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Analysis and Estimation of Economic Influence of IoT and Telecommunication in Regional Media Based on Evolution and Electronic Markets in Romania

Andreea Nistor [1,*] and Eduard Zadobrischi [2,3,*]

[1] Faculty of Economics and Public Administration, "Stefan cel Mare" University, No.13. Str. Universitatii, 720229 Suceava, Romania
[2] Department of Computers, Electronics and Automation, Faculty of Electrical Engineering and Computer Science, "Stefan cel Mare" University, No.13. Str. Universitatii, 720229 Suceava, Romania
[3] Department of Computer Science, Technical University of Cluj-Napoca, Gh. Baritiu St. 26-28, 400027 Cluj-Napoca, Romania
* Correspondence: andreea.nistor@usm.ro (A.N.); eduard.zadobrischi@usm.ro (E.Z.)

Abstract: The interconnection of devices, intended to collect and transmit data via the Internet, is called the Internet of Things (IoT). This technology has the potential to revolutionize both the economic and industrial sectors, especially in terms of data confidentiality and information security. New media, with a merger between those two, have increasingly replaced traditional media, but many researchers characterize them as two distinct but interconnected types of media. From the traditional media, with its technological evolution, the IoT has supported the development of the media through the emergence of applications, websites, and social networks designed to spread information worldwide. This research focuses on how the IoT has the ability to influence economic growth by trying to determine the impact of the IoT through theories and the evolution of economic growth. Thus, the concept of the IoT is interdependent on information and communications technology and, from an economic point of view, is correlated with productivity. In addition, the processes that have an impact on the media are those of an economic nature, all of which are interconnected with progress, innovation, and the promotion of goods and services. At the same time, this paper aims to determine the correlation between IoT and the economy, with a focus on the media, which has the main result of the development of new businesses. Thus, a bibliometric analysis of the scientific papers on the Web of Science platform regarding the IoT field was performed, in order to identify the current state of knowledge in this field. The results of this analysis highlighted that both the IoT and the economy are shaped by innovation, opportunities, and development.

Keywords: Internet of Things; bibliometric; digital economics; telecommunications; media; social networks; 5G

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1. Introduction

Information and communication technology have become a set of tools present in everyday life and in the economic sector, by increasing production, by determining the emergence of new services, and last but not least, by stimulating cost reduction, producing an influence on the management system of an organization. Thus, the company is presided over by innovations that focus on information and communication technologies, and among these innovations is the evolution produced by communications technology. At the enterprise level, IoT grew exponentially in 2020, with the highest growth in Asia at 17%, North America at 14%, and the slowest growth in Europe at 9.7%. Through their communication sensors, it is possible to exchange data and information only through technology, without resorting to human action.

The term "Internet of Things" was coined in 1999 by Ashton, co-founder of the Massachusetts Institute of Technology's Auto-ID Center [1], when he identified radio frequency tags in supply chains to interconnect the Internet with physical objects. The IoT field is shaping a new era, meant to develop society both economically and socially [2], being able to revolutionize even more than the Internet. In this paper, we aim to pursue the economic dimension of the IoT, having the ability to innovate in the field of entrepreneurship through economic models that, in turn, generate new directions [3]. IoT is a model through which objects connect to the Internet, and people have the ability to transfer data with minimal intervention. The Internet of Things also enhances the functionality of applications related to production, transportation, energy, or the medical field, with multidisciplinary implications [4], including computer science, social science engineering, management, and business administration.

The IoT is estimated to have an impact of USD 11.1 trillion on the global economy [5] in 2025. This age of technology includes a number of factors meant to generate real progress in various fields, such as health, the environment, agriculture, transport, and capitalizing on the economy. In this sense, through the connectivity of the Internet, which benefits from high upload and download speeds, much more stable connections are created with wider coverage. In this context, 5G technology is the one that generates speeds of 1–10 G bit/s, which results in much better connectivity, a wider bandwidth of data, as well as fewer releases. Thus, mobile networks have the ability to interconnect devices in order to streamline economic sectors.

Technology has created an interconnected society, and the IoT is considered the future, through the realization of a learning process called M2M (machine-to-machine). In addition, devices and applications are connected and allow the data exchange to create a solid economy, resulting from increased productivity. Rectified productivity through the introduction of technological factors has a long-term or even permanent effect, so that, as far as the microeconomic is concerned, productivity factors can be seen as a direct link between GDP and the combined inputs [6]. Technological progress is always closely linked to increased productivity and, implicitly, to economic growth. In this context, technologies developed a long time ago, such as electricity, engines, or the production line, involve both technologies designed to transform life in a positive way, as well as various factors of production. Information technology has a wide coverage of productivity sectors, contributing to the emergence of new products and services and improving related processes [7]. IoT is the function of tangible objects and means of connection and interaction using communication networks in order to remove the existing barrier between the physical and virtual environment. Through the IoT, traditional media have begun to be replaced more and more frequently by new media, with a merger between those two, but many researchers characterize them as two distinct types of media interconnectivity.

The Internet has produced significant changes in the way people work and interpersonal communication, and at the same time, the Internet of Things takes this connectivity to another stage by connecting several devices to the Internet simultaneously, providing facilities for human interaction with the machine.

In order to analyze the media economy to estimate the economic influence of IoT and telecommunications in the regional media, we aim to answer the following questions (Q): Q1—What is the most prevalent research in the literature on the economic influence of IoT on the media? Q2—In which countries do you have the most well-established knowledge about the IoT economy? Q3—What are the dominant areas of use of the IoT technologies? In order to answer these questions, a bibliometric analysis was conducted, through which all research publications on the influence of IoT on economic sectors were analyzed. This study also identifies a number of opportunities and best practice models for European Union countries regarding the economic evolution of IoT.

