DIGITIZATION, INTERNET OF THINGS, AND SUPPLY CHAINS FROM THE ASPECT OF SMEs

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Key words: *SME, supply chain, digitalization, Internet-of-Things, Industrial-Internet-of-Things, blockchain.*
Abstract: *The paper analyzes the business opportunities of small and medium-sized enterprises in the field of supply chains using digitalization, and the opportunities provided by Internet-of-Things (IoT) and Industrial-Internet-of-Things (IIoT). The impacts of IoT and blockchain technology on supply chains, preventive maintenance, smart metering, fixed asset tracking, and related vehicles are discussed in more detail. Special attention is paid to the potential of SMEs in this area and the risks to which SMEs are exposed. In the final part of the paper, the risks related to security and data protection are analyzed. The authors conclude that digitalization and IoT provide real opportunities for SMEs to accelerate their development and market positioning. Whether they will use these opportunities primarily depends on the leadership of the SME and its readiness for change.*

1   INTRODUCTION

Given the importance of small and medium-sized enterprises (SMEs), it is important to consider the factors that affect and may affect their more efficient and quality work. In the time of the ubiquity of information technology, digitalization is imposed as an undoubted impact on the functioning of small and medium enterprises. Having in mind who uses information technology, and the value of hardware and software used in SMEs, the human factor can be singled out as the most influential in this group of economic entities.

If by supply chains we mean networks of connected and interdependent organizations working together to control, manage and improve the flow of materials and information from suppliers to users, we can see SMEs often appear as participants in the process. It is usually said that a chain is as strong as its weakest link. That is why the participants in the supply chain must develop in parallel. Here, too, it can be expected that SMEs are the weakest link, so it is necessary to pay the greatest attention to their development.

The Internet of Things (IoT) has been mentioned very often in recent years, and when it is mentioned, everyone has an already formed image of it. Due to its diversity, it is difficult to give a comprehensive definition. Nevertheless, it can be said that IoT as a concept represents the idea that devices that are in everyday use connect to the Internet and can be identified with other devices and communicate with them. This term is closely related to radio frequency identification (RFID), but different sensors (Wi-Fi, QR codes, …) can also appear in communication. As the object appears as a digital unit, it becomes much more important

not only to the direct user but in connection with other such objects and databases it can participate in the creation of "ambient intelligence". That is why the Internet of Things (IoT), as a system of interconnected computing devices, with its rapid development and distribution has come to the center of interest of Internet users, especially users of smart devices. This is helped by the fact that IoT is not limited to mechanical and digital machines, but can also cover other objects, animals, and even people. All these objects have unique identifiers that can transfer data over the network. The term Internet of Everything (IoE) is often used as the term with the broadest meaning. Within the IoT, the Industrial Internet of Things (IIoT) subcategory is rapidly evolving. Although these are similar products, the differences are due to their purpose. The photo can be taken with a mobile phone camera, but also with the help of a top professional camera. It is much more likely that better photo quality in extremely difficult conditions will be obtained by using a professional camera. [1] This small comparison can serve as an example for all other cases of IIoT application.

There are already various types of IoT applications in everyday life and industry, especially in supply chains, warehouse inventory, vehicle tracking, shipment tracking, theft protection, and the like. Some of the more innovative are [2]:

- Optimization of the energy network,
- Equipping jet engines with artificial intelligence,
- More efficient garbage collection,
- Avoiding dangerous police chases,
- Use of sensors for safer driving, etc.

In all these and other areas, SMEs can find their interest and their market, so IoT is becoming increasingly important for SMEs.

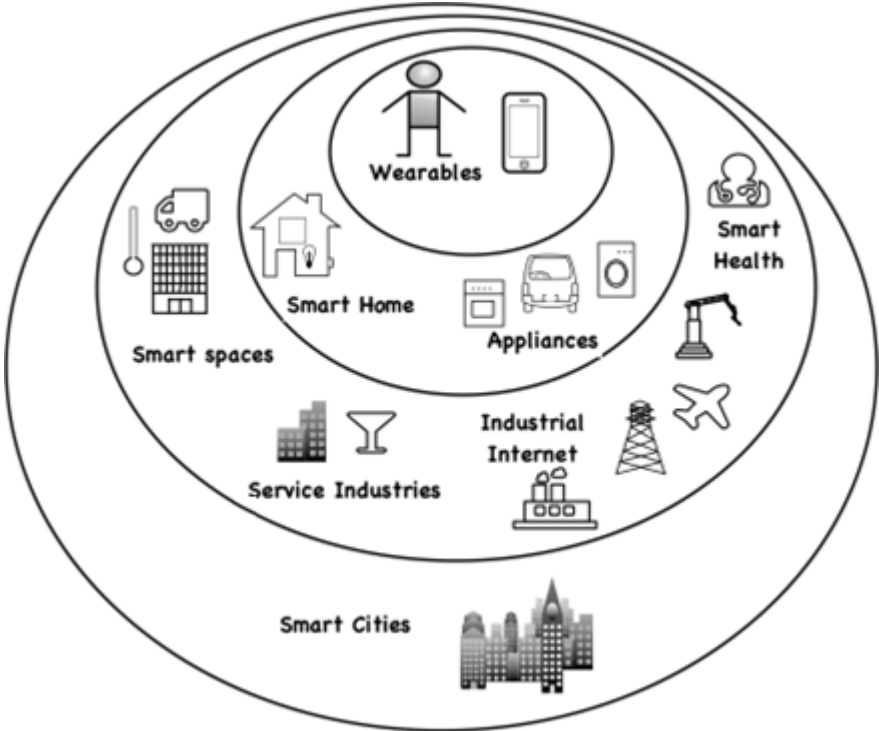One good visualization of IoT development is shown in Figure 1.

Figure 1 Division of IoT application cases [3]

The first group within the IoT consists of portable devices whose main goal is to be always at hand and to be able to perform a certain task, whether it is telephoning, presence on social networks, finding the position and path of the vehicle, or real-time face recognition.

The second group consists of the so-called *smart homes* with *smart devices*. The task of this group is to provide the user with comfort and efficiency, safety, and automation of part of the activity. *Smart cars* are also increasingly positioned in this group.

The third group is even broader and includes *smart spaces* (shops, farms, forests, etc.), *smart services*, and *logistics* (smart supply chains, transport including air transport, telecommunications networks, drones, financial services, etc.). One of the large subgroups is the *Industrial Internet*. The application of IoT in this area allows the owner an insight into the processes and their better understanding, as well as greater flexibility. How much process information the owner will collect, process, and use depend on his willingness to invest in sensors, equipment, large data analysis software, and manpower.

The fourth group would refer to *smart cities*. Moreover, this border can be raised to the level of the state, and even to even higher levels. This group focuses on everything related to public infrastructure and public services that make life in cities (states) better.

If we look at the IoT from today's perspective, we can see that it went the furthest in the first group, in portable devices, primarily in smartphones. Everything else is still in the early stages of development with somewhat greater strides in the field of logistics and transport. The rapid development of IoT and IIoT is expected after the introduction of fifth-generation mobile networks, in 2022.

From the above, the topicality of the considered topic is obvious. The fact that entrepreneurs and SMEs have the greatest innovation potential also supports the topicality of the topic.

2   IOT I IIOT
2.1   Impact of IIoT and blockchain technology on supply chains

IoT and IIoT, technologies that can be applied in supply chains (SC) are extremely heterogeneous in terms of platforms, equipment, and connectivity. There are also many users whose data and communications need to be virtualized, stored, planned, and managed. The introduction of IIoT technology in SC requires several steps, phases that should be successively implemented to obtain the best results. The process should start by connecting the devices, then continue with data collection and monitoring, data analytics, automation, and, finally, it should end with the so-called *Edge Computing*. Within the mentioned phases, data collection should be realized at the place of their origin, and then that data should be transferred to databases located in the cloud. It is necessary to achieve complex data analysis and real-time data visualization, and then return those complex analytics to the device level. All these complex activities should be accompanied by machine learning, the development of logical rules, and the automation of activities. This is an extremely complex task, especially when it comes to SMEs. Things become even more complicated if the company satisfies part of its functions by outsourcing. [5] These outsourced activities can bring inefficiencies but always bring reduced process transparency. Both risks can be minimized by introducing sensors and platforms in the cloud. Door-to-door solutions are the most demanding.

Based on the analysis of a survey conducted on a sample of 600 managers of companies involved in supply chains [6] it was found that 41% already use IoT solutions and that 87% of them are looking for ways to expand the use of IoT. 69% of respondents expect a return on investment within two years, 21% in the third year, and 10% in more than three years. From the same survey group, 59% of respondents used IoT for real-time alarm and monitoring purposes, and 41% for business optimization and prediction. The same survey found that 61% of respondents analyzed less than one-half of the data collected. This unequivocally shows that companies are not yet ready for the efficient use of IoT. Some because of the high cost of data management (31%), and some because of the cost of hardware (26%). [1]

Another study [7] with 195 respondents indicates that blockchain technology is gaining in popularity, but 69% of organizations still spend their money on understanding technology. About 35% of respondents spend money on technology testing (20%) and implementation (15%). As many as 50% of companies did not invest even $ 1 on the blockchain, and 33% spent less than $ 100,000.

2.2 Preventive maintenance

IoT and blockchain models allow companies to be proactive. Sensors, IoT, and predictive analytics enable maintenance and supply to be realized in the same way as in aviation. In this way, the company can reduce the cost of maintaining machines and vehicles, as well as supplies, reducing the number of spare parts in warehouses, and planning to engage overhaul capacity. The use of sensors in warehouses (and large stores) allows easy inventory and even reading of stock status in real-time. This method can also be used as a security element in theft protection. One example of the use of RFID identifiers is shown in [8].

The use of sensors, cameras, and data analysis allows managers to predict when a part will fail and when it needs to be replaced to prevent a failure. In this way, IoT systems can either give warning signals of impending failure or even define the maintenance schedule of individual pieces of equipment, machines, or vehicles. Individual maintenance activities can also be automated. With this approach, significant savings can be achieved, because maintenance activities will be realized at the right time. This increases the security of the entire system and reduces the number of glitches.

2.3 Smart measurement

Smart metering devices can connect to the Internet, and can measure vehicle weight, fuel, gas and electricity consumption, water consumption, and more. Measurements can be performed on the company's premises, in plants, or on the route. Previous measuring devices have measured the total consumption, and smart measuring instruments can measure and register the current values of resource consumption, which is a significantly higher level of quality, and which allows better management of the consumption of individual resources. This also brings benefits to the consumers who have a better insight into their needs and consumption, so they can plan consumption or possibly change the work schedule of individual consumers. It also has a positive impact on the providers because it allows them to see the needs of users in terms of quantity and time and to activate its capacities so that users are always well supplied.

2.4 Monitoring of fixed assets

According to research by Infosys and the Institute of Industrial Management at the University of Aachen, 85% of manufacturing companies in the world are aware that not every way of using fixed assets is equally efficient, but only 15% of that group apply adequate measures systemically. [9] Only large companies have carried out activities to collect information on the efficiency of fixed assets in real-time and at the same time engaged in real-time analytics that can help make decisions. The goal of fixed asset tracking is that the company can track the most important fixed assets, and everything related to them in real-time. This domain also includes logistics optimization, fixed asset maintenance, quality maintenance, and theft detection. One such example, applied in one SME in Serbia, the protection against fuel theft using RFID systems is explained in [10]. In addition to this, there are numerous cases of application of IoT temperature sensors for monitoring the temperature of shipments in refrigeration chambers, containers for multimodal transport, which can control the correct operation of the container. This proved to be extremely important for the supply of Pfizer vaccine during the COVID-19 pandemic. Inertial sensors are also in use,

which enables insight into the way of handling and the quality of transportation of sensitive pieces of equipment.

2.5 Connected vehicles

One of the latest trends is to equip vehicles with devices and equipment that will enable them to move safely independently following the user's wishes, without his specific engagement in driving the vehicle. Such a vehicle, without a driver, if it is in constant contact with such vehicles while on the move, can enable a faster reaction than a human being can have. Also, vehicles can move remarkably close to each other (like wagons in a railway composition), which also saves driving energy and enables better utilization of roads. Applied radars, lasers, and cameras provide better visibility even in unfavorable conditions of fog, smoke, rain, or snow. Together, they can also provide greater safety for pedestrians and other road users. And while the global development of the driverless vehicle concept can only be undertaken by large companies, SMEs can produce components, devices, and software accessories. Vehicles without drivers, in addition to mutual communication, can also communicate with traffic signs, traffic lights, and traffic infrastructure facilities, which can lead to a remarkably high level of traffic optimization. However, in all these activities there is a significant dose of risk, be it equipment failures, hacker attacks, system failures, etc. So far, driverless vehicles have performed well in strictly controlled conditions. In real driving conditions, mostly driverless vehicles appear on certain parts of the roads for testing equipment, but even in such conditions, there were accidents such as in the case of Google cars, in the crash of a similar Uber car, or crashes of Tesla's self-driving cars. [4] Although it is a small number of accidents, it should be borne in mind that it is also a small number of such vehicles, so there will be a lot to do for all, large companies, and SMEs.

While large companies spend huge sums of money on the development of automation, SMEs can try themselves in less demanding areas. There are many different attempts to create:

- small autonomous delivery units such as DRU – Domino's Robotic Unit [11],
- 3D printers [12]
- customer services and fully automated stores [13] etc.

It is quite certain that investments in development in this area bring uncertainty regarding the return on capital, but those who succeed will have extremely fast growth.

3 POTENTIALS AND RISKS IN THE CASE OF SMEs

What is common in research studies is the conclusion that entrepreneurs and SMEs' owners/managers must become more capable and competent in measuring the performance of digital and social media. To do this, and to be able to take advantage of the many digital options available to them, entrepreneurs and owners/managers need help in overcoming the digital challenges they face. Numerous studies indicate that the limited use of integrated use of digital technologies by SMEs is primarily due to three reasons [4]:

- owners/managers do not know how to fully assess the contribution that digital systems can make to their companies.
- owners/managers often do not have the skills to evaluate, apply and take full advantage of digitization. One of the factors influencing the fact that owners and managers do not decide on more intensive digitalization of business is the rapid development of information technologies associated with the emergence of new terms. They are primarily focused on the technical field, and as such is difficult for managers to understand. Due to the lack of understanding of terminology, managers cannot see the advantages of investing in digitalization, or the possibility of return on investment, as well as the possibility of creating additional value that the digitalization model can

achieve from marketing. These two previous ones have implications when measuring or evaluating digitalization within a business.

– The third important reason is the perception of high investment costs required for the implementation of digital technologies in SMEs. Research has shown that, although one of the main challenges for ICT acceptance, it is not seen as a central barrier equally in all SMEs, and that owners and managers' opinions on its importance differ depending on the characteristics of industry sectors, competitive environment, consumer behavior, ICT, etc.

The adoption of digital technologies brings regularities in terms of profitability, productivity, and growth prospects of SMEs. Digital technology has the potential to transform traditional business strategies into modular, distributed, interoperable, and global business processes that enable business transactions to be conducted virtually without restriction. Numerous pieces of evidence suggest that with the help of digitalization, SMEs can become global in a short time. European SMEs grow two to three times faster when supported by digital technologies [14]. At the strategic level, the digitalization of business enables the formation of various forms of dynamic capabilities suitable for turbulent environments. These abilities are key to survival and growth. Increasing customer interaction and engaging suppliers in e-business activities improve procurement, production, and sales processes, as well as logistics services that support globally connected business.

The rapid spread of social media and channels such as Facebook and Twitter also encourage the rapid growth of commerce, especially e-commerce. The application of social networks can radically transform the traditional processes of traditional companies by providing a better impression to customers when shopping in real-time. At the same time, these platforms are great channels for attracting and retaining online customers [15]. Social networks allow companies to "use social capital" to spread information like word-of-mouth. In the context of B2B commerce, SMEs can use social media to communicate with customers and suppliers, build relationships and trust, and identify potential business partners.

An integrated e-market provides a favorable environment in terms of reducing operating and marketing costs. E.g.:

– reduces search costs by making it easier to compare prices of products and services.
– improves production and supply [16].
– improves personalization and customization of product offerings [17].
– improves customer relations [18];
– reduces marketing costs compared to traditional marketing media [19].

E-commerce is still a new way of communication between seller and customer and has not yet used its potential. It cannot be seen as a simple substitution of the way of trading, ie. on the application of new technologies in the well-established way of doing business. E-commerce essentially changes the way we look at trade, influences the creation of new business strategies that must be integrated into existing SME strategies, which can bring additional benefits. Modern SMEs still make mistakes either due to poor implementation of e-commerce strategies or due to ignorance of technology. This is true for both developed and developing countries. [20]

4 SECURITY AND DATA PROTECTION

Depending on the country in which they operate, SMEs have different views on the security of online commerce due to different experiences in data leakage and security of information transmission over the Internet. Also, in their confusion, many managers are willing to claim that what they sell is not suitable for online sales. Ritchie and Brindley [21] determined that the main risk of SMEs is not whether they will choose the right business

model of online commerce, but whether they will succeed in changing the consciousness of managers, or owners, i.e., way of looking at this possibility.

Relying on e-business on the one hand brings many advantages, but on the other hand, it also brings challenges. The more an SME relies on IT, the more it must take care of the correct choice and reliability of the system. AICPA/CICA considers a system reliable if it can operate without material error, defects, and malfunctions in a certain environment at a certain time. [22] There are four principles for assessing system reliability [23]: availability, security, integrity, and ease of maintenance.

The security of information is especially important both during its transmission and during its storage and processing. Due to their limited protection capabilities, SMEs are particularly vulnerable to ransomware, and Man-In-The-Middle and Denial-of-Service attacks.

5 CONCLUSIONS
The reliance of an SME on the digitalization of its business can provide it with many competitive advantages if SME appropriately digitizes its business. If SME performs the digitalization incompletely and/or in the wrong way, it can face ruin.

How quickly and with what enthusiasm SMEs will enter the digital transformation depends mostly on the ability, creativity, and willingness of the director/owner to accept new technologies. Those with greater readiness for change have a better chance of further development. One of the most common problems that SMEs face in digital transformation is the perception of the high investment costs required for the implementation of digital technologies. Those who successfully overcome the mentioned challenges open new opportunities for access to the integrated e-market with all the advantages provided by e-business. Particularly good results are expected in the digitization of supply chains. SMEs can get involved in this area with small investments and with great opportunities for profit both as producers and as service providers.

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ДИГИТАЛИЗАЦИЯ, ИНТЕРНЕТ НА НЕЩАТА И ВЕРИГИ НА ДОСТАВКА ОТ АСПЕКТА НА МАЛКИТЕ И СРЕДНИ ПРЕДПРИЯТИЯ

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Ключови думи: малки и средни предприятия, верига на доставки, дигитализация, интернет на нещата, индустриален интернет на нещата, блокчейн.

Резюме: Статията анализира бизнес възможностите на малките и средни предприятия в областта на веригите за доставка, които използват дигитализация, както и възможностите, предоставени от интернет на нещата (IoT) и индустриален интернет на нещата (IIoT). Влиянието на IoT и на блокчейн технологията върху веригите за доставка, превантивната поддръжка, интелигентното измерване, проследяването на дълготрайните активи и свързаните с тях превозни средства се обсъжда по-подробно. Специално внимание се обръща на потенциала на малките и средни предприятия (МСП) в тази област и на рисковете, на които МСП са изложени. В последната част на доклада се анализират рисковете, свързани със сигурността и защитата на данни. Авторите заключават, че дигитализацията и IoT предоставят реални възможности на МСП да ускорят своето развитие и пазарно позициониране. Дали те ще използват тези възможности, зависи преди всичко от ръководството на МСП и от неговата готовност за промяна.