DECISION-MAKING SUPPORT IN THE ORGANIZATION USING IOT

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Abstract: The orientation of the article is related to the area of IoT and IoE. The main goal was to summarize the possibilities of using IoT in the managerial decision-making of organizations, based on which it was possible to draw several specific recommendations. The presented results were mainly gained from the content analysis and analysis of practical examples. The technique of deduction, induction and synthesis was also used. The presented results are related to the analysis and mutual comparison of three selected examples from practice. The following is an analysis of the risks associated with the implementation of IoT in the organization. Specific recommendations are based on the positive aspects brought as the impacts of the application of IoT technology. It brings opportunities to support decision-making, optimize processes and improve the overall operation of the organization.

Keywords: decision-making, organization, IoT, case of use

*JEL Classification:* M15

1. INTRODUCTION

The concept of *Internet of Things* (IoT) is gaining prominence and is increasingly used not only in cities but also in organizations. As such, the Internet allows the sharing of abundance of information and provides easier access to information. In this way, it supports the improvement of decisions in organizations. In relation to the main concept of IoT, it can be stated that almost every device can currently connect to the Internet. This fact makes it possible to connect almost all "things". The introduced IoT concept enables organizations to unify communication, share data or streamline employees' work. These are new possibilities that will help in the management of individual parts of the organization.

Internet connection is an integral part of operation of the organizations, industry, and products. The meaning of IoT is fulfilled in the case when technologies can dynamically respond to human action. The 2018 prediction suggested that in 2020 there should be a comprehensive network of nodes, within which 50 billion devices will be connected (Chase, 2013).

A related term is the *Internet of Everything* (IoE). This can be defined as a global system of computer networks, sensors, actuators, and devices connected via the Internet Protocol. IoE's vision was created by Cisco, which can be described as a global leader in networking. This term includes the ways in which people communicate, cooperate, and connect themselves (i-Scoop, 2021).

The interconnection of the presented terms is graphically shown in the following figure (Figure 1). The sequence of steps is represented by both the assigned numbers and the directional arrows. The core of logic is the identified problem. The main goal of this article is *to summarize the possibilities of using IoT in decision making.* The main purpose will be fulfilled after evaluating the decision-making state of the organization that has already used IoT to support its decisions.
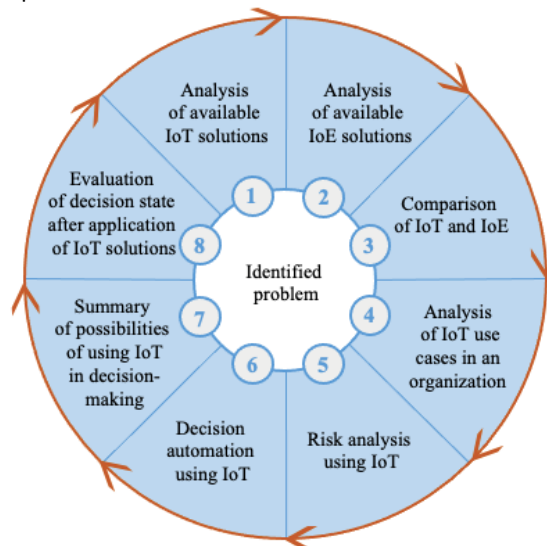
Figure 1 Interconnections of the presented concepts

2. LITERATURE REVIEW

The analysis of literature sources focused primarily on the characteristics of the terms IoT, IoE and their mutual comparison.

IoT specification and use

Internet of Things – IoT can be defined in various ways. For example, connecting homes, cities, cars, and roads with devices that monitor individuals' behaviour. This term includes all devices that can communicate over an Internet connection and can use nodes of remote computers. This allows devices to perform more complex analyses, respond to needs, and make complex decisions without human intervention. From a technical point of view, IoT can be defined as an intelligent tool communicating with computers, objects, and environments. This link leads to large volumes of generated data that is processed and used in management and decision-making (Karimi, Atkinson, 2013).

Other authors define IoT as the interconnection of various objects around us in a way that provides seamless communication and context services. Gradual technological progress in the field of RFID tags, sensors and mobile phones has enabled the emergence of IoT. Devices communicate and cooperate with each other, thus improving the services provided and access to them (Kong et al., 2012). The Internet is gradually expanding into the real world, where physical objects can be controlled remotely (Mattern, Floerkemeier, 2010; Weber, Weber, 2010).

IoT technology is used by many industries and companies (healthcare, science, social sphere, etc.). The described technology can be used in communication between machines; patient monitoring, diagnosis, and drug delivery; automatic traffic management – intelligent transport and mobility; remote control – Smart Living; environmental monitoring and control; or in the automation of homes and industrial buildings, etc. (Karimi, Atkinson, 2013).

The application of IoT, using its full potential, requires the fulfilment of certain conditions. The basic ones include (Chase, 2013):

a) **Connectivity** – there will be a wide range of options for connecting wired or even wireless connections. These will be connected to the elements in IoT. The individual nodes must communicate with each other in a single language when exchanging data.

b) **Power management** – several elements belonging to the IoT will be powered by a battery or will use energy collection. Line-powered devices will need to be more energy efficient.

c) **Security** – hardware security and the use of protocols are necessary for the operation of IoT to ensure a suitable connection.

d) **Complexity** – for new devices that have not yet been connected to the IoT, the simplicity of the design as well as the development itself is important. The user must be able to use the device without major problems and technical skills.

e) **Rapid development** – the annual increase in sales of electronic equipment affects the need for flexibility and rapid response of manufacturers to market needs.

IoE specification and use

The Internet of Everything (IoE) can be described as the connection of people, processes, data, and things, which works in such a way that these connections in the concentrated network become more valuable. The basic principle of IoE is the transformation of information into actions that create new skills, experiences and economic opportunities for businesses, individuals, or countries (i-Scoop, 2021).

Based on other sources, IoE deals with the interconnection and autonomous coordination of a huge number of computer elements and sensors, non-living and living beings, people, processes, and data, via the Internet infrastructure. Such a modern concept represents a huge potential, it enables the use of new methods of interfering in processes or expanding human consciousness (IoE Group, 2021). According to Cisco, "the Internet of Everything is an intelligent connection of people, processes, data and things" (Singh, 2016).

Based on the previous definitions, it is appropriate to characterize the individual elements used in the IoE concept. *People* will be able to connect to the Internet in different ways. With the gradual development of the Internet towards IoE, more efficient ways of connection will be created than just via devices (mobile phone, computer, etc.). It is possible to assume that people themselves will become nodes on the Internet. The transformation from data sharing to *information* sharing within the IoE concept is crucial. It allows people to make faster, smarter decisions and manage the environment more efficiently. *Things* in IoE are physical items like: sensors, consumer devices, and business assets that are connected to the Internet and to each other. These can perceive more complex data and provide more information. With the *process* set up correctly, connecting people, information and things brings higher added value. It can be stated that the right information is passed on to the right person at the right time (Goldenberg, 2015).

Comparison of IoT and IoE

When comparing the presented concepts of IoT and IoE, it is possible to identify several similarities. These technologies have brought new challenges and opportunities in the field of computer technology. IoT allows the connection of physical and virtual states. IoE goes beyond this statement by ensuring the interconnection of entities other than "things". In IoE, subjects, people, data, and processes communicate, connecting the whole world (Sarbani, Chandreyee, 2016).

Decentralization is one of the similarities between IoT and IoE technologies. Both systems do not have only one centre, but each communication node functions as a separate control centre. Another similar feature is *security*. Introduced technologies are sensitive to information leakage and cyber-attacks. It can be stated that the more devices are connected to the network, the higher the susceptibility to its disruption (Sakovich, 2021).

3. METHODOLOGY

The main goal of this article was to *summarize the possibilities of using IoT in decision-making, based on which it was possible to make recommendations.* To fulfil the presented goal, (1) analysis of theoretical background related

to the subject area was performed, as well as (2) analysis of practical examples, which mainly concerned providers and developers in the field of IoT.

The method of content analysis was also used in the processing of the obtained information. Thought procedures for *deduction, induction, comparison, and synthesis* were used primarily in the results, conclusion, and discussion sections.

4. RESULTS

This section presents the results of the analysis of secondary data, which are linked to three selected examples from practice. This is followed by a comparison as well as an analysis of the risks associated with the implementation of IoT in the organization.

Analysis of practical examples

A specific example of the use of IoT for decision support is **the production of automotive components at Varroc.** This company seeks to solve production problems through the introduction of IoT. Using this technology, they want to achieve a smooth transition to Industry 4.0 (Altizon, 2021).

Varroc used IoT primarily to maximize operational efficiency and capacity; increase productivity and reduce energy footprints. The company had assembly lines with various types of machines, systems and sensors that communicated on different protocols. Through IoT, a heterogeneous set of activities has been linked to a single platform. The great advantage of introducing IoT technology was the processing of large amounts of data in a short time. Shortly after using this technology, machines and systems began streaming data in real time using the centralized Datonis platform (Altizon, 2021).

Specific results of Varroc's use of IoT include, for example: *centralized machine data; centralized platform; real-time monitoring of machine condition and energy consumption; constant availability of machine data analysis reports; detection of inefficiency; real-time identification of bottlenecks.*

In relation to decision-making, it can be stated that this key process has improved since the introduction of IoT. Decision support led to an increase in the overall efficiency of the equipment, which resulted in a 20% increase in operational efficiency, a 10% reduction in the direct operating costs of the machine, and a 20% increase in work efficiency (Altizon, 2021).

Another example of the use of IoT to support decision-making in organizations concerns the field of transport and logistics. In particular, the specificities related to **UPS's fleet management can be mentioned.** Sensors and devices built into vehicles make it possible to obtain important information about the condition of the vehicle (monitoring of tire pressure, coolant level, petrol, or diesel, etc.). With the use of IoT, the number of unexpected failures is minimized, maintenance becomes much simpler and more efficient.

Thus, UPS uses a type of intelligent fleet management system. It has developed and subsequently implemented a monitoring system that collects data from GPS and IoT sensors. They also applied this solution in relation to the description of driver behaviour. In this case, it is possible to access information on driving speed or time between breaks.

The information is then used in the decision-making process to set up a more efficient and environmentally friendly ride.

IoT solutions in logistics can provide real-time data on the location of goods, determine if theft has occurred or if a shipment has been delayed. The use of IoT in supply chain management supports the efficient setting of the quantity of goods needed. The whole process can be optimized to minimize costs and maximize profits. (Arm, 2021).

Decathlon was chosen as the last analysed example of IoT application in the decision-making process. It uses RFID technology, which is based on radio waves determining the position of goods, based on implemented microchips. Individual brands can transmit a variety of information. Examples of information obtained in real time are: product identification, product location, product shipping location, etc.

One of the biggest advantages of RFID technology over traditional scanning is its wireless operation. In addition, the data is transferred to the database in real time. It provides up-to-date and available information for more effective decision-making, as managers have access to necessary and useful information from anywhere. The presented company uses the RFID system to deliver products to its stores in more than 20 countries (Arm, 2021).

Comparison of practical examples

The presented examples were analysed in detail and subsequently the benefits related to *the support of the decision-making process* could be identified. The graphical form of the performed analysis and specific results are presented
in Figure 2. The main points concerning the use of IoT technology, which result from the evaluation of the performed analysis include:
– solution options to support decision-making,
– process optimization in many industries,
– improving the operation of companies.

Risk analysis

However, there are risks associated with the use of IoT technology that can negatively affect the processes and activities in the organization. The most common risks that can occur include (BusinessIT, 2018):
– direct harm to the user (individual, business, state, public organization),
– misuse of IoT as an access point through which valuable data can be accessed,
– misuse of IoT as a source of communication to harm another person or organization.

A major problem can emerge even when an organization has many devices with outdated software. Therefore, these devices are not able to undergo any code modification. If the organization has such devices, it should pay more attention to them to ensure at least partial security.

5. CONCLUSION AND DISCUSSION

The rapid development of the IT field in recent years has opened new opportunities in several areas. IoT is considered a stage in the information revolution that will continue to expand (Tutorialspoint, 2021). This statement is also supported by the growing number of companies that are increasingly focused on working with the IoT technology.
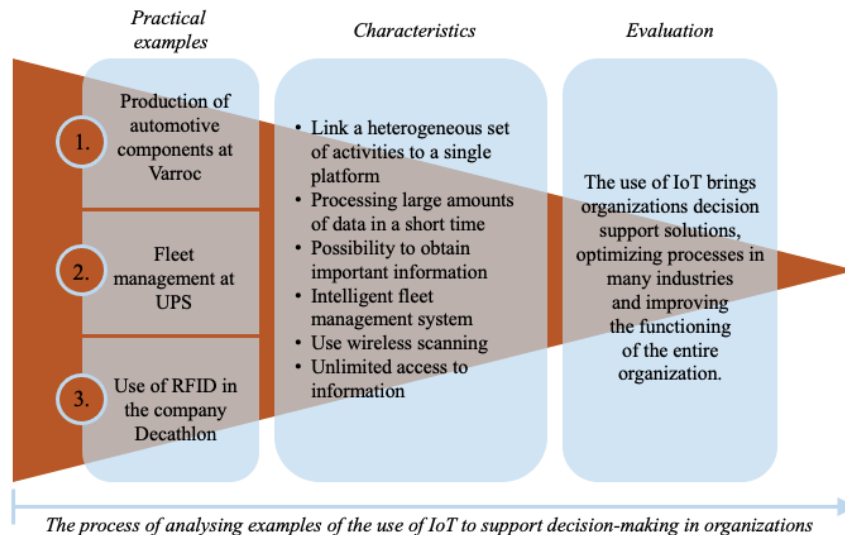
Figure 2 Analysis of practical examples

They are always looking for new ways of application (Verma, 2018). Great emphasis is placed on obtaining real-time information or performing repairs and maintenance remotely.

The scope for the use of IoT in organizations is wide. It largely depends on the operation of the company and the openness of management to new technologies. After using the IoT solution, companies will save costs, increase productivity, and, ultimately, support their competitiveness. However, it is necessary to consider who will be the provider of the IoT solutions, what are the financial options, what is the organization's capacity and the relationship of employees towards new trends and IT (Turc, 2019).

The Internet is an important and useful part of the lives of individuals, groups, and organizations if they know how to use it properly and effectively. It is important to identify specific successful practical examples that will guide recommendations for the introduction of IoT technology in the decision support. Properly connecting the Internet to production, unifying systems, processing data at the right time or integrating the old and new systems have led, for example, to reduced costs, increased efficiency, or the increase in the employees' productivity.

Regarding the IoE technology, it can be stated that the main benefits include: fast personal communication; effective decision-making; dissemination of new pieces of information; or connection automation (Sarbani, Chandreyee, 2016).

It is essential for organizations to be able to work with data so that they can make the right decisions in all circumstances and thus save their costs. It is important that the IoT technology is used not only in production but also in other parts of the company, so that all parts work together and achieve the synergistic effect.

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