This article is structured as follows: Section 2 presents the current stage of the concept of IoT, including media and economics. Section 3 contains the methodology used in this article, which consists of a bibliographic analysis of the most important articles published in the field of the IoT. Also described in this regard are the concepts presented by specialized publications. In addition, through the theory of endogenous growth, it is emphasized that economic development is not the result of external factors, but is due to endogenous factors, concluding that investment in human resources, knowledge, and innovation facilitate economic development. Section 4 highlights the results obtained from the analyzes performed on IoT technologies, both by analyzing publications in the literature and by analyzing existing IoT technologies in Romania. Section 5 also presents a number of partial conclusions and discussions on the articles under review, with guidance on future research. Section 5 presents the conclusions of this article.

2. Related Work

2.1. IoT Conceptualization

The Internet is a set of computers connected by a network, which is based on a series of protocols in order to interconnect multiple computers or mobiles worldwide in order to transmit services and information [8]. The Internet of Things is a combination of physical and electronic things that offers the ability of physical things to collect and exchange data. The Internet of Things is also considered to be of great importance in the field of wireless communications, so the foundation of this field is the ubiquity of the diversity of things, such as computers, mobile phones, sensors, and labels designed to interact with each other [9].

The Internet of Things works because of fundamental components such as devices, sensors, connectivity, data processing, and last but not least, interfaces. Thus, devices or sensors support the process of collecting environmental data, which can have various complexities [10]. They have a reduced capacity to store data, to pass data on, or to calculate, so that they have the ability to collect data, which is the final stage in the information process. Devices are usually connected to the internet for data attachment. Subsequently, the data are transferred to a cloud infrastructure, and in this case, by means of transport and communication, the sensors are usually connected to the cloud, such as satellite networks, Bluetooth, Wi-Fi, WAN networks, and many other examples [11]. After the data collection process in the cloud, the data are processed by software that is included in an interface and made available to users so that they have access to the IoT system. In data processing and management, the software consists of back-end data, a front-end user, and a B2B (business-to-business) interface. Usually, "things" are reported as devices, which can take various forms and have various uses, which make applications connect to the Internet in multiple ways. Experts are increasingly discussing the difference between IoT (Internet of Things) and IoE (Internet of Everything) [12], so they are considered to be two sides of the same coin.

In other words, if the Internet of Things focuses on what physical objects are, the concept of the Internet of Everything is based on four important factors, such as the following: things, people, processes, and last but not least, objects [13]. The Internet of Everything has the ability to store data about people or processes, resulting in a number of applications, such as ERP. Organizations, the educational environment, and entrepreneurship are the ones that use IoT data in order to save a number of time-related costs or to generate new ventures [14]. Moreover, the future is determined by IoT technologies in which physical and digital things are connected and information is communicated through services and applications.

The Internet of Things is the interconnectivity of promoting technologies, being an industrial revolution. It is aimed at devices that are part of the physical system that access the Internet. Things are equipped with built-in technologies through which they can interact with the outside world. At the same time, the IoE is concerned with things, people, data, or processes, making connections before turning information into business [15], which creates new opportunities in economics and business.

The IoT dataset is meant to reduce acquisition costs, and data analysis is used to examine small or large datasets to make relevant conclusions about the prospects that can be acquired. IoT is facing a number of challenges in terms of security issues, so IoT technologies are shaping up around private and open exchanges. In terms of privacy, issues related to identifying a person from various public or private organizations are concentrated on the Internet.

One of the most important IoT applications is smart cities. To increase efficiency, it uses ICT for better operability, to exchange information, and to improve the quality of services and the well-being of users [16]. At the same time, the smart environment is another application meant to integrate life with smart devices that have sensors or actuators. They have the ability to provide users with an easier environment for interaction with their immediate surroundings, so this concept was developed to combine innovation with administration, which relies on the programming side for good applicability. Smart meters also have the role of satisfying customers with faster interaction, giving them the opportunity to have more control over energy in order to save financial resources and also reduce carbon emissions [17]. With this application, smart grids can be monitored by calculating precise parameters. The IoT also has a number of benefits by outlining the smart water application, which can monitor water cycles, water leaks, and even water spills. At the same time, the Internet of Things is shaping security applications, emergency applications, logistics applications, and health applications [18], offering people with disabilities access to care, patient monitoring, and quality control applications. States with a developed economy are leading countries in terms of the process of innovation and technology transfer, so the analysis of the process of technology innovation is one of the most addressed topics of research in the literature [19].

In 2021, in Romania, there were 860 smart city projects in 124 cities. The cities with smart city planned projects are the following: Alba Iulia, which has 106 projects, Cluj-Napoca, with 58 projects, Iasi, with 56 projects, Bucharest, with 39 projects, Arad, with 29 projects, Sibiu, with 27 projects, Timișoara and Oradea, with 26 projects, and last but not least, Brașov, with 18 projects [20]. At the same time, IoT technologies have been implemented in road transport in the last five years, so in order to develop IoT, 5G networks are extremely important and represent a pillar for virtual reality, but also a basis for the development of production and management systems based on the process of artificial intelligence [21]. These systems offer the opportunity to communicate in real-time various risks, from medical to production-related, and their effectiveness was necessary in the pandemic period when medical risks could be communicated quickly, and patients closely monitored using a series of intelligent systems.

Regarding the adoption of the 5G network in Romania, the economic effects are estimated at about 4.7 million euros, and this could generate over 250,000 jobs. In order to implement 5G in Romania, it is necessary to follow a series of aspects, such as the following: radio spectrum for territorial coverage, new frequency bands, as well as the implementation of pilot projects to test the success of 5G. At the same time, Romanian SMEs rank 27th among the top countries in the European Union that use digital technologies [22]. Although the 5G system is of relatively low interest to the authorities, a number of companies have begun to invest in and offer 5G commercially, using frequencies that are already available. Currently, the 5G system is present in Bucharest and in several other cities in the country, so by 2025, a 5G expansion is expected in other cities as well.

2.2. IoT Applicability in Economy

The IoT is an integral part of the Internet that identifies a number of perspectives, such as focusing on the Internet and network-oriented connectivity based on things that determine interconnected functionality and identity, and the semantic perspective that addresses data management in the IoT [23]. By determining these perspectives, the following key factors are created: connection, variety, security, and scalability [24]. Schoenberger and Upbin were the first to refer to the Internet of Things, outlining the impact that technologies have had not only on the economic sector but also on society [25]. The first web cloud, implemented by Amazon, appeared in the early 2000s, which led to new opportunities and ideas for the implementation of new IoT technologies, marking a new era of cloud computing. IoT progress is the creation of a bridge between the Internet and the network sensor infrastructure. Cavalcante et al. [26] show that cloud computing addresses IoT exploitation by promoting tangible benefits to the economy, society, or the environment. Another IoT perspective is associated with the challenges of M2M communications operability, with a focus on networking features such as security, mobility, resource efficiency, addressability, and last but not least, routing [27]. The limitations of the IoT architecture are represented by low network and cyber security, and in this context, Weber and Studer [28] focused on the regulations of the legal environment in terms of IoT security, as well as a number of perspectives on cybersecurity issues. Although there are a number of limitations to IoT development, this technology is used in most economic areas with the ability to improve the production process as well as the quality of life [29].

With regard to IoT projections, it is estimated that it will have an extremely high impact on the Internet and, implicitly, on the economy. For example, Huawei estimates that there will be more than 100 billion Internet connections by 2025 [30], and the McKinsey Global Institute, assessed the impact of the IoT on the global economy could reach USD 11 trillion by 2025 [31]. In this context, IoT users could benefit from an improved health care system by monitoring patients remotely with the help of technology. Most businesses and organizations could benefit from about 90% of the IoT potential as determined by applications and networks. The IoT system has an M2M (machine-to-machine) connection that is usually based on either Wi-Fi or cellular technologies. The number of IoT connections has been steadily increasing in recent years, so that in just 10 years, the number of connections has reached 1026 million in the period 2011–2018, starting from a figure of 76 million, and many of these connections are in China and the United States, respectively, thanks to smart machines or industrial applications.

By extrapolating the IoT concept to the automotive industry, a vehicle has an assembly that allows the exchange of information between the vehicle and the surrounding environment through local networks without being equipped with wires. Thus, technological developments have led to changes in the safety and driving systems of motor vehicles, incorporating efficient driving modules for the human factor to take action to solve a number of problems that they face in traffic [32]. Therefore, the implementation of a system designed to contribute to road safety through adaptability and compatibility with other vehicles is an important step in the development of new devices for the safety of road users. All this is shaped with the help of the IoT.

IoT technologies can be implemented in all sectors where the human factor operates, so that around the IoT technologies gravitate the social factor, the production factor, as well as the environmental factor, which in turn involve several subcategories [33]. Thus, Figure 1 shows the areas of activity around which the human factor carries out its duties.

Another approach to the structure of IoT is that of Gubbi et al. [34], which suggests the applicability of IoT in the following four areas: in the personal field for solving everyday problems; in business, with an influence on infrastructure, health, and community issues; in the field of utility, with a focus on the mobile field and a predominance of network data and wireless connections, Figure 2 shows the applicability of IoT to the personal domain, the enterprise domain, the utility domain, and the mobile domain, according to the classification suggested by Gubbi et al. [35].

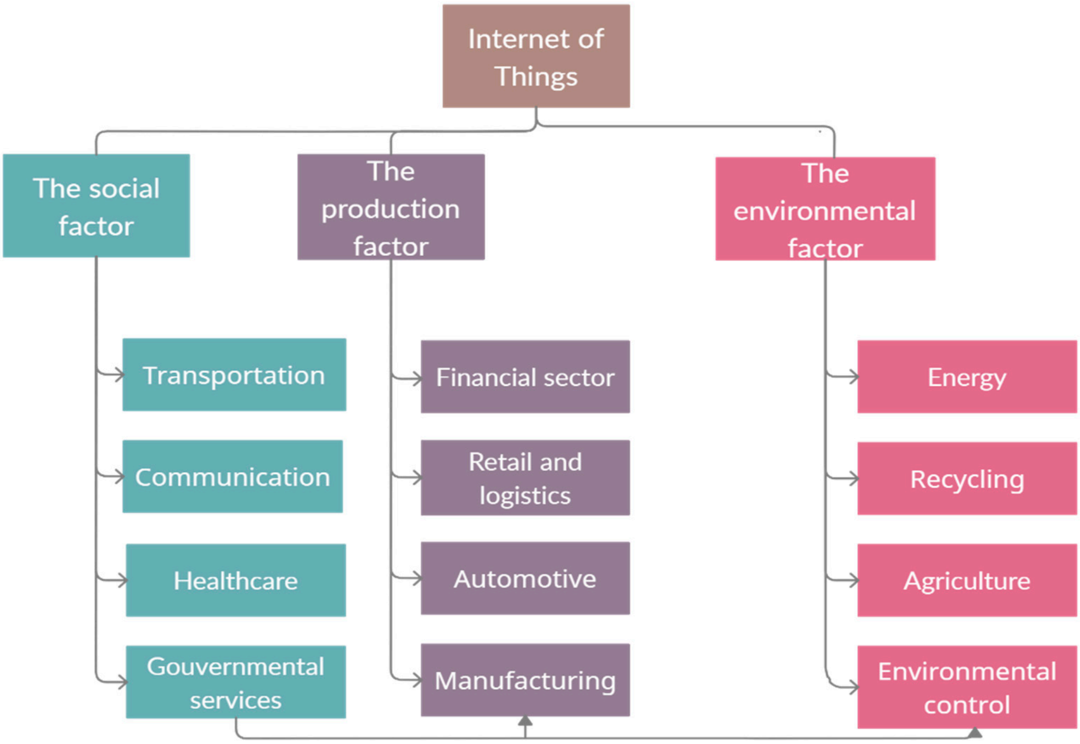

Figure 1. The main areas of IoT applicability.

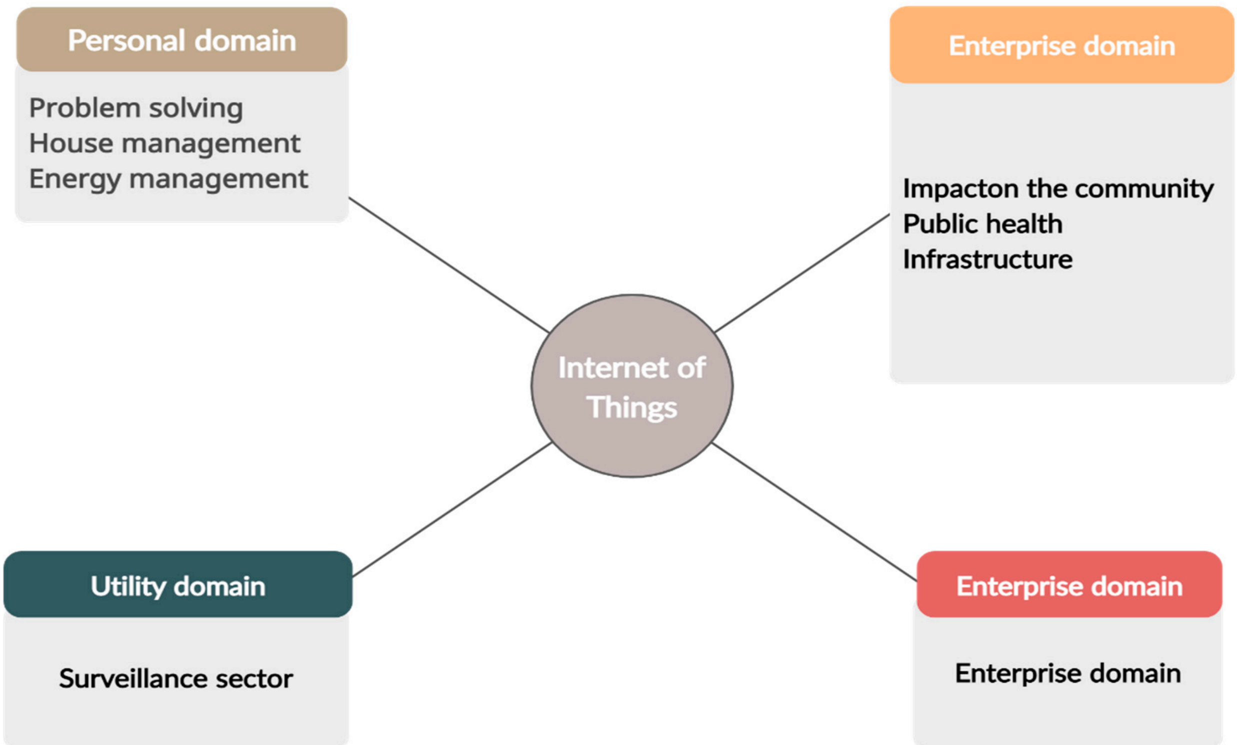

Figure 2. The advantages of IoT application in various fields.

IoT technologies are used in the case of the SARS-CoV-2 pandemic, in the medical system, with an emphasis on interconnected medical technologies [36], in the production process, as well as in the implementation of new products, services, and business models. The limitations of the IoT architecture are represented by low network and cyber security, and in this context, Weber [37] focuses on regulations of the legal environment in terms of

IoT security, as well as a number of perspectives on cybersecurity issues. Although there are a number of limitations to IoT development, this technology is used in most economic areas and has the ability to improve the production process as well as the quality of life [38].

2.3. Internet of Things, a Determinant of the Media Broadcasting Market

In the 21st century, the population has entered a new stage, driven by information, communication, and knowledge. These three principles contribute significantly to the development and progress of society. The creation of a society based on information and knowledge has been a long and complex journey based on economic, financial, technological, social, and cultural components. The rapid process of setting up an information society has led to the emergence of a new digital economy that has spread worldwide. Through the digital economy, work styles have undergone a number of changes, so teleworking, digital socialization, and teleactivities have been fundamental features of the knowledge-based information society.

Cable television appeared in the early 1950s in the United States, being used in student dormitories, which due to the relief barriers did not have the capacity to receive the transmission of the transmitters. Initially, the first coaxial cables had the ability to broadcast six programs, but later, their number increased to 36, and then over 50 fiber optic networks in the 1970s. In 1990, in the USA, over 40% of homes were wired in this way, and in Europe, about 90% [39]. In Romania, a communist country until 1989, the media were owned by the state. Later, after the fall of the communist regime, they underwent an extensive privatization process [40]. In other words, the Romanian media appeared after the 1989 Revolution because society was facing a series of turbulence specific to the transit of the political regime. Table 1 shows the evolution of the media between 1990 and 2020.

Table 1. The evolution of the media between 1990 and 2021, in Romania.

Year	The Evolution of Media in Romania	Characterization	Media Distribution Techniques
1990–1993	Media trusts were rapidly emerging and disappearing in the same way.	The media was supported by sales	Cable transmission Satellite broadcast Terrestrial emission
1993–1998	The media goes from state-owned to privately-owned.	Local licensing was later expanded	Cable transmission Satellite broadcast Terrestrial emission
1998–2000	The phenomenon of media ownership has clearly crystallized.	Increasing transparency	Cable transmission Satellite broadcast Terrestrial emission
From 2020	Private television focused on news and entertainment.	Higher quality content	Cable transmission Satellite broadcast Terrestrial emission
2000–2008	Political parties started acquiring and subsidizing media content.	The «influence model» is used	Cable transmission Satellite broadcast Terrestrial emission
2008–2021	Since 2008, the Internet has strengthened the media industry	Declining trend for traditional media.	Cable transmission Satellite broadcast Terrestrial emission Internet transmission

In the period between the 1990s and 2000s, the media in Romania experienced an "explosion", both politically and socially, with an influence from an economic point of view [41]. In Romania, after the fall of the communist regime, in the period from 1990–2008, the media trusts were distributed through satellite, cable transmissions, and terrestrial broadcasts. After 2008, internet transmissions appeared in Romania, which completely changed the media industry. The variety of the means of distributing media content via the

Internet has managed to transcend borders, so that the online distribution of TV content can be described by the following: online television, internet videos, streaming, web, Internet Protocol Television, etc.

In Romania, at the end of 2020, there were 614 licenses for broadcasting services and 344 licenses for audiovisual services. These were distributed in 194 localities from all counties in Romania and Bucharest. The situation of the licenses obtained in both the television and broadcasting fields, with terrestrial and satellite broadcasting, is presented in Table 2, in the period between 2010 and 2020.

Table 2. Licensing for broadcasting and audiovisual services (terrestrial and satellite).

	Radio Licenses					Television Licenses			
Year	**Local**	**Regional**	**National**	**International**	**Total**	**Local**	**Regional**	**National/International**	**Total**
2020	557	21	8	3	589	1	6		101
2019	539	21	8	3	571	1	8		113
2018	586	19	8	3	616	1	9		113
2017	564	15	9	3	591	-	10		109
2016	545	16	9	3	573	-	7		95
2015	569	14	9	3	595	-	7		88
2014	529	1	6	-	536	171	22		294
2013	588	1	5	-	594	287		18	305
2012	579	1	5	-	585	343		18	361
2011	573	1	5	-	579	366		18	384
2010	586	1	5	-	592	371		18	389

Source: own processing according to data provided by the National Audiovisual Council.

National audiovisual licenses offer the possibility of a broadcast whose geographical coverage includes over 60% of the Romanian population. In addition, the regional audiovisual licenses allow a broadcast whose geographical area includes a potential audience of up to 20% of the population, from the territory of three to eight counties. The local audiovisual licenses have a smaller potential audience, compared to the regional ones. In 2010, the total number of radio licenses was 592, including local, regional, and national licenses. The trend has been declining for two years, in 2011 and 2014, respectively, especially among local licenses. In 2013, the number of licenses exceeded that of 2010, with 594 licenses being granted at that time. The trend has been oscillating over the years, so that most radio licenses were granted in 2018, with 616 licenses, and in 2020, 589. Moreover, in 2015, they began to be granted radio licenses internationally. Regarding satellite or terrestrial television licenses, most of them were granted in 2010, these being both local, regional, national, and international. They had a downward trend, so in 2015, no local licenses were granted until 2017. Subsequently, at the local level, from 2018 to 2020, one license was granted per year, with the total number decreasing to 101 TV licenses granted locally, regionally, nationally, and internationally. This proves that the Internet has overtaken the traditional media, so many televisions have resorted to the online version of the broadcast, especially since 2014. Table 3 shows the situation of licenses existing in television and radio between 2010 and 2020, with broadcasting through other electronic communications networks.

With regard to licenses granted for broadcasting through other electronic communications networks, with regard to televisions, there is a tendency to increase them. If in 2010 there were 141 licenses granted at the local, regional, national and international level, in 2020 they reached a number of 245, the peak being reached in 2015 when 344 licenses were registered. Figure 3 shows the evolution of licensing in the media in the period 2010–2020.

Table 3. Licenses granted for broadcasting through other electronic communications networks.

Radio Licenses		Television Licenses			
Year	**Local**	**Local**	**Regional**	**National/International**	**Total**
2020		129	54	62	245
2019		144	49	39	232
2018		179	54	24	257
2017		221	41	21	293
2016		249	46	17	312
2015		287	46	11	344
2014					154
2013					132
2012	6				161
2011	2				129
2010	1				141

Source: own processing according to data provided by the National Audiovisual Council.

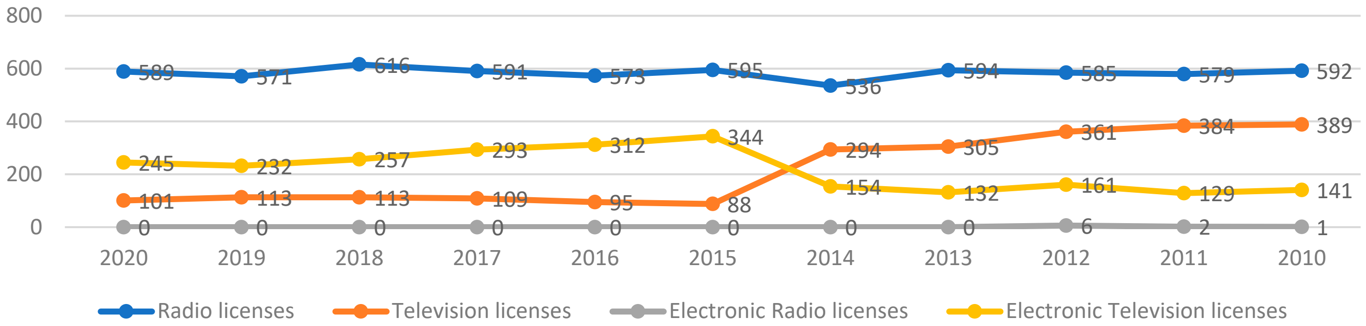

Figure 3. Evolution of media licensing in 2010–2020.

Electronic TV licenses have grown exponentially, from 141 to 245 in 2020. On the other hand, TV, terrestrial, and satellite licenses have fallen sharply since 2010, when there were 245 licenses, and in 2020, there are 141 licenses left. At the same time, radio licenses remained on the same line, with a decline in 2014.

3. Materials and Methods

3.1. A Bibliometric Analysis on IoT in Economic Development

The purpose of this article is to analyze the economic influence of IoT technology on the Romanian media, and for this purpose, we used a qualitative analysis, but also a bibliometric one, using VOSviewer software, with a special emphasis on articles on the Web of Science, in order to identify the state of knowledge in this field. At the same time, among the main objectives of this research are the following: determining the approach of the most common research topics and identifying the keywords used in the research analyzed. Thus, the purpose of the bibliometric analysis is to use a number of statistical means that have the ability to determine the economic impact of IoT on the media, both in terms of quality and quantity. The analysis has the ability to provide important information about the scientific investigation, being an indicator in the economic study of IoT in the media. The process used in WoS focuses on the WoS Core Collection, which involves a search by keywords or by title, for example for the following media: "IoT economy" OR "Internet of Things" OR "IoT media" OR "IoT economics", for the period 1975–2022.

After the search process, 16,962 results were identified. Subsequently, the following categories were selected: Computer Science, Telecommunications, Information, Science, Electrical Engineering, and Electronic remained 1501 results, most of them being published in the period 2017–2021. Thus, in 2017 1220 articles were published, in 2018, 1964 results were identified, in 2019, 3038 articles were published, in 2020, a total of 4164 articles were identified, and in 2021, 4964 articles were identified. In this context, it can be seen that interest in IoT technology research has grown exceptionally in recent years, especially since 2017. Most publications are in China (5156), the USA (2599), India (1929), South

Korea (1934), and England (1204). In terms of publications, Romania ranks 39th, with 125 publications. A limitation of this research was the fact that the analyzed works were only in English and from the Web of Science database, so that no other research from other databases was included.

3.2. The Use of Endogenous Growth Theory in the Growth of Social Media

In addition, to determine the economic influence of IoT on the media, we used the Theory of Endogenous Growth, which argues that economic development is not the result of external factors but is due to endogenous factors [42]. Thus, the theory concludes that investments in human resources, knowledge, and innovation facilitate economic development. This model has grown, becoming more and more prominent due to the unsatisfactory functionality of some classical theories, which could not explain the fundamental features of economies that could propagate growth over a longer period. In general, the endogenous growth pattern can be expressed as the following:

$$GDP = PK,\ a_e\ L^{1-a}\ e\ K^{\beta} \tag{1}$$

If each industry used the same capital and the same level of labor, then this theory could be simplified as the following:

$$GDP_t = PK^a\ L^{\beta} \tag{2}$$

In this equation,"GDP_t" means the time of GDP growth per capita, "K" represents the investment capital, consisting of human and physical factors, and "L" represents the work performed. "P" in this case determines an endogenous production function, intended to quantify technological progress. Moreover, "α" and "β" represent the process of accommodation in capital and labor. From the point of view of the media, the model of endogenous growth represents technological progress, focused on a series of means of securing the Internet is about servers, subscription bands, on human and physical capital investments. Based on the gross establishment of capital or the development of trade, which are key factors in economic growth and the use of social media [43,44]. The hypothesis is that the use of social media can lead to enhanced efficiency when there is well-founded technological support because the optimal functioning of social platforms is based on the full opening of the economy and the productivity of the factors involved. Consequently, "P" can be integrated as follows:

$$P = (SN,\ IU,\ BS,\ SIS,\ M) \tag{3}$$

If all characteristics are equal, then the efficiency of social networks (*SN*), in which the input factors focus on internet users (*IU*), broadband subscriptions (*BS*), secure internet servers (*SIS*), and the opening of the market (*P*) of an economy. In this case, the following:

$$GDP = f(SN,\ BS,\ IU,\ SIS,\ GC,\ IHC,\ L,\ M) \tag{4}$$

In this equation, economic growth is due to the function of social networks (*SN*), broadband subscriptions (*BS*), internet users (*IU*), secure internet servers (*SIS*), a gross form of capital (*GC*), investment in human capital (*IHC*), labor force participation rate (*L*), and last but not least, market or trade opening (*M*). The equation is based on the endogenous growth model, so that "*A*" represents technological progress, "*K*" represents investments, and "*L*" represents the availability of the labor force, as well as other macroeconomic aspects, from which the investment of gross capital formation. Thus, the econometric model can be interpreted as the following:

$$GDP_{e,t} = \beta_0 + \beta_1 SN_{e,t}\begin{pmatrix} FB \\ IG \\ YT \end{pmatrix} + \beta_2 P_1(AB)_{e,t} + \beta_2 P_2(IU)_{e,t} + \beta_4 AP_2(SIS)_{e,t} + \beta_5 K_1(GC)_{e,t} + \beta_6 K_2(IHC)_{e,t} + \beta_7 L(L)_{e,t} + \beta_8 (P)_{e,t} + \varepsilon_{e,t} \tag{5}$$

In this equation, the variables "*SN*" (*FB*, *IG*, *YT*) represent social media, embedded in the following three social networks: Facebook, Instagram, and YouTube. Therefore, "ε" is the margin of error, "*e*" is the cross-section, and "*t*" is the time. " β_0" are the interception coefficient, and "β_1 to β_8" is the coefficients of the estimated independent variables [44,45].

4. Results

4.1. A Co-Occurrence Map from a Bibliographic Database

After analyzing the 1501 research articles, taken from the search of the Web of Science database, a co-occurrence map was created through VOSViewer, based on the keywords from the bibliographic publications that were exported. If in the first stage, 16,962 terms were identified, a number of 14,610 terms remained, thus a number of 2352 terms were excluded. In the second stage of the selection process, depending on the relevance of the terms, 2196 terms were excluded by the software, which were determined in the first instance, leaving a number of 156 keywords, shown in Figure 4. The 156 terms were grouped into 11 clusters, detailed in Table 4.

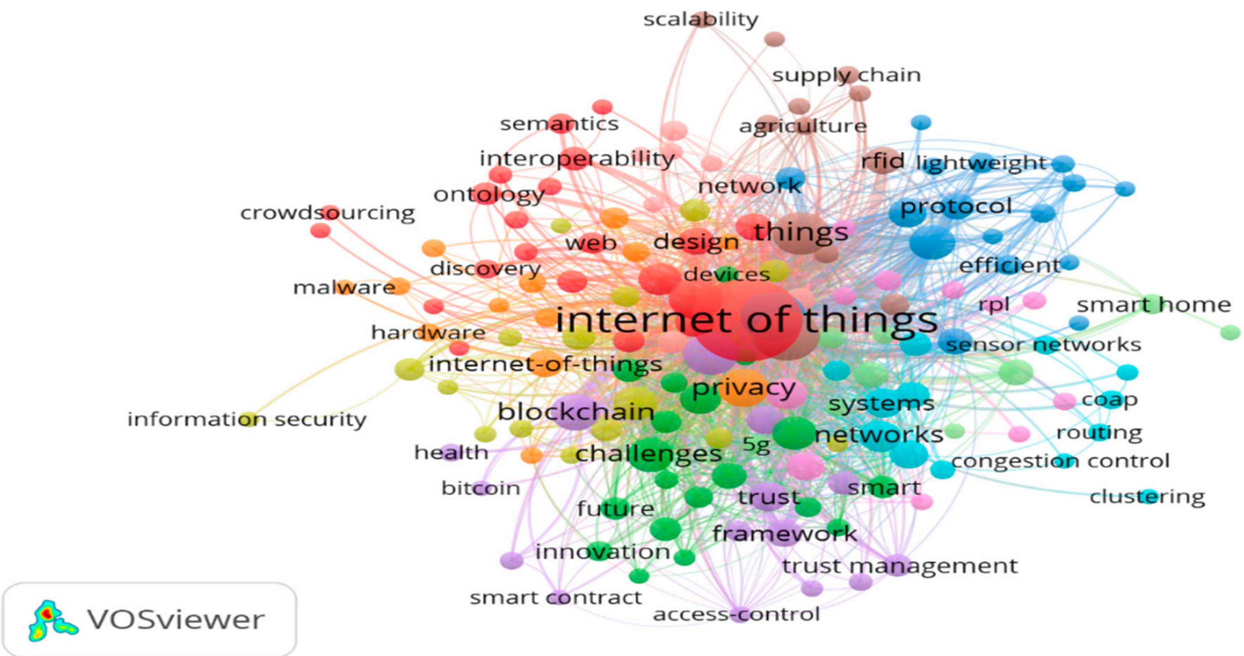

Figure 4. Bibliographic map based on VOSviewer.

Table 4. Co-occurrence of terms of research related to IoT on WOS platform.

Cluster	No. of Terms	Most Occurrences	Fewest Occurrences
1–11	156	Internet of Things	Smart contract
		Blockchain	Deep learning
		Privacy	Edge computing
		Challenges	Future
		Things	Industry
		System	Data fusion
		Framework	Network security

The bibliometric analysis conducted through VOSViewer highlighted the fact that IoT technologies are connected with a series of keywords, such as the following: Internet of Things (848 appearances), blockchain (307 appearances), privacy (430 appearances), challenges (353 appearances), things (573), system networks (230 issues), and framework (171 issues). At the same time, in Table 5, other terms with a significant occurrence were identified.

Table 5. Synthesis of VOSviewer keyword occurrences on the economic influence of IoT.

Cluster	No. of Terms	Most Occurrences	Fewest Occurrences
Cluster 1	22	Industrial Internet of Things IoT Sensor Design Web	Arduino Automation Crowdsourcing Data fusion Taxonomy
Cluster 2	19	Challenges Management Communication Big data Future	Devices Adoption Classification Issues Opportunities
Cluster 3	17	Authentication Security Wireless sensor networks Protocol Scheme	Anonymous Confidentiality Consensus Cryptanalysis Performance evaluation
Cluster 4	16	Cloud computing Cryptography Encryption Protocols Smart cities	Validation Standards Software Integration Informatics
Cluster 5	15	Blockchain Framework Internet of Things (IoT) Model Social Internet of Things	Social networks Smart contract Reputation Health Bitcoin
Cluster 6	13	Cloud Networks Optimization System Wireless	Clustering CoAP Congestion control Routing Sensor networks
Cluster 7	13	Cybersecurity Internet of Things Implementation Privacy Intrusion detection	Analytics Attack detection Industrial internet Malware Network security
Cluster 8	12	Internet Things RFID Energy	Lora Scalability Supply chain Agriculture
Cluster 9	11	Architecture Edge computing Edge	Fog Gateway Smart devices
Cluster 10	9	Algorithm Information Network System	Indoor navigation Location Mobile Selection
Cluster 11	9	Fog computing Healthcare Machine learning Smart home	5G Prediction Sdn Resource-allocation

Regarding the identified keywords related to IoT, a total of 118 expressions and revealing terms were found for the Internet of Things. It is about terms such as automation, data fusion, design, monitoring, sensors, web, big data, devices, wireless, attacks, cloud computing, software, smart contracts, machine learning, smart homes, etc. In addition, regarding the terms related to the "IoT economy", 38 terms were identified, such as smart cities, industry 4.0, innovation, management, opportunities, blockchain, trust management, agriculture, environment, scalability, etc.

4.2. The Potential of IoT Implementation in Romania

Within this research, a ranking of the IoT technology market was made, through the following participating actors: users, businesses, and authorities. IoT users focus on everyday technologies, which have the ability to improve their businesses and, thus, their productivity as well as their efficiency, and the use of IoT by the authorities makes a greater contribution to public safety. At the same time, these technologies have the ability to stand out through their interdisciplinary nature, including in sectors such as sensors, cloud computing, and big data analysis. Thus, this ranking of the IoT technology market presents a number of sectors in which the IoT, at the time of implementation, could attract a large number of users. Vacancies could also benefit from automation, so that the problem of labor shortages is alleviated. Sectors such as trade, transport, agriculture, or manufacturing have a high potential for digitization, and the implementation of technology could help companies in these sectors overcome barriers to labor and help grow, see Figure 5.

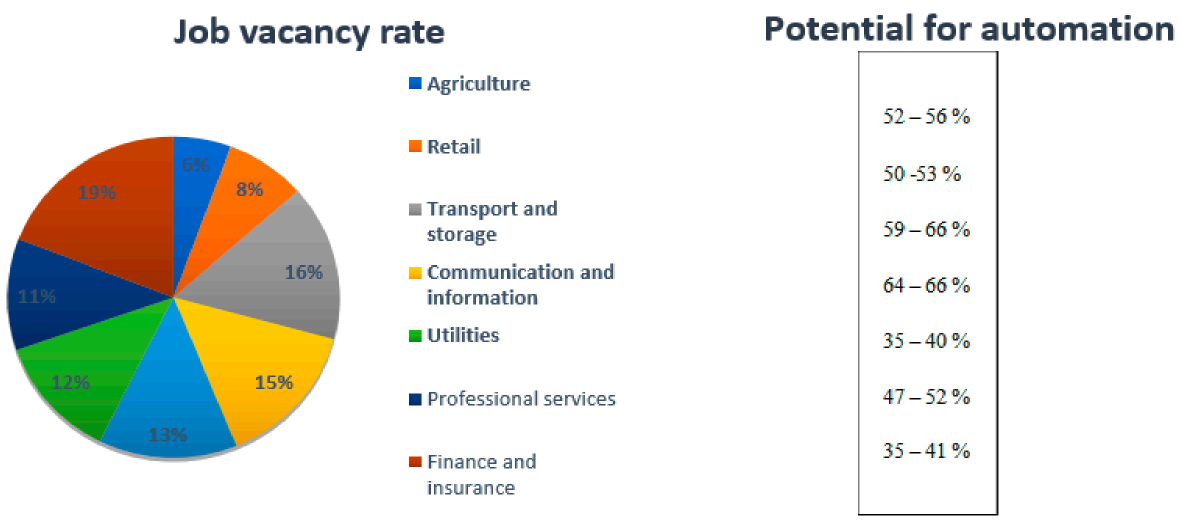

Figure 5. Sectors with the highest job vacancies and potential for automation.

The role of the IoT is to increase the efficiency of the production chain and to generate new business models so that the IoT directions include asset management, supply, goods, inventory management, and equipment. Therefore, IoT technologies have the ability to facilitate transactions or orders for goods and services because they allow for lower costs and a much more efficient buying or selling process.

4.3. IoT Technologies, in the Sales Process, in Europe

The digital economy has also expanded the coverage of smaller businesses, giving them the opportunity to reach markets that were previously impossible to reach. As a result, the number of companies conducting commercial transactions on the Internet has increased considerably, at least in the last decade. For example, in the Netherlands, e-commerce increased its share of the company's total revenue from 3.4% in 1999 to 14.1% in 2009. The same was true in Norway, where there was an increase of 2.7% to 18.5% in the period 2004–1011, and in Poland, there was an increase from 2.8% to 11% in the same period. Thus, online commerce, according to the chart below, exceeds 20% of total fiscal value in Malta, Belgium, Denmark, the Czech Republic, Ireland, Spain, Belgium, Austria, Croatia, Lithuania, