outcomes, patient experience, increases in adherence and compliance and improvements in access. EMRs save time and costs as they reduce paperwork while making the system more transparent for all – patients, providers, and insurance companies. They also help support improvements in the quality of care as they provide a comprehensive view of patients' treatments and medications, eliminating double-procedures and adverse drug events. Moreover, as we move into a world of personalized medicine, advanced analytics can be used to predict possible illnesses based on family history or upcoming symptoms so that illnesses can be prevented or therapies started at an early stage. There is also remarkable potential to reduce waste in the system through EMRs. It has been suggested that 13 to 22 percent of tests could be avoided if information was better shared.²⁷

For instance, the Australian Government used financial incentives and later penalties to ensure the successful rollout and adoption of EMR across GP practices, and EMRs adoption is now 100% with GPs. Similarly, it is driving a high level of digitization of patient records in hospitals and, within the next 24 months, aims to have more than 90% of hospitals fully digitized.

²⁷ "Medical Errors, Lack of Coordination and Poor Physician-Patient Communication Are Pervasive in Health Systems of Five Nations (Australia, Canada, New Zealand, UK and US)", The Commonwealth Fund, 2003.

Use technology to allow real time management

Compared to leading Western European health systems, overall asset use and patient flow in hospitals is low within the Czech health system. Similar to the retail and manufacturing sectors, hospitals are starting to adopt the use of radio trackers (RFID) to tackle this issue. RFID enables tracking and monitoring of items through the application of invisible radio waves over distances. The tags are essentially smart labels and, in most cases, have a chip and an antenna as their main components. RFID can track inventories, equipment, and people in real time as the tagged item travels around the hospital. Tracking is of course only the first stage; in addition, hospitals need a robust performance management culture supported by a balanced scorecard with tiered metrics from 'Ward to Board'. A hospital in the USA applied RFID to help manage inventory and annual inventory losses were reduced by 10%. Czech hospitals should look to embed a robust performance management scorecard and put in place a strategy to move towards digital tracking.

Real time management is helping clinicians work together more effectively. A Spanish hospital that successfully implemented a central IT system (incl. EMR) reduced costs and increased the quality of care provided. The computer system allows physicians to collaborate online to simplify access to specialist opinion. The system provides continuous analysis about doctors' workload, together with recommendations for efficient work share between them. When saturation is predicted, the system automatically calls the next doctor's shift offering them extra remuneration. Moreover, patients have easy access to services including appointment booking, medical history, waiting times, physician web messaging, information and advice on vaccination and other services. The overall impact is a 30% reduction in the average length of stay, a 34% annual patient cost reduction and 50% shorter waiting times compared to other hospitals in Spain.



There are many opportunities to make healthcare more effective by digitization. We have identified 5 ways, both customer facing and internal, that can bring significant improvements. The promise of digital technology stems from the power of interconnection; better links between physicians and specialties, stronger connections between patients and clinicians, more efficient information sharing on common platforms, and more effective collaboration with technology providers to identify needs and shape solutions. Everyone plays a part in accelerating the transition to a new, digital world. To achieve the full benefits of digitization, healthcare systems cannot just adopt technology—they must use it to transform the way healthcare is delivered. Managers must clarify and articulate a powerful value story and work with all stakeholders to bring about the digital revolution. They should think not in terms of successful technology deployments, but rather of the outcome they hope to achieve, measuring success by the performance change against the business objectives.

Every stakeholder has a role to play

To achieve the full benefits of digitization of our healthcare system, 5 different interest groups have to take common action. To do that, they have to overcome existing barriers related to the diverse interest they currently have.

Technology vendors

Vendors need to do two things well. They must invest effort in making technology easy to use for clinicians and patients by creating simple, intuitive interfaces. They must also clearly articulate the value model—that is, how the technology will generate savings or new revenue, or else improve quality.

Policy makers

As technology changes delivery models, policies must follow. Therefore, policy makers must address issues around data exchange and privacy, interoperability, technology quality standards and the regulation of professional roles. It is their role to persuade all remaining stakeholders about the importance of the innovation by showing the benefits it will bring to them.

Payers

Whether payment comes from private insurers or from public funds, reimbursement mechanisms need to support technology adoption rather than discourage it. Payers also need to set service standards and explicitly encourage data sharing in their contracting arrangements.


Providers

Too often, technologies are deployed that at best replicate and often duplicate current work rather than enabling higher-quality, lower-cost care. Therefore, to achieve real and lasting impact, providers must first standardize the processes across functions before they procure new technology solutions. This task is no small feat. It requires that providers map key patient journeys and workflows and prioritise the impact of digital interventions. They need to elevate the role of IT, making sure that all members of executive teams take ownership of the digital transformation and that there are sufficient skills within the organisation to match clinical and technological requirements.

Patients

Patients will continue to demand more control over shaping their own care and then embrace the opportunities they are given. Whether this means using more remote options, such as mobile devices and video appointments, or offering more support to self-manage chronic conditions, providers can meet these needs by selecting the appropriate technology.





Making a difference for everybody: Businesses, government and individuals

As we grow older, we quickly realize that no man is an island, and that as we are influenced by the people around us, we in turn influence them. The effects of digitization also depend on different groups. Only by working together, can we realize its full potential.

Introduction

As technology races ahead, we are entering a hypercompetitive, warp-speed world. Digitization is reshaping the way companies operate, outpacing the ability of many institutions to adapt, and putting the onus on individuals to navigate their way through a more uncertain labor market.

Many traditional companies are struggling to develop new capabilities and respond to challenges from digital players that may not be burdened with heavy capital costs or legacy systems. Incumbents can take a page from their competitors' playbook by viewing their digital transformation as an opportunity to rebuild a more agile and customer-focused business model. The most formidable tech firms are continuously inventing, experimenting, and taking risks—and incumbents will have to do the same.

Policy makers are wrestling with the need to create the right enabling environment for technology to fuel growth, while at the same time easing the stresses and dislocations it may unleash. Additionally, governments could be on the cusp of transforming their own operations at all levels. The first focus should be on digitizing public services to serve citizens in more transparent, cost-effective and creative ways.

As individuals, many of us are both enamored of technology and overwhelmed by it. Most of us are still struggling to find the right balance in a world of constant connectivity and constant digital distractions. The pervasiveness of digital technology is opening up new professional, personal, and entrepreneurial opportunities that were largely unimagined just a few years ago. However, it also raises questions and challenges that will have to be resolved through trial and error in the near future.

In this section, we want to discuss what companies, policymakers and individuals can do to enable and make the most of digitization. The section aspires to act as a thought and discussion starter, rather than an exhaustive recipe.





Companies: Achieving a successful digital transformation

The ongoing digitalization of the Czech economy places companies under immense and constant pressure to evolve. Digitizing can be a daunting challenge for larger incumbents that operate in more traditional, physical sectors. Meeting it starts with the recognition that digital strategy and business strategy is now the same. Wide-ranging organizational change is never easy, and a successful digital transformation demands a high level of coordination and a completely new set of capabilities. Silos that have been in place for many years may need to be dismantled in order to capture the full benefits of streamlining processes.

On the other side of the spectrum, the shift to a digital economy is an empowering moment for entrepreneurs. The barriers to entry have never been lower, as new businesses of all stripes can piggyback onto larger platforms and immediately tap into a substantial customer base. They can instantly recruit specialized help on a project basis, access computing power via the cloud and connect with a wide range of suppliers.

As described in the first section, different firms are affected differently by digitization. Many companies have recognized the need for a digital transformation, but may face difficulties determining whether their approach to transformation is the right one. In our experience, answering the following nine questions greatly improves a company's chances of getting its digital transformation right.²⁸

1. How well do you know where the change is occurring? Is digital opening new frontiers, is it affecting your core business, or does it require foundational change?
2. Do you know which customer journeys matter? Focusing on those that do helps ground the transformation and ensure that its focus is on the customer.
3. Are your teams collaborating across functions? Is your digital transformation stuck in a silo, or does your transformation team bring in the best people from across the organization?
4. Do you have a disciplined 'test and learn' approach? Or are you stuck in long planning cycles that end up producing something your customers do not want?
5. Are your budgets tied to progress? Are you willing to pull the plug on your digital projects or quickly pump in funding when performance indicators justify it?
6. Do you have mechanisms to challenge ideas? Do you have people with the digital expertise that can prevent poor or poorly thought-through ideas from squandering resources?
7. Are your people empowered to act? Are your digital transformation project leaders "dragon slayers" that have a remit from the CEO to act fast and without advance approval?
8. Is your IT operating at two speeds? Are your customer-facing apps under agile development and prototyping, with weekly or even daily releases and an experimental mind-set?
9. Are you coordinating a portfolio of initiatives? Are your initiatives aligned with your business strategy, with clearly determined dependencies and well-coordinated resourcing and budgeting?

²⁸ For more information, see also *Nine questions to help you get your digital transformation right*, McKinsey Digital, October 2015.



Government: Bringing digitization to citizens

Governments have a dual role in the digital economy. They establish the policy framework and shape the environment for innovation. These are critical for national competitiveness in an interconnected—and increasingly digital—global economy. However, governments are also operating entities and provide services to citizens, and like any private-sector enterprise, they can use digital tools to manage complexity. Below, we explore the challenges that lie ahead on both of these fronts.

Use digital to transform the delivery of government services

The UN assesses countries on the performance of their E-Government with the E-Government Development Index.²⁹ The index is composed of a score on telecommunication infrastructure, human capital, and online services. While the Czech Republic ranks high on Human Capital and relatively well on infrastructure (25th and 42nd in the world, respectively) it has fallen behind on the Online Services Index (OSI). The UN scores countries' E-government portals based on what features they offer and how usable they are. In the latest comparison from 2016, the Czech Republic ranks 92nd in the world on Online Service, just below Belarus and El Salvador, and just above Egypt. It fell from 91st place in 2014 and 56th in 2012. While the Czech Republic has the pre-requisites to do well on E-Government, it has fallen behind in its provision of high-quality online services, while others have improved.

29 Based on UN E-Government Survey 2016

The trailblazers are building more seamless interfaces and using digital to drive innovation and to fundamentally change the way they interact with citizens. South Korea, for example, has been rolling out more mobile and multichannel services.³⁰ Governments around the world are beginning to realize tremendous cost savings; the United Kingdom, for instance, estimated that gov. uk saved GBP 42 million (CZK 1.3 billion) in public spending within a year of its launch.³¹ Streamlining cumbersome back-office functions can free up state and local employees to provide better customer service to citizens, decrease their wait times and lower costs.

However, E-government has not only been the domain of high-income economies like South Korea and the United Kingdom. Slovenia, Estonia, and Mexico all rank in the top 20 countries with the best online services, according to the OSI. Countries are also able to improve. Countries with poor online services such as Uganda, ranked 152nd in 2014, have now overtaken the Czech Republic, while those with comparable services have used the two years to improve further. Croatia, 71st in 2014, has risen to 33rd.

Estonia, a country that emerged from the fall of communism in no better shape than the Czech Republic, has used digitization to improve the business environment and simplify public services. (Exhibit 21)

30 UN E-government survey, United Nations, 2014

31 £10bn saved in 2012/13: Efficiency and reform 2012/13 summary report, UK Cabinet Office, 2013.

For example, starting a business in the Czech Republic takes on average 15 days and requires 8 individual procedures. The longest procedure – registering in the Business Registry of the Regional Commercial Court – takes 7 days and cannot be done fully online. In comparison, starting a business in Estonia takes 4.5 days on average and requires only 4 procedures. The registration is submitted online and takes minutes. Through digitization, Estonia has successfully made it easier to do business in the country, and indeed is part of the reason why Estonia is ranked 16th globally for doing business, while the Czech Republic ranks 36th.³²

Approaching the digitization of government services with a citizen-centric mindset is crucial. For example, submitting taxes online in the Czech Republic is a complex process, mimicking offline forms. As a result, only 10% of tax returns are filed electronically,³³ Estonia has had online tax filing

since 2000 and the system has gone through a number of improvements. Since 2015, the system displays all known data together with the calculated result, and citizens need only click on a button to confirm. The process takes less than a minute. The result is that in Estonia, 95% of tax returns are filled online.³⁴

Voting is another area where Estonia is a leader. Estonians have been able to vote online since 2005, and in the last election, almost one in three votes was conducted online. This not only simplifies the process, but also increases participation, particularly from those that live far from polling stations or abroad.

Communication with public authorities is a process citizens cannot avoid. Of the 14 Czech ministries, 4 stand out as having direct contact with the citizens more frequently than others: the Ministries of Labor and Social Affairs, the Interior, Finance, and the Ministry of Regional Development.

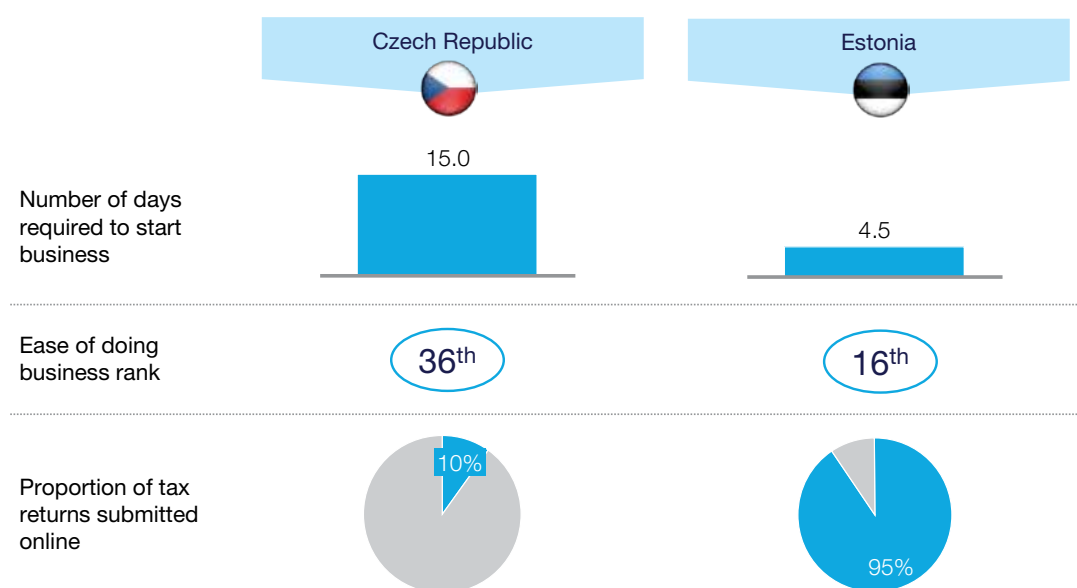
32 Ease of Doing Business Rank, World Bank Group, 2015

33 Czech Tax Authority

34 e-Estonia, 2015

Exhibit 21

Digitalization of government services in the Czech Republic and Estonia



SOURCE: World Bank, Team Analysis, 2015

In order to leverage digitization to improve the efficiency of government operations, the correct priorities need to be set. From the perspective of the citizens, focus should be on services that are needed frequently and are time-consuming. This is true of tasks that are triggered by changes in personal data (changes in citizen registry, obtaining new documents), activities that stem from one's economic activity (registering for social benefits and pensions, submitting tax returns), or activities regarding accommodation (applying for an apartment renovation, obtaining all the permits necessary for house construction). All of these happen with sufficient frequency that citizens can reasonably expect a level of service and degree of digitization that in some ways compares with that of banks or mobile network operators.

A good example to follow can again be taken from the UK, where the digital government initiative did two things. Firstly, it became possible to perform some tasks completely online (I can request a copy of a birth certificate and have it delivered; I do not have to do the task physically), and secondly, all services can be accessed through one central hub. Going in this direction, at least in the areas mentioned, would decrease costs and improve citizens' experience.

The Czech Republic is lagging behind, however, some efforts have been made. A positive development in this area is a slowly growing array of services provided by Czech POINT, a network of terminals that allows citizens to obtain a variety of certificates and records from numerous databases. If, in the future, this is combined with a reliable way of identity verification, the service could even be provided remotely.

The concept of E-government has moved beyond simply making government operations more efficient. Going digital also presents an opportunity to increase government transparency, accountability, participation and responsiveness.

One way that the government can do so is to consolidate data from disparate sources, digitize existing paper-based systems and records, and freely publish the data that it already has. The Czech Republic already has several non-governmental organizations that are active in promoting open data in the country. The Ministry of Finance has been a pioneer in opening up its data to citizens. For example, the state budget is now published in machine-readable form, allowing external developers to use the data in their own applications. A Brno-based initiative pulls data from the public transit company, the road administration, and the Czech Hydrometeorological Institute, to show real time data on public transport, traffic conditions, and the environment to help citizens decide on how to move around the city, report issues, breakdowns, and long-term problems.

Nevertheless, while the Czech Republic is making some progress on open data, a great deal of potential is still unrealized, particularly at the local level, where technical capabilities vary dramatically.

The two basic elements of e-government remain online services and open access to data. Both are in the need of improvements. The Czech government should thus continue to focus there, developing or allowing others to develop easy-to-use applications that bring real value to citizens. However, the potential for digitization is much broader than that. For example, cities can use the Internet of Things to transform how they manage complex systems such as traffic, transit, water, energy use, and emergency response.

Accelerate the digital participation of Czech individuals and businesses

The government can accelerate digitization in the Czech Republic by bridging the gap between those companies and individuals that are able to benefit from digitization and those that are left out. Individuals left out face narrowing prospects as workers, and miss significant savings and convenience as consumers, while companies forfeit opportunities to increase revenues from new products, services, and markets.

One of the key levers at the government's disposal is improving internet infrastructure. Here the Czech Republic has fallen behind. While internet penetration approaches 29% and almost reaches EU levels, connection speeds are below those in neighboring countries.³⁵ This is mostly caused by outdated infrastructure. Modern fiber lines account for only 16% of all connections.³⁶ The majority of customers still use DSL or Wi-Fi technology that cannot compete with fiber in either speed or stability.

For fixed networks, the Czech Republic still lacks a national strategy to achieve the EU2020 target of 30 Mb/s speed for all households. Different regions have varying coverage and the market is fragmented, with hundreds of local providers building their own networks. This leads to overlaps in coverage in some areas while other areas

(mostly rural) are left behind. Public authorities need to identify the existing white spots and set up a clear and transparent strategy on how to cover them. Public and private players can then take full advantage of EU infrastructure investment subsidies of up to CZK 14 billion.

For the next generation of mobile networks, policy makers should encourage the centralization of infrastructure development, enabling Czech operators to build new-generation networks jointly. This would reduce the inefficiency of having multiple independent networks operating in the country, and significantly reduce the investment needed. Similar strategies have been successful in countries as diverse as Singapore and Australia, and have resulted in quick deployments and almost 100% coverage.

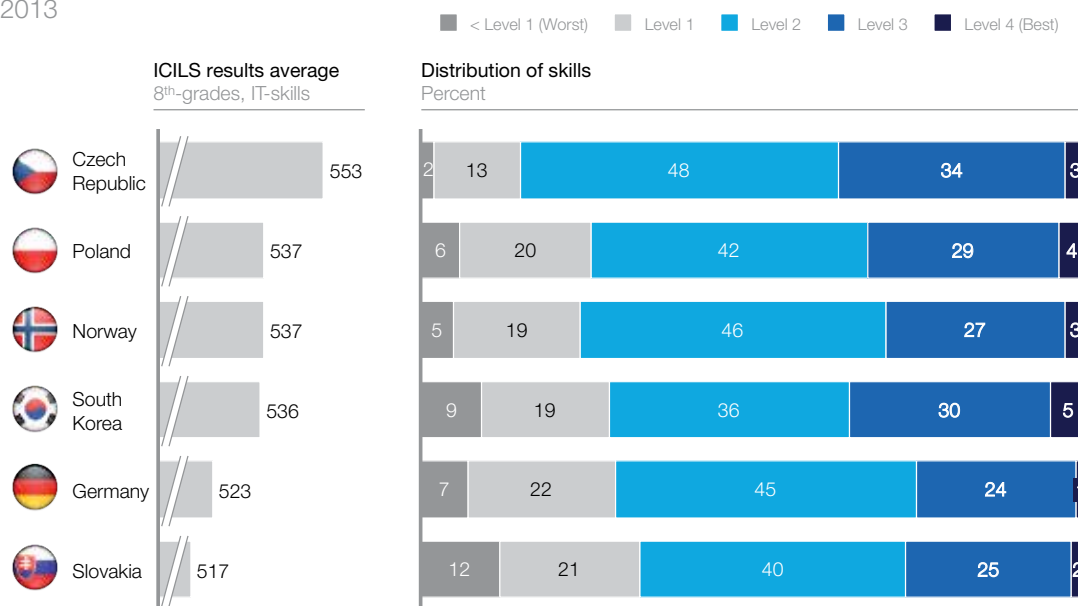
35 European Commission – Digital agenda scoreboard, Eurostat

36 OECD Broadband Statistics Update, 2015

Exhibit 22

Czech primary school students outperform their peers in IT-skills

2013



SOURCE: ICILS 2013

This period of sweeping technological change will not be painless. To be ready for digitization, the Czech education system needs to further improve in teaching the skills that will be needed in the future.

While Czech secondary school students have average results in mathematics and science and fall behind in reading compared to students in other developed nations, they outperform their peers in information & communication technology skills (Exhibit 23). 85% of Czech students score level 2 or above, which is higher than in the United Kingdom, South Korea, and Slovakia.³⁷ While Czech eighth graders have all the potential to excel in the digital labor market (Exhibit 22), the education system needs to ensure that they get the skills and knowledge they need at every step. This includes excellence in vocational training – including new apprenticeships in digital fields – as well as higher education and research.

For those that have left school, the government needs to establish adult education programs to develop basic digital skills. First, however, the government needs to create a clear reason for people to go online. This means providing E-government services that would motivate people to invest time and effort towards going online.

More broadly, however, there is an enormous opportunity to use the data now at our disposal to design a more effective and responsive system for education and training. Publishing data on where graduates of a given institution wind up in the labor market could help people decide where to go to school and help educators shape their offerings. Over the longer term, the overall mix of skills in the workforce could adapt to meet the needs of the economy more dynamically.

37 International Computer and Information Literacy Study, 2013

Exhibit 23

Czech secondary school students have average results in mathematics and science, and below average in reading

Percent of 15-year-old students performing at given level, 2012



SOURCE: PISA

Take a new approach to setting the rules of the game

Building a more comprehensive regulatory and policy framework will require attention to ongoing issues such as consumer privacy, data sharing and sector concentration. However, more broadly, it requires a new mindset.

Regulatory bodies tend to assume that the rules they set will provide long-term stability and clarity. However, the digital revolution is taking us into an uncharted territory. New digital business models can spread rapidly, sometimes within gray areas. Uber and Airbnb, for example, built substantial user bases before regulators and local governments could fully respond. Future challenges will likely follow similar patterns.

The rapid pace of innovation demands a more experimental, adaptive, and test-and-learn approach to policy and regulation. Governments should enable and potentially encourage real-world pilot programs and trials – most likely on a municipal level – that will allow them to rapidly compare and evaluate the effects of new developments.

Another major focus area is worker protection. As technology reshapes the world of work, the distinctions between employees and the self-employed are fading. Digital platforms for freelancers and on-demand service workers, for example, are raising questions about how project-based workers are treated under the law. Germany, Sweden, and Canada, for example, have created a new category of worker – a “dependent contractor” – that grants additional protections to workers that do not fit into current designations.³⁸ These new categories of workers can then have new forms of benefits and safety net protection.

Reacting to new business models and protecting workers are just two ways in which regulators can influence digitization and manage its effects. Others include facilitating the development of common standards and ensuring clarity on data privacy and security. How Czech regulators rise to this challenge will determine both the speed and the extent of digitization in the Czech Republic, as well its implications on citizens.

Another regulatory lever is creating a seamless digital market in Europe. According to an analysis by the European Parliamentary Research Service, a fully integrated digital sector could boost Europe’s annual GDP growth by 0.45 percent in a decade.³⁹ While creating a true Digital Single Market has been an EU priority since 2012, there is still a long way to go. One of the biggest advantages brought by digitization is scale, but Europe’s digital landscape remains fragmented in terms of telecom networks, regulations, standards and the logistics of e-commerce. The Czech government should work with its European partners to remove some of the barriers to creating a regional ecosystem with bigger scale.

38 Judy Fudge, Shae McCrystal, and Kamala Sankaran, eds., *Challenging the legal boundaries of work regulation*, Hart Publishing, 2012. See also Lauren Weber, “What if there were a new type of worker? Dependent contractor,” *The Wall Street Journal*, January 28, 2015

39 Joseph Dunne, *Mapping the costs of non-Europe, 2014–19*, European Parliamentary Research Service, March 2014





Individuals: Fighting for a happier life

Our ever-present smartphones are changing everything, from the way we interact with our families, to how our brains are wired. This transition poses a host of implications for individuals in their various roles as workers, consumers, citizens, and entrepreneurs. Individuals will need to prepare for a new way of working, take an advantage of completely new ways of consuming goods and content, and exploit opportunities for entrepreneurship and engaging with their friends and communities.

(1) Career

Digitization in the labor market has enabled individuals to gain more insight into opportunities, but they have to act on that information and plot a long-term career path. People are increasingly using the internet to highlight their skills and find work online: 600 thousand Czechs already have a LinkedIn profile⁴⁰. They may face more uncertainty and more frequent transitions, but that can bring greater access to new opportunities than ever before for individuals who successfully adapt. Smartphones and notebooks can untether workers from the office. However, this flexibility comes at a price; “always on” working conditions and distractions that impinge on personal relationships. Increasingly, individuals will have to decide where to draw the borders in their own lives to preserve their health and family life.



(2) Shopping and consumption

The digital economy has created an astounding array of consumer surplus, yet most users have barely scratched the surface of the time and money-saving applications out there. Most have yet to take advantage of the newly available tools in areas such as personal finance, health, and education. For example, Czech universities are starting to offer Massive Open Online Courses (MOOCs), that could transform how people access education, but uptake is still low. However, participating in much of this activity entails sharing personal data—and many people remain unaware of just how pervasive this practice is. Consumers will need to weigh these trade-offs and take basic steps to prevent identify thefts and guard their most sensitive information.



40 LinkedIn Ads manager, 2016

(3) Entrepreneurship

Digital technologies offer new scope for individuals to become their own boss. Barriers to entry are falling, allowing anyone with a connection and a great idea to become an entrepreneur, even with limited capital. For example, more FinTech startups were launched in the Czech Republic in 2015 than in the three previous years combined.⁴¹ Digital technology has put powerful tools, such as enterprise software and cheap computing power, on the cloud and within easy reach. Even for those who simply want to work as independent contractors, it is also becoming easier to strike out on your own. New digital platforms for services help freelancers connect with clients and market their services more widely.⁴²



(4) Getting information

When it comes to media content, consumers are enjoying ever more variety. Traditional news sources are being joined by new media, fresher and more diverse voices have emerged, and citizens are speaking out on a multitude of new platforms. However, to some extent, these developments have drawn audiences into echo chambers that reinforce existing views. It has also placed the onus on citizens to seek out information and apply a healthy degree of skepticism and critical thinking as they evaluate sources.



41 McKinsey Panorama FinTech database

42 For more see "A labor market that works: Connecting talent and opportunity in the digital age", McKinsey Global Institute, June 2015

(5) Social and community life

Keeping up to date with friends has become a matter of simply reading a social news feed, and keeping in touch is as easy as sending a message or opening Skype. However, while we are able to stay connected with distant friends, we may be neglecting relationships closer to home. Indeed, according to a recent study, 20% of Czech internet users browse Facebook for over 4 hours per day.⁴³ While social media can be a window into the friends' lives, it can also create pressure to make our lives seem more glamorous than they are.

Digitization's final effects – positive and negative – are a product of individual choices. Technology requires people to continuously balance its positive and negative aspects in their day-to-day lives. However, if we make the right choices, it can enrich our lives and change them for the better.



43 AMI Digital Index, STEM/MARK





Summarizing what we learned: Conclusion

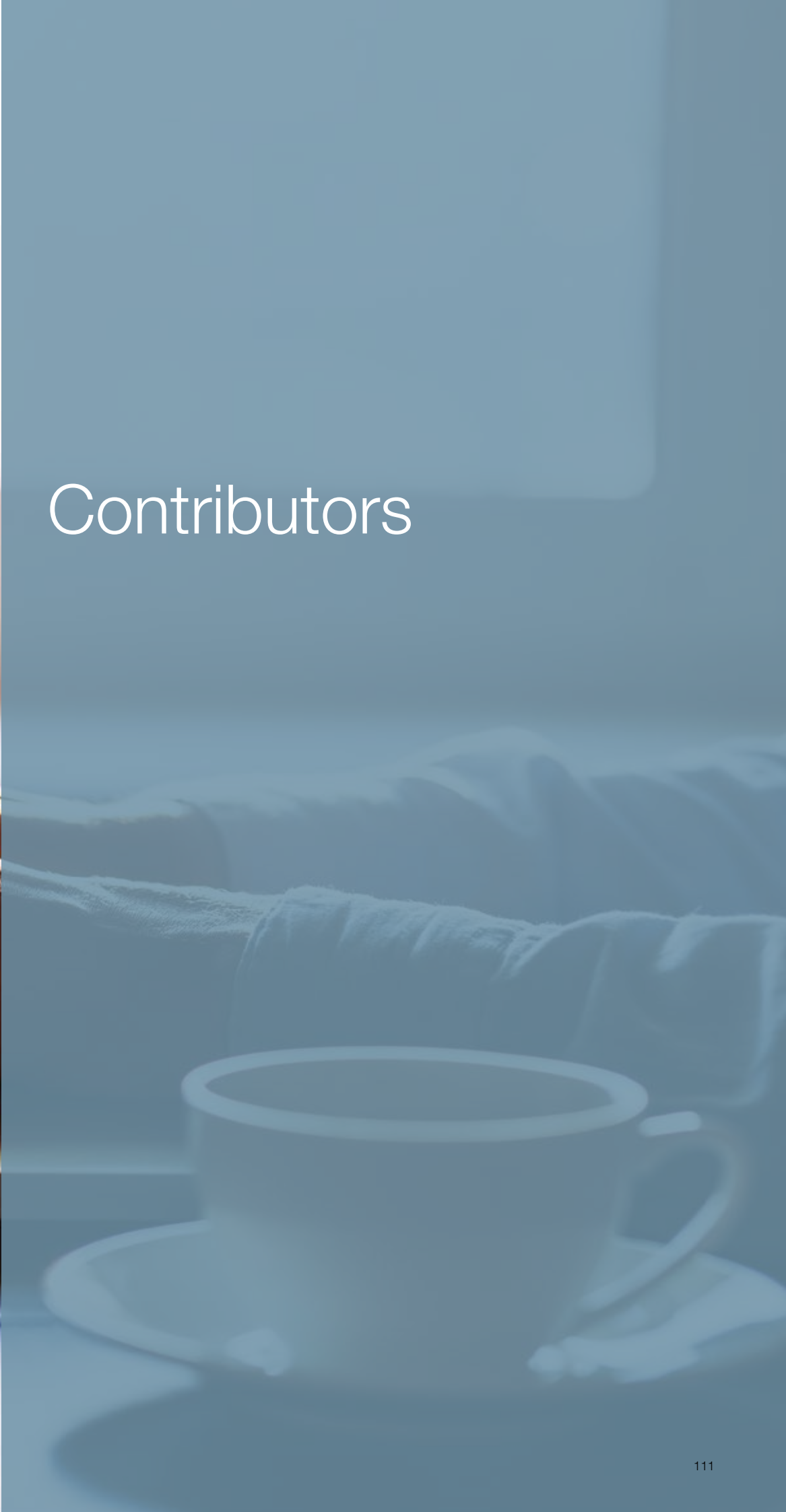
Digital technologies are changing every facet of life in the Czech Republic, and their unstoppable spread is accelerating. We are experiencing their effects in our day-to-day lives. Some sectors are digitizing at a rapid pace, while others lag far behind. Inexorably, it is integrating the Czech economy closer into the global economy, bringing with it considerable opportunities, but also new threats. Digitization offers a way to accelerate Czech productivity growth and catch up with the West. However, to reap the benefits digitization requires an effort from all stakeholders – companies, policy makers and individuals. Each will need to find new ways of doing things, to acquire new skills and capabilities, and to embrace the coming change.







Contributors





Wojtek Bogdan

Senior Expert, Warsaw

Leader of CEE Consumer Goods
and Retail Practice



Michal Čermák

Expert Partner, Prague

Leader of EMEA TMT
Customer Operations Practice



Viktor Hanzlík

Partner, Prague

EPNG Cleantech Service Line Practice



Ivan Jelic

Expert, Dubai

Expert on Construction
and Capital Productivity



András Kadocsa

Associate Partner, Budapest

Expert on Industry 4.0;
Leader of CEE Automotive Practice



Tomáš Karakolev

Senior Expert, Prague

Leader of CEE Strategy and Corporate Finance;
Banking and Insurance Practice



Peter Kováčik

Associate Partner, Prague

TMT Transformation and Technology Practice;
Consumer Goods and Retail Practice



John Leach

Associate Partner, Prague

Leader of EMEA Public, Social
and Healthcare Practice



Michal Skalský

Partner, Prague

Leader of McKinsey Digital in CEE;
Banking and Insurance Practice



Daniel Svoboda

Managing Partner, Prague

Leader of CEE TMT Practice



Michal Valachovič

Associate Partner, Prague

Banking and Insurance Practice;
Customer Operations Practice



Jiří Franta

Senior Expert, Prague

Manufacturing and EPNG Practice





Appendix: Methodology of the macroeconomic section

Digital intensity

The Eurostat Digital Intensity score is based on a count of 12 technologies that are used by each enterprise in an industry or a country. The 12 technologies are the following:

1. usage of internet by a majority of the workers
2. access to ICT specialist skills
3. fixed broadband speed > 30 Mbps
4. mobile devices used by more than 20% of employed persons
5. has a website
6. has some sophisticated functions on the website
7. presence on social media
8. use an ERP software
9. use a CRM software
10. share electronically supply chain management information
11. does e-sales for at least 1% turnover
12. exploit the B2C opportunities of web sales

Using seven or more of these technologies results in a high digital intensity score, while using three or fewer results in a low score.

For the purposes of describing industry digital intensity in this work, we defined “high digital intensity” as an average of businesses using 7 or more of these technologies (weighted by a coefficient of 1) and businesses using 4-6 technologies (weighted with a coefficient of 0.5)

Metrics included in the MGI Industry Digitisation Index

		Metric	Description
Assets	Digital 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 licences)
Usage	Transactions	Enterprises selling online	Annual sales realised via any computer networks; computer networks include websites, EDI-type systems, and other means of electronic data transfer (excluding e-mails)
		Enterprises purchasing online	Percentage of companies doing at least 1% of their purchases via any computer networks; computer networks include websites, EDI-type systems, and other means of electronic data transfer (excluding e-mails)
	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 two 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	
		Companies where at least half of business is digital in nature	
	Processes	Enterprise Resource Planning use	Enterprises that have an ERP-enterprise resource planning software package, which they use to share information between different functional areas (e.g., accounting, planning, production, marketing)
		Customer Relationship Management use	Enterprises that use a CRM, i.e., any software application used for the analysis of information about clients for marketing purposes
Labour	Digital spending	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
	Digitisation of work	Share of jobs that are digital	Digital jobs (e.g., computer and information systems managers, web designers, social media community managers, database administrators, big data scientists) as a share of total jobs

Source: McKinsey Global Institute analysis

