

IoT Technology Challenges for the Business Media from Suceava

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Abstract

Knowing that IoT technologies have the potential to dramatically increase the availability of information, most likely to transform companies and organizations in a practical way, we want to identify the level at which companies in Suceava County are also located.

This paper aims to analyze the challenges of IoT Technologies encountered by companies in Suceava County. On the one hand, it is intended to carry out a critical study of specialized literature in order to highlight the current state of IoT technologies at the level of economic operators as well as at that of enterprises. The focus will be on the quantitative approach, but there will also be aspects of the qualitative approach. On the other hand, we will start from the level of IoT technologies outlined on the official platform, reaching the economic level of local companies.

Key words: IoT technologies, business media, challenge, digital, Suceava

J.E.L. classification: M15, M16, M21

1. Introduction

The Internet of Things (IoT) will allow entry into a new economic era for the entire globe.

A world governed by the Internet of Things is one where appropriate measure are needed, due to the growing economic complexity and the development of the framework that industries and governments have adopted to stimulate economic growth and competition. The Internet of Things will have an impact in every country and economy on the planet, even in the developing world, where the benefits of technological progress have usually been denied. The perspectives offered by IoT relate not only to simple improvements to existing economic processes and models, but rather to the transformation of their scope.

In terms of objects or things, the Internet in IoT currently has different interpretations.

We can think of the current Internet network as the network that supports the remote transport of traffic generated by connected objects or the network of objects in IoT services through special gateways. We can also see it as the IP communication model adapted to manage communication between objects in the object network, as well as in sensor networks. An example of IP adaptation to networks with different needs is IPv6, which is adapted to small devices with resource limitations, especially energy limitations.

2. Theoretical background

We can also see IoT as a subset of features developed by the Internet community, such as the appointment resolution service; domain name server that can be used to resolve the mail of an object identifier (for example, radio frequency identification) to certain addresses on the network that could trigger a specific application or service. We can see it as just a buzz word, which refers to the connectivity of objects, but not to the IP model or the current internet network. In this case, IoT could be called a network of objects, because connectivity could follow any existing or future communication model. (Stankovic, A., 2014)

What is IoT (Internet of Things)? According to the authors (Neagu, Vrejoiu, Preda, Stanciu, 2021).

IoT is a network of physical (smart) objects that are interconnected with each other, which have built-in technology they need to communicate and detect data about their internal state, as well as interaction with the external environment. In 2012, Rand Europe defined the Internet of Things in a European Commission research report. This report states that: "The Internet of Things is a development of the Internet achieved by creating a universal network of connected physical objects capable of self-organizing, identifiable and addressable that allow the development of applications in and between key vertical sectors through the use of embedded chips, sensors and actuators and by low-cost miniaturization".

There are also other definitions of the Internet of Things developed by different international researchers or bodies. Here are some of these:

- the definition developed by T. Lu and W. Neng: "Things have virtual identities and personalities operating in intelligent spaces using intelligent interfaces to connect and communicate within social, environmental and user contexts.";
- the definition developed by the European Commission: "From a semantic point of view, the expression is composed of two words and concepts: The Internet and The Thing (thing), in which the Internet can be defined as a universal network of interconnected computer networks, based on a standard communication protocol, TCP / IP (Transmission Control Protocol / Internet Protocol), while Thing (work) is an object that is not accurately identified. Therefore, from a semantic point of view, the Internet of Things has the meaning of a universal network of single-addressable interconnected objects based on standard communication protocols.";
- the definition developed by P. Guillemin and P. Friess: " The Internet of Things allows people and objects to be connected anytime, anywhere, with anything and anyone, using any path/network, as well as any service."

The field of technologies IoT has experienced a sensational development both in the last decade and more considerably during the current context (Covid-19).

Thanks to the development of IoT technologies, we decided to carry out statistical research in this regard. The characteristic of this technology, which has attracted our attention is to provide information resources that then take the form of services that beneficiaries (in our case companies in Suceava County) can use the quantity and quality they need from any corner of the world.

Along with other technological developments such as Cloud computing, smart grids, nanotechnology and robotics, the Internet universe of things ensures a huge step towards an economy characterized by increased efficiency, productivity, safety and profit. The interconnection between business and IoT technologies Thanks to IoT technologies, researchers have developed a suite of ways to integrate and develop considerably these opportunities offered by IoT in organizations, with the aim of spending on information technology. Addressing this theme from a commercial point of view, we could see that IoT aims to improve the quality of life, sparing the human resource from effort thus diminishing a certain part of its responsibilities. We chose this theme to demonstrate and confirm the change of vision that IoT brings, namely:

- expanding the diversity of these objects by standardizing communication and interaction solutions;
- harnessing data on the evolution of these objects by purchasing, transmitting and storing them in dedicated, centralized or cloud-based infrastructures, as well as by advanced analysis of these objects, using specialized services, to extract, synthesize and use relevant information.

What directions does IoT prove its usefulness?

Industrial areas / Cities

Smart buildings and care for the environment

Smart housing

Transport, convenience, mobility and dynamics

The healthcare system is consistent with smart homes.

During the course of this study, analyzing the activity of companies in Suceava County, we identified some characteristics of the Internet of things, priority for those companies, these are the following:

- **Distributivity:** The Internet of Things evolves in a highly distributed environment. Data is collected from different sources and processed by multiple entities in a distributed manner;
- **Interoperability:** devices from different suppliers cooperate to achieve common objectives. Systems and protocols shall be designed in a way that allows objects (devices) from different manufacturers to exchange data and work in an interoperable manner;
- **Scalability:** In the Internet of Things systems and applications run at the top of the network and manage an unprecedented amount of data;
- **Resource shortage:** both energy and computing resources are extremely limited;
- **Security:** the existence of an unknown external control that generates frustration among users which would represent a serious impediment to the implementation of the Internet of Things.

Looking at it from a different perspective, all opportunities present a certain level of risk and, in terms of the Internet of things, risks are as important as rewards.

Starting from cyber breaches to the transfer of a ownership problem, businesses cannot afford to enter this new technological world unprepared. For example, any Internet-connected object is an entry point through which cybercriminals can enter a business system of an enterprise. In conclusion, we can say that IoT technologies are a revolutionary transformation, both qualitative and quantitative, of our interaction with the environment in which we are located.

3. Research methodology

Phenomena such as the rapid evolution of technology, the need for adaptive scalability, cybersecurity, easy-to-use design, the length of time for verification, the customization of IoT solutions or projects, are normal in the century in which we live, but they periodically involve large-scale changes. These changes have created the challenges of IoT technologies. The purpose of this study is to identify which of these challenges also applies to firms in Suceava County and the extent to which they apply.

This paper aims to analyze the challenges of IoT Technologies encountered by companies in Suceava County. As such, it is expected to be found ways to harness the power of IoT technologies, considered a factor in the strategic objectives of most firms, regardless of their focus on the industry. In relation to the overall objective, we will outline the operational framework of the research by setting specific objectives, general assumptions, and specific working hypotheses.

Therefore, the use of mixed methodologies in economic research requires an analysis of quantitative and qualitative methods as to their possibilities of being integrated into a coherent whole or system leading to the achievement of a well-defined research objective. Some methods lend themselves better to this process, and others less so. Certain methods are also useful to achieve specific objectives at different stages of complex research (Pintilescu, Muntean 2018).

In this paper, several such methods are investigated, and their selection was carried out in order to achieve a double objective. On the one hand, it concerns the evaluation of specific elements of these methods, in relation to the perspective of mixed methodologies. On the other hand, it is desired to analyse these methods in relation to the empirical part of the work, where they will be used to verify certain hypotheses concerning the use of research methods in the economic field.

Quantitative research is used to test and validate previously constructed assumptions, the results obtained through this type of research are relatively independent of the researcher. The research is carried out via the Internet, the questionnaire being conducted in Google Forms and distributed, by email, social networks with appeal to companies in Suceava County. After the introduction, the first section of the questionnaire follows, consisting of two filter questions "1. Do you know the concept of the Internet of things? (IoT aims to connect any device to the Internet so that these objects can exchange data with each other on a network)" and "2. The company you are currently operating in or operating in Suceava County?", depending on the answer that respondents give to these questions, can continue the questionnaire or be directed to a section that will explain why the questionnaire ends and the assessment that there was the initiative to complete the questionnaire.

The research subjects are employees of 30 companies, namely: directors, managers, who can provide us with the information needed to carry out the research.

In relation to the overall objective, we will outline the operational framework of the research by setting specific objectives, general assumptions, and specific working hypotheses.

Secondary objectives of the research

- O1. Identifying the most influential challenges of IoT technologies within Suceava companies
- O2. Identifying the extent to which the challenges that appeared may affect the company's business
- O3. Identifying the readiness and available resources of firms for these new challenges in IoT technologies
- O4. Identifying the most important challenges at the level of the practice of IoT technologies at the level of the companies in Suceava
- O5. Identifying the safety and security of companies in the use of IoT technologies
- O6. Identification of adaptability (to cope with ...)
- O7. Identification of the use of IoT technologies in Suceava County companies
- O8. Identifying the advantages and disadvantages of IoT technologies
- O9. Identification of the most advantageous industries in Suceava County, following the use of IoT
- O10. Make a respondent profile

Statistical assumptions of research

- H1: 25% of respondents, working age, between 2 and 4 years;
- H2: 50% of respondents to the questionnaire work in companies with up to 50 employees;
- H3: More than 40% of the population surveyed believe that IoT Technologies greatly influences the company's activity;
- H4: 30% of those evaluated believe that there are difficulties in keeping up with the evolution of IoT technologies;
- H5: The most common in the sample analysed is considered the degree of security between "safe" and "very safe";
- H6: 60% of respondents consider "safe" how IoT technologies develop their safety;
- H7: The most commonly used answer for the question related to this hypothesis is 40% prepared by the firm for that challenge;
- H8: In a proportion of 30/30 % the firms in the sample analyzed consider either "neutral" or "prepared" the firm for customizing IoT solutions or IoT projects.
- H9: On average, the firms in the sample analyzed have responses between 'prepared' and 'very prepared', as regards to the firm, if the following challenge is taken into account: the need for scalability;
- H10: 30% Consider cybersecurity a neutral challenge for the company in which it operates, 30% confirm the company's prepared for this challenge;

4. Findings

The sample is structured as follows: 20% of respondents work in agriculture, 16% in real estate, the rest being in areas such as: construction, transport, media/internet, construction in relatively equal percentages. If we pay attention and experience in the fields in which they work, we note that 30% have experience between 2 and 3 years, 30% less than 1 year, 23% over 10 years, 13.3% 5 years the difference being by those who are 8-9 years old.

By the number of employees, the enterprises are 26.7% in micro-enterprises, 23.3% in medium-sized enterprises with up to 50 employees; 26.7% large enterprises and 24.3% more than 250 employees. It should be noted that 80% of companies use IoT and 14% believe that IoT technologies greatly influence the activity of the company in which they operate.

Among the factors influencing the challenges arising in IoT technologies we recall: 73% responded that the rapid evaluation of technologies, 15% the time for recovery, cybersecurity, customization of solutions or projects, the last place being the easy-to-use design.

Section three of the questionnaire: "Are you having difficulty keeping up with the evolution of IoT (Internet of things) technologies?", the following statistical table was found, according to the indicators of the central trend and the location.

Table 1. Analyse of data

Lim Inf	Lim Sup	Xi	ni	d	N↓	Xi*ni	Xi- X	(Xi- X)^2*ni
1	1	1	7	0	9	7	-2	28
2	2	2	7	0	16	14	-1	7
3	3	3	10	0	26	30	0	0
4	4	4	4	0	30	16	1	4
5	5	5	2	0	32	10	2	8
Total		15	30			77		

Source: (Authors' own research).

It follows from the calculation of the median that about half of the respondents do not see it as difficult in keeping up with IoT technologies, the result being equal to 3, having the expressive equivalence of "neutral / indifferent", according to the questionnaire.

From the calculation of the mode, it follows that the central trend of the sample is equal to the value of 3, so that the vast majority of respondents are neutral in terms of difficulty in keeping up with IoT technologies.

It follows from the arithmetic average calculation that about half of the respondents encounter to a small extent or are neutral about the difficulties in keeping up with IoT technologies, the result being equal to about 2.56, having the expressive equivalence of "to a small extent / neutral / regardless", according to the questionnaire.

It can therefore be observed that there is approximate equality of an equality $\bar{x} = Mo = Me$ resulting in the distribution of frequencies being symmetrical.

The starting point is section three of the questioner, namely the question: "Assess the degree of security and safety of IoT technologies within the company in which you operate". It follows that more than half of respondents work in firms where there is a degree of safety and security of IoT technologies equal to the value 4, represented by the expression "safe" according to the questionnaire. Thus, there is a symmetry between the distribution of frequencies.

It is apparent from the calculation of arithmetic averages for both coordinates that most respondents work in firms where there is a degree of safety and security of IoT technologies is equal to 3.66 and 3.86 respectively, having the expressive equivalence of "neutral / safe", according to the questionnaire.

Another aspect taken into account is the challenge - Cybersecurity on IoT projects shows that about 40% of respondents are trained in the cybersecurity aspect of IoT technologies, the result being the value 4, equivalent to the same value expressions, according to the questionnaire.

It can be seen that about 30% of respondents are neutral to the ready in terms of the cybersecurity aspect of IoT technologies, the result being equal to 3.47, meaning 3-neutral/4-prepared according to the questionnaire.

Interesting to highlight are the opinions of respondents on IoT technologies:

- I believe that IoT technologies represent the future of a company, enabling communication between people, processes and things. I think it is about communication between the physical and digital worlds, resulting in a level, perhaps the highest to date, of efficiency, competitiveness and communication.
- I believe that we should keep up with new technologies so that we would not fall behind and become a serious problem, due to the increasingly accelerated development of technology.
- I believe that IoT technologies represent the future of mankind.
- I have a good opinion so far, given the development of these technologies. I find many advantages in the use of this technology.
- It's worth investing in.
- In the current context, there is a growing need for automation.
- I am satisfied with her.
- It's a positive one because it guarantees efficiency.
- I'm delighted.
- A step forward towards evolution in any field.
- It is of major help when used for a well-defined purpose.

- IoT technologies help a company a lot if used properly.
- I believe that IoT technologies are of major importance and necessity within companies.
- Facilitates access to various services. It's the future.
- It is important.
- It's a current technology that the vast majority of campaigns need.

Efficient and transparent. Analyzing the indicators used we can conclude the validation of statistical assumptions, therefore 80%, the assumptions have been validated, except for hypotheses 5 and 9 that have been disproved.

5. Conclusions

The digital age revolutionized human society in the last century. In fact, the digitization of information processes has led to the design of computers, phones and other machines that offer a lot of applications running on independent computing machines. Then the digitalized information transport developed.

Our society is now completely dependent on the largest network ever, the Internet - one of the most amazing and major human inventions. On this network, most information traffic is created and generated by people via email, web and other user services.

Now, after digitizing information, transportation, and communication, the ubiquitous computer appears. It is based on digitized information from the real environment and allows us to build more task automation to better interact with the real environment. Automated processes are expected to be around us to build the so-called "smart world," where the real and the internet of virtual world sorbes coexist together. Here not only people communicate over the network, but any connected object or thing involved in a particular process, with and without human intervention, will communicate and generate network traffic.

The Internet of Things (IoT) is somehow a driving path to the intelligent world, with computers and ubiquitous networks to ease different tasks around users and provide other tasks, such as easy monitoring of the various phenomena that surround us.

In IoT, the environment and everyday articles, called "things", "objects" or "machines" are enhanced with computing and communication technologies. They join the communication framework, encountering a variety of services based on person-person, person-machine, machine-person and machine-machine interactions using cable and wireless communications. These connected machines or objects/things will be new Internet or network users and will generate data traffic. They will perform new services that will be carried out by the current or future internet.

In summary, a vision of the future is that IoT becomes a utility with increased sophistication in detection, actuation, communications, control and in the creation of knowledge from large amounts of data. This will result in qualitatively different lifestyles than today. Lifestyles would be anyone's guess. It would be fair to say that we cannot predict how lives will change. I didn't predict the Internet, the web, social networks, Facebook, Twitter, millions of smartphone apps, etc., and all of this has qualitatively changed the lifestyle of companies. New research issues arise from the large scale of devices, the connection of physical and cyber worlds, the opening of systems, and ongoing privacy and security issues. It is hoped that there is more cooperation between research communities to solve the multitude of problems earlier, as well as to avoid reinventing the wheel when a particular community solves a problem.

6. Limits and future directions of research

Given the polyvalence of the development and use of a mixed methodology, limits are imminent, but also the inconvenience of moving them forward at this stage of the research.

The following are a number of limits captured both methodologically and empirically. From a methodological point of view, only a few more or less classical qualitative and quantitative methods have been analyzed that can be framed in multilateral mixed research strategies. Empirically, an important first limit derives from the small number of respondents who accepted the challenge of answering the online questionnaire, but also from the low level of knowledge about IoT technologies. As for quantitative study, the volume of the study sample may also be a limitation of the research.

On the one hand, the application of the questionnaire online has been an impediment to carrying out the research, in the context that the current situation is such that you end up considering the mails as a whole- spam.

In consonance with the identified limits, as well as with the high dynamics of international research on IoT technologies, we point to a string of future directions opened by this research topic. A first direction envisages the analysis of other quantitative and qualitative methods on their possibilities to be integrated into a whole or a coherent system built on the coordinates of a mixed methodology. The second proposal is empirical and aims to develop this research by applying the questionnaire to a larger sample including specialized respondents from other regions and fields of activity in Romania, as well as by introducing new series of questions in the questionnaire guide to allow surprise and other dimensions to explore on the research issue.

Finally, also with a view to the development of research, other mixed research strategies should be used to assess the use of research methods in the economic field.

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