INTERNET OF THINGS, DIGITALIZATION AND THE FUTURE OF BUSINESS MODELS

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Abstract: *Internet of Things (IoT) and digitalization are ultimately terms for one and the same phenomenon: objects we use everyday are becoming interconnected allowing for greater cooperation between systems, collaboration with humans and redefinition of daily activities that allow creation of new paths in business.*
The digilization of the world of work is devided into various stages of development: computers, automation in production, mobile devices, cloud services, processes – all together becoming one of the main drivers of the business world with the Internet. Most companies have spent years on fine-tuning processes and getting them to work individualy. Digitalization means merging processes, about enabling new business models, new revenue opportunities and encouraging service innovation.
To investigate resulting impacts of IoT and digitalization, we draw on the existing business models, deduce specifics for the Internet of Things and analyse the digitalisation path. Building on this, in order to reach the aims of the paper the authors will use a descriptive research method to present the future business models in the era of IoT and digitalization.

Keywords: *Internet of Things (IoT), digitalization, business models*

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1. Introduction

More and more companies rely on the Internet of Things (IoT). However, its implementation is an enormous challenge for many companies. In the first instance, the technical implementation is usually not at all. On the contrary, strategic decisions have to be made that often cause uncertainty or are even overlooked because of the lack of experience.

The IoT opens up many growth opportunities, especially in the area of supply and market positioning: many companies are already upgrading their products with free digital additional services and developing new monetisable services or products for existing target groups in order to exploit new sources of revenue.

One of the most difficult questions in this context is: how can the existing business model be further developed or how can successful new business models be established? The answer to this question is complex, because the Internet of Things raises completely new demands on supply and market positioning, the configuration of the value chain and the orientation of the revenue model.

Starting from this point the paper tries to answer this question by analyzing the numerous sources of secondary data through a comprehensive literature review and by illustrating the impact of IoT in the current business processes.

The remaining subdivisions of the paper are organized as follows: Section 2 deals with the literature review. The research methodology is presented in Section 3. Section 4 and 5 provide a discussion of the findings. Paper ends with the conclusion on digitalization and the future of business models.

2. Literature review

The main concepts of the paper are Internet of Things, digitalization, business models and the Fourth Industrial Revolution. The Internet of Things is a concept, a vision, a new perspective [Fraunhofer Institute], a collective term for technologies of a global infrastructure of information societies, which makes it possible to network physical and virtual objects and to let them work together through information and communication technologies [Mark Weiser]. The concept of digitalization has been defined in different ways. Some researchers consider that the fresh thinking induced by digitalization leads to value creation [The Economist] while others see digitalization as the implementation of a new product/process, or a new way to think about business strategies [Kuczmarski]. A business model shows the way an organization creates, delivers, and captures value [Osterwalder]. On its turn, the Fourth Industrial Revolution refers to the fusion of several technologies (e.g., nanotechnology, quantum computing) and their interaction across the following three domains: physical, digital and biological [Schwab]. As Industry 4.0 creates an integrated relationship between business and technology, digitalization is increasingly representing a key element of today's business models [Mandapaty]. Moreover, successful business model digitalization leads to value creation [Wirtz]. Therefore, there is a link among Internet of Things, digitalization, business model and the Fourth Industrial Revolution.

3. Research methodology

In order to achieve the research objective, the authors used a quantitative research method combined with analyzing existing case studies. The information was gathered from numerous sources of secondary data, such as books and articles from the domains of management, IT, and digitalization, or corporate reports of IoT in different industries, through a desk research. The literature review was carried on mostly in the German libraries where the electronic databases (e.g., Elsevier, Cambridge University Press, Emerald Insight) were found and consulted.

4. Internet of Things (IoT)

So far, the Internet consists of a network of servers, laptops, desktops and smartphones. Everyone communicates with each other and exchanges information. This networking allows us to do online banking, read in Wikipedia or post on Facebook.
But the networking of computers was only the beginning. When it comes to the pioneers of digitization, soon all things from the washing machine to the bike will become part of the Internet. This concept is called the Internet of Things. As a result, everyday objects can communicate with each other or with central servers via the Internet. The range is broad and could even include the package for the post, a bottle of milk or your own keychain. They would all be part of the global digital network.
Some things have already happened in this direction. As an evolution of the well-known bar codes on product boxes you can, for example, view RFID chips [CHIP]. These can be read by radio without the need for direct visual contact between the scanner and the product. Such a technology has great advantages, especially in logistics: Packages can pass a measuring point on an assembly line or even on a forklift, without having to show the label directly to the scanner. A linked database then holds more information ready and is updated again and again with the current location or process step in which the package is located.
But the innovation goes even further: in the next step, the objects are to establish a direct contact to the Internet and communicate there with central computers, such as a production control. Of course, they need more computing power than the usual RFID chips provide. Also, the radio range must increase further. In addition, it requires additional technology, because the objects initially only know what they once told them. They know who they are, where they want to go, or what ingredients are in them. It will be interesting if these objects are equipped with a variety of sensors. These sensors can then, for example, measure the temperature or determine the location. This would provide real-time information about every item that could be used to generate added value. For example, a milk bottle could report that the cold chain has been broken on its way.
The basic idea behind the Internet of Things is, in addition to sensors, communicating the objects directly with each other - in such a way that no one needs it. Let's call the situation of a parcel delivery. Usually, the postman hands over the package to his recipient. If this is not found at home, the employee brings it to a warehouse, where it can be picked up later. The human is needed here to make appropriate inputs with a handheld scanner. But how about the package itself recognizing whether it arrived at the right place or found its way into the warehouse? This would require a GPS receiver that can determine the position. For example, if the package finds itself in the warehouse, it will automatically send a pick-up notification to the recipient - exactly when it's ready. Up to now, service providers have

often included buffer times so that staff have enough time to check in the packages. This unnecessarily prolongs the terms of a shipment.
Even medicine could benefit from this concept. This allows sensors to be placed in the human body that measure blood pressure or collect other vital signs. There are even already thought sensors that can test the blood. By means of the collected data, for example, insulin pumps could be operated which always supply the patient with the correct dose. The examples presented were relatively simple. There are endless possibilities to use the concept of the Internet of Things.
The Internet of Things (IoT) will access all areas of business and life. This is reflected in the sales forecasts. The consulting firm McKinsey [McKinsey&Company] estimates the global sales potential of IoT in the year 2025 at 4 to 11 trillion dollars (Figure no. 1). The largest shares are attributable to the manufacturing sector, "smart" systems in urban areas, such as traffic control, as well as applications in the fitness and health sector.

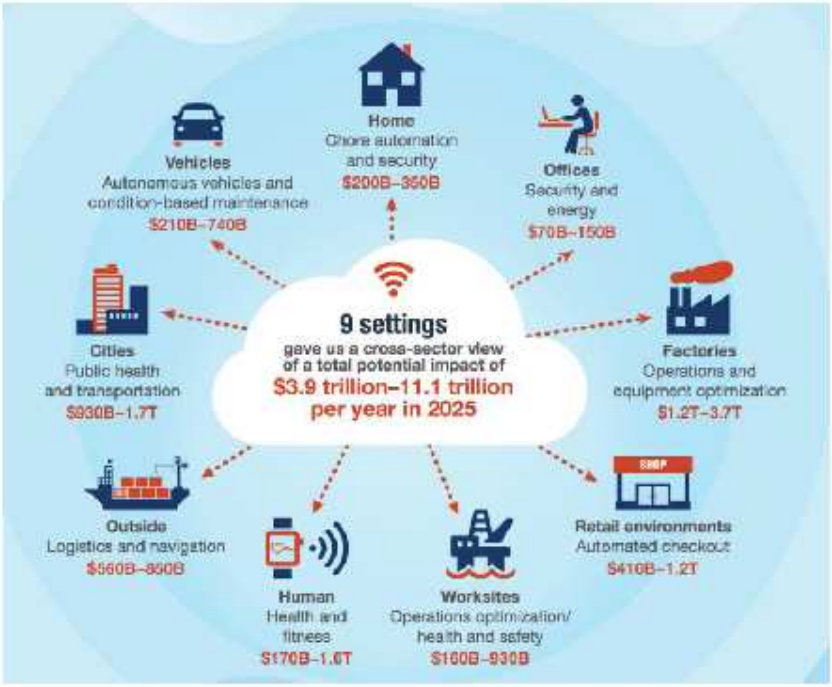

Figure no. 1 Global sales potential of IoT. Source: McKinsey

IDC's market researchers [IFS] estimate that the number of "IoT endpoints" [Watson IoT] will increase from 13 billion worldwide in 2015 to more than 30 billion by 2020. This is associated with a massive increase in the data that generate such components. According to IDC, the volume of data will skyrocket from 0.6 zettabytes (2015) to 4.4 zettabytes (2020). Cloud data centers are essential in order to process these amounts of data. Only they offer the option of storing this data avalanche at acceptable cost and consolidating it using IoT

platforms [Watson IoT]. In turn, big-data-and-analytics applications from the cloud make it possible to "translate" IoT data into business-relevant information.
According to a survey by Tata Consultancy Services (TCS) [TATA], providers of products and services can benefit from IoT in two ways. For example, the data that networked products provide to the manufacturer can be used to improve product quality. The information from machine tools shows, for example, which potential weak points the systems have and under which conditions of use it comes increasingly to wear phenomena. With the help of IoT platforms, providers can thus develop "tailor-made" solutions that are tailored exactly to the requirements of a customer.
An automatic IoT strategy that offers an economic success does not exist. Rather, several factors need to work together: companies must be prepared to engage with digital transformation and accept the Internet of Things as part of it. In addition, it is necessary to select the right IoT platform - and, above all, a technology partner who will assist the user with advice and assistance. A central role is played by "backend services" [SAP], which are often located in the cloud, frameworks and analytics platforms from cloud providers as part of IoT as a Service.

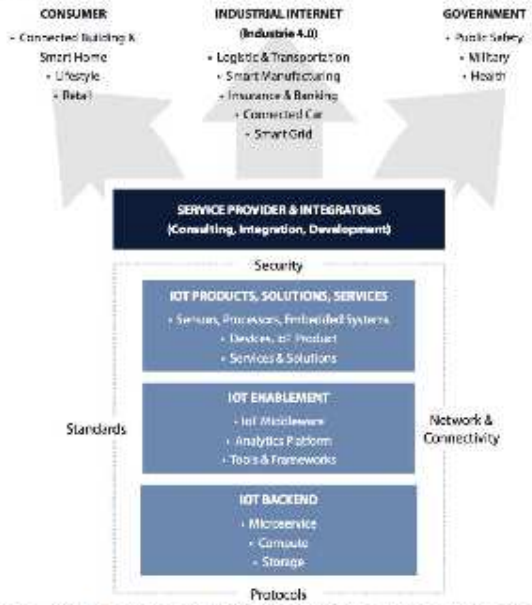

Figure no. 2 The components of IoT solutions. Source: Crisp Research

5. Industry 4.0: networking of production and logistics

Many expectations are made of the 4th Industrial Revolution (a.k.a. Industry 4.0). It aims to leverage the benefits of the Internet and digital networking to boost business competitiveness. The point is to link production even more closely with IT technology [Rodig, J] and to use data streams for intelligent control of the overall process. As a result, more flexibility in production is to be achieved and efficiency will once again increase considerably.

Flexibility becomes more important as the trend is clearly towards individual products. Everything is to be tailored directly to the customer, from shoes to fashion to the car. Industrie 4.0 picks up on this trend towards individualization and sets itself the goal of achieving lot size "1" in an industrially organized production. This means that only one copy of the respective product is produced in parts, without having to forego the efficiency advantages of mass production. In the past, however, one had to decide to either produce a product in large numbers and thereby disregard individual customer wishes, or to work with very small quantities as a manufactory and thereby to make significant compromises on the cost side. Industrie 4.0 brings the advantages of both worlds together and enables a customer-specific product at reasonable prices. This promotes complexity (Figure no. 3). This is particularly impressive in the automotive industry. So manufacturers such as BMW [BMW IoTHUB] and VW [VW IoT] have over 1,200 model variants in their program. Each of them entails a multitude of components and alters the assembly process depending on the ordered configuration of the vehicle. Such a production could not be mastered without IT. For this reason, as in other phases of renewal of production, the automotive industry is a great beneficiary of the new possibilities.

Figure no. 3 Industrie 4.0. Source: Macrovector, Depositphotos

To achieve such diversity and flexibility in production, it is time to say goodbye to centralized production planning. So far, all work steps on the products have been completely controlled via a main system: Every little change in the production process had to be planned here. In the world of Industry 4.0, there is a vision that every component knows about its processing steps. Processing steps that it can independently request along the production line. The production plant is thus almost a big buffet.

When considering the impact of Industry 4.0 on a company's overall processes, the term is perhaps somewhat biased with a focus on production. It would be better to call the whole thing "Company 4.0" [Kerkhoff Consulting]. Because in order for Industrie 4.0 to work, all

processes in the company must be coordinated with each other in an increasingly close digital manner.

6. Digitalization and the future of business models

"Digitalization" is defined by Gartner [IT Glossary] as leveraging digital technologies to change business models and provide new revenue and value-producing opportunities. It is an evolutionary process that has been well underway across industry for some time and dovetails with Industry 4.0. Briefly, digitalization makes business future-ready with technology that enables: interoperability, information transparency, automated assistance and support and decentralized decision making.

These four goals are reflected in a digitalized business via systems, devices and people that connect and communicate with each other over the internet. A digitalized business information systems will enhance operations by collecting data and transforming it into insight and action that supports the business. Ultimately, digitalized business systems will be able to make many decisions without the need for human involvement and to perform specific tasks autonomously. These cyber-physical capabilities comprise a functioning industrial internet of things infrastructure, with everything from the tiniest sensors in manufacturing equipment to data-visualization dashboards used to perpetuate organizational health.

Successfully transforming a business to meet those criteria is not a simple process, but it results in an enormous competitive advantage. A recent study of digital transformation in over 400 companies conducted by The Massachusetts Institute of Technology Center for Information Systems Research [MIT CISR] and management consulting firm AlixPartners [MIT CISR] found that 23% of those businesses could be considered "future-ready." That means they had digitally transformed their business operations and customer interface. As a result, their net margins were 16% higher than the industry average.

Supporting such a service or process would require a vast network of people, device and systems connected over the internet, exchanging data and transforming it into specific action performed autonomously — that sounds a lot like the IoT. It also sounds like the future of business - digital transformation is rewriting business models.

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