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IoT Technologies: Realities of the Future

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Abstract: IoT pervades with small steps, but confident in the everyday life of consumers in the most diversified fields of their activity through smart devices, successfully used in e-commerce, health, smart homes, education, e-government, courier services, transport, etc. . This article aims to treat new IoT technologies entered in the market place from the perspective of the final consumer, as well as the applications and challenges arising from their use on a global scale and their impact on the social life.

Keywords: Internet of things (IoT), IoT predictions, effects generated by IoT.

JEL Classification: *O31, O33*

Introduction

IoT is a concept that involves a wide range of electronic devices connected in an online environment that can collect and provide information about objects, time, space and people. This technology includes intelligent communications sensors and interfaces that allow connection between devices or between devices and internet (software platforms on the internet) and offer a multitude of services and benefits in our daily lives.

The term “IoT” (Internet of Things) was first time introduced by Kevin Ashton in 1999[1], which analogized IoT with a system of sensors contained in physical objects connected to the internet.

The Internet of Things (IoT) represents the interconnection of machines and physical devices containing sensors (included in intelligent objects, cars and intelligent cities) and internet connections, a connectivity that allows, through these devices, that an enormous amount of data about the environment to be collected and processed.

Influences of IoT on society

a. The conversion of simple objects into complex objects

The daily objects until recently known as "simple and customary, even banal" are now becoming, through IoT technologies, new and smart objects that, along with their basic functions, come with sensors and internet

[1] A. Kevin, "That ‘Internet of Things’ thing, in the real world things matter more than ideas," RFiD Journal, vol. 22, 2009.

connection interfaces. Through software, web or mobile applications, the user can interact remotely with them, thus controlling their status.

An example of this would be the following: by taking an intelligent lightbulb[2] as a reference, besides the role of lighting, it can be controlled from any location (the lightbulb may turn on or off from a distance) at any time, anywhere on the globe and its status (if it is lit or not) can be checked at any time. Moreover, the intelligent lightbulb can be commanded vocally and it even can make decisions by itself, in the sense that it can adjust its brightness according to the daytime or natural light that enters the location.

b. The onset of IoT on the consumer market

IoT technology has been used for a very long time in the production process which makes it possible the handling of the machinery and plant equipment through computer devices. These machines can communicate with each other, the information is synchronized, it does not require human presence, but only the correct application of the computer program to drive the robot / the car to the correct execution of the tasks administered. This process that uses local network infrastructure to communicate with a range of IT applications for the purpose of automated monitoring and control is possible thanks to M2M (Machine to Machine) communications technologies.

IOT technology allows a factory to be transformed into an ecosystem where all machineries involved in the production process work harmoniously, complementarily and congruently in order to increase global efficiency, by identifying and eliminating potential errors.

These technologies allow the new devices and systems to be automated in an efficient manner of intelligence-cost, that allows control and monitoring support in real time. With all the relevant information gathered and available (in real time, along with historical trend data), these new technologies enable the ability to combine and process data collected in an innovative manner, which leads to a more effective control over decisions making.

Large amounts of data generated by IoT devices require extreme performance to store and process these data, and all these challenges can be successfully sustained by Cloud Computing systems.

Cloud computing, in simple terms, means storing and accessing data through software programs in a centralized pool of computing resources that can be ordered and consumed on demand based on the amount of data and the need for computing power to be used in processing of this information.

Cloud computing and IoT have a complementary relationship that serves to streamline the collection, storage and processing of large amounts of data, where IoT generates massive amounts of data, and cloud computing provides the technology needed to store and process these data.

By implementing IoT and cloud computing, businesses will be permanently connected to technological changes in the industry, requiring continuous adaptation to compete and minimize losses or manage errors by

[2] Personal wireless lighting - https://www.philips.co.uk/c-p/8718291547778/hue-personal-wireless-lighting

taking into account and integrating tools of risk management, change management and performance management. The experts believe that in order to cope with competition and achieve the best quality products in consensus with waste management and consumer needs and taking into account the reliability of the products made, the technology will need to be changed over a period of 3-7 years. However, investments will be profitable because although the final consumers buy increasingly IoT devices, the business area is investing more and more in these types of devices.

c. Predictions on the evolution of the IoT market

By 2020, spending on IoT equipment in both segments will reach more than 2 trillion of dollars, according to a study released by Gartner.

Table 1 :IoT Endpoint Spending by Category (Millions of Dollars)

Category	**2016**	**2017**	**2018**	**2020**
Consumer	532,515	725,696	985,348	1,494,466
Business: Cross-Industry	212,069	280,059	372,989	567,659
Business: Vertical-Specific	634,921	683,817	736,543	863,662
Grand Total	**1,379,505**	**1,689,572**	**2,094,881**	**2,925,787**

Source: Gartner (January 2017)[3]

Contemporary challenges consist of IoT technologies transposition from the level of production to the domestic and individual consumers, and also of creating a routine as for the use of IoT products with significant environmental impact: reducing pollution sources, rationalizing natural resource consumption by programming and fortuitous choosing of some consumer programs with differentiated costs from the invoicing perspective.

Thus, agriculture, education, health system, retail, factories, cities, automobiles, all areas of activity will benefit from the implementation of IoT technologies. For this, there is a need for a prior education both for producers in standardizing products and creating a homogeneous offer of economical goods that can be considered as assimilated IoT, and also for consumers, in order to configure their demand for economical goods by adapting their needs to the demands of economical sustainability, in the sense of a creative and reliable use of economical goods. These goods behave by taking into account the connection of the product to the Internet, the transmission of messages and its remote control. These goods, considered intelligent, will be configured on the basis of a software program and using databases to gather information from them. For this reason, consumers need to know that this kind of products can monitor and send the collected data to a central server. Also, by connecting to the internet, the manufacturer will always keep control of the sold products and may decide whether to stop the support and operation of the products, leaving the consumer out of the product's usefulness. This raises the issue of the security of consumer`s intelligent products, of the management of data collected from consumers and also of the consumer`s full access to the product while it is under the control of

[3] https://www.gartner.com/newsroom/id/3598917

the manufacturer. At the same time, if the products communicate with each other, the problem of product`s security also affects the other users on the same market.

d. Trends in the evolution of IoT

Over time, there have been more predictions made by major global IT marketers about the market penetration of IoT and M2M devices.

Tabel 2: Previziuni privind creșterea pieței "IOT" și „M2M"

Year	Organization	Raport
2010	IBM	"A world of 1 trillion connected devices" by 2015
2011	Ericsson's CEO Hans Vestberg:	"50 billion connected devices" by 2020.
2013	Cisco	"50 billion things will be connected to the internet by 2020."
2013	ABI Research report	"30 billion" by 2020.
2013	Morgan Stanley report	"75 billion devices connected to the IoT" by 2020
2014	an Intel infographic	"31 billion devices connected to internet" by 2020.
2014	ABI Research updated report	"41 billion active wireless connected devices" by 2020
2015	Gartner Research	"4.9 billion connected things in use in 2015 … and will reach 20.8 billion by 2020."

Source: IBM (2010), Erricson (2011), Cisco (2013), ABI Research (2013, 2014), Morgan Stanley(2013), Gartner (2015)

What can be noted as a common denominator in all these predictions is that the number of IoT devices estimated for 2020 has consistently been extremely high over these years.

According to these studies, in 2020 there will be over 30 billion IoT products - devices connected to the Internet, either for personal use, or business utilization.

The rise of the marketplace is also very important for the users' interest in smart products, taking into account the existence of risks, especially generated by the products` security and data integrity.

e. Effects generated by the expanding of IOT usage

Tabel 3 - Effects of using IOT technology for users categories

Users categories	**Advantages**	**Efects**
Producers	Cost reduction	Increasing the competitiveness of products on the specific market
	Automation	Increasing the overall productivity

	Robotization / Technologizing	The risk of under-employment (falling labor demand as a result of labor-capital substitution)
		Increasing the spending on innovation and scientific research
Consumers	Time saving and energy resources	Balanced time budget, designed to enrich the human being
		Less energy consumption, better management of pollution, recycling and waste management issues
	Improving skills in the use of superior technologies, intelligence based on knowledge and artificial intelligence	Diversification of educational programs, university curricula by emphasizing the creative side, the use of artificial intelligence languages for the purpose of using it as a specific technique for the domestic industry
State	Sustainability of the natural environment / rational use of economical resources	Cost cuts on energy production
	Use of creative industries to manage global issues such as traffic, public transport, energy supply to localities, citizens' security	Increasing living standards and life quality

Source: Own contribution of author

The management of IoT tools provides increased opportunities for citizens and society, in general, to converge to rational and timely usage patterns of economical resources, human factor and public institutions.

Conclusions

The IoT market will face explosive growth worldwide and due to these increases, there will be a need for massive implications in the political, security, regulatory, confidentiality and technology provision.

The future reserves a multitude of uses for IoT technology, from production to consumption, from complex and engineering products to household products or educational content. The pleading for these products has to be done in terms of cost-benefit, in order to identify the relationship between the product and the environment, the person and the product and the science and consumption. Profitable to these products is the gain in terms of protecting environmental resources, meaning the sustainable approach to natural resources, increasing the level of accountability of the participants in the production act, producers and consumers alike by adopting smart, creative solutions of the products configured into simple tasks, with daily content, in order to increase the free time of the individual and the responsible use of natural resources.

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