University of Economics, Prague

Faculty of Business Administration

Specialization: International Business Strategies

The Digital Economy, Industry 4.0 and digital payment systems: impacts on international organizations

Author: Bc. Radek Mojžíš

Thesis supervisor: Ing. Ilya Bolotov, MBA, Ph.D.

D e c l a r a t i o n o f A u t h e n t i c i t y

I hereby declare that the Master´s Thesis presented herein is my own work, or fully and specifically acknowledged wherever adapted from other sources. This work has not been published or submitted elsewhere for the requirement of a degree program.

Prague Bc. Radek Mojžíš

A c k n o w l e d g e m e n t s

Hereby, I would like to express gratitude to Ing. Ilya Bolotov, MBA, Ph.D. for supervision of the thesis, his inspirational role for me and for his valuable and insightful comments during our consulting sessions.

Title of the Master´s Thesis:

The Digital Economy, Industry 4.0 and digital payment systems: impacts on international organizations

Abstract:

This paper examines the emerging Digital Economy with relation to Industry 4.0 and digital payment technologies. An objective of the study is to present main trends in these segments and their impacts on international organizations. The first part focuses on general introduction to the Digital Economy and Industry 4.0. This includes description of fundamental terms, trends and connections to chosen European countries. The second part inspects current trends in digital payment systems, digital currencies and blockchain technology. The third part analyses and deduces impacts of new technologies on economy and international organizations regarding their management, strategies and social responsibilities. Conclusion summarizes main trends of digitization and their impacts on economy and international organizations.

Key words:

Digital economy, digital currencies, Industry 4.0, international organization

Table of Contents

Introduction

What can we imagine under the term digital economy? The digital economy is in root based on computer technologies and is often also called the internet economy, the new economy and the web economy. Beginnings of the digital economy emerged in the United States of America after an invention of the internet, specifically the internet protocol suite TCP, IP. The first public internet networks started in 1989 and 1990 in some American cities. Since this time the internet has had immense effect on every aspect of our lives. It changed everything, how we perceive the world, how we communicate, how we shop and created infinity possibilities for new businesses and global economy. Nicholas Negroponte (Negroponte, 1995) used metaphor of shifting from processing atoms to processing bits. The digital economy provides a global platform which people and organizations utilize for conducting businesses, interactions, communication, collaboration and search for information.

A technology is one of the most significant factor of how our civilization progress. There are technologies that bent the curve of our history. Inventions such as steam engine, agriculture, money were always followed by increased global population and production. What steam engine did for physical work, computers did to mental work. We are now still at the beginning of the digital era and many inventions are still in front of us. As Eric Schmidt commented on development of the digital industry in the book The Digital Economy: "*Who could have seen the way open platforms like the Web would transform nearly every part of our society and economy? That the power of networking would redefine collaboration and leadership, expanding both humanity's productivity and its potential? That technology would suddenly begin to uproot major industries and challenge the power of incumbents? Who could have possibly known all that? It is transforming science and education. Slowly but surely spreading knowledge and strengthening education worldwide. And it's even changing the way governments those hidebound bureaucracies interact and deliver services to their citizens.*" (Tapscott, 2015, p. 12) This era will bring many positive things, more freedom and bounty on the other hand also some complex problems, challenges and choices we will have to address. Among the most significant problems belong structural unemployment and inequality in wealth distribution.

Main research questions for the thesis are:

1) How the emerging Digital Economy, Industry 4.0 and digital payment technologies impact economy and international organizations?
2) What are the most significant trends in these areas that affect economy and international organizations?
3) How should international organizations address these trends?
4) What are potential positive and negative impacts of the discovered trends?

For realization of the goals of the diploma thesis I used descriptive research, literary research, secondary data analysis, induction and comparison. Among researched sources belong notable works such as Principles of Macroeconomics by Gregory Mankiw, The Age of Discontinuity by Peter Drucker, also publications from significant universities such as the University of Oxford, the University of Cambridge, the University of Chicago, these sources were mainly used for theoretical basis of the work. Sources from institutions: The Bank of England, the European Central Bank, the World Economic Forum, Statista.com were used for secondary research of statistics. In the following paragraphs I describe goals of each chapter in the work.

In the first chapter of work I focus on description of the digital economy and main trends within the industry. Goal of this analysis is to uncover major trends in the digital economy and represent them in comprehensive form, so that this material could be used for individuals which are planning to operate in the digital economy. These data can also be used for academic research of the internet. My main questions in first part are: How can we define the digital economy? What are the components of the digital economy? What type of services occupy biggest revenues? What are the biggest players in this field? In this part, I focus on the Czech Republic and Germany performance in these sectors and Germany approach to Industry 4.0 as leading economy of the European Union.

In the second chapter of work I focus on digital payment systems and digital currencies as this is very present topic in the digital economy. I start with so far used traditional payment systems and continue with emerging trends of cashless society, cryptocurrencies and blockchain. I analyze usability, impacts and potential of digital currencies and blockchain. I focus on wideness of usage of cryptocurrencies, economic impacts and ability to serve as money.

In the last (third) chapter I focus on the main goal of the thesis and that is what are the impacts of these analyzed trends on international organizations in general. Here firstly analyze what are general impacts of these new trends and what are the approaches to measure these impacts on economy.

I continue with impacts on strategies and management of both nongovernmental and intergovernmental international organizations with connection to these new trends analyzed in chapters one and two.

In the last section of this chapter I investigate possible social benefits and problems connected with technological progress and automation of work and suggestions of how international organization should adjust their approach to fully employ these technologies and mitigate risks of negative social impacts such as unemployment.

1 Introduction to the digital economy and industry 4.0

The digital economy is founded on previous technological innovations such as personal computers, telecommunications, the Internet, software, protocols and many more technologies. The integration of activities at various levels generate the value that make business models operating profitable. (European Commission, 2014, pp. 1-2) Another title for the digital economy are the internet economy, the new economy and the web economy. According to Thomas Mesenbourg (Mesenbourg, 2001) there are three main components of the digital economy:

- e-business infrastructure (information infrastructure, hardware, software, telecoms, networks, human capital, etc.),
- e-business,
- e-commerce.

The European Commission (European Commission, 2014, p. 2) considers defining what constitutes the digital economy, problematic as it is difficult to separate elements of this economy, because of the ever-changing technologies and widespread diffusion of the digital economy within the whole economy. According European Commission it can no longer be described as a separate part, or subset, but it is possible to characterize it through a set of key features:

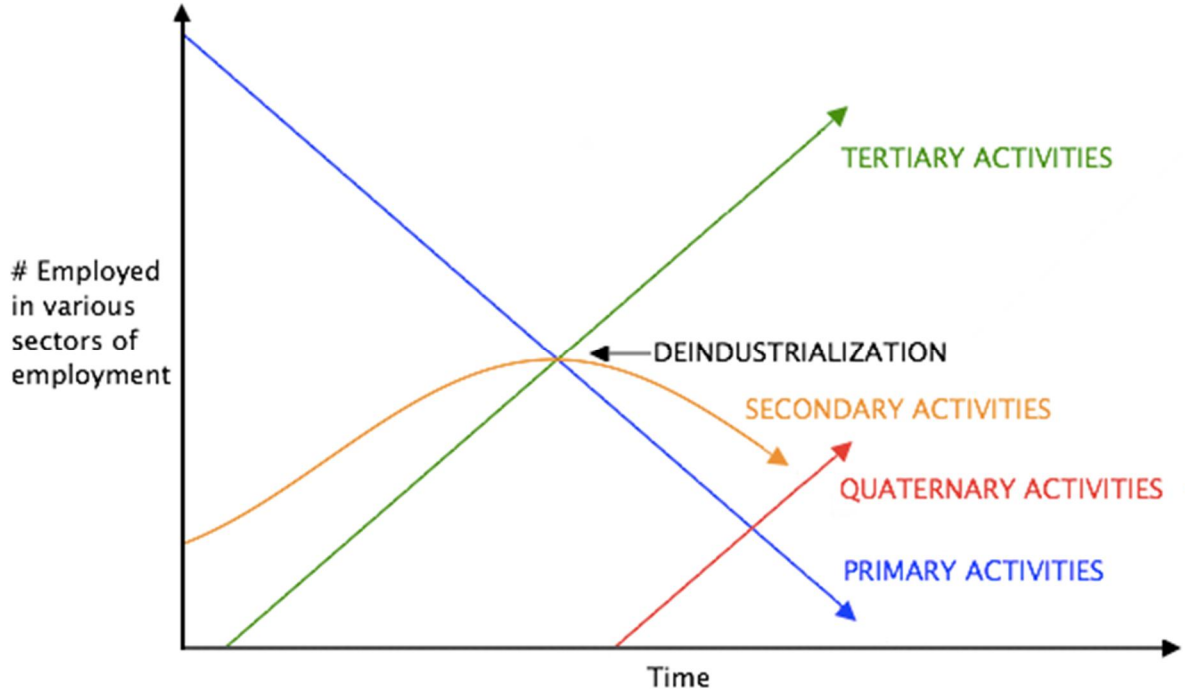
- enhancement of mobility (easily transferrable data, possibility to perform commercial activities across borders etc.),
- data as a source of value (big data in marketing, data in public, government activities etc.)
- network effects (social media, working groups etc.).

Organizations and people in digital economy interact, communicate, search for information and create strategies through digital infrastructures. Digital economy has impacted all the sectors of the economy and social activities for example: education, media, healthcare, manufacturing, retail, communication etc. Internet is empowering people in a new way to create and share ideas. (European Commission, 2014, pp. 1-4)

OECD consider the Internet as an important tool for communication but also emphasizes that the Internet has transformed into a ubiquitous technology supporting all sectors across the economy. The Internet is now widely considered a fundamental infrastructure in OECD countries, in much the same way as electricity, water and transportation networks. (OECD Digital Economy Papers, 2013, p. 6)

We can categorize the digital economy as part of the quaternary sector of economy. (Selstad, 1990) According Colin Clark´s sector model in the later stages as one sector produces a surplus revenue and this revenue is then invested in new industries and technologies is increasing the range of industries in an area. Weakness of the model is that it is desriptive and offers only rough analysis. It does not say how or why the country developed. According to this model the quaternary sector grows as depicted in the graph below (Figure 1):

Figure 1: Colin Clark´s sector model



Source: (Nagle & Spencer, 1998, p. 13)

1.1 E-business and E-commerce

The term e-business stand for any type of business processes that are conducted with use of electronic networks, the term was invented by IBM team engaging in marketing and internet matters. On the other hand, e-commerce stands for buying and selling of services, goods or transmitting data or funds, crucial for this term is exchange of value that is moment when e-business becomes e-commerce. E-commerce generates revenue using internet to sell. So, e-business comprise e-commerce, but in addition also other services not limited to commercial transactions. (Amor, 1999)

Some examples of e-business activities are:

- an email marketing,
- an online inventory management system,
- an online content management system,
- business intelligence – collecting, storing, accessing and analyzing information about market to help conduct decisions using internet,
- CRM (customer relationship management).

E-commerce examples by nature of transactions and size:

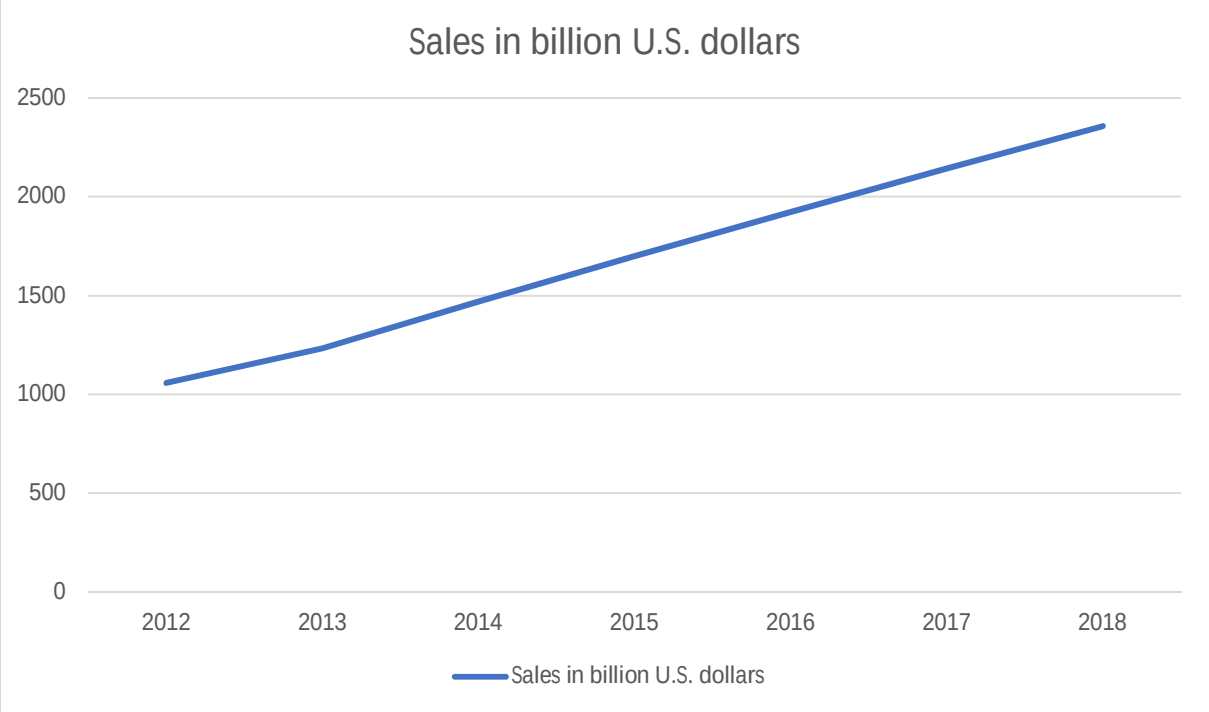
- B2B – business to business (companies such as Cisco, Staples, Spiceworks etc.),
- B2C – business to consumer (Amazon, Alza, Mall etc.),
- C2C – consumer to consumer (eBay, Craiglist, Aukro),
- B2G – business to government (usually internet is used for licensing procedures, procurement, taxation, business registrations etc.)
- C2B – consumer to business (Elance, The Best Deals on Hotels, Flights and Rental Cars)
- M-commerce – mobile commerce (Google play, iTunes) and
  P2P – peer to peer (sharing files between users directly without mediator server, this includes services as Napster, Tamagon)

E-commerce works through three types of distribution channels:

- pure-click businesses, also pure-play internet businesses (only online business),
- bricks-and-clicks businesses (already existing companies that employed utilized online space later in development) and
- click-to-brick businesses (first online business building physical locations)

Following graph (Figure 2) shows worldwide B2C e-commerce sales in period of 2012 till 2018. *„In fourth quarter of 2016 the average value of global online shopping orders via desktop PC amounted to over 143 U.S. dollars. E-commerce orders via mobile devices averaged around 114.52 U.S. dollars and tablet shoppers usually spent close to 110 U.S. per online shopping order.*“ (Statista Ltd., 2018)

Figure 2: Worldwide B2C e-commerce sales 2012 - 2018

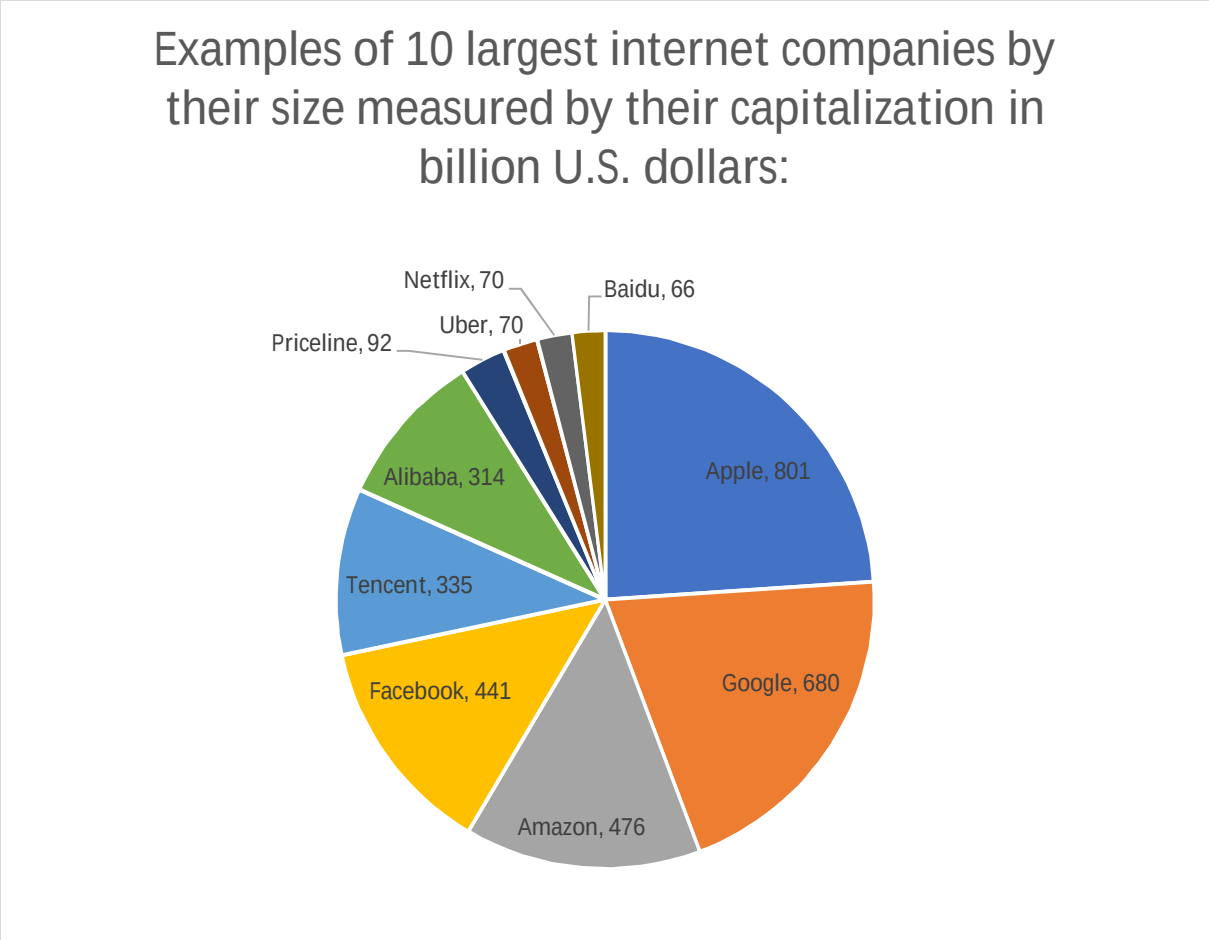


Source: (Statista Ltd., 2018)

Pie chart (Figure 3) on the next page shows top 10 largest internet companies in the world by their size measured by their capizalization in USD dollars as of May 2017. The largest company by market capitalization was Apple 401 billion U.S. dollars, followed by Google (Alphabet) 680 billion USD, Amazon 476 USD, Facebook 441 USD. However concept of pure-play internet company and click & mortar business models is important to consider as most of included companies accompany combination of different business models, not necesserily only pure-play internet business models. This figure is usefull to analyze currently biggest players

within field of digital economy. All companies except Alibaba and Tencent (Chinese companies) in chart have been founded in US, also US and China are considered currently as global leaders in the fields connected to digital economy.

Figure 3: Top 10 largest internet companies, May 2017



Source: (Statista Ltd., 2017)

1.2 Relation of the digital economy and knowledge economy

The knowledge economy use knowledge for creation of tangible and intangible assets, whereas technology and knowledge technology play significant role in incorporation of human knowledge into machines.

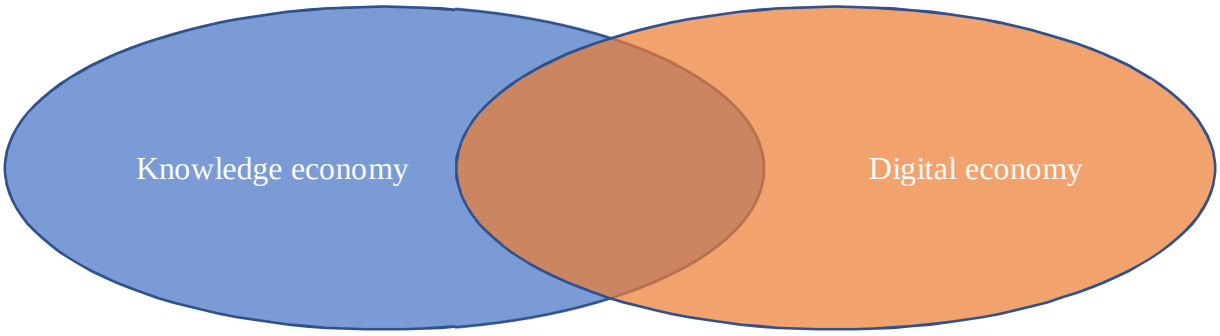
The term became more known after Peter Drucker published his book The Age of Discontinuity. Here Drucker refers to knowledge economy and knowledge industries, which he characterized as which produce and distribute ideas and information rather than goods and services and stress out the importance of industry as it accounted for one-quarter of U.S. Gross National Product in year 1955. (Drucker, 1992)

The first concept of the knowledge economy is that knowledge and education can be treated as a business product, and by second concept as productive asset.

Knowledge contribute to growing pace of technical and scientific progress, in the knowledge economy there is a bigger focus on intellectual capabilities rather than on physical factors of production. (Walter W. Powell, 2004)

The Digital economy overlap knowledge economy. As cited: *"Knowledge economy is based on information or knowledge quality & availability to power the economy whereas digital economy is an economy dependent on Information Technologies (IT), Internet, eCommerce etc. IT etc. (tools) are commonly used to process, store, deliver & automate information or knowledge (contents) to shape our economy to become more dynamic, vibrant & competitive."* (Han, 2016). Digital economy is based on computers, while knowledge economy is based on knowledge, from this perspective they incorporate each other. Knowledge economy is not necessary based on digital economy. Picture below (Figure 4) illustrates penetration of both economies reflected by two ellipses and their intersection of common features.

Figure 4: Penetration of Knowledge economy and Digital economy



Source: Author

1.3 Industry 4.0

Production of goods underwent lot of changes during human history, industrialization period starting 1760 to 1840 brought mechanization and steam power, this depicts a significant shift from an agrarian economy. In the beginning of the 20th century came mass production famously represented by Ford Motor Company with Ford Model T. Modern manufacturing utilizes computers for automatization and optimization of production starting in the late 1960s. "*Next development is heading towards technological evolution from embedded systems to cyber-physical systems*" (MacDougall, 2014), this trend is known under term Industry 4.0, also the fourth industrial revolution (Schwab, 2017).

MacDougal position the Industry 4.0 as representing field of this coming fourth industrial revolution represented by concepts as Internet of Things, data services, decentralized intelligence etc. "*For example, decentralized intelligence helps create intelligent object networking and independent process management, with the interaction of the real and virtual worlds representing a crucial new aspect of the manufacturing and production process. It represents a paradigm shift from centralized to decentralized production. This in simplicity means that industrial production machinery no longer just "processes" the product, but that the product communicates with the machinery to provide instructions of exactly what to do."* (MacDougall, 2014, p. 6) In report from Germany Trade and Investment (GTAI), "*Industry 4.0 refers to the technological evolution from embedded systems to cyber-physical systems*." (Bunse, Kagermann, & Wahlster, 2014, p. 6)

Embedded system is the intelligent microprocessor-based central control system that is built to control a function or range of functions within larger mechanical or electrical system. We can find these systems in all types of products of today, for example: wash machines, cars, termostats, medical equipments, but also in manufacturing tools and robots. (Heath, 2003)

"*In a different way cyber-physical production system made up of smart machines, logistics systems and production facilities allow peerless ICT-based integration for vertically integrated and networked manufacturing.*" (Bunse, Kagermann, & Wahlster, 2014, p. 6)

The National Science Foundation provides another expert definition of CPSs: "*Cyber-physical systems are defined as the systems which offer integrations of computation, networking, and*

physical processes, or in other words, as the systems where physical and software components are deeply intertwined, each operating on different spatial and temporal scales, exhibiting multiple and distinct behavioral modalities, and interacting with each other in a myriad of ways that change with context. These are controlled by computer-based algorithms, tightly integrated with the internet and its users." (Plimpton, 2010, p. 7).

Some of the defining characteristics of CPS include:

a) cybercapability in every physical component,
b) high-degree of automation,
c) networking at multiple scales,
d) integration at multiple temporal and spatial scales and
e) reorganizing/reconfiguring dynamics (Miclea & Sanislav, 2011, pp. 17-21).

Practical examples of CPS include smart grid, autonomous automobile systems, medical monitoring, process control systems, robotics systems, and automatic pilot avionics (Khaitan & James, 2014).

Bunse, Kagermann and Wahlster in Germany trade and invest report of Industry 4.0 (Bunse, Kagermann, & Wahlster, 2014, pp. 6-9) describes cyber-physical as systems that: *"are enabling technologies which bring the virtual and physical worlds together creating a truly networked world in which intelligent objects communicate and interact with each other. Together with the internet and the data and services available online, embedded systems join to form cyber-physical systems. Cyber-physical systems provide the basis for the creation of an Internet of Things, which combines with Internet of Services. They are "enabling technologies" which make multiple innovative applications and processes a reality as the boundaries between the real and virtual worlds disappear.*

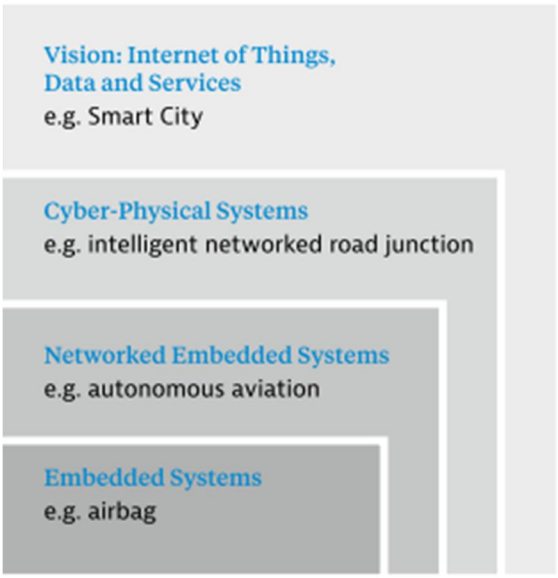
Cyber-physical systems also represent a paradigm break from existing business and market models, as revolutionary new applications, service providers and value chains become possible."

They also express high confidence in the future usage of cyber-physical systems and new value chain models that will due emerge and they comment it: *"Industry sectors including the automotive industry, the energy economy and, not least, production technology will in turn be*

transformed by these new value chain models. In the future, cyber-physical systems will make contributions to human security, efficiency, comfort and health in ways not previously imaginable." (Bunse, Kagermann, & Wahlster, 2014, p. 8)

Picture below (Figure 5) depicts how embedded systems evolve from simple to more complex solutions.

Figure 5: The Evolution of Embedded Systems into Internet of Things, Data and Services



Source: (Bunse, Kagermann, & Wahlster, 2014, p. 8)

1.4 Internet of Things

Internet of things in report Industrie 4.0 (Bunse, Kagermann, & Wahlster, 2014, p. 13) is described as:*"a bridge between the real and virtual worlds that is being created with the digital refining of everything from production facilities and industrial products to everyday products with integrated storage and communication capabilities, radio sensors and intelligent software systems.*"

Evolution of IoT

IoT isn't new. It has been around for years, in various forms. For example, banks run large, distributed automated teller machine (ATM) networks, retailers operate large point-of-sale (POS) networks, as well as extensive deployments of radio-frequency identification (RFID) tags to track the movement of millions of inventory items. Manufacturers connect thousands of devices to monitor and manage production in machine-to-machine (M2M) networks and many more examples could be found.

Utility companies deploy connected sensors and meters to enable everything from customer billing to maintenance troubleshooting. Each network could amount to tens of thousands of connected devices. If a car lacks even a Bluetooth interface, its trade-in value will be considerably lower. Car-buying criteria have changed completely for most buyers. The electronics and device connectivity make a car appealing today. Similar changes are sweeping other industries. (Kranz, 2017, pp. 21-22)

Benefits of IoT implementations and mass customization

Maciej Kranz (Kranz, 2017, pp. 13-14) in his book Building the Internet of Things see benefits in improvement of efficiency and productivity around existing processes within business-to-business commerce relations as the market with most implementation of IoT systems. The real payoff from IoT comes down to automating existing processes that have a large labor or time component and streamlining the related process in one way or another.

Kranz also comments on mass customization (Kranz, 2017, p. 21) he describes mass customization as the ability to customize mass-produced products to each individual buyer's

specifications. A lot of visionaries talked about it a decades ago already and a few companies tried it, but it proved very difficult to implement efficiently. The process had too much latency (delay), which added cost and slowed the results. However, IoT makes strategies like mass customization far more practical and cost efficient. Latency isn't a problem as information can be shared in real time between every element in the supply chain. Buyers can click on the components they want. Suppliers and logistics providers can see what components are being ordered, and with rapid systems retooling adjust their schedules appropriately —on the fly, if necessary. With IoT, mass customization is starting to happen.

Economic merits

The research conducted by James Manyika and Michael Chui of the McKinsey Global Institute in July 2015 pegged the real dollar value of the global IoT market at potentially $11.1 trillion by 2025. (Manyika & Chui, 2015) In the report Worldwide Internet of Things Forecast Update 2016 – 2020 (MacGillivray, et al., 2016) authors predicted that the worldwide Internet of Things (IoT) market spending will grow from $692.6 billion in 2015 to $1.46 trillion in 2020 with a compound annual growth rate (CAGR) of 16.1 percent.

Following table (Table 1) summarizes sources of value by different areas of use.

Table 1: Sources of value by settings

Settings	Description	Examples
Human	Devices attached to or inside the human body	Devices (wearables and ingestibles) to monitor and maintain human health and wellness; disease management, increased fitness, higher productivity
Home	Buildings where people live	Home controllers and security systems
Retail environments	Spaces where consumers engage in commerce	Stores, banks, restaurants, arenas, anywhere consumers consider and buy; self-checkout, in-store offers, inventory optimization
Offices	Spaces where knowledge workers work	Energy management and security in office buildings; improved productivity, including for mobile employees
Factories	Standardized production environments	Places with repetitive work routines, including hospitals and farms; operating efficiencies, optimizing equipment use and inventory
Worksites	Custom production environments	Mining, oil and gas, construction; operating efficiencies, predictive maintenance, health and safety
Vehicles	Systems inside moving vehicles	Vehicles including cars, trucks, ships, aircraft, and trains; condition-based maintenance, usage-based design, pre-sales analytics
Cities	Urban environments	Public spaces and infrastructure in urban settings; adaptive traffic control, smart meters, environmental monitoring, resource management
Outside	Between urban environments (and outside other settings)	Outside uses include railroad tracks, autonomous vehicles (outside urban locations), and flight navigation; real-time routing, connected navigation, shipment tracking

Source: (McKinsey Global Institute, 2015)

Key obstacles of IoT technologies

- **Technical (privacy, standards/interoperability).** To deliver on its promise, IoT needs to assure privacy, the variety of connected devices needs to operate and interoperate seamlessly, and data needs to be exchanged in a fluid and understandable way. All of this requires truly open standards, industry-wide interoperability, and universal adoption of industry-accepted protocols.

- **Security.** To paraphrase real estate industry wisdom about the importance of location, IoT requires ironclad security and security that management and users can count on. Equally important, self-reliant systems and devices that can continue to safely function even if under attack must be deployed. Smart analytics being built into IoT, especially with fog computing designed to deliver real-time processing, will go far in addressing a number of security gaps.

- **Organizational (cultural change) -** This may be the biggest obstacle. Change is hard, especially for established organizations that, for decades, have been so successful with their existing business models, practices, and processes. It isn't easy for IT and OT to come together and cooperate, and it isn't easy for vendors to embrace common open standards but it has been done; the benefits are undeniable. Change is mostly a question of communication, leadership, retraining, and keeping an open mind.

- **Government -** IoT benefits government in the form of smarter cities, like Barcelona, Spain, arguably one of the most advanced smart cities on the planet today. But in addition to adoption, government also has a role to play in regulating and agenda setting, ensuring that IoT develops and grows by applying regulations in some areas but also easing regulatory impediments in others to encourage new business models based on IoT. (Kranz, 2017, pp. 29-30)

Three Driving Trends

Kranz also identifies three driving trends of IOT (Kranz, 2017) in business:

- The lines of business, as represented by the line of business (LOB) manager, are emerging as a major buying center for technology. LOB managers are concerned with business outcomes and look for business solutions, especially those that reduce cost, increase productivity, and most importantly increase profitability. They look for the ways to improve overall equipment effectiveness, production delivery times and throughput, asset uptime and increasingly target specific sustainability metrics. LOB managers can create and spend budgets, but they're looking to increase both top-line and bottom-line results. For example, some manufacturing operations are reporting a 160 percent return on investment (ROI), a 20 percent reduction in cost, and a 75 percent reduction in network downtime from IoT. To LOB managers, such outcomes demonstrate a value proposition.
- The convergence of information technology and operational technology improving communication and efficiency.
- The proprietary/specialized technologies moving to open standards.

In the next chapter I focus on analyzing countries within European Economic Area and their suitability for previously mentioned trends and technologies.

1.5 Analysis of competitiveness of the Czech Republic and Germany in the relation to the fourth industrial revolution

Because generally this diploma thesis is focused on the European Economic Area I will focus on countries and companies within this area, mainly on Germany and the Czech Republic. On Germany because it has highest GDP in the European Union and therefore has high impact. On the Czech Republic, because I grew up and study there.

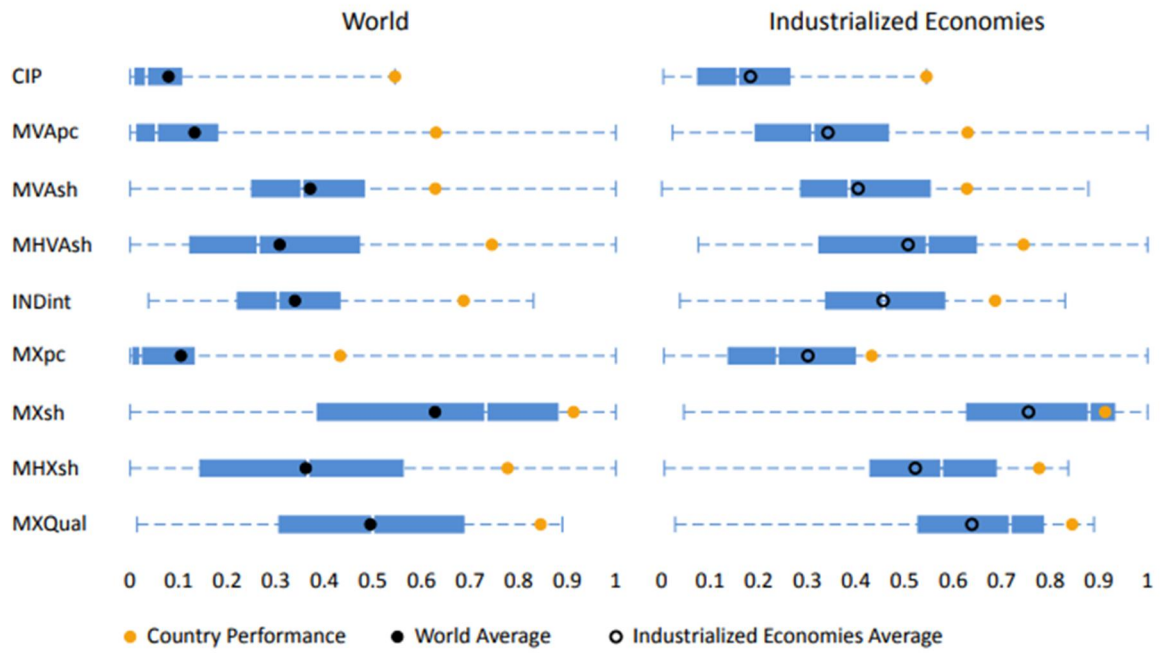
"*The fourth industrial revolution is unique to Germany as nowhere else in the world to the required conditions necessary for the fourth industrial revolution exist. This has its basis in two things:*

- *Germany´s continued role as one of the world´s most competitive and innovative manufacturing industry sectors and*
- *the country´s technological leadership in industrial production research and development, most especially in embedded systems technology that give birth to enabling cyber-physical systems (CPS).*" (Bunse, Kagermann, & Wahlster, 2014)

Germany ranks as number 1 in Competitive Industrial Performance Index[1] with total MVA of 749.4 billion USD and manufacturing exports of 1 331 billion USD. (UNIDO, 2016) Comparative competitiveness profile is visualized in the following picture on the next page (Figure 6):

[1] „*CIP index is a composite measure of the competitive industrial performance of countries based on eight indicators reflecting their capacity to produce and export, technological deepening and upgrading and impact on global industrial production. CIP index is based on the normalization procedure of individual indices and their aggregation based on given weight to the component of the composite measure.*"

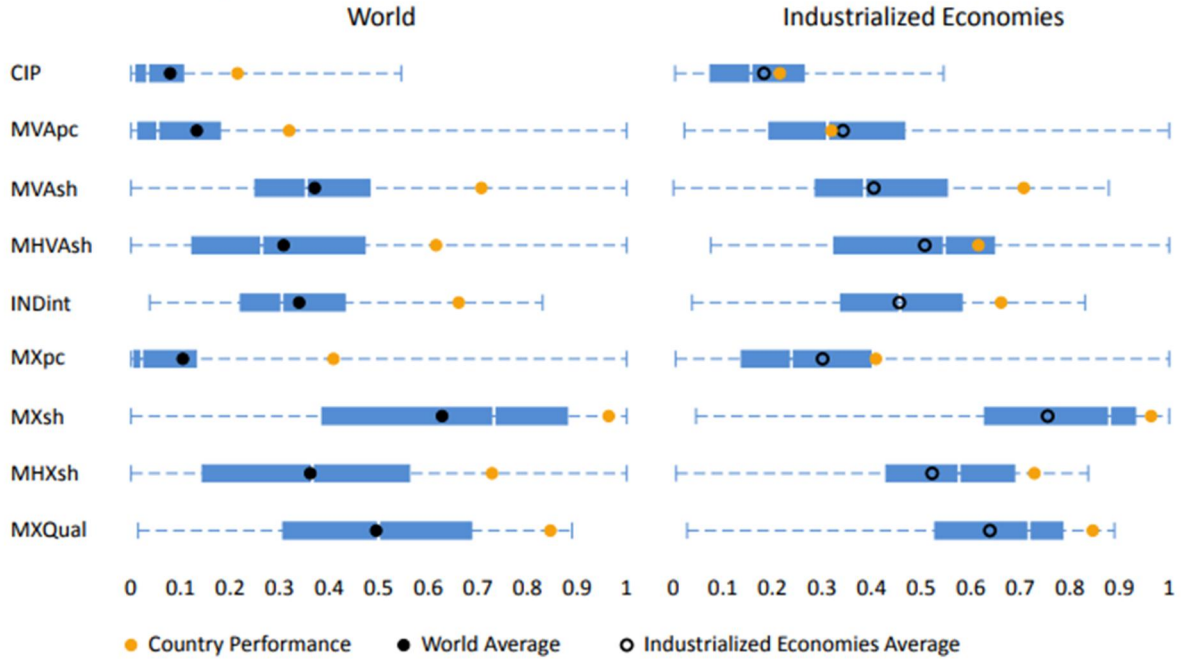
Figure 6: Rank of Germany in Competitive Industrial Performance Index



Source: (UNIDO, 2016, p. 2)

The Czech Republic overall Competitive Industrial Performance Index rank is 18 out of 148 countries that were captured by UNIDO research with MVA of 49.4 billion USD and manufacturing exports of 163.4 billion USD, detailed graphical comparison with world is reflected on the next page (Figure 7). The Czech Republic is significantly smaller economy and therefore in total values is outperformed by Germany. Germany also is more competitive in relative values as seen in illustration.

Figure 7: Rank of the Czech Republic in Competitive Industrial Performance Index



Source: (UNIDO, 2014, p. 2)

Table below (Table 2) numerically compare both countries regarding their score.

Table 2: Comparison of Germany and the Czech Republic rank, Competitive Industrial Performance Index

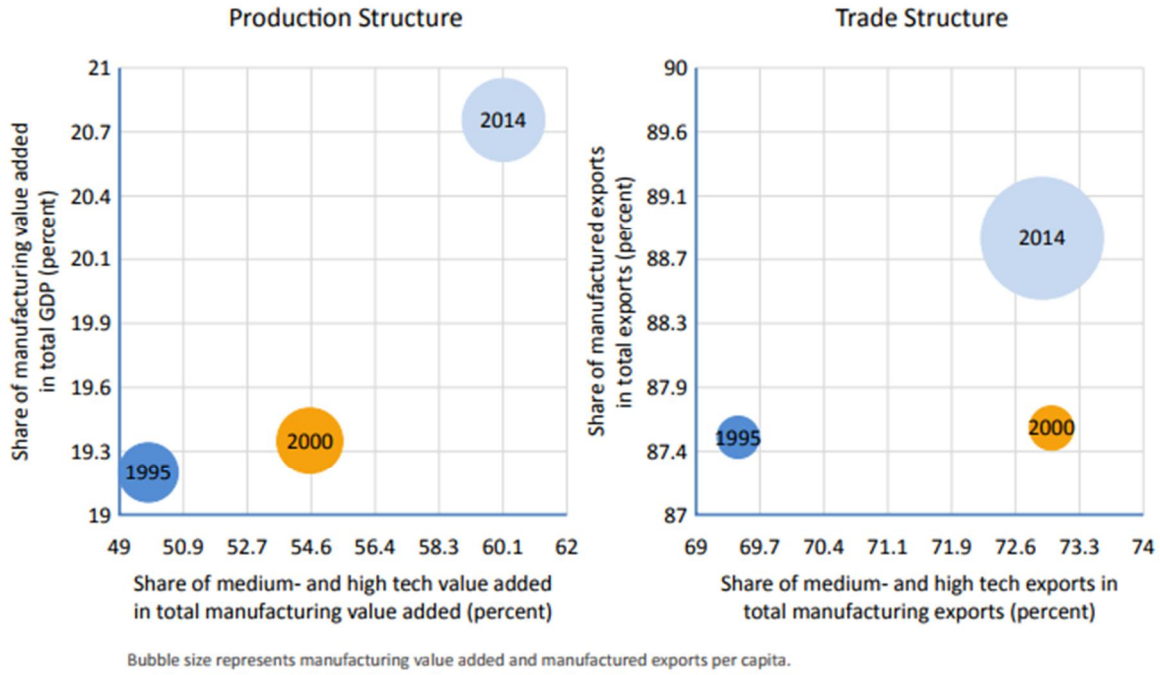
	Germany rank	The Czech Republic rank	Germany score	The Czech Republic score	World Average score
CPI	1	18	0.545	0.215	0.079
MVA per Capita	4	21	0.630	0.319	0.133
Share of Medium and High-Tech Activities in Total MVA	7	15	0.745	0.615	0.308
Manufacturing Export per Capita Index	8	9	0.432	0.408	0.104
Share of Medium and High-Tech Activities in Total Manufacturing Export	6	12	0.777	0.728	0.361

Source: (UNIDO, 2016)

The Czech Republic MVA per Capita Index is 0.319 in comparison with Germany 0.628 and world average of 0.133. This put both countries highly above the world average.

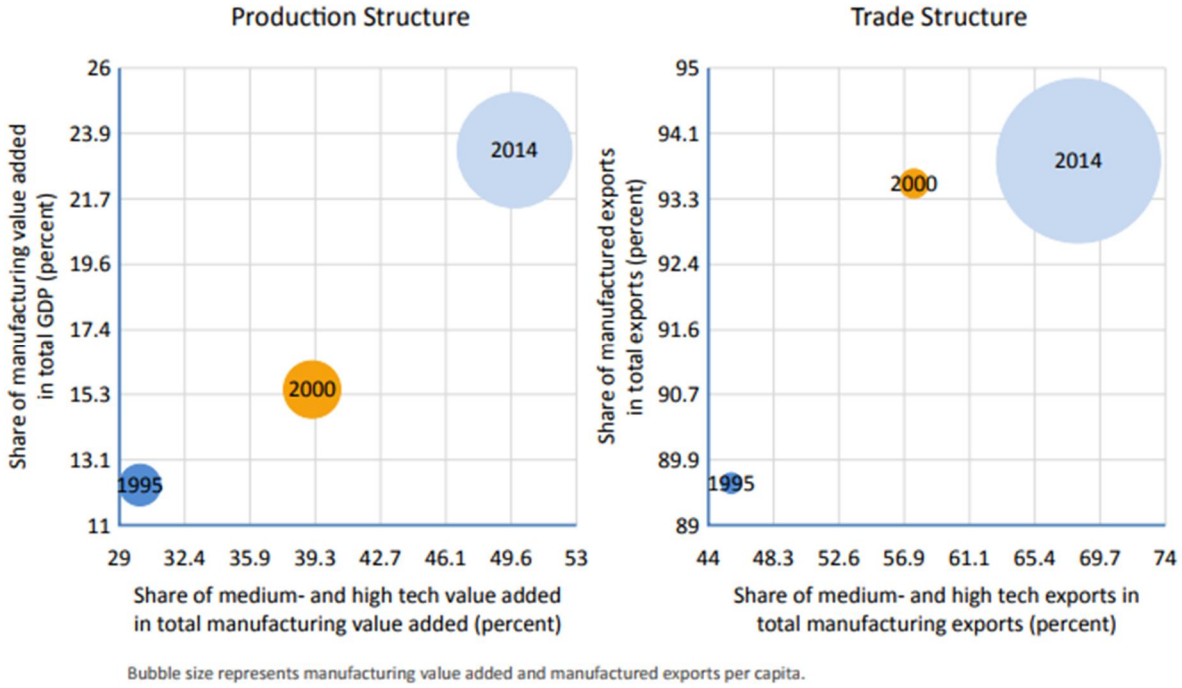
Following graphs (Figure 8 and Figure 9) depict trends and changes of Germany production and trade structure, from year 1995 to 2014. On horizontal axis is total manufacturing value added and on vertical axis share of MVA in total GDP, both in percentages.

Figure 8: Trends and changes of Production and Trade Structure of Germany



Source: (UNIDO, 2016)

Figure 9: Trends and changes of Production and Trade Structure of the Czech Republic



Source: (UNIDO, 2014)

As we can see from the previous graphs (Figure 8,9), both countries strongly improved both in share of manufacturing value added in a total GDP and share of medium and high-tech value added in a total manufacturing value added. Also, this trend is more significant in the Czech Republic, where there is bigger increase share of production structure and trade structure both as share in percent of total GDP and per capita.

1.6 Germany approach to the Fourth Industrial Revolution

Technological Background: Embedded Systems and Networks

Germany Trade and Invest (GTAI)[2] predicts that the bedrock of tomorrows innovative solutions are information and communication technologies (ICT), embedded systems and global networks are two major ICT motors driving current technological progress.

Based on findings of Germany Trade and Invest (Bunse, Kagermann, & Wahlster, 2014, p. 7), "*Germany´s embedded system market currently generates around 20 billion EURO annually, which should rise to more than 40 billion EURO by 2020. As such Germany´s embedded systems market is the third biggest in the world behind the USA and Japan.*"

Germany Policy Framework and Programs

The High-Tech Strategy

"*Launched in 2006, this strategy represents the first national concept to bring key innovation and technology stakeholders together in a common purpose of advancing new technologies.*

The initiative combines the resources of all government ministries, setting billions of euros aside annually for the development of cutting-edge technologies.

The objectives were extended within the framework of the "High-Tech Strategy 2020" launched in July 2010. This successor initiative intends to create lead markets, further intensify partnership between science and industry, and continue to improve the general conditions for innovation based on solutions in the fields of:

[2] GTAI is the economic development agency of Germany, it supports German companies setting up in foreign markets, promotes Germany as a business location and assists foreign companies settings.

- *climate/energy,*
- *health/nutrition,*
- *mobility,*
- *security and*
- *communication.*

Action plan for this strategy identifies 10 "Future Projects", within these lighthouse projects, specific innovation objectives will be pursued over a 10 to 15-year time frame." (Bunse, Kagermann, & Wahlster, 2014, pp. 12-13)

Agenda CPS

"*The goal of the Agenda CPS project that is led by the German National Academy of Science and Engineering on behalf of the Federal Ministry of Education and Research is to establish an integrated CPS research agenda that allows Germany to shape this technological revolution as a lead market and provider in competition with other industrial and technological players.*

Agenda CPS set four major fields of application up to the year 2025:

- *energy" (cyber-physical systems for the smart grid),*
- *mobility" (cyber-physical systems for networked mobility),*
- *health" (cyber-physical systems for telemedicine and remote diagnosis) and*
- *industry (cyber-physical systems for industry and automated production).*"

(Bunse, Kagermann, & Wahlster, 2014, p. 13)

ICT 2020: IT Systems for INDUSTRIE 4.0

ICT research focus is concentrated on ICT in complex systems, new business processes and production methods as well as the IOT and Services. "*Software systems and knowledge processing research funding is divided into three specific categories:*

- *embedded systems focusing on software-intensive embedded systems with links to electronics, communication technology and microsystems technology;*
- *simulated reality for grid applications and infrastructure, virtual/augmented reality and ambient intelligence, simulation, information logistics and software development for high-performance computing;*
- *human/machine interaction with language and media technologies, service robotics and usability.*

"*Applicant projects should be business-oriented and include cooperation with either university or non-university research institutions. Calls for application are published on a case-by-case basis.*" (Bunse, Kagermann, & Wahlster, 2014, p. 13)

CyProS (Cyber-Physical Production Systems)

This research project consists of a group of actors from science and industry. "*CyProS was initiated in 2012 for purpose of research and development of a representative spectrum of cyber-physical system modules for production and logistics systems for industrial use.*"

"*Together with the underlying reference architecture, also to be developed during the three-year project, these system modules should allow the manufacturing industry to increase productivity and flexibility which should also equip Germany to become the lead user and provider of such systems.*"

"*These initiatives ought to allow the complexity of increasing competition to be controlled and also lead to a sustainable and significant increase in productivity and flexibility of manufacturing companies through the development and introduction of cyber-physical production systems (CPPS).*" These resulting CPPS technologies are supposed to allow Germany to increase its competitiveness as an international production location as a result of improved productivity and flexibility, while simultaneously allowing CPPS to be introduced

to the market as marketable products, thereby establishing the country as a lead CPPS provider. (Bunse, Kagermann, & Wahlster, 2014, pp. 12-15)

CyPros includes three detached goal stages:

- "*Development of a reference architecture and a representative spectrum of cyber-physical system modules for production and logistics systems.*
- *Provision of universal practices, support tools and platforms for the introduction of cyber-physical production systems.*
- *Technical and methodological basis for the commercial operation of cyber-physical production systems and their implementation in the real production environment of a showcase factory.*" (Bunse, Kagermann, & Wahlster, 2014, p. 15)

RES-COM

"*RES-COM was launched in June 2011 and funded by the Federal Ministry of Education and Research. The RES-COM project addresses automatized conservation of resources through highly interconnected and integrated sensor-actuator systems in an INDUSTRIE 4.0 context. Prototype scenarios for context-activated resource efficiency are being implemented. RES-COM adopts a completely new type of core technology based on active digital product memory and software service agents with embedded sensors and actuators. The project is overseen by the German Research Center for Artificial Intelligence in partnership with partners including SAP, Siemens, IS Predict, and 7x4 Pharma.*" (Bunse, Kagermann, & Wahlster, 2014, pp. 14-16)

Institutions that participate in realization of INDUSTRY 4.0

- "*Industry-Science Research Alliance is advisory group of 19 leading representatives from science and industry to accompany the High-Tech Strategy.*
- *Acatech, National Academy of Science and Engineering represents the interests of the German scientific and technological communities.*
- *The German Research Center for Artificial intelligence. DFKI.*
- *Fraunhofer-Gesellschaft is research organization that undertakes applied research that drives economic development and serves the wider benefit of society.*

- *It´s OWL /Intelligent Technical Systems OstWestfalenLippe) is a science and industry technology network which intends to set international standards in the field of intelligent technical systems.*
- *Plattform INDUSTRIE 4.0 is a joint initiative of the industry organization BITKOM (Federal Association for Information Technology, Telecommunications and New Media), VDMA (German Engineering Federation), and ZVEI (Electrical and Electronic Manufacturers Association) and acts as a central point of contact for companies, employee representative, politics and science in matter INDUSTRY 4.0 related.*
- *SmartFactory KL is technology initiative is located at the German Research Center for Artificial Intelligence (DFKI) in Kaiserslautern. It is the first European vendor independent demonstration factory for the industrial application of state-of-the-art information and communication technologies.*" (Bunse, Kagermann, & Wahlster, 2014, pp. 1-40)

2 Digital payment systems

Payment systems are any systems that are enabling transfer of funds between subjects. Used in purpose to settle financial transactions using transfer of monetary value or cash-substitutes as mediate for transfer. This system also includes all involved subjects as institutions, people, instruments, procedures, standards, rules and technologies that enable exchange. (Farlex Financial Dictionary, 2017

Traditional payment systems include checks, letters of credit and other negotiable instruments.

Recent payment systems include electronic funds, direct debits and credits, e-commerce payment systems. Electronic payment systems are used for payment of buying and selling services and goods through any type of electronic funds transfer, most frequently through Internet.

Payment systems reduce costs of exchange, there are important for stability and development of an economy, securing efficient usage of financial resources, trust in financial system and use of medium of exchange. Inefficiencies in the payments can have significant negative effects throughout the economy. Cost efficiency has been at the forefront of arguments for moving from paper-based to electronic payment instruments. As the world becomes more globalized there is trend of more frequent transactions across borders both for consumers and companies. (World Economic Forum, 2016)

2.1 Examples of current payment systems:

SWIFT (Society for Worldwide Interbank Financial Telecommunication)

"*SWIFT is a global member-owned cooperative and the world's leading provider of secure financial messaging services.*

Platform, products and services connect more than 11,000 banking and securities organizations, market infrastructures and corporate customers in more than 200 countries and territories.

SWIFT does not hold funds or manage accounts on behalf of customers. SWIFT enable users to communicate securely, exchanging standardized financial messages in a reliable way, thereby facilitating global and local financial flows, and supporting trade and commerce all around the world.

Headquartered in Belgium, SWIFT's international governance and oversight reinforces the neutral, global character of its cooperative structure. SWIFT's global office network ensures an active presence in all the major financial centers." (S.W.I.F.T. SCRL., 2017)

A SWIFT code (or SWIFTBIC, as it's sometimes known) is a code that helps overseas banks identify which bank to send money to. For example, if an overseas bank is sending to a payment to your Barclays UK account, they'll need to know our SWIFT code: BARCGB22. (Barclays UK, 2017)

IBAN

"*The IBAN (The International Bank Account Number) is an international for numbering bank accounts, which we can use when making or receiving international payments, it is an additional number with extra information to help overseas banks identify account for payments.*" (S.W.I.F.T. SCRL., 2016) The IBAN facilitates the communication and processing of cross-border transactions. It allows exchanging account identification details in a machine-readable form.

The current standard is ISO 13616 and Registration Authority for ISO is SWIFT company. Structure of the IBAN is defined in ISO 13616-1 and consists of a two-letter country code, followed by two check digits and up to thirty alphanumeric characters for a BBAN (Basic Bank Account Number) with a fixed length per country and includes bank identifier with a fixed position and a fixed length per country. The check digits are calculated based on the scheme defined by ISO/IEC 7064. (S.W.I.F.T. SCRL., 2016)

SEPA

SEPA stands for the Single Euro Payments Area and creates European Single Market for retail payments in euro where transfers, direct debits and payments between Member States are easy and fast as domestic transactions. (European Comission, 2014)

2.2 Cashless society

The world is heading towards cashless society. It is a trend that was allowed by recent technological changes and improvement of payment means. This lead to possibility of having higher financial disposals with better security and faster exchange for everyone thanks to credit/debit cards. Nowadays cashless payments are ordinary among people in the European Union and are innovated even more, such as touchless technologies or payments by mobile phones.

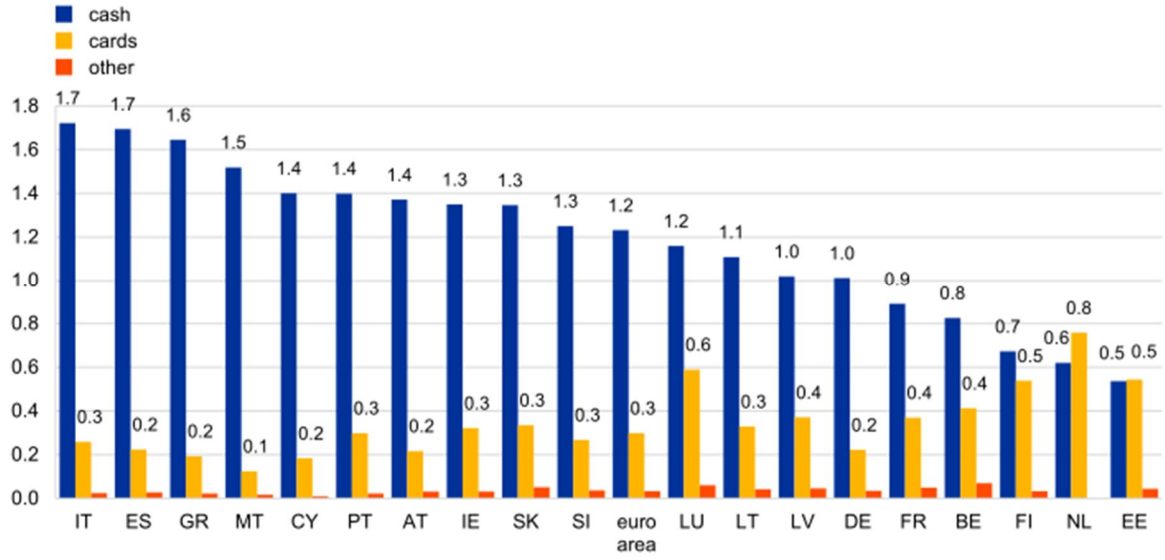
In the book "The cost of cash in the United States" the trend is described very aptly: "*Money is an abstraction built on trust. As such, alternatives to the most tangible form of money and its replacement with cashless payments have become possible. Such an ecosystem is one where no transaction requires money in the form of notes and coins, and where value can be exchanged through the transfer of information between transacting parties. There have been multiple waves of such alternatives. Established alternatives to cash include checks, credit cards, debit cards, and prepaid debit cards. More recently, innovative options have sprung up that not only threaten to imperil the ubiquity of cash but also upend the traditional payment ecosystem. These include smartphone-enabled credit card acquirers, such as Square, and Automated Clearing House or ACH acquirers, such as PayPal and Dwolla. And then there are even more ambitious alternatives to cash that have been proposed, such as Bitcoin, a web-based cryptocurrency. Unlike traditional money, such alternatives do not derive their value*

from government fiat. Each of these alternatives have evolved networks within which they are uniformly accepted as a means of payment; the more established alternatives, of course, have the widest networks." (Chakravorti & Mazzota, 2013)

Werner in his book Negative Interest Rates and the War on Cash (Werner, 2016) menitons that by the 2010s cash had become even actively disfavored in some kinds of transaction which would historically have been very ordinary to pay with physical tender as larger cash amounts are in some situations treated with suspicion, due to its versatility and ease of use in money laundering and financing of terrorism, and actively prohibited by some suppliers and retailers. Use of cashless methods eliminates these risks.

The graph below (Figure 10) depicts use of cash among European countries in 2017.

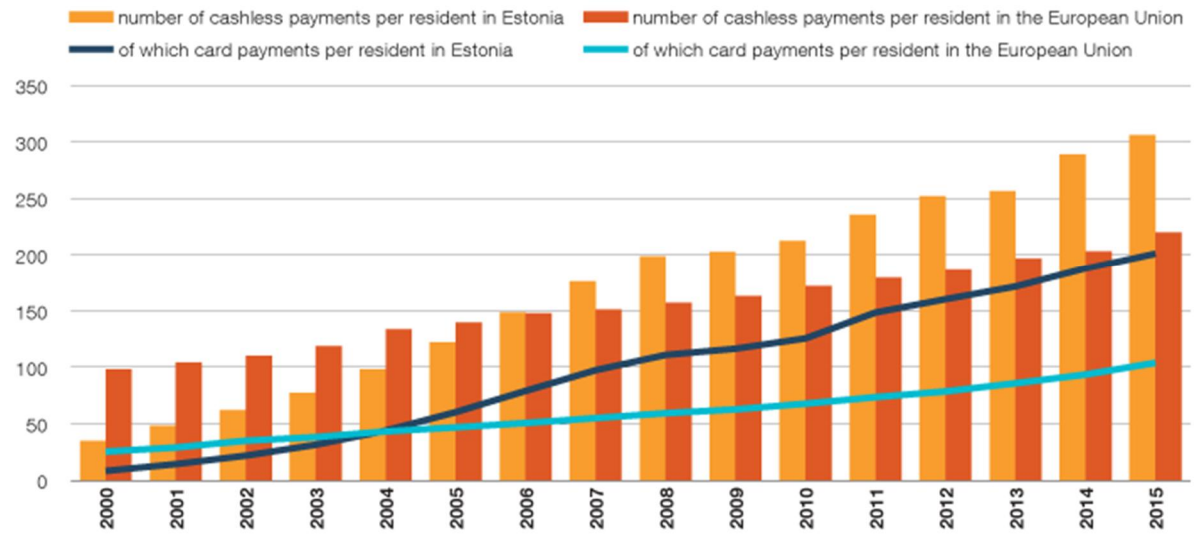
Figure 10: Average number of transactions per person per day, by instrument of payment



Source: (Esselink & Hernández, 2017)

We can see that Italy, Spain and Greece are countries where people use cash most frequently and are above average of euro area. The lowest rate of card usage was in Malta. On the other hand highest frequency of card usage was recorded in Netherlands, followed by Estonia and Finland, these countries also have low frequency of cash usage. Another graph (Figure 13) shows trend over the years, with focus on Estonia.

Figure 11: Number of cashless payments and card payments per resident in Estonia and the European Union



Source: (Soosalu, 2016)

This graph (Figure 11) shows more in depth how this trend develop by time. In general we can say that number of cashless payments in the European Union increased during period from 2000 to 2015, approximately twice the time, with steady increase every year. Trend is unambiguously towards cashless transactions. Interesting is fact, that in Estonia this trend is significantly stronger and during period number of cashless payments increased about by five. Estonia is leading country in this trend of emergence of cashless society.

2.3 Digital Currencies and digital payment systems

Digital currency (digital money, electronic money) differ from a physical money (such as banknotes and coins) as it exists purely in electronic form and it is intangible. Digital currency stores value, serves as medium of exchange and measures value in the electronic form. (Dodgson, Gann, Berger, Sultan, & George, 2015)

We can talk about digital money as digital commodity, intangible assets as they are not backed up by any underlying asset such as gold etc. There are claims of development of digital currencies that will use underlying asset, but these are usually private experiments.

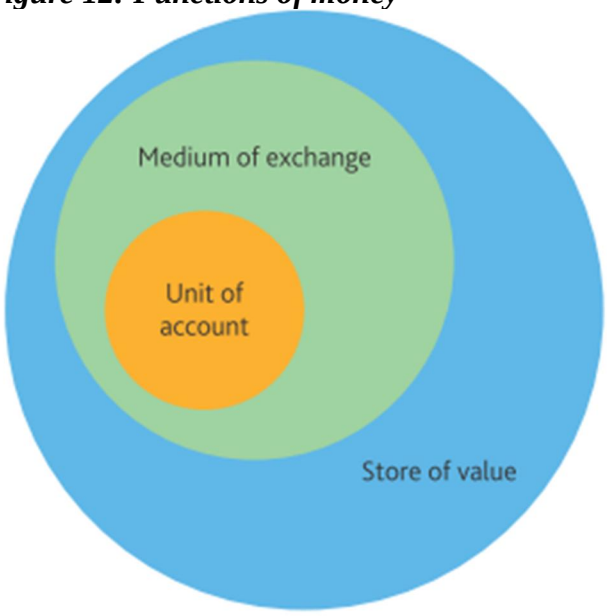
2.3.1 Usability of digital currencies

Digital currenices are valid only to the extent of how many participants agree that they are valid. Economic theory identifies money by the role it plays in society: a store of value, a

medium of exchange, a unit of account. From the perspective of economic theory, whether a digital currency may be considered to be money depends on the extent to which it acts as a store of value, a medium of exchange and a unit of account. How far an asset serves these roles can differ, both from person to person and over time. (Mankiw, 2008, p. 325) At present, digital currencies are used by relatively few people. For these people, data suggest that digital currencies are primarily viewed as stores of value. (Ali, Barrdear, & Clews, 2014, p. 1)

The following picture on the next page (Figure 12) shows functions of money in hierarchy. There are many assets that people use as store of value for example: house, land. These are neither used as medium of exchange nor unit of account. An asset can only act as a medium of exchange in case if at least two people are prepared to treat it as a store of value, at least temporarily. For an asset to be considered a unit of account, it must be at least used as a medium of exchange across a variety of transactions between several subjects and as such represent a form of co-ordination across society. Economists consider the function unit of account to be the most important characteristic of money. (Woodfort, 2003)

Figure 12: Functions of money



Source: (Ali, Barrdear, & Clews, 2014, p. 4)

As most of current digital currencies are characterized by huge fluctuation therefore, it is impractical to use them as reliable unit of account and stable store of value. Retailers that quote prices in bitcoins appear to usually update those prices at a high frequency, also some start-up companies are seeking to offer bitcoin payment facilities typically offer retailers the opportunity to price entirely in fiat currencies, using the digital currency only as a temporarily

payment system. Currently, there is little evidence of any digital currency being used as a unit of account.

Next feature of cryptocurrencies such as Bitcoin is that digital currencies are not controlled by central banks or any central authority and allow payments to be made directly between payer and payee without the use of any intermediaries. (Ali, Barrdear, & Clews, 2014, pp. 2-3)

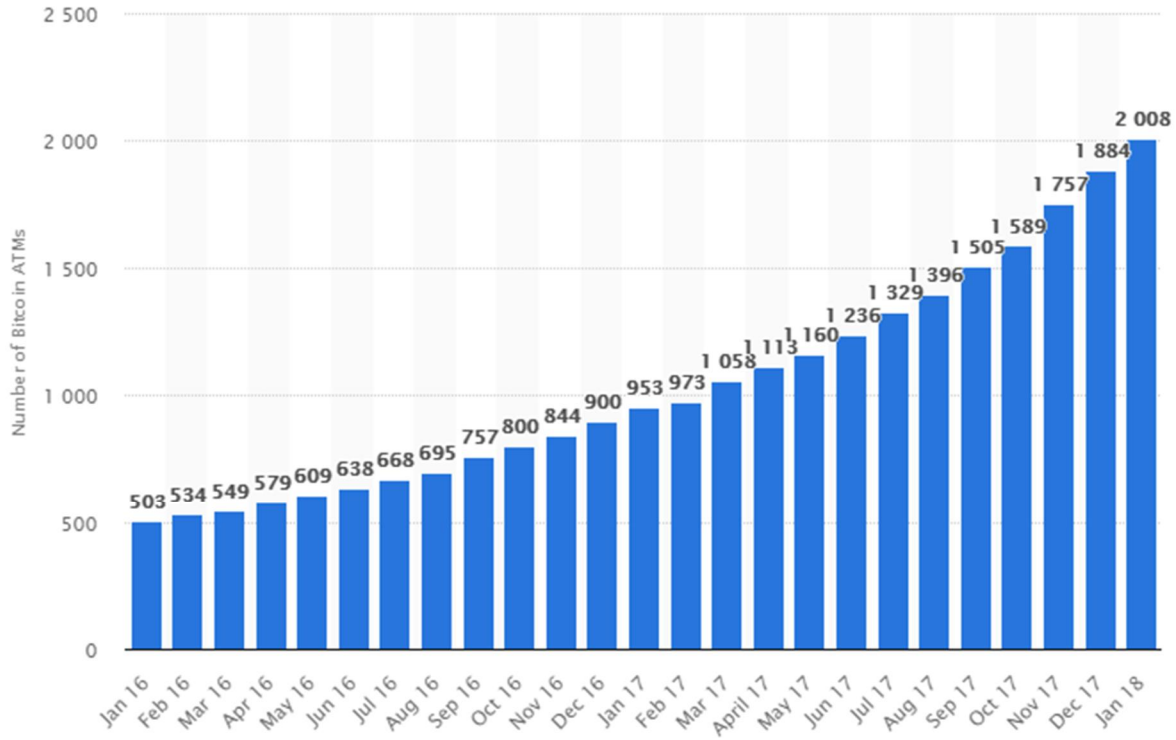
Another significant feature of digital currencies and the primary driver of interest from retailers in accepting them in payment is the promise of low transaction fees. Fees are low for digital currency payments despite the fact that, as currently designed, the marginal cost of verifying transactions by miners is generally higher than that for centralised payment systems. The incentives embedded in the current design of digital currencies pose impediments to their widespread usage as a key attraction of such schemes at present is their low transaction fees. These fees may need to rise as usage grows and may eventually be higher than those charged by incumbent payment systems. Most digital currencies incorporate a pre-determined path towards a fixed eventual supply. Also authors point that fixed money supply may also harm the macroeconomy as it could contribute to deflation in the prices of goods, services and wages. Inability of the money supply to vary in response to demand would likely cause greater volatility in prices and real activity. (Ali, Barrdear, & Clews, 2014, pp. 1-6)

Economic theorist (Ali, Barrdear, & Clews, 2014) suggest that social welfare would be lower in a hypothetical economy based on a current digital currency model compared with a second hypothetical economy based on a fiat money system as deflation and inability of the money supply to vary in response to demand could cause volatility in prices with negative effects on economy. When the prices of goods and services are falling, households have an incentive to postpone or even abandon spending plans. Expected price deflation also raises the minimum return an entrepreneur must offer to raise funding for investment in physical capital. On the other hand, authors note, that there are no technical obstacles why cryptocurrencies could not adopt ‘smarter’ rules that seek to provide ongoing subsidies to miners and remove the incentive to postpone or abandon spending. The simplest example would be a rule in which the money supply was permitted to grow at a constant rate per year, similar to that advocated by Milton Friedman. Supply would no longer be fixed, but in principle there would still be no discretionary management of the currency.

2.3.2 Wideness of usage of digital currencies

The statistic (Figure 13) depicts the number of Bitcoin ATMs worldwide from January 2016 to January 2018. There were 2,008 Bitcoin ATMs as of January 2018 globally. We can see that increase of ATMs is consistent, change from January 2016 – January 2018 totals 1505 new ATMs, that makes average of 62.7 ATMs per month.

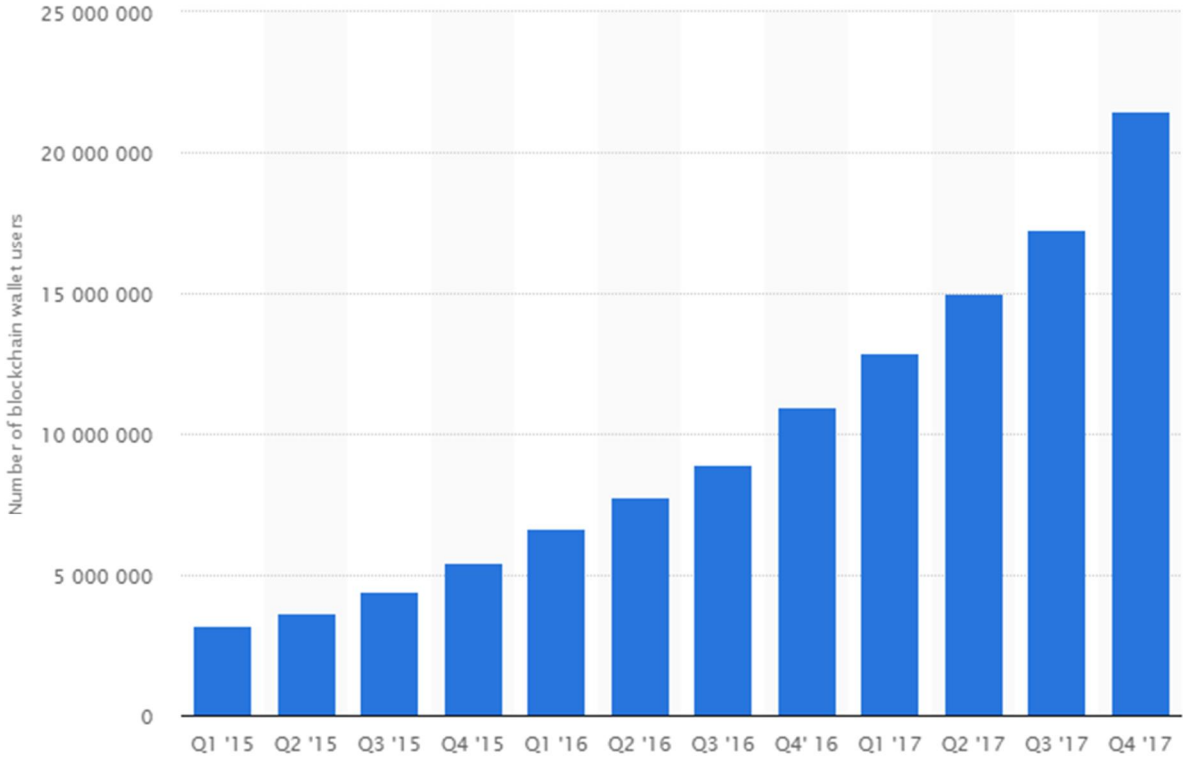
Figure 13: Number of Bitcoin ATMs worldwide from January 2016 to January 2018



Source: (Statista Ltd., 2018)

"*ATM is abbreviation for automated teller machine. ATM is a device that enables the holders of debit or credit cards to withdraw cash from their banking accounts. There are two main types of Bitcoin ATMs. Basic ones, that allow the users only to purchase Bitcoins and more complex that enable users both to buy and sell Bitcoin. As of January 2018, the main manufacturers of the Bitcoin ATMs were Genesis Coin and General Bytes, with 36.01 percent and 27.64 percent of the market share, respectively. The highest number of Bitcoin ATMs was recorded in the United States as of January 2018. In total, approximately 75 percent of global ATMs were concentrated in North America.*" (Statista Ltd., 2018)

Figure 14: Number of Blockchain wallet users worldwide from 1st quarter 2015 to 4th quarter 2017



Source: (Statista Ltd., 2018)

Number of Blockchain wallet users displayed in the graph above (Figure 14) does not exactly tell how much there is people involved, it shows how much wallet IDs exists. That means that one person can own more than one wallet. Here we can again see consistent rise of users and if we would assume that average number of IDs per user does not change, there is increase from Q1 2015 till Q4 2017 of about 20 million new users, totaling approximately 22 million users. In comparison of world population, the adoption of cryptocurrencies and blockchain wallet users is fractional.

2.3.3 Overview of digital currencies

According above findings mentioned in the thesis, current major impediments to the widespread usage of cryptocurrencies include: general unfamiliarity with the technology, the insufficient user-friendliness of applications associated with day-today use of the schemes, the increased need for personal security compared to deposits held with regulated institutions and volatility of digital currency exchange rates.

Digital currencies represent both innovations in payment systems and a new form of currency, but it is very unlikely that as currently designed, would be used as the predominant form of money. Presently, digital currencies fulfil the roles of money only to some extent and only for a relatively small number of people, even that these numbers are increasing. Digital currencies are also connected with many criminal activities such as operations on black market, evading taxes and fraud. In case of wider widespread of digital currencies it is important to monitor situation and set suitable regulations.

2.4 Blockchain Technology

The blockchain is the public ledger of all Bitcoin transactions that have ever been executed. It is constantly growing as miners add new blocks to it (every 10 minutes) to record the most recent transactions. The blocks are added to the blockchain in a linear, chronological order. The blockchain has complete information about addresses and balances from the genesis block to the most recently completed block.

Users can trust the system of the public ledger stored worldwide on many different decentralized centers maintained by “miner-accountants,” as opposed to having to establish and maintain trust with the transaction counterparty (another person) or a third-party intermediary (like a bank).

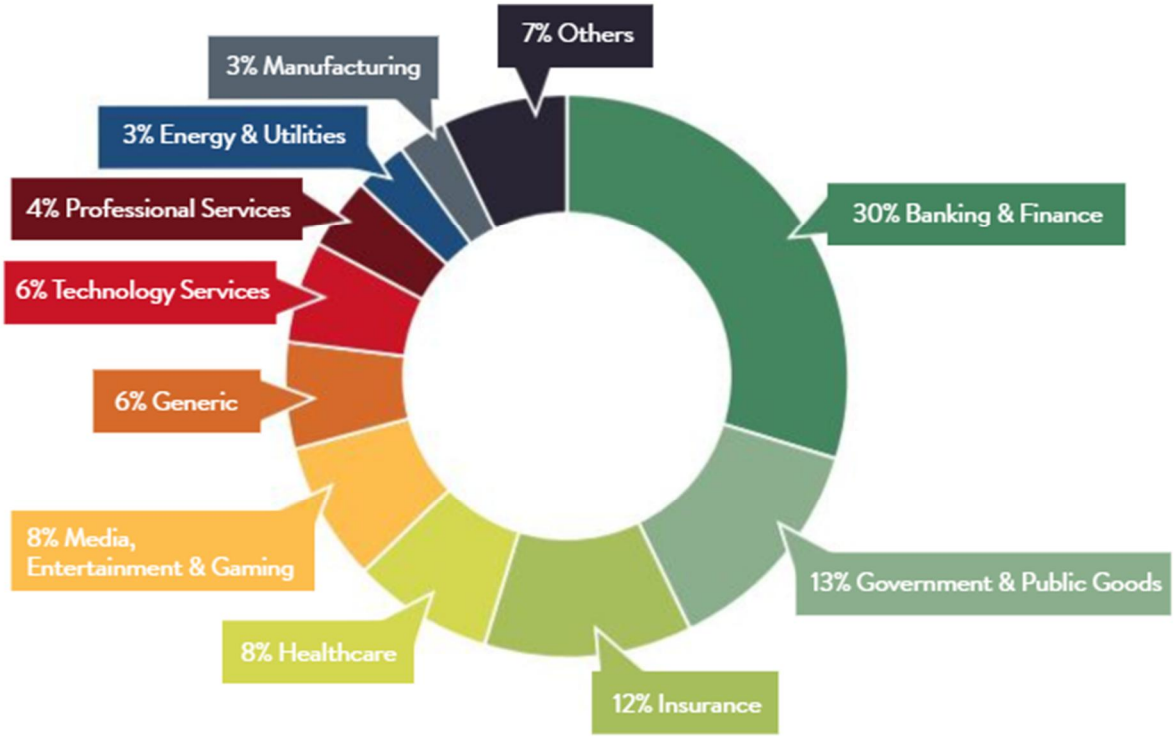
Any currency, financial contract, or hard or soft asset may be transacted with a system like a blockchain. Further, the blockchain can be used for any form of asset registry, inventory, and exchange, including every area of finance, economics, and money; hard assets (physical property); and intangible assets (votes, ideas, reputation, intention, health data, etc.).

The economy that the blockchain enables is not merely the movement of money, however; it is the transfer of information and the effective allocation of resources that money has enabled in the human- and corporate-scale economy. (Swan, 2015, pp. 1-12)

The potential benefits of the blockchain are more than just economic, they extend into political, humanitarian, social, and scientific domains and the technological capacity of the blockchain is already being harnessed by specific groups to address real-world problems. (Swan, 2015, pp. 1-12) Examples of areas where blockchain is being used already and its prevalence in

percentages within different industries is shown in the graph below (Figure 15). This graph is based on a list of 132 use cases, grouped into industry segments, that have been frequently mentioned in public discussions, reports, and press releases.

Figure 15: Examples of blockchain usage

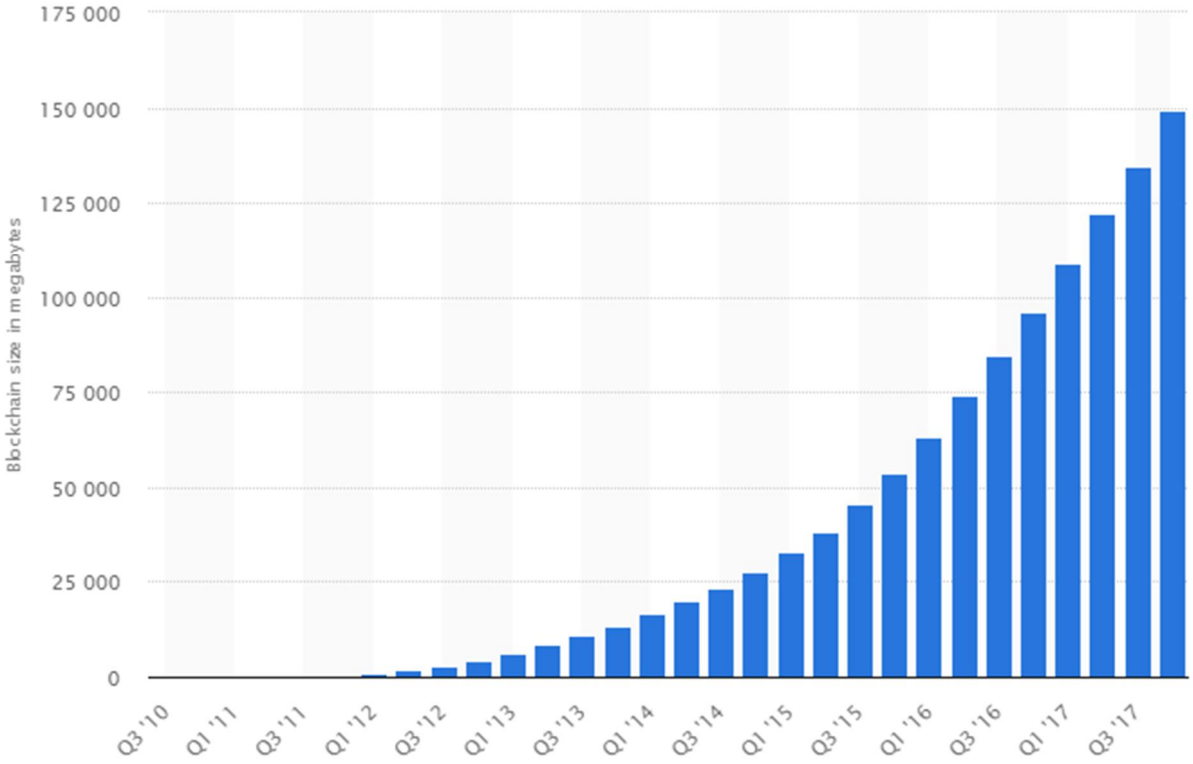


Source: (Hileman & Rauchs, 2017, p. 37)

We can see that currently blockchain usage is dominated by the finance sector followed by the government and public sector. This result is not any big surprise as origins of blockchain lies in use of money. Healthcare and media rate of usage is approximately similar in this sample. Manufacturing and energetical sectors don´t use blockchain as much as other sectors yet, but this can change in the future. This graph does not depict exact data of usage of blockchain worldwide but can serve as useful illustration of current situation based on reliable source from Cambridge University.

Let´s move on and examine some difficulties that are present in blockchain technology. Blockchain is characterized by growth of its size as more transactions and data are saved in the system. This leads to problems such as too big size of blockchain, therefore not enough storage for nodes, high demand for computer power and low transaction speeds. Graph (Figure 16) on the next page depicts size in megabytes of Bitcoin blockchain during recent period.

Figure 16: Size of the Bitcoin blockchain from 2010 to 2017, by quarter (in megabytes)



Source: (Statista.com, 2018)

From this graph we can see massive increase in Bitcoin blockchain size totaling 150 thousand megabytes, that equals 150 Gigabyte. That is size that each node that ensures operation of blockchain must store. The Bitcoin community calls the size problem “bloat”. If throughput were to increase by a factor of 2,000 to VISA standards, for example, that would be 1.42 PB/year or 3.9 GB/day. (Swan, 2015, p. 82) For clarification 1 PB (Petabyte) equals 1000 Terabytes and that equals 1e6 of Gigabytes. That is very huge amount of data that by this forecast will arise and it will lead to less subjects to be able to store blockchain data. This lead to centralization and costliness of running blockchain.

Another problem is Latency. Each Bitcoin transaction block took about 10 minutes to process in 2017, meaning that it took at least 10 minutes for transaction to be confirmed. For sufficient security, there is even more time required, about an hour. For larger transfer amounts it needs to be even longer. (Swan, 2015, p. 102)

There are also challenges how governments will regulate blockchain and could be one of the most significant factors and risks to blockchain industry. One issue is practical impossibility of carrying out taxation with current methods. A decentralized peer-to-peer sharing economy

with individuals paying for services such as Airbnb, Uber with cryptocurrencies causes traditional taxation structures non-functional. Ordinary tracking points to trace the consumption of goods and services might be gone. This could also have impact on measurement of economic performance such as GDP.

Another problem is with privacy challenges for personal records as nowadays storing personal records in a decentralized manner online, in case that keys to these data would be stolen. This could happen same as with routinely known cases of stolen databases in companies, user passwords and data leakage. If a thorough personal record would be stolen, the implications could be very serious and dangerous for an individual. (Swan, 2015, p. 88)

In conclusion, it is clear, that Bitcoin and blockchain nowadays are disruptive technologies and their impact is already visible in mediums and growing familiarity of these technologies among people. In the end, if these technologies will not survive, there will persist some legacy for future of ideas such as decentralization and new business models.

3 Impacts on international organizations

To establish impacts of digitization on the international organizations it is important to understand economics of digitization and how to measure digital economy, this is described in the following chapter. In the last part I focus on main aim of the thesis and that is, what is the impact on international organizations in general, regardless their purposes. These impacts depend on many variables. In context with Germany and Czech Republic I firstly focus on how well countries within European Union are prepared for new trends. Based on these findings, company should adapt its strategy and location. After that I solely focus on representative qualities that should organization possess to thrive in new economy with connection to trends analyzed in the thesis. The final chapter is focused on social impacts and role of international companies, as well as a role of government regarding unemployment and education of employees/public.

3.1 Economics of digitization

In report Economic Analysis of the Digital Economy (Goldfarb, Greenstein, & Tucker, 2013, pp. 1-2) authors describe research on the economics of digitization as studies whether and how digital technology changes markets. They suggest that the transformative nature of digital technology has implications for how we understand economic activity, how consumers behave, how firms develop competitive strategy, how entrepreneurs start new firms, and how governments should determine policy. Digitization has some features that suggest that many well-studied economic models may not apply anymore.

There is no widely accepted methodology for assigning an economic value to the Internet. Given the growing importance of the Internet as a policy tool, the question about the value of the digital economy becomes relevant.

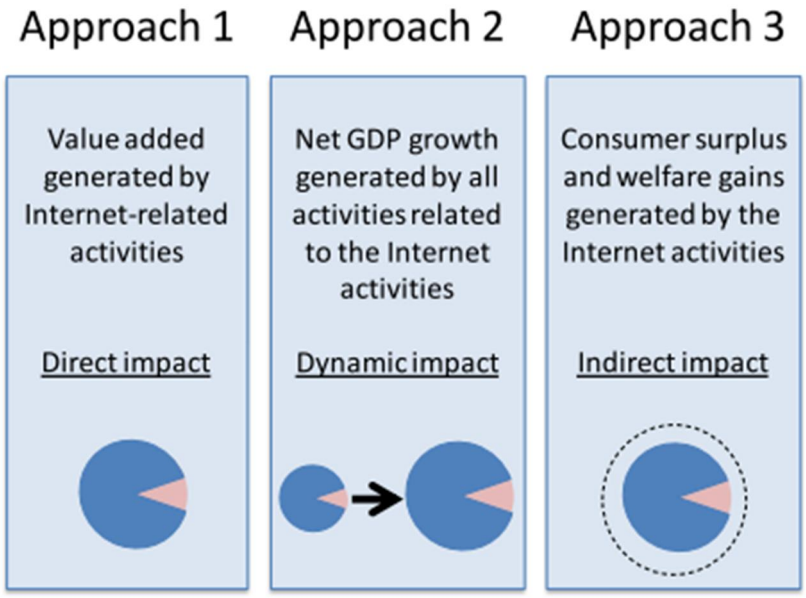
3.1.1 How to measure digital economy

In searching for appropriate terminology and measurement concepts, the OECD held an expert roundtable focusing on methodologies to measure the Internet economy.

OECD (OECD Digital Economy Papers, 2013, pp. 6-7) set several general approaches to measure the broad universe of the Internet Economy as graphically illustrated below (Figure 17), these involve three types of classification:

a) **Direct impact** – is the most conservative and relies mainly on official data, it measures size of the Internet economy expressed as a part of GDP, approach look at those parts of the economy that are closely related to the Internet.
b) **Dynamic impact** – what impact has the Internet on all industries and hence on the rates of productivity growth and GDP growth. These studies evaluate the contribution of the Internet to the net growth of the economy as measured by official statistics.
c) **Indirect impact** – takes into account the indirect impact of the Internet. Studies within this approach examine the effects of the Internet on economic phenomena like consumer surplus or how the Internet contributes to social welfare gains. These studies look at the additional impacts of the Internet on economic welfare that are not necessarily measured by official statistics.

Figure 17: Classification mechanism



Source: (OECD Digital Economy Papers, 2013, p. 7)

In the year 2000 contribution of ICTs to economic growth was firstly demonstrable in macroeconomic data. OECD (OECD Digital Economy Papers, 2013, p. 9) describe the experience in the context of measuring the Internet Economy.

First finding is that it is probably only possible to reliably estimate the economic impacts of the Internet after these impacts occur. However, investments in ICTs must take place before researchers are able to demonstrate that economic impacts of these investments are, in fact, positive.

Second, the first and best evidence of economic impacts is likely to come from micro-data (firm or smaller) before it shows up in macro-data (industry or national).

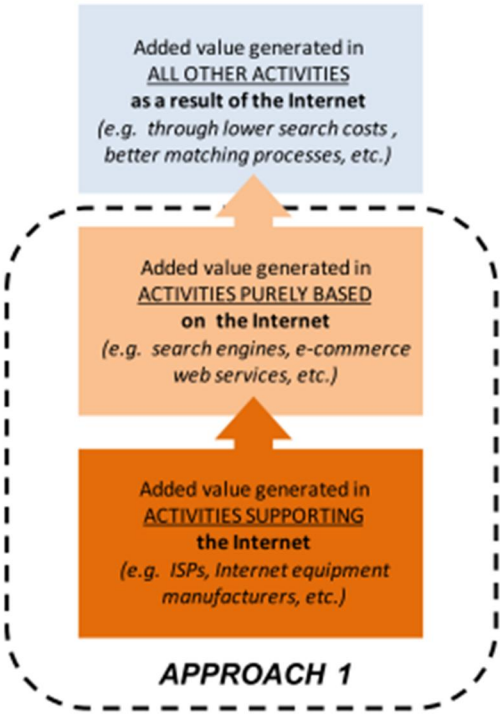
These challenges of measuring ICTs and the Internet are largely related to their general and transformational economic character. In fact, it is often argued that ICTs, including the Internet are a "special" technology in the sense that they affect a multitude of sectors and economic activities, and most importantly make other sectors more productive. A narrow definition of just the ICT and the Internet sectors would not capture their true impact on the economy. Rather, ICT and the Internet are often considered to be general purpose technologies (GPTs).

3.1.2 Approach 1: Direct impact of the Internet

This approach attempts to measure the share of GDP value added that is generated by Internet-related activities. This includes value added generated by two kinds of acitivities (Figure 18):

- Activities supporting the Internet (e.g. ISPs, Internet equipment manufacturers, etc.)
- Activities purely based on the Internet (e.g. search engines, e-commerce services, etc.)

Figure 18: Direct impact of Internet activities:



Source: (OECD Digital Economy Papers, 2013, p. 42)

There are only a few studies that measure the value of Internet-related activities. These include for example recent studies done by BCG, McKinsey, Deloitte in 2011, results are in the following table (Table 3).

Table 3: Internet-related value added in various economies; results from existing studies

Study	Analysed economy	Estimated Internet-related value added (% of GDP)
Hamilton Consultants (2009),	United States	2%
BCG (2010)	United Kingdom	7.2%
BCG (2011)	Sweden	6.6%
BCG (2011)	Hong Kong, China	5.9%
BCG (2011)	Denmark	5.8%
BCG (2011)	Netherlands	4.3%
BCG (2011)	Czech Republic	3.6%
BCG (2011)	Germany	3.4%
BCG (2011)	Poland	2.7%
BCG (2011)	Belgium	2.5%
BCG (2011)	Spain	2.2%
BCG (2011)	Italy	1.9%
BCG (2011)	Egypt	1.6%
BCG (2011)	Russia	1.6%
BCG (2011)	Turkey	1.2%
McKinsey (2011)	Brazil, Canada, China, France, Germany, India, Italy, Japan, Russia, United Kingdom, United States, South Korea, Sweden	3.4% on average
Deloitte (2011)	Australia	3.6%

Sources: (BCG, 2011, p. 12), (McKinsey Global Institute, 2015), (Delloite, 2015, p. 2)

OECD also suggest that the results are likey to underestimate the contribution of the Internet to GDP because the approach is based on the number of jobs deemed to be Internet-related. The focus is on some key sectors but does not take into consideration all the Internet-related employment in other sectors throughout the economy. From above table we can also see, that there are 3 states where the internet has biggest added value and that is the United Kingdom (7.2%), Sweden (6.6%) and Hong-Kong (5.9%).

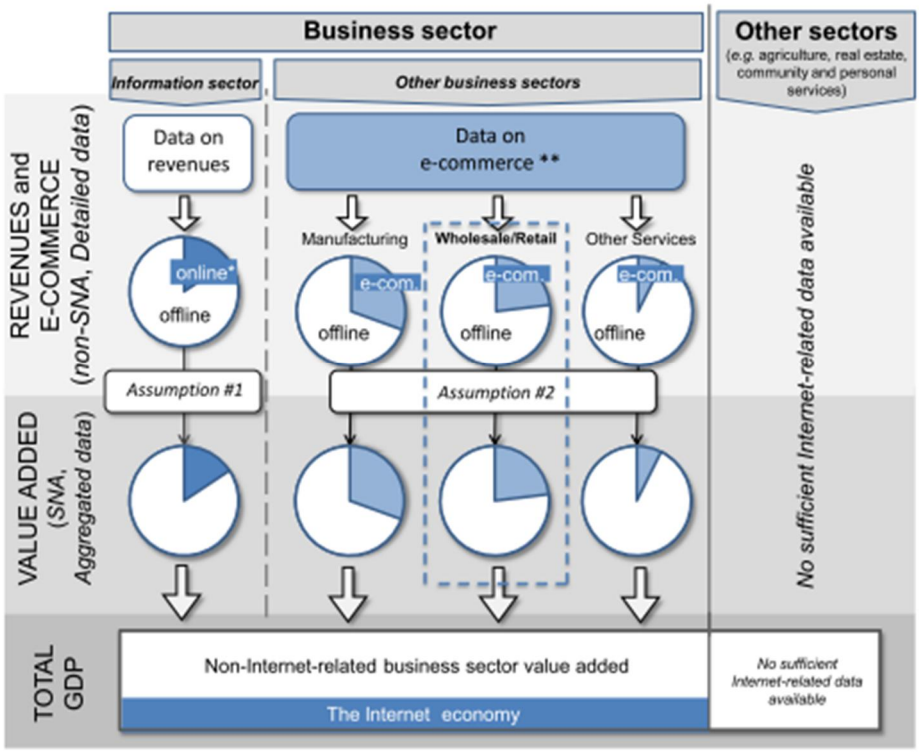
Another approach used by OECD is focused on impact of E-commerce on other business sectors such as manufacturing, wholesale/retail and other services. There is an assumption that the share of revenue from e-commerce in total revenue for each industry sector is proportional to the share of value-added from e-commerce in total value added for that same industry sector.

Using this assumption yields the estimated value added generated by e-commerce in certain sectors of the US economy from 3.2% up to 13.8% of total business sector value added in 2011.

Combined value added generated by the Internet-related activities of the information sector and value added generated by e-commerce in particular sectors of the US economy provides

an order of magnitude of the value added in the US business sector (OECD Digital Economy Papers, 2013, pp. 19-20), as depicted on the following graph (Figure 19).

Figure 19: Estimation of the direct impact of the Internet in the USA in year 2011



Source: (OECD Digital Economy Papers, 2013, p. 29)

This figure depicts revenues and e-commerce of detailed non-SNA data. SNA stands for System of National Accounts where statistical concept of value added is used to capture the value generated by an economic activity. SNA concept includes measuring the value that the firm adds to that of the firms that supply its inputs. The value added is defined as the value of output minus the value of intermediary inputs, meaning all inputs that a firm buys from other firms and uses in its own production. (OECD Digital Economy Papers, 2013, p. 21)

3.1.3 Approach 2: The dynamic impact of the Internet

As defined by OECD (OECD Digital Economy Papers, 2013, p. 31), dynamic approach of measuring the impact of the Internet examines the net share of additional GDP that is generated by all Internet-related activities across the economy. This is done by looking at the statistical relationship between measures of Internet development and economic variables such as GDP growth or employment. There is an important trade-off with this approach because it captures the net GDP benefits of the Internet across all sectors of the economy, but without the level of detail necessary to understand the precise sources of these benefits. Additionally, because the approach captures only "net" benefits, the Internet full impact could be tempered by GDP or employment losses in other sectors as an effect of Internet development."

This approach checks what is the dynamic impact of the Internet. In particular it checks aggregated and net impact that the Internet has on GDP. Studies within this approach take into account:

- All possible industries that generate added value thank to the Internet
- The net economic effect of the Internet on the GDP

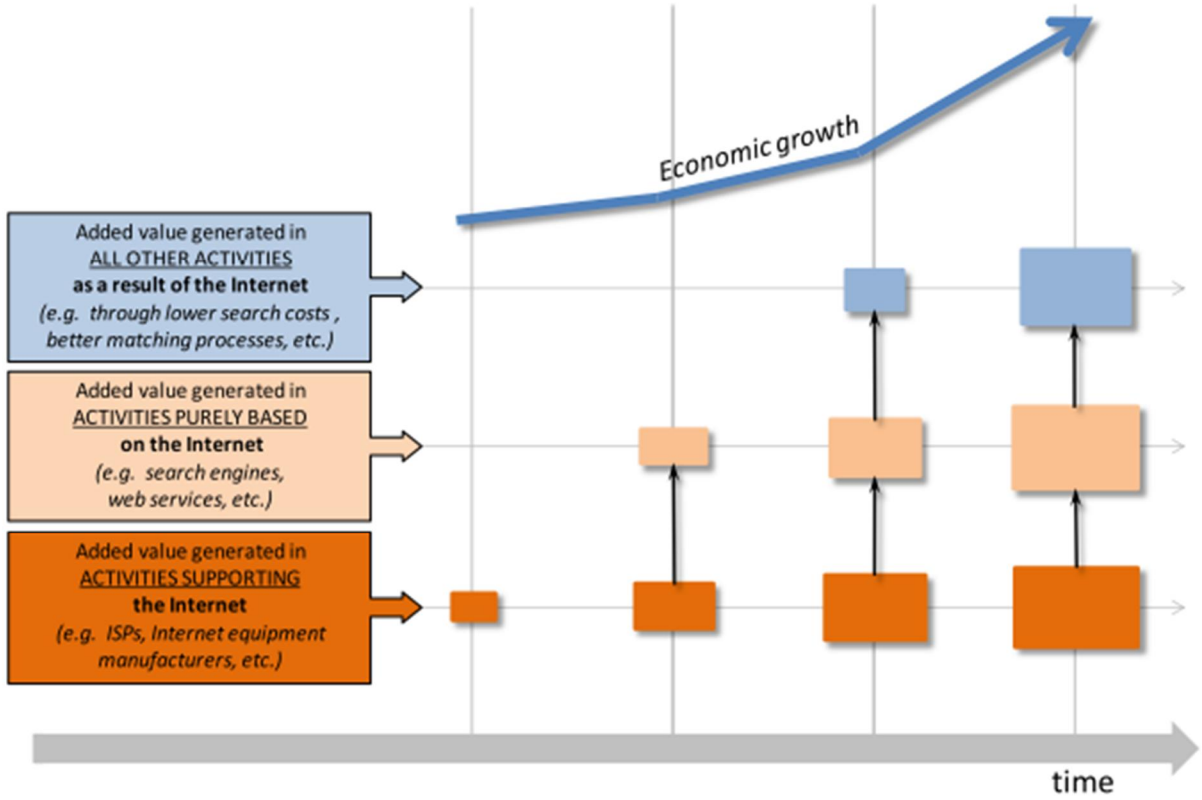
The value added generated thanks to the Internet refers to the simple observation that the Internet results in efficiency gains not only in the industries producing for and on the Internet, but in virtually all sectors, including those that are seemingly unrelated to the Internet such as the gas and oil extraction industry.

To illustrate mechanism of dynamic impact of the Internet there are 3 stages to assume. First stage is about development of the Internet infrastructure, this includes companies that build, install or manage Internet infrastructure.

The second stage, service providers such as search companies, e-mail hosting companies and other content firms appear and use the Internet infrastructure to provide new services. Among these activities belong broad spectrum of e-commerce related businesses for example: online shopping, e-banking etc. Internet services add to GDP but also become a key platform for the third stage, where the Internet´s impact spreads much broader to virtually all activities in all sectors of economy.

This dynamic co-existence of these industries can be than observed at the aggregated macroeconomic scale in terms of a higher rate of economic growth. Following picture depicts dynamic impact of the internet, economic growth and different activities during time as demonstrated in the diagram below (Figure 20).

Figure 20: Dynamic impact of the Internet



Source: (OECD Digital Economy Papers, 2013, p. 33)

This approach also assesses the net effect of the Internet in the economy. Introduction of the Internet often results in displacement of economic activities from the off-line environment to the online environment. Indeed, numerous industries observe dynamic introduction of the online channel of distribution that are paralleled with the reduction of importance of the traditional offline channels. This approach considers only the net change, i.e. the net surplus in added values generated by the internet.

3.1.4 Approach 3: Indirect impact of the internet

Based on OECD research (OECD Digital Economy Papers, 2013, p. 41) third approach cover the economic impact of the Internet that reaches beyond the GDP. It studies two main areas of impact:

- The impact of the Internet on consumer surplus, and
- The broader welfare gains generated thanks to the Internet.

There are many types of interactions on the Internet. These interactions arrise within the market and non-market environment or within a combination of the two. Market interactions involve transactions between buyer and sellers of a product or service and are characterized by a price and market-clearing mechanism. Some of these transactions are captured by traditional measurements of economic activity in national account systems and, therefore, can be measured by both approaches mentioned previously (approach of direct impact of the Internet and the dynamic impact of the Internet).

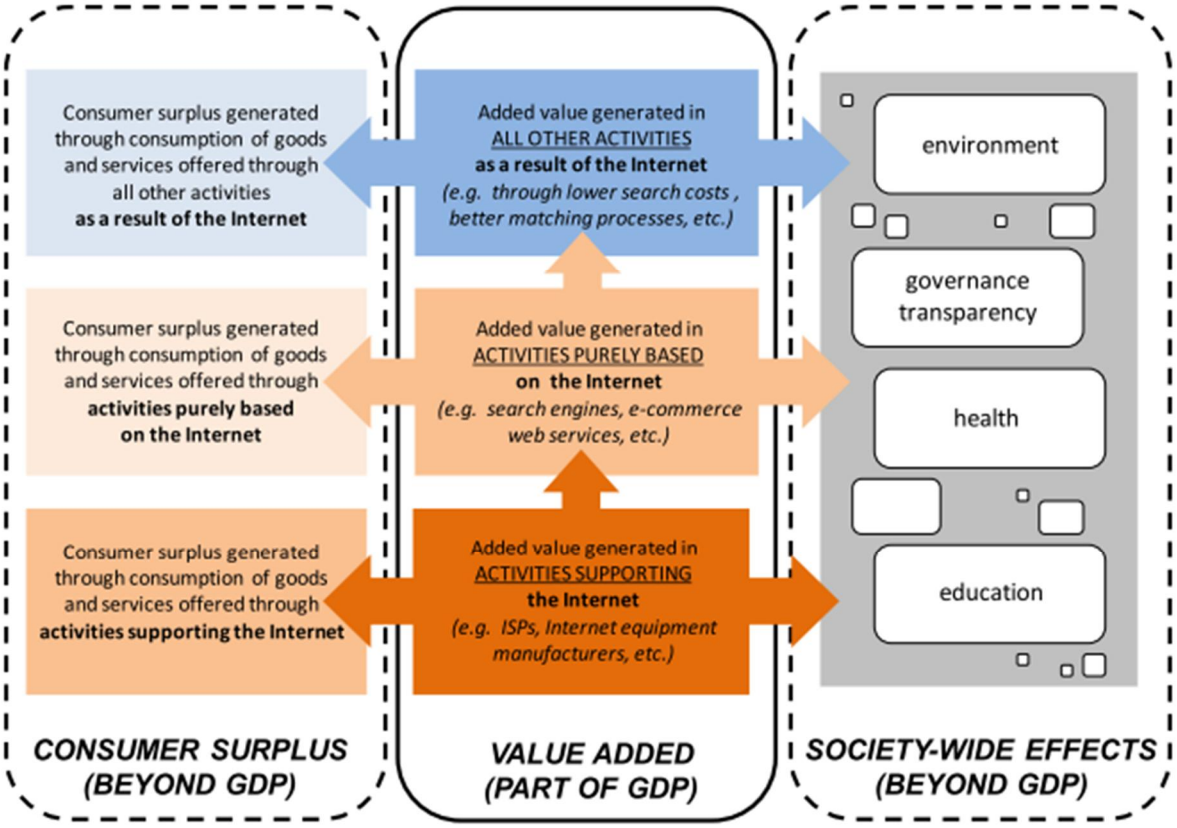
The Internet´s effect on market transactions has been huge, its impact on non-market interactions is even bigger. These interactions and impacts contribute to individual utility and the prosperity of the entire society. But this is not captured within the traditional measure of national accounts. The economic impact of the Internet reaches beyond what can be measured using existing statistical data. The Internet completely changes business models and increses competition in existing markets. It also introduces new economic models and paradigms which impacts go beyond effects captured within the classical SNA framework (SNA explained in previous text).

Two broad impact areas could be distinguished in the context as diplayed:

- The posittive impact that the Internet has on consumer surplus, and
- The broader welfare gains generated thanks to the Internet

In the picture on the next page (Figure 21) we can see examples of links between consumer surplus and value added and it impacts on society in general.

Figure 21: Indirect impact of the Internet

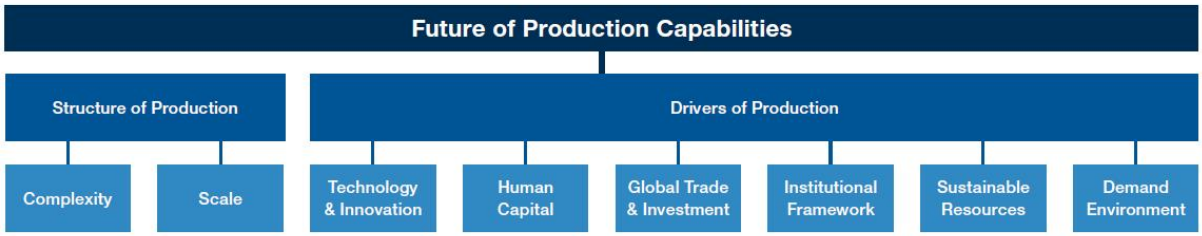


Source: (OECD Digital Economy Papers, 2013, p. 42)

3.2 Impacts on strategies and management of international organizations

To be globally competitive, preparedness of organizations for future technologies is crucial but confronts many uncertainties. The speed of change adds complexity and increase requirements for implementing successful strategies. One of the key steps in transformation is understanding the current state. Collaboration of World Economic Forum and A. T. Kearney developed The Readiness for the Future of Production Report (World Economic Forum, 2018) with focus on 100 countries and economies with more than 96% of global GDP. The report took in consideration the structure of production and the presence, or lack of the key enablers (the drivers of production) as depicted on the scheme (Figure 22) on the next page.

Figure 22: Readiness Diagnostic Model Framework

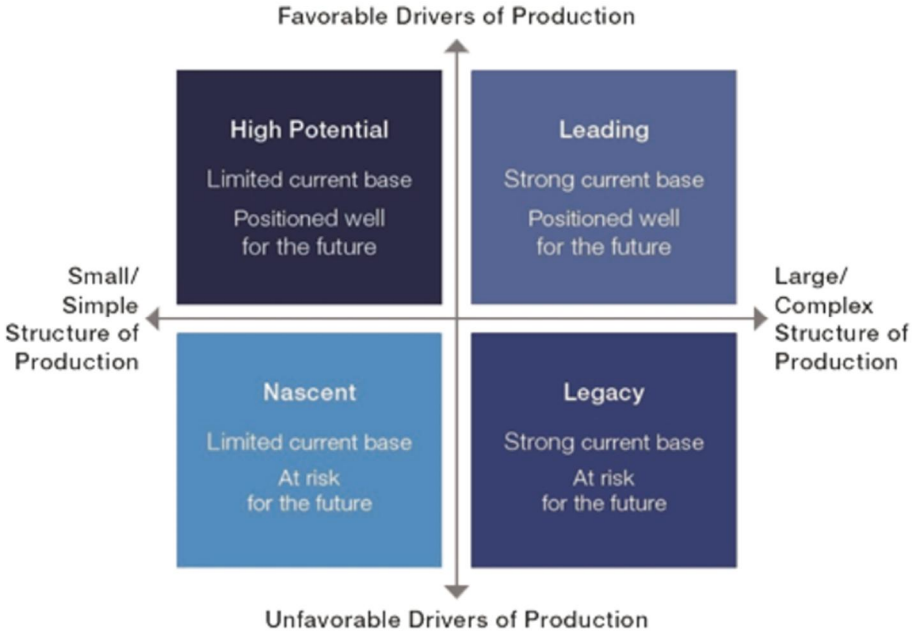


Source: (World Economic Forum, 2018)

As we can see from framework main identified drivers of production are technology and innovation, human capital, global trade and investment, institutional framewrok, sustainable resources and demand environment.

„*In the report* (World Economic Forum, 2018), *based on unique development path and production objectives of each economy, they have been placed into four archetypes based on their scores according of assesments.*“ The archetypes that emerged are depicted in following picture (Figure 23).

Figure 23: Four readiness archetypes of economy according WEF



Source: (World Economic Forum, 2018)

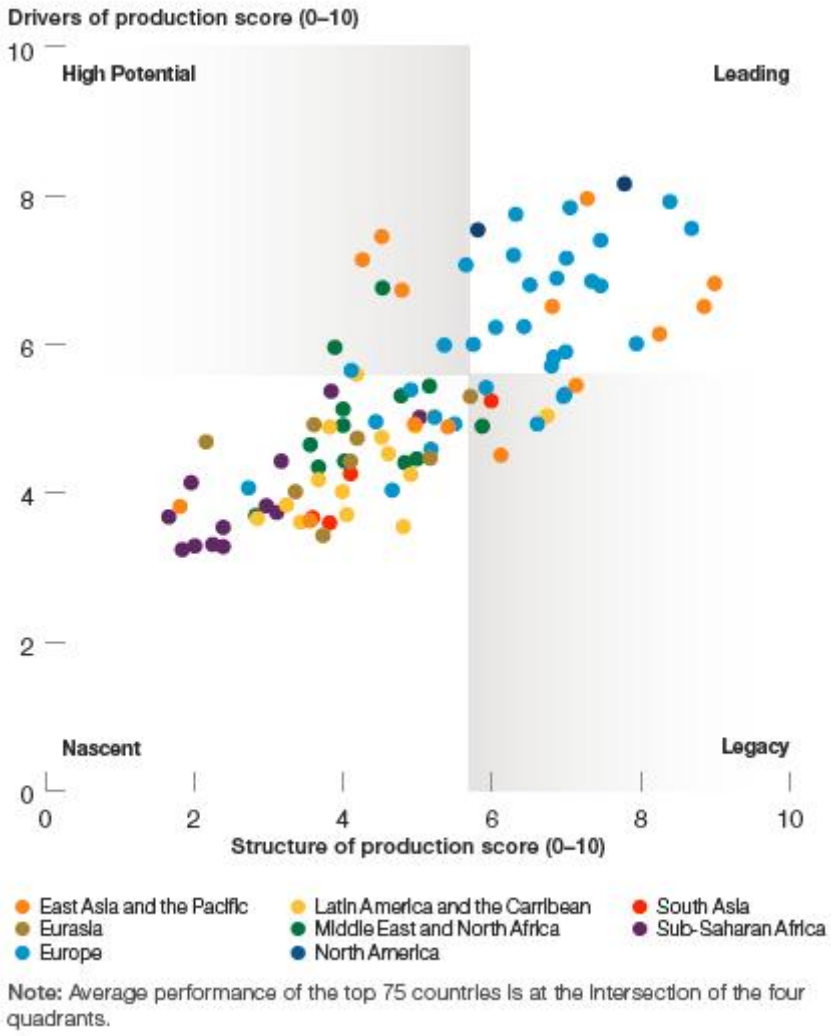
Leading archetype signals countries with a strong present production base with high level of readiness for the future and high performance in all criteria. „*These economies also posess highest current economic value at stake for future disruptions.*

Legacy archtype signals strong present production base, but with risk for the future due to weaknesses across the Drivers of Production.“

High potential economies have a limited present production base but score well across the Drivers of Production that indicates that capacity exists to increase production in the future depending on priorities within the national economy.

Nascent archetype represent economies with a limited production base today that exhibit a low level of rediness for the future through weak performance across all drivers.“ (World Economic Forum, 2018) The results of the report are depicted by Global Map of Readiness in the below matrix (Figure 24).

Figure 24: Global Map of Readiness



Source: (World Economic Forum, 2018)

Total of 25 leading economies was identified with location in Europe, North America and East Asia, together these 25 countries account for 75% of global Manfuacturing value added[3].

Majority of the economies showed a low level of readiness, 58 of them was identified as Nascent archetype, 90% of them economies from Latin America, the Middle East and North Africa, Sub-Saharan Africa and Eurasia. They make just 10% of world MVA this imply, that these economies will need high levels of investment in order to reap any potential rewards from new porduction landscape.

Into Legacy archetype fell 10 economies including India, Mexico, Brazil, Indonesia and Russia.

„Among High Potential archetype are Australia, the United Arab Emirates and 5 more countries, all of them are high-income economies and several are rich in natural resources." (World Economic Forum, 2018)

According report (World Economic Forum, 2018), each country will puruse different path of developing their economies, not all of them will pursue advanced manfuacturing. *„What is the most important is that each economy will recognize its own competitive advantages and makes wise trade-offs in forming a unique strategy that will take into account the effects of new technologies.*"

Using these data, organizations can better decide their location or where to focus activities. Based on findings from World Economic Forum, most of developed countries within the European Union should be suitable for development of new type of organizations, or transformation of current without need of relocation of activities in general. However, there is need of specific analysis fitted to each organization needs.

[3] *„Manufacturing value added (MVA) of an economy is the total estimate of net-output of all resident manufacturing activity units obtained by adding up outputs and subtracting intermediate inputs. Measurement of MVA requires appropriate demarcation of the type of economic activity and of the territory in which the activity takes place. The boundary of manufacturing as an economic activity is defined by the International Standard Industrial Classification of All Economic Activities (ISIC)."*

3.2.1 Recommended strategies and approach of management

Currently existing corporations must respond on three levels to ensure their future according Deloitte (Hallam & Gerd, 2012, p. 15):

- transforming their core business to become more efficient,
- access new revenue sources,
- develop new business models.

According to Deloitte, to become more resources effective requires timing which is difficult in fast changing markets and days when corporate executives could expect their operating budgets to increase year on year to keep pace with inflation and business growth are gone. In present market, leaders have to deliver more with less for the future to succeed.

By accessing new revenue sources as industries transform, and traditional sector boundaries shift, incumbents encounter opportunities to generate new revenue. A manufacturer, for instance may start producing software that is complementary to its goods, and telecommunication company move into areas such as home security and “carrier billing”.

Deloitte suggests organizations set to win in the digital economy share 5 characteristics:

- They invest in new capabilities over old business models
- They treasure their customer relationships
- They have become fast and agile
- They know their true competitors
- They invest in talent

Below I will focus on each characteristic in more detail. These suggestions are based on study done by Delloite (Hallam & Gerd, 2012, pp. 15-23).

New business models

Many firms can expect their core business model to be obsolete. For instance, high prices, that were once justified by high cost structures of physical assets and sustained by limited competition, are about to collapse as low cost, intense competition enters a market. Therefore, new business models have to be developed by organizations to be competitive.

Multisided business model: Offers different solutions to multiple categories of customers. For example, LinkedIn provides advertising opportunities to publishers as well as the ability for consumers to pay to promote their profiles.

Outside/In business model: This is where an organization makes its own resources available to customers. For example, the Amazon EC2 cloud service (a cloud solution sold to third parties) is based on insight developed by Amazon around the cost of maintaining a reliable, scalable infrastructure in a traditional multi-data center model.

Collaborative consumption business model: Economic model based on sharing, swapping, bartering, trading or renting access to products as opposed to ownership. A recent example AirBnB (airbnb.com) matches people seeking vacation rentals and other short-term accommodation with hosts who have an unused space to rent.

Treasure your customer

Customer relationships are crucial for any organization. Firms are often tempted to improve profits the lazy way by adding extra fees and increasing prices without enhancing the value they add to their customers.

Most sales and marketing departments now focus on online sales and digital marketing. That have impact, that every marketer is now a digital marketer, and sales models must be optimized for digital channels. Digital technologies promise radically lower cost and more effective customer service than traditional means.

Becoming agile

The pace of the digital economy is very fast and traditional corporate processes and tools are not designed for frequent and rapid decision making. Most of the investment decision tools were designed in the industrial age. As an example, Net Present Value and other risk-based return evaluation frameworks may penalize innovation and longer-term investments. These methods rarely consider the opportunity cost of not acting and leaving a new field to a competitor. Annual planning processes focused primarily on performance over the financial year and against a predetermined budget provide little room to react to the new insight and new competitors throughout the year.

Discover true competitors

Often companies forget to look beyond their traditional boundaries and therefore are in the position of missing the most important competition - substitutes. Many times, substitutes are free or much lower cost to customers than traditional products, and they tend to be written off by incumbents as “unsustainable”. In the digital economy past competitors may also become future partners, and current customers may become future competitors, as traditional value chains that were held together by physical limitations dissolve and new, networked based competition forms.

3.2.2 Changes in financial management of international organizations

In 2015, CFO Research with cooperation with SAP (CFO research; SAP SE, 2015) conducted a report based on 1,544 survey responses from finance professionals working at large companies around the world.

Composition of main intervieweed participants:

Chief financial officer (CFO) or equivalent 18%
Accounting staff 16%
Controller 9%
Chief executive officer (CEO),
president, or equivalent 8%
Chief administrative officer or equivalent 8%

Trend of evolving mandate for finance, as well as the higher expectations that other management has for their finance colleagues, are changes taking place in the global business environment. Information of all types is being generated from more sources than ever, and a company's success is being more dependent increasingly on its ability to capture that data, analyze it, and make immediate decisions under fast changing conditions.

In the report there were identified three main topics regarding how digital technologies affect financial management:

a) The shift in finance department responsibilites. Finance teams will be taking on new roles and new responsibilities as business leaders have new expectations for working more closely with their colleagues in finance.

b) The sources of success for the finance team will be in transformation how finance professional work and how they fullfil their responsibilites. There are arising new type of tools and systems helping with increasing complexity of environment.

c) Finance departments will need to response to these new expectations and opportunities. Finance professionals have to look for the ways how to expand their skills and adapt to their changing environment.

Based on interviews of exmployees from financial departments of companies, report identified main trends in finance, for purpose of my diploma thesis I picked up 8 of them.

1. Finance professionals don't see themselves standing still they expect to grow professionally and extend their reach into more parts of their companies.

To fulfill that ambition, the survey respondents expect to continue to grow professionally and make a changes. A 57% of them, expect to expand the roles they have now, taking on new responsibilities within five years in addition to their current work. 14% anticipate being promoted to a different job within five years. Only 24% expect they will remain doing the same type of work they're doing now. Almost no respondents 4%, are looking to move out of finance altogether.

2. Finance is becoming the central touchpoint for many different aspects of their enterprises.

Many finance professionals also expect their mandate to continue to expand and cover areas such as information technology, human resources, legal, and supply chain management.

Finance professionals are increasingly expecting to be closely involved with sales, marketing, and corporate strategy, as well as other activities that span the enterprise geographically and functionally.

The largest number of respondents 35% predict, that the information technology function will come under their purview.

3. Finance teams must adapt to a business environment in which decisions are more complex and have to be made faster.

85% of respondents agree that, over the next five years, their companies' success will increasingly depend on their ability to adapt to the rapid pace of change and greater business complexity.

For 84% of the respondents, success will also mean being able to translate the flow of data into swift and decisive action. And it's becoming harder to match the pace of analysis with the pace of information.

75% of the respondents believe their companies must get better at making effective use of much larger, unstructured data sets called „big data".

77% of the respondents cite the need for instantaneous access to a unified, comprehensive, and fully up-to-date set of financial and performance data.

4. Finance professionals want to involve forward-looking analysis and business insight.

Based on findnings 31% entered the profession expecting that they would be taking the lead in business analysis, decision making, and strategy setting for their companies.

36% expected they would at least be an equal partner with others in their companies.

Regardless of their expectations, 81% say that the finance function has gone beyond their expectations, and now plays an even greater role than they had imagined originally.

87% of respondents insist that their finance functions will need to contribute more to the kinds of high-value activities that underlie performance management across the entire enterprise, setting expectations for performance, business planning, and adjusting actions in response to changes in the business environment to ensure that the company achieves its financial targets.

Only 7% of all respondents report that their companies do not employ advanced analytics at all.

5. Finance professionals are looking for ways to gain a deeper understanding of more parts of the business.

76% of respondents report that finance now is central to the use of advanced analytics. To deliver the kinds of advanced analytics that help drive the business, finance professionals recognize that they need to understand the business. Over the years, both large and small enterprises have come to rely on their finance teams to be increasingly engaged with their businesses, providing insight and guidance.

6. Better use of sophisticated technology is important for financial proffesionals.

For example of such sophisticated technology. Converting information into machine-readable electronic formats now allows a company to generate, capture, and manipulate exponentially greater volumes of data on virtually anything: people, processes, equipment, facilities, and performance.

Today’s finance professionals agree that, within the next few years, developing very high levels of automation will be critical for managing digitalization more effectively and moving to the next level of business analysis and partnership within their enterprises.

68% of respondents expect that, over the next five years, the increasing complexity and volume of data will make more difficult for their companies to translate data into swift and decisive actions.

44% believe their finance functions currently are well equipped to produce meaningful business analysis and reporting, that can keep up with the speed of change their companies are experiencing.

79% say that their companies must develop or acquire capabilities in advanced analytics that they do not possess today. That includes sophisticated analytical tools and methods to predict outcomes, assess risk, model complex business scenarios, and support management decision making.

7. Finance professionals do perceive digitalization of information flows as the foundation for their success in delivery of advanced analytics.

Financial proffesionals know that they will need to employ all the tools at their disposal in order to keep up with the increasingly fast-paced decision-making environment and move towards real-time analytics. Simply put, they have to get better at using advanced technology to further both their companies' goals and their own careers.
Digitalization is one of the first steps on the path to real-time analytics. In today's world, digitalization and automation are accelerating the speed of information at the same time that they are swelling the volume of data available to corporate decision makers.

Finance professionals will have to take the next steps forward in their own transformation from data caretakers to information analysts, diving into this flow of data and providing insights and analysis providing guidence for enterprises toward success.

8. Digitalization and automation are more likely to be seen as opportunities to provide additional value, rather than as disruptive threats to finance jobs.

The foundation for developing advanced analytical capabilities may lie in pressing forward with very high levels of automation for finance processes effectively automating many, if not

all, of the accounting, compliance, reporting, and transaction-processing activities that currently absorb the finance function's time and attention.

If automation will be successful, many of the survey respondents say that their finance functions can have be significantly more devoted for higher-value work, and they can become more involved with their colleagues from the operating or business units.

Ultimately, this evolution giving rise to sophisticated, on-demand reporting and highly advanced, predictive analytics will become the basis for solidifying and strengthening the position of importance that the finance functions of the future will command at their companies.

They see the increasing automation of financial processes enabled by digitalization, as an opportunity, rather than a threat.

72% of respondends believe that automating more finance processes actually would raise the finance function's importance within their organizations.

They see automation as allowing them to meet some of their goals that includes becoming more involved with operating or business units and having more time available for higher-value work.

67.5% acknowledge that, to take full advantage of automation, their finance functions will need to develop new skill sets and capabilities that hadn't been required before.

Connection to international organization practice

Nowadays, big organizations are using complex systems such as provided by SAP, Oracle, Microsoft in management practice. To connect with practice I chose to refer to the SAP insights.

According the SAP report (SAP SE, 2016), the finance processes and technology platforms of the last decades are obsolote for the digital economy. New business models can't be held back by disconnected processes and legacy technologies, and enterprises can't wait until the end of the month to see results, or for the annual budget cycle to make investment decisions.

Based on the report many technology trends have matured and are radically changing finance I will mention few from the report:

Hyperconnectivity is creating opportunity and eliminating work across finance. Every consumer, every supplier, every partner is connected, disrupting all the established processes and rules around finance.

Supercomputing enables networking and in-memory computing allow for on-the-fly analysis, dynamic planning and simulation, real-time situational and risk awareness, and infinite new business models.

Cloud computing allows for rapid technology adoption at reduced cost. Business-to-business (B2B) transactions are moving to new cloud-based collaboration platforms, where millions of businesses and users are connected. The lowering of barriers to entry results in faster innovation times for finance and business.

The digital economy is replacing products and services with outcomes. For finance, managing profitability and working capital becomes indeed precise. With embedded sensors, robotics (automation), and artificial intelligence, today's financial systems eliminate the mundane and allow to focus on the highest value-add outcomes.

Cyber securirty couple with trust as trust remains the ultimate currency, giving security-focused businesses a significant advantage in brand reputation. Cyber criminals have expansive new capabilities to attack, undermine, and disrupt businesses. Today's fraud detection capabilities manage this risk and provide holistic views into real-time business exposures.

The primary focus of financial planning and analysis will be on strategic modeling and analysis to take advantage of predictive capabilities and real-time analytics. Finance will move from historically cumbersome annual budget cycles to rapid investment review cycles.

New concepts in accounting and tax. For example "soft close" and real-time financial analysis through continuous monthly processes. Enterprise-wide visibility allows for optimization of tax payments and regulatory compliance.

In treasury proactive cash flow management aided by business networks. Real-time views of currency, country, and commodity risk are managed as complex enterprise exposure.

Automation of majority of finance process, rapid development and automation of new processes to support evolving business models. This requires highly specialized skills required for exception handling and complex topics.

Risk and compliance with core compliance automated, focus turns to protecting the brand. Enterprise risk topics become a focus while business networks provide visibility into supplier and credit risk.

A new generation of ERP solution, running in real time, integrating predictive, Big Data, and mobile, will change how offices of the CFO work, how the business is run, and how information is consumed.

3.2.3 Industry 4.0 and Internet of Things impacts and strategies

The book Building the Internet of things predicts that the Internet of Things (IoT) will change organizations unlike anything before. Predictions are that it will change organizations more than business process reengineering (BPR), Six Sigma, lean manufacturing, agile computing, or any of the other business concepts. (Kranz, 2017, p. 13)

To better understand how company can benefit from implementation of IoT I chose for demonstration Harley Davidson company. This company focuses primarily on production of motorcycles. Harley-Davidson's strategic business outcomes from the IoT-induced changes in one factory:

- Eighty percent faster decision making due to workforce enablement
- Dramatic reductions in costs and set-up time
- Continuous asset management, enabling even better decision making
- 6.8 percent increase in production throughput due to asset tagging
- Ten to 25 times improvement in build-to-order (BTO) cycle times (18 months reduced to two weeks)

- Seven to 12 percent increase in IoT automation-driven equipment utilization
- All of this led to a profitability increase between 3 and 4 percent. (Kranz, 2017, p. 15)

Which company can be classified as IoT generation company and is better way towards success? According Kranz it is company that embrace open standards, open collaboration, open communications, and open, flexible business models and if company is willing to assemble a comprehensive partner ecosystem to build and deploy agile, flexible business solutions. Kranz mentions that IoT presents an opportunity for every organization. Even small and midsize enterprises can participate. Winners will transform their businesses based on open standards and build ecosystems of partners to deliver vertical solutions based on horizontal capabilities.

On the other hand, companies that will probably emerge as losers, will insistently stick to the old ways of doing business or try to do it all themselves. Losers will ignore changes and stick to their old business models based on proprietary or semi-proprietary technology and ensure customer lock-in until those customers steadily abandon them and ultimately destroying whatever value they initially delivered. (Kranz, 2017, pp. 17-28)

That applies to all types of organizations businesses, governments, and non-government, as these are scrambling to figure out how they must adapt to thrive in this new world. (Kranz, 2017, p. 24) Also, Kranz predict that some economic sectors will experience a renaissance for example manufacturing and the rest of the "maker" movement is already an early beneficiary; for the first time in generations, young people popularly referred to as Millennials—are being attracted to manufacturing. (Kranz, 2017, str. 29)

Important to IOT implementation is strategy and the desire to explore and adopt IoT concepts, without it there are possible three outcomes:

1. Being surpassed by competitors with new approaches to business, new business models, and go to market strategies
2. Losing good people who, in effect, evacuate what they see as a doomed ship
3. Being abandoned by customers who are attracted to the value and advantages IoT brings. (Kranz, 2017, p. 40)

3.3 Social impacts

This chapter focus on questions as: How digital transformation brings a positive or negative outcome to society? What are dangers and challenges of new trends in economy. What key questions should organizations ask to be responsible and involve in general welfare of society?

Challenges

Paragraph from study of World Economic Forum, Understanding the impact of digitalization on society (World Economic Forum, 2016) describes challenges with relation to transformation of organizations, stresses importance of coherent strategy, accelerated speed of changes and potential income inequality: *"Digital technologies fundamentally transform organizations, with the pace of technological change exacerbating the challenge. Organizations must have a coherent strategy that includes a plan to reskill workers. Whereas previous technological revolutions (most notably the industrial revolution) played out over a relatively long period of time, the speed of digital transformation is such that businesses need to move quickly. For governments, the challenge is equally pressing. The potential inequality and wage deflation or even social unrest requires urgent action to prepare the workforce for a digital future."*

3.3.1 Positive and negative impacts on society

According World Economic Forum, Digitalization could create up to 6 million jobs worldwide between 2016 and 2025 in the logistics and electricity industries. "*On the other hand, current estimates of global job losses due to digitalization range from 2 million to as high as 2 billion by 2030. With both winners and losers resulting from digital transformation, a huge premium rest on the near-term ability of businesses to upskill employees and shape the next generation of talent for the machine age.*" (World Economic Forum, 2016)

This trend is called technical unemployment. As technological improvement accelerated in recent years capacities of machines and computers became sufficient for plenty of jobs, especially jobs which do not require qualification or special skills, representative of this group could be routine jobs. Technological progress forces people and businesses to adapt and keep pace. As a key role in this advancement play governments it is important to think and mitigate risks and create new opportunities. In the report from the University of Oxford term

technological unemployment is more precisely explained as unemployment caused by new technologies that replace humans. (Frey & Osborne, 2013)

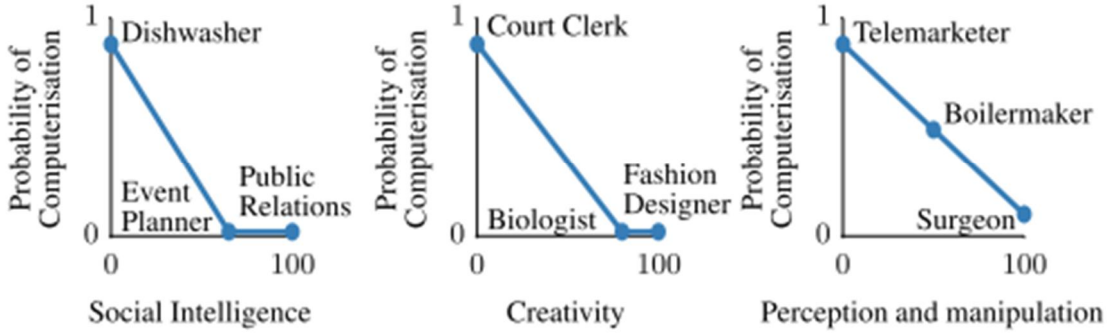
Based on the findings from Jill Wong working for World Economic Forum, up to 47% of jobs could be automated in just a decade or two. The potential scale of the disruption created by technological developments requires that organizations and governments think deeply. Technological innovation in recent years has made computers, robots and software so sophisticated that machines are now able to recognize patterns and generate insights being used for fraud detection, medical diagnostics, legal research, and auditing and many more activities. (Wong, 2017)

Katz and Murphy stress that at the same time, with falling prices of computing, problem-solving skills are becoming relatively productive, explaining the substantial employment growth in occupations involving cognitive tasks where skilled labor has a comparative advantage, as well as the persistent increase in returns to education. (Katz & Murphy, 1992)

"*The impact of digitalization has also acted positively as a catalyst for employment growth in the wider economy. In India, for example, it is estimated that three to four jobs are created for every job within the business process outsourcing and IT-enabled services sectors. The digital revolution has created new roles (such as search engine optimization managers and social media account managers).*" (Tholons, 2011)

A sketch (Figure 25) on the next page shows of how the probability of computerization might vary as a function of bottleneck variables below, presents probability of computerization of work based on three dimensions: social intelligence, creativity, perception and manipulation.

Figure 25: The probability of computerization of specific occupations



Source: (Frey & Osborne, 2013, p. 28)

The probability of an occupation being automated can thus be described as a function of these task characteristics. As apparent on above sketches, the low degree of social intelligence required by a dishwasher makes this occupation more susceptible to computerization than a public relation specialist. We can examine the susceptibility of jobs to computerization as a function of the above described non-susceptible task characteristics.

"*The future of work categorized by the percentage of codifiable tasks within the role:*

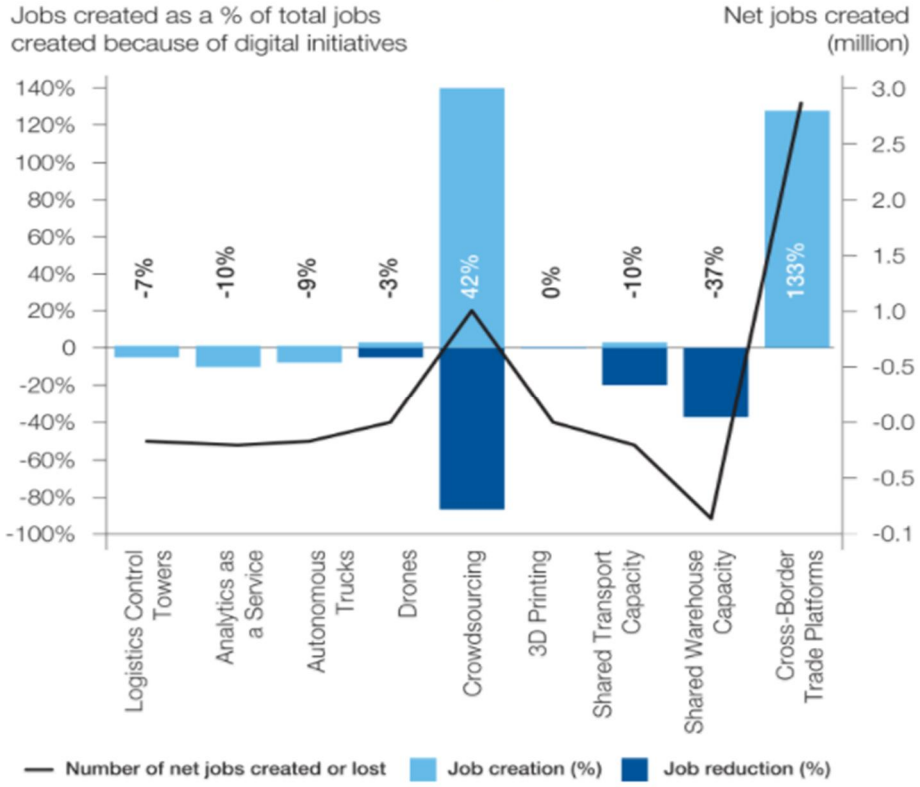
- *Those that will disappear (lost the race against the machine). For example, clerks and administrative staff, or truck drivers.*

- *Those that are in collaboration with machines / algorithms (run with the machine). For example, those professions that rely on cognitive and social capabilities, such as doctors / surgeons.*

- *Those jobs that are completely new or remain largely untouched (running faster than the machine or running a different race). For example, roles in the creative arts are unlikely to be automated, as are new roles that involve managing data and machines.*

There will be both winners and losers." (World Economic Forum, 2016) Graph on the next page (Figure 26) shows as an example projected net job creation in logistics.

Figure 26: Projected net job creation from digital initiatives in logistics (2016-2025)



Source: (World Economic Forum, 2016)

Digital initiatives will as projected by WEF positively affect job creation within cross-border trade platforms (projected increase of 133%), negatively shared warehouse capacity (decrease by 85%) and shared transport capacity (decrease by 40%).

3.3.2 Implications for international organizations HR strategies

The Centre for Strategic Futures, a think-tank within the Singapore Government, and the Ministry of Manpower in Singapore (Wong, 2017), are conducting a study to explore some of these issues.

One question the study has raised so far is whether some professions might face “broken career ladders”, where entry-level workers no longer have a clear path for career progression because the tasks they would traditionally perform to progress have been automated.

For instance, entry-level tasks in professions such as law and accountancy, e.g. basic research and cleaning up financial data for processing, can be automated more easily than higher-order

cognitive tasks, such as framing and solving problems or making judgements, performed by more senior professionals.

For example, the automation of cognitive tasks can transform auditing, allowing for real-time audits. Current auditing rules in some countries require all suspicious transactions spotted during an audit to be investigated in detail. Such a rule works today because human auditors pick only a sample of documents to audit, rather than going through their clients' entire database of documents, which results in a manageable volume of suspicious transactions to investigate.

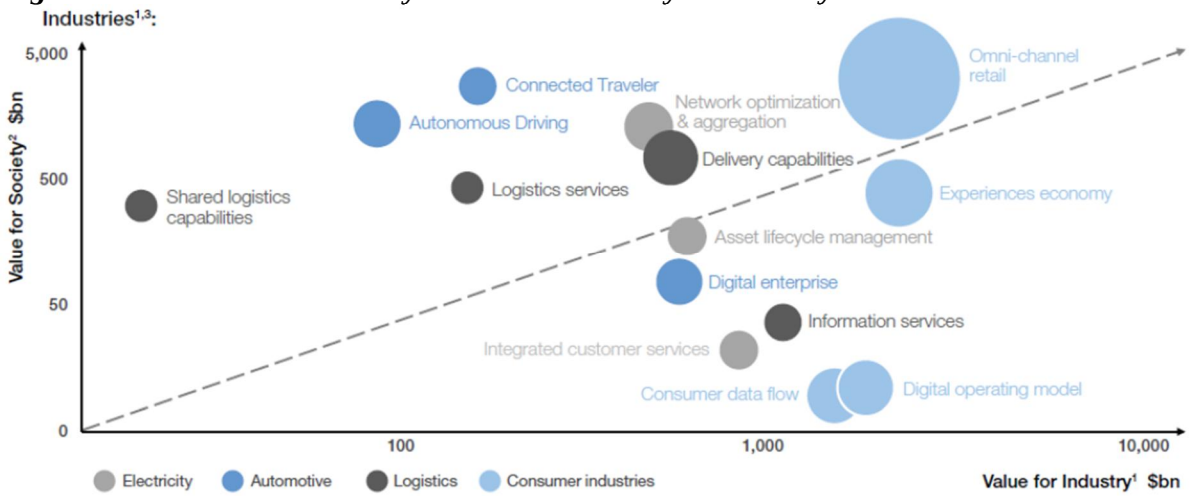
However, because it is likely to throw up many more suspicious transactions and impose an overly onerous burden on both the auditor and its clients, having such a rule means auditing firms are unlikely to use algorithms for their audits even though they can potentially make a chief financial officer's job easier by providing real-time analysis and insights into an organization's financial health.

3.3.3 Value to society and to Industry

The World Economic Forum analysis of Societal Implications of economy transformation considered sample of industries and range of indicators such as: "*jobs, carbon emissions, lives saved and consumer benefits, serving as a proxy measure for emerging value to society. According WEF, in aggregate terms, these represent a cumulative combined value opportunity of 21.2 trillion dollars for both industry and society between 2016 and 2025, with potential gains to society 12.7 trillion exceeding the potential value for industry 8.4 trillion dollars. Scaled up beyond the industries analyzed, this could mean a potential value opportunity of as much as 100 trillion dollars by 2025 on a cumulative basis*." (World Economic Forum, 2016)

The World Economic Forum value at stake analysis of combined value to industry and society steaming from digital initiatives across four industries from 2016 to 2025 is depicted on the following image on the next page (Figure 27).

Figure 27: Value at stake analysis value to industry and society



Source: (World Economic Forum, 2016, p. 5)

From above graph (Figure 27) we can see which industries deliver higher value for society and for industry. According this analysis top industries adding value to society include omni-channel retail, autonomous driving, logistic services. More value for industry is assigned to consumer data flow, digital operating model, digital enterprise, information services, that means initiatives that are focused on company processes.

According WEF: "*digital initiatives are projected to deliver high value to business and society. This 'true north' means that no intervention is likely needed to realize those benefits as the industry has a clear incentive to act of its own accord. For example, omni-channel retail is likely to deliver such huge benefits to industry, estimated at $1.4 trillion and to society from a $5 trillion reduction in costs and productivity improvement, amounting to 300 billion hours saved, that there would appear to be little need for intervention.*" (World Economic Forum, 2016, str. 11)

Value-at-stake methodology

Value-at-stake is a framework designed by WEF (World Economic Forum, 2016, p. 12). "*For assessing the impact of digital transformation initiatives on the industry, customers, society and the environment. It provides a differentiated and evidence-based understanding of the extent of impact that digital transformation will have on selected industries, and where potential value creation opportunities exist. It provides likely value estimates of global industry operating profits that are at stake, from 2016 to 2025, and the contribution that digital transformation can make to customers, society and environment in that time frame.*"

Industry value

Value-at-stake for the industry is composed of two elements.

"*First element, the potential impact on an industry's operating profits that will be generated because of the digital initiatives (value addition).*

Second element, operating profits that will shift between different industry players (value migration)." (World Economic Forum, 2016, p. 12)

Value to society

"*Value-at-stake for society includes three elements: customers, society and the environment. Each element is measured as follows:*

1. Value impact for customers: the potential gain to customers (both B2B and B2C) in the form of cost and time savings, discounts and ability to earn additional profits (for B2B customers only).

2. Value impact for society: the impact (both financial and non-financial) of digital initiatives on productivity gains, jobs, reduced traffic congestion and lives saved.

3. Value impact on the environment: the estimated impact of the digital initiatives on increasing or reducing CO 2 emissions." (World Economic Forum, 2016, p. 12)

Approach

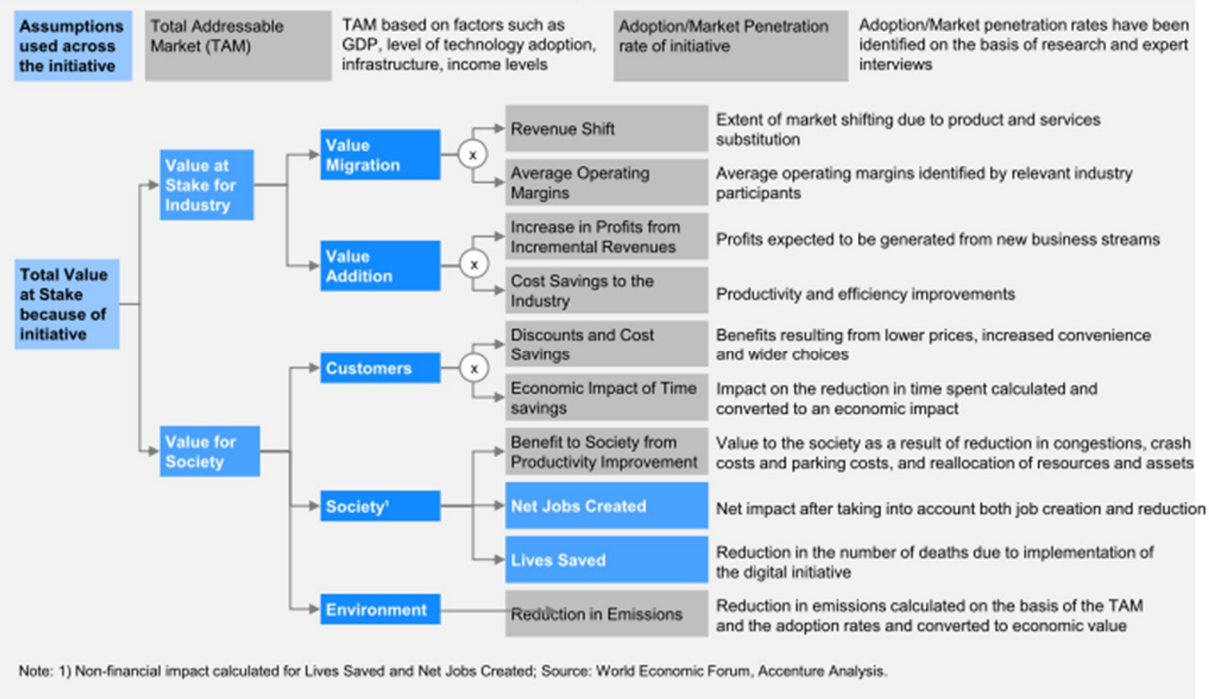
The value-at-stake has been calculated by WEF (World Economic Forum, 2016) using a top down approach involving three key steps:

"1. Identification of the total addressable market and the adoption/penetration rates over the next 10 years for each digital initiative based on secondary research, industry reports, existing use cases and interviews with subject and industry experts.

2. Creation of a value tree to represent the different industry and society value categories mentioned above.

3. Testing, revision and validation of assumptions and results with academics, economists, DTI working group members and select industry partners of the World Economic Forum."

Figure 28: The Value at stake, Modelling approach



Source: (World Economic Forum, 2016, p. 13)

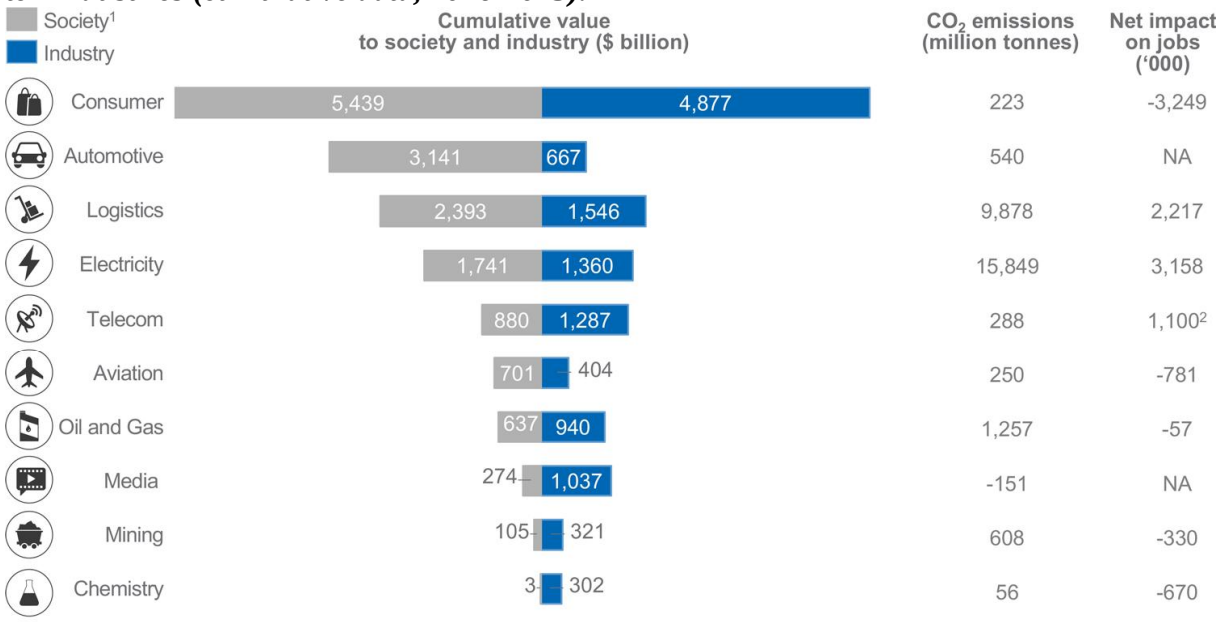
The diagram above (Figure 28) depicts individual elements of value at stake analysis done by WEF. This consists of assumptions, total addressable market (TAM), "*TAM is than based on factors such as GDP, level of technology adoption, infrastructure and income levels.*" Next level of model are actual effects, adoption/market penetration rate of initiative. Last level is focus based on research and expert interviews. "*For example, if we decompose one branch of model ending with review of reduction in emissions calculated based on the TAM and the adoption rates and converted to economic value.*" (World Economic Forum, 2016, p. 13) We start with Value for Society that is total addressable market, factor is represented by environment, measurement/rate of adoption is represented by reduction in emissions.

3.3.4 Case study: Skills Future in Singapore

To assess the combined value of digital transformation to business and wider society The World Economic Forum (World Economic Forum, 2016) looked at the potential impacts of digitalization in ten industries on both business and society. Using their value-at-stake analysis,

they analyzed the impact over the next decade of different digital initiatives across industries the results represents following picture (Figure 29).

Figure 29: The combined value to industry and wider society of digital initiatives across ten industries (cumulative data, 2016-2025).



Note: [1] Total societal value at stake includes impact on the customers, society and environment. Impact on external industries has not been considered. [2]Excludes Extending Connectivity digital initiative.

Source: (World Economic Forum, 2016)

From the picture (Figure 29) we can see balance of value to society and industry in billions of USD in period from 2016 – 2025. The highest total amount of value out of 10 industries is projected to consumer segment of 10,316 billion USD with prevailing value to society, followed by automotive industry in total of 3,808 billion USD also with prevailing value to society. Sectors in which industry benefits more are telco, oil and gas, media, mining and chemistry.

Projected highest CO2 emissions production relates to electricity industry followed by logistics. Net impact is negative in consumer sector, mining and chemistry. Highest positive impact is projected within electricity and logistics industry, this affirm that logistics industry should provide growth of demand for labor. Based on these data, we can deduct how big is impact of digital transformation to business and wider society throughout value added expressed in monetary value.

3.3.5 Key questions for businesses and policy-makers

Based on the research done by WEF (World Economic Forum, 2016, p. 6) I selected key questions that should companies and policy makers ask themselves to align their strategies with corporate social responsibilities and endeavor in sustainable entrepreneurship. These practices should be based on principles of voluntariness, cooperation with all stakeholders, systematic and long-term approach in all activities of a company. I added questions based on triple-bottom line framework as presented in book Cannibals with Forks: The Triple Bottom Line of 21st Century Business written by John Elkington (Elkington, 1999). This framework includes three domains: economic, social and environmental. In my diploma thesis I cover only social domain.

For businesses

Are you aware of the value added for society from your digital initiatives?

Are you creating conditions for employees to harmonize their work-life balance?

Does your company assist in developing human capital of employees?

Does your company respect principle of non-discrimination and helping in employment of minorities or endangered groups of people?

"Are you able to measure and track the socio-economic impact of your future digital initiatives?"

"How can you incubate digital initiatives that could in future deliver a high value to society and your business?"

"Is your corporate affairs / social responsibility function suitably aligned with your corporate strategy team?"

Do you have processes for measuring, reporting and auditing ethical and social conditions within your company?

For policy-makers and regulators

"To what extent do you understand how industry-led digital initiatives could help you achieve specific policy objectives and targets?"

"What policy tools could you use to incentivize industry towards digital initiatives that deliver value to society?"

"Are you taking sufficient steps to digitize your own organizations?"

"Do you have the right digital skills and talent in place?"

"*How can you learn and exchange lessons from the experience of private sector organizations?*"

3.3.6 Role of government and education

It is very important that government will help mitigate the risks and create new opportunities. This can be made through requalification, incentives, dotation's and other tools. It is crucial to develop new disciplines within education system to ensure that there will not be gap between what is required by market and what is teach.

In 2000 at a summit in Lisbon, European Union set the goal of making Europe the most competitive and "dynamic knowledge-based economy in the world." (European Parliament, 2010, p. 32)

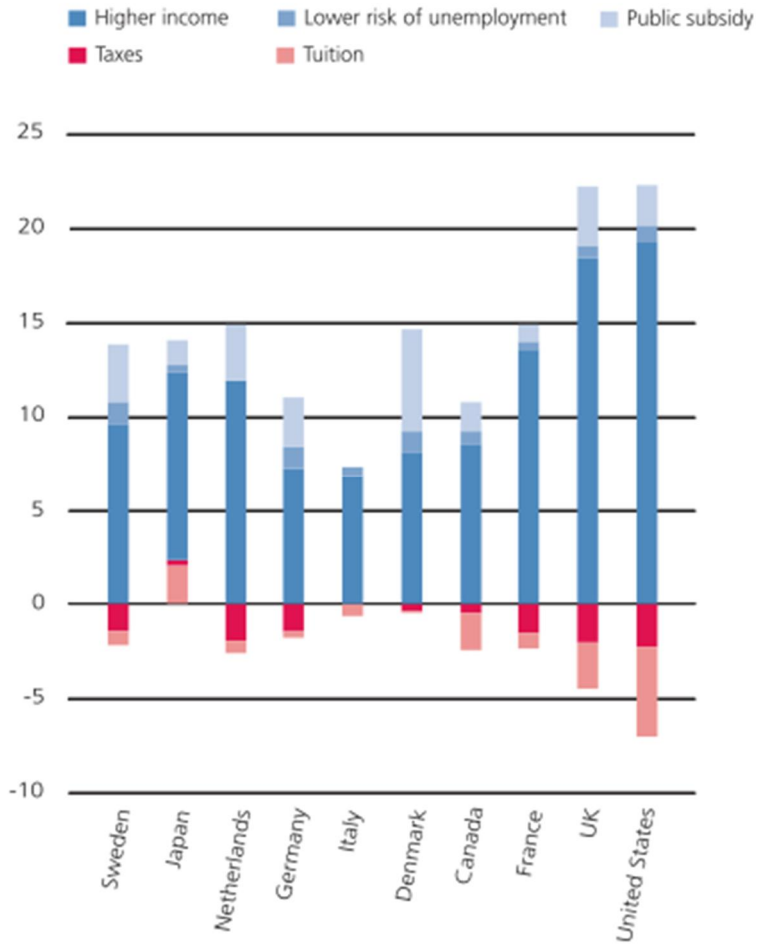
The most progressive modern economies will be those that produce the most information and knowledge – and make that information and knowledge easily accessible to the greatest number of individuals and enterprises. Europe does not compete with countries that offer low-skilled work at low wages, nowadays countries such as China and India are becoming to deliver high skills at low costs. Also barriers to entry to entry global markets are falling. Companies and individuals are able to collaborate and compete globally, regardless their location.

In the new digital economy, education plays essential role, „education pays off always“. Evidence shows that countries and continents that invest heavily in education and skills benefit economically and socially from that choice long-term. „For every euro invested in attaining high-skilled qualifications, tax payers get even more money back through economic growth. this investment provides tangible benefits to all of society – and not just to the individuals who benefit from the greater educational opportunities.

European school systems must learn to be more flexible and effective in improving learning outcomes, more effective and more easily accessible to a wider range of people to create new opportunities.

The graph below (Figure 30) visualizes returns of education compared to tax transfers of society for and individual obtaining a university-level degree from an upper secondary and post-secondary non-tertieary level of education as a male.

Figure 30: Returns of education compared to tax transfers



Source: (Schleicher, 2006, p. 3)

Graph shows clearly that education provides significantly more benefits to individuals than it is its cost in all analysed countries.
Schleicher in hist study, Why education is key for Europe's success (Schleicher, 2006, p. 4), provides recommendations to transform education to be more effective:

1) *„Creating and maintaining diverse system,*

2) *sustainable and high-quality educational institutions with the freedom to respond to demand and accountable for the outcomes they produce,*

3) *ensuring that the growth and development of tertiary educational systems are managed to improve access, raise quality and enhance equality*

4) *implementing financing and student-support policies which mobilize public and private funding in ways that better reflect the social and private benefits of tertiary education*

5) *encouraging universities to evolve so that their leadership and strategic management capacity matches that of modern enterprises, with appropriate strategic, financial and human resource techniques to ensure long-term financial sustainability and accountability requirements,*

6) *ensuring that universities are governed by bodies that reflect a much wider range of stakeholder interests than the academic community.“*

Schleicher also streses that Europe must ensure that the growth and development of tertiary educational systems are managed in ways that improve access and enhance quality such as utilizing appropriate strategic, financial and human-resource management techniques. And that the university system itself must be governed by bodies that reflect a much wider range of stakeholder interests than the academic community.

Examples of questions for government

In report The Impact of Automation on Jobs and Society What Role Might Governments Play, (Wong, 2017) stresses questions that should governments consider, such as:

What are the new job opportunities that may emerge?

What regulations impede and encourage the adoption of automation, artificial intelligence and/or analytics?

How a government approaches the ethical and legal implications of technologies like autonomous vehicles (AVs)?

Should governments be bold in encouraging innovation, whilst helping the “losers” take part in the broader improvements – or at the least helping to buffer them from the downsides?

These are just exemplary questions, that governments should tackle in order to improve their public services and aid society in uncertain environment of fast changing economic environment as government and role may increase to provide stability to society.

Conclusion

First chapter of the thesis was focused on the digital economy innovations and Industry 4.0. In the thesis it was demonstrated, that these new technologies are already making significant changes in economic system and have impact on strategies and management of international organizations. Digital phenomenon of digital currencies and blockchain technology shifted attention of many people and organizations. All data quoted in the work confirmed the growing importance of the digital economy and Industry 4.0 technologies supported by statistical data of increasing sales in e-commerce, market capitalizations of internet companies and analysis of value added done by many trustworthy authorities. Currently the leading countries within scope of the digital economy are the United States of America, China and very well-prepared countries of the European Union. Among them Germany and the Czech Republic which were also highly ranked in the studies.

Identified main trends within Industry 4.0 are mainly innovations in manufacturing. Significant is trend of shift from centralized manufacturing to decentralized interconnected systems, such as smart grids, autonomous automobile systems, remote medical monitoring, process control systems, internet of things and mass customization. The main benefits of innovations in manufacturing are primarily an automation of existing processes in labor intensive industries and mass customization that enables benefit of variability of products, as well as individual personalization. IOT technologies allow products differentiation and add on attractivity for customers. As for example car with smart functions, internet connection etc., can be perceived as product with higher value for today's customers. IOT implementations add value in wider range of sectors, not only in manufacturing or automotive industry. For example in health care, real-estate, retail environments, offices, vehicles, cities.

However, there are still some obstacles of implementation of IOT technologies. This relates mainly to technical obstacles, security threats, cultural and regulatory questions.

First chapter was also dedicated to analysis of Germany and the Czech Republic level of competitiveness in the era of the fourth industrial revolution. Based on the findings of The United Nations Industrial Development Organization, Germany is highly competitive and ranks top among all researched countries, with its advanced manufacturing industry base and as well leading the industrial production research and development. The Czech Republic either

ranks high in the Competitive Industrial Index with ranking 18 out of 148 researched states. UNIDO analyzed either development of production and trade structure of both countries in period from 1995 to 2014. This analysis showed, that both countries have strongly improved in the share of manufacturing value added in a total GDP and share of medium and high-tech value added in a total manufacturing value added.

Last part of the chapter focused on Germany strategies and initiatives connected with the Industry 4.0. Germany engaged in creation of national high-tech strategy in 2006 and successor strategy High-Tech Strategy 2020. These strategies represent national concept to bring key innovations and technology involved parties together, in a common goal of improvement new technologies. This successor initiative goals are to continue to improve condition for innovation within fields of climate, energy, health, nutrition, mobility, security and communication.

Other significant programs initiated in Germany include Agenda CPS, ICT 2020 and CyProS. "*The Agenda CPS objective is to establish an integrated research agenda that allows Germany to shape this technological revolution as a lead market and provider in competition with other industrial and technological players.*" Research of ICT 2020 orientation is directed on ICT within context of new business processes, complex systems, production methods, the IOT, services, software systems and knowledge processing. "*CyProS research project consists of a group of participants from science and industry, purpose of this consortium is to research and develop a representative spectrum of cyber-physical system modules for production and logistics systems for industrial use. This initiative is supposed to equip Germany to become the lead user and provider of such systems."* (Bunse, Kagermann, & Wahlster, 2014)

It is evident that Germany is very active in research and application of new technologies and has many projects going on. Germany set up detailed strategies on how to be ahead and has strong vision to become a leader in the field. Together with Germany already good manufacturing base, it is very presumable, that it will achieve stated goals. Germany approach may serve as good inspiration for other countries to improve their approach to new technologies and remain competitive. As these initiatives are very complex, it would be too long to present all of them in the detail, so this overview can serve as reference to further exploration.

The second section was dedicated to digital payment systems. I firstly introduced standard payment systems such as SWIFT, IBAN and SEPA to provide basic understanding what are

current payment systems, how they work and what are used for. Then I followed up with concept of cashless society, which was allowed by recent technological changes and improvement of payment means. This led to possibility of having higher financial disposals with better security and faster exchange for everyone, thanks to credit/debit cards, digital payments systems, touchless technologies, payments by mobile phones or controversial digital currencies. Nowadays, cashless payments are ordinary among people in the European Union as demonstrated on statistical data. Data showed, that Italy, Spain and Greece are countries, where people used cash most frequently and are above average in the Eurozone. The lowest rate of card usage was in Malta. On the other hand, the highest frequency of card usage was recorded in Netherlands, followed by Estonia and Finland, these countries also have low frequency of cash usage.

Cash had become even actively disfavored in some countries, because to its ease of use in money laundering and financing of terrorism. Use of cashless methods eliminates these risks significantly.

Generally, volume of cashless payments in the European Union increased during period from 2000 to 2015 approximately twice the time, with steady increase every year. Trend is clearly heading towards cashless transactions. Interesting is fact, that in Estonia this trend is significantly stronger and during period number of cashless payments increased approximately fivefold. Estonia is the leading country in this trend of emergence of cashless society.

One of the most well-known trend from media are digital currencies. Briefly, digital currency differs from a physical money as it exists only in an electronic form and it is intangible. Digital currency stores value, serves as medium of exchange and measures value in the electronic form. At present, data suggests that digital currencies are used by relatively few people compared to majority of population. For these people, as researchers show, digital currencies are primarily viewed as stores of value. Data also shows, that there is a consistent increase of ATMs from January 2016 to January 2018, change totals 1505 new ATMs. That makes average of 62.7 ATMs per month. This supporting growth of infrastructure may lead to constantly bigger adaptation by general public.

Against digital currencies stands the fact, that most of current digital currencies are characterized by huge fluctuations, therefore, it is impractical to use them as reliable unit of

account and stable store of value. For instance, retailers that quote prices in bitcoins usually update those prices at a high frequency and currently, there is rare evidence of any digital currency being used as a unit of account.

Economic theorists suggest, that social welfare would be lower in a hypothetical economy, based on a current form of digital currency model, as deflation and inability of the money supply to vary in response to demand could cause volatility in prices with negative effects on economy. However, simple example of solution would be a rule in which the money supply would be permitted to grow at a constant rate per year, similar to that advocated by Milton Friedman.

Next current major obstacles to the widespread usage of cryptocurrencies include: general unfamiliarity with the technology, the insufficient user-friendliness of applications associated with day-today use of the schemes, the increased need for personal security compared to deposits held with regulated institutions. Digital currencies are also connected with many criminal activities such as operations on black market, evading taxes and fraud.

Digital currencies represent both innovations in payment systems and a new form of currency, but it is more unlikely that as currently designed would be used as the predominant form of money in near future. In the case of wider widespread of digital currencies, it is important to monitor situation by international organizations, especially governments and regulators. Digital currencies may also affect financial management of organizations with new additional possibilities of diverse transactions.

Subsequent trend to digital currencies is a blockchain technology, a general ledger of all transactions made with cryptocurrency. The potential benefits of the blockchain are more than just economic, they extend into political, humanitarian, social, and scientific domains and the technological capacity of the blockchain is already being harnessed by specific groups to address real-world problems. Blockchain also enables function of smart contracts and new business models to be utilized by international organizations on all levels of organization.

Researches show that currently, blockchain usage is dominated by finance sector followed by government and public sector. This result could be anticipated, as origins of blockchain lies in finance. Level of usage by healthcare and media is approximately similar in this sample.

Manufacturing and energetical sectors don´t use blockchain as much as other sectors yet, but this can change in the future.

Consequential are difficulties that are connected to a blockchain technology. Blockchain is characterized by growth of its size as more transactions and data are saved in the system. This leads to problems such as too big requirements on storage capacities, therefore high demand for computational power and lower transaction speeds

There are also challenges how governments will regulate blockchain and could be one of the most significant factors and risks to blockchain industry. One issue is practical impossibility of carrying out taxation with current methods of taxation. A decentralized peer-to-peer sharing economy with individuals paying for services such as Airbnb, Uber with cryptocurrencies causes traditional taxation structures non-functional.

In conclusion, it is clear, that digital currencies and blockchain nowadays are disruptive technologies and their impact is already visible. International organization need to keep up with this trend and analyze demand for services connected to these technologies.

Chapter 3 starts with research on how digital technology changes markets and how to measure the impacts. Findings from this research suggest, that the transformative nature of digital technology has implications for how we understand economic activity, how consumers behave, how firms develop competitive strategy, how entrepreneurs start new firms and how governments should approach these trends. Digitization has some features that suggest that many well-studied economic models may not work anymore.

On the topic of measuring the impact of the Internet, there is no widely accepted methodology. But given the growing importance of the Internet as a policy tool, the question about the value of the digital economy becomes relevant.

The Organization for Economic Co-operation and Development set several general approaches to measure the Internet Economy, these involve three types of classification. First, direct impact is the most conservative approach and relies mainly on official data, it measures size of the internet economy expressed as a part of GDP. Second, dynamic impact focuses on what impact has the internet on all industries and hence on the rates of productivity growth and GDP growth.

Third, indirect impact approaches problem by examining the effects of the Internet on economic phenomena like consumer surplus or how the Internet contributes to social welfare gains.

OECD claims it is probably only possible to reliably estimate the economic impacts of the Internet after these impacts occur and that the first and best evidence of economic impacts is likely to come from micro-data before it shows up in macro-data. ICTs including the Internet are frequently labeled as “special” technology in the sense, that they affect a multitude of sectors and economic activities, and most importantly, make other sectors more productive.

OECD focused on impact of E-commerce on other business sectors such as manufacturing, wholesale/retail and other services. There is an assumption, that the share of revenue from e-commerce in total revenue for each industry sector is proportional to the share of value-added from e-commerce in total value added for that same industry sector. Using this assumption yielded the estimated value added generated by e-commerce in certain sectors of the US economy from 3.2% up to 13.8% of total business sector value added in 2011. The Internet´s effect on market transactions has been huge, its impact on non-market interactions is even bigger. These interactions and impacts contribute to individual utility and the prosperity of the entire society. But this is not captured within the traditional ways of measurement of national accounts.

To be globally competitive, preparedness of organizations for future technologies is crucial, but confronts many uncertainties. The speed of change adds complexity and increase requirements for implementing successful strategies. One of the key steps in transformation is understanding the current state. The World Economic Forum developed The Readiness for the Future of Production Report with focus on 100 economies. The report analyzed the structure of production and the presence, or lack of the key enablers within each country researched.

Main identified drivers of production were technology and innovation, human capital, global trade and investment, institutional framework, sustainable resources and demand environment. In the report each economy has been placed into four archetypes based on their scores according of assessments. Majority of the economies showed a low level of readiness, 58 of them was identified as Nascent archetype that represent economies with a limited production base, 90% of them economies were from Latin America, the Middle East and North Africa,

Sub-Saharan Africa and Eurasia. This imply, that these economies will need high levels of investments to reap any potential rewards from new production landscape. Among High Potential archetype are Australia, the United Arab Emirates and 5 more countries, all of them are high-income economies and several are rich in natural resources.

Using these data, organizations can better decide about their locations for conducting a business or where to focus activities. Based on the findings from the report, most of developed countries within the European Union are suitable for development of new type of organizations, or transformation of current, without need of relocation of activities in general. However, there is need of specific analysis fitted to each organization needs.

Currently existing corporations must respond on three levels to ensure their future according Deloitte. Firstly, transforming their core business to become more efficient, secondly access new revenue sources and develop new business models. According Deloitte successful organization will be very active in investing in new capabilities and new business models. Many firms can expect their core business models to be completely obsolete. For example, high prices are collapsing in some segments, as low cost, intense competition enters a market. Therefore, it is important to find added value for customers from different sources. It is becoming much more important than ever, treasuring customer relationships. Most sales and marketing departments now already focus on online sales and digital marketing. It is important to be digitally present and that is valid for most of international organizations. Also, digital technologies promise radically lower costs and more effective customer service than traditional means.

Companies need to be agile as never before, as the pace of the digital economy is very fast and traditional corporate processes and tools are not designed for frequent, rapid decision making. Most of investment decision tools were designed in the industrial age. As an example, Net Present Value and other risk-based return evaluation frameworks may penalize innovation and longer-term investments. Often companies forget to look beyond their traditional boundaries and because of that are prone to miss the competition of substitutes. Many times, substitutes are free or much cheaper to customers than traditional products, especially in the digital economy.

Winning company will be that which embraces openness and will develop appropriate business models. A company that will be willing to assemble a functioning partner ecosystem to build and deploy these agile and flexible business solutions.

International organization will have to adjust to new challenges either in financial management. These challenges are mainly ability to adapt to fast changing business environment, confront growing volumes of data, utilize new technologies and systems. Main future trends in finance comprise of hypoconnectivity, cloud computing, high level of automatization, real-time analysis and dynamic planning. High emphasis is devoted to cyber security as essential requirement for trustworthy business.

Digitalization and automatization of finance are seen as opportunities among financial professionals as providing additional value, eliminating redundant operations, providing more insightful and accurate data. On the other hand, automatization will require different skills of employees in finance as simple administrative work will be automated by most companies, especially international companies.

Last part of thesis explored social impacts of the new economy. I consider social effects highly important and relevant, as they relate to everyone inseparably. World Economic Forum stresses the speed of the digital transformation and need of businesses and governemnts to act quickly. The potential inequality and wage deflation or even social unrest requires significant action to prepare people for a digital future.

There are expected both positive and negative impacts on society. Therefore, it is important to identify trends soon and prepare for changes that will cause. It is estimated that changes in economy could create up to 6 million jobs worldwide between 2016 and 2025 in the logistics and electricity industries. *"On the other hand, estimates of global job losses due to digitalization range from 2 million to as high as 2 billion by 2030."* (World Economic Forum, 2016)As technological improvement accelerates in recent years capacities of machines and computers became sufficient for plenty of jobs, especially jobs which do not require qualification or special skills. This trend is called technical unemployment. From another point of view, the impact of digitalization has also acted positively in employment as a catalyst. For instance, digital revolution has created new roles such as social media account managers and search engine optimization managers.

For HR departments there is emerging challenge of so called broken career ladders, where entry-level workers no longer have a clear path for career progression, because the tasks they would traditionally perform to progress have been automated. Example of this entry-level tasks in professions such as law and accountancy, basic research and cleaning up financial data for processing, can be automated more subtly.

WEF conducted study regarding which industries deliver higher value for society and for industry. According this analysis, top industries adding value to society include omni-channel retail, autonomous driving, logistic services. More value for industry is assigned to consumer data flow, digital operating model, digital enterprise, information services, that means initiatives that are focused on company processes.

According another study done by WEF, the highest total amount of value added to industry and wider society out of 10 industries is projected to consumer segment of 10,316 billion USD with prevailing value to society, followed by automotive industry in total of 3,808 billion USD value added, also with prevailing value to society. Sectors which benefits more industry are telco, oil and gas, media, mining and chemistry. Projected highest CO2 emissions production relates to electricity industry followed by logistics. Based on these data, we can deduct how big is impact of the digital transformation to business and wider society throughout value added expressed in monetary value.

In the new digital economy, education plays essential role. Evidence shows that countries and continents that invest heavily in education and skills benefit economically and socially from that choice long-term. Same is valid for any type of organization.

Merits and rate of meeting the goals of diploma thesis

According opinion of the author, diploma thesis fulfilled set goals and objectives of analyzing current trends of the digital economy, industry 4.0 and IOT. Thesis provides wide comprehensive spectrum of new trends and connect them with analysis of individual economies, strategic recommendations and social connections based on reputable institutions and also provide author own insight. Thesis describes methods of measuring the impacts on general economy and therefore can help as navigator in further analysis of the digital economy.

Main obstacles in compiling of thesis

Analyzing of such wide term as the digital economy, Industry 4.0 and digital payment systems required a lot of variable literature and sources to be studied. As there are constantly new innovations discovered, I focused on the most significant trends. I did not focused on detailed descriptions, but more on principal concepts and impacts. Some findings can become quickly obsolete, especially within the field of digital currencies and blockchain technology, other findings such as strategy are less prone to be outdated, but still must be adjusted according each organization individually.

Works Cited

Book publications

[1] Amor, D. (1999). *The e-business (r)evolution.* Prentice Hall.

[2] Drucker, P. F. (1992). *The Age of Discontinuity: Guidelines to Our Changing Society.* Routledge.

[3] Elkington, J. (1999). *Cannibals with forks: the triple bottom line of 21. century business.* Oxford: Capstone Publishing Ltd.

[4] Heath, S. (2003). *Embedded Systems Design.* Oxford: Newnes.

[5] Khaitan, S. K., & James, M. D. (2014). *Design Techniques and Applications of Cyber Physical Systems: A Survey.* IEEE Systems Journal.

[6] Kranz, M. (2017). *Building The Internet of Things.* New Jersey: John Wiley & Sons, Inc.

[7] Mankiw, G. (2008). *Principles of Macroeconomics.* Mason: Cengage Learning.

[8] Nagle, G., & Spencer, K. (1998). *Development and Underdevelopment.* Cheltenham: Nelson Thornes Ltd.

[9] Schwab, K. (2017). *The Fourth Industrial Revolution.* Geneva: World Economic Forum.

[10] Swan, M. (2015). *Blockchain Blueprint for a New Economy, 1st edition.* Sebastopol: O´Reilly Media, Inc.

[11] Tapscott, D. (2015). *The Digital Economy, Rethinking Promise And Peril In The Age Of Networked Intelligence.* New York: McGraw-Hill Education.

[12] Woodfort, M. (2003). *Interest and prices: foundations of a theory of monetary policy.* Princeton: Princeton University Press.

Studies and Expert Publications

[1] Ali, R., Barrdear, J., & Clews, R. (2014). *The economics of digital currencies.* London: Bank of England.

[2] Bunse, B., Kagermann, H., & Wahlster, W. (2014). *Industrie 4.0.* Berlin: Germany Trade and Invest.

[3] CFO research; SAP SE. (2015). *Thriving in the Digital Economy: The Innovative Finance Function.* Boston: CFO Publishing LLC.

[4] Chakravorti, B., & Mazzota, B. (2013). *The cost of cash in the United States.* Medford: Institute for Business in the Global Context.

[5] Dodgson, M., Gann, D., Berger, I. W., Sultan, N., & George, G. (2015). MANAGING DIGITAL MONEY. *Academy of Management Journal*, 1-10.

[6] Esselink, H., & Hernández, L. (2017). *The use of cash by households in the euro area.* European Central Bank.

[7] European Commission. (2014). *Digital Economy - Facts and Figures.* Brussels: European Commission.

[8] European Parliament. (2010). *The Lisbon Strategy 2000 – 2010 An analysis and evaluation of the methods used and results.* Brussels: European Parliament.

[9] Frey, C. B., & Osborne, M. (2013). *The Future of Employment: How susceptible are jobs to computerisation?* Oxford: University of Oxford.

[10] Goldfarb, A., Greenstein, S., & Tucker, C. (2013). *Economic Analysis of the Digital Economy.* Chicago: University of Chicago Press.

[11] Hallam, S., & Gerd, S. (2012). *TAKING LEADERSHIP IN A DIGITAL ECONOMY.* New York City: Deloitte Touche Tohmatsu Limited.

[12] Hileman, G., & Rauchs, M. (2017). *Global blockchain benchmarking study.* Cambridge: University of Cambridge.

[13] Katz, L., & Murphy, K. (1992). Changes in relative wages. *The Quarterly Journal of Economics*, 35 - 78.

[14] MacDougall, W. (2014). *Industrie 4.0 - Smart Manufacturing for the Future.* Berlin: Germany Trade and Invest.

[15] MacGillivray, C., Marcus, T., Cinco, M., Kalal, M., Kumar, M., Membrila, R., Turner, V. (2016). *Worldwide Internet of Things Forecast Update 2016 - 2020.* Framingham: IDC Corporate USA.

[16] Manyika, J., & Chui, M. (2015). By 2025, Internet of things applications could have 11 $ trillion impact. *Fortune*.

[17] Mesenbourg, T. (2001). *Measuring the Digital Economy.* Suitland: U.S. Bureau of the Census.

[18] Miclea, L., & Sanislav, T. (2011). *About dependability in cyber-physical systems.* Sevastopol: EWDTS.

[19] OECD Digital Economy Papers. (2013). *Measuring the Internet Economy: A contribution to the Research Agenda.* Paris: OECD Publishing.

[20] Plimpton, S. H. (2010). *Cyber-Physical Systems (CPS).* Arlington: The National Science Foundation.

[21] SAP SE. (2016). *Transforming Finance for the Digital Economy.* Walldorf: SAP SE.

[22] Schleicher, A. (2006). *The economics of knowledge: Why education is key for Europe's success.* Brussels: The Lisbon Council.

[23] Selstad, T. (1990). The rise of the quaternary sector. The regional dimension of wisdom or knowledge-based services in Norway, 1970–1985 - Norsk Geografisk Tidsskrift. *Norwegian Journal of Geography*, 21-37.

[24] Tholons. (2011). *IT-BPO Industry's Direct and Indirect Economic Impact: The Outsourcing Multiplier applied to the Philippines and Indian Economies.* Tholons.

[25] UNIDO. (2014). *Competitiveness profile of Czech Republic.* Vienna: UNIDO.

[26] UNIDO. (2016). *Competitiveness profile of Germany* . Vienna: UNIDO.

[27] Walter W. Powell, K. S. (2004). *THE KNOWLEDGE ECONOMY.* California: Annual Reviews.

[28] Werner, R. (2016, February 9). „Negative" Interest Rates and the War on Cash.

Web Sources

[1] Barclays UK. (2017, December 4). *Barclays*. Retrieved from https://www.barclays.co.uk/help/international/payments/making-and-receiving-international-payments/what-iban-swiftcode/

[2] European Comission. (2014, July 31). *europa.eu.* Retrieved from http://europa.eu/rapid/press-release_MEMO-14-502_en.htm

[3] Han, P. F. (2016). *researchgate.net*. Retrieved from https://www.researchgate.net/post/What_is_the_difference_between_the_knowledge_economy_and_the_digital_economy

[4] McKinsey Global Institute. (2015, June). *Unlocking the potential of the Internet of Things.* San Francisco: McKinsey & Company. Retrieved from McKinsey: https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/the-internet-of-things-the-value-of-digitizing-the-physical-world

[5] Negroponte, N. (1995, January). *Bits and Atoms.* Retrieved from mit.edu: http://web.media.mit.edu/~nicholas/Wired/WIRED3-01.html

[6] S.W.I.F.T. SCRL. (2016, May). *IBAN REGISTRY.* Retrieved from swift: https://www.swift.com/sites/default/files/resources/swift_standards_ibanregistry.pdf

[7] S.W.I.F.T. SCRL. (2017, December 4). *www.swift.com*. Retrieved from https://www.swift.com/about-us/discover-swift

[8] Soosalu, T. (2016, 10 26). *Estonia stands out in Europe and the wider world for its use of cashless payments.* Retrieved from https://www.eestipank.ee: https://www.eestipank.ee/en/press/estonia-stands-out-europe-and-wider-world-its-use-cashless-payments-26102016

[9] Statista Ltd. (2017, May). *Market Capitalization of the biggest internet companies worldwide as of May 2017 (in billion U.S. dollars)*. Retrieved from Statista.com: https://www.statista.com/statistics/277483/market-value-of-the-largest-internet-companies-worldwide/

[10] Statista Ltd. (2018, 1 23). *B2C e-commerce sales worldwide from 2012 to 2018 (in billion U.S. dollars)*. Retrieved from Statista.com: https://www.statista.com/statistics/261245/b2c-e-commerce-sales-worldwide/

[11] Statista Ltd. (2018, 1 27). *Number of Bitcoin ATMs worldwide from January 2016 to January 2018*. Retrieved from Statista.com: https://www.statista.com/statistics/343127/number-bitcoin-atms/

[12] Statista Ltd. (2018). *Worldwide blockchain wallet users*. Retrieved from Statista.com: https://www.statista.com/statistics/647374/worldwide-blockchain-wallet-users/

[13] Statista.com. (2018, March 4). *Worldwide bitcoin blockchain size*. Retrieved from Statista.com: https://www.statista.com/statistics/647523/worldwide-bitcoin-blockchain-size/

[14] Wong, J. (2017, December 20). *Global Strategic Foresight*. Retrieved from World Economic Forum: http://reports.weforum.org/global-strategic-foresight/jill-wong-singapore-government-the-impact-of-automation-on-jobs-and-society/

[15] World Economic Forum. (2016, January). *Digital Transformation of Industries: Societal Implications.* Geneva: World Economic Forum. Retrieved from World Economic Forum: http://reports.weforum.org/digital-transformation/aligning-incentives-maximizing-gains-to-society-and-industry/

[16] World Economic Forum. (2016, February 02). *The importance of retail payment systems to economies*. Retrieved from weforum.org: https://www.weforum.org/agenda/2016/02/the-importance-of-retail-payment-systems-to-economies

[17] World Economic Forum. (2016). *Understanding the impact of digitalization on society*. Retrieved from Weforum: http://reports.weforum.org/digital-transformation/understanding-the-impact-of-digitalization-on-society/

[18] World Economic Forum. (2018, January 11). *Which countries are best prepared for the future of production?* Retrieved from weforum.org:

[19] https://www.weforum.org/agenda/2018/01/time-for-action-who-is-really-ready-for-the-future-of-production/

Table of Figures and Tables

Figures:

Tables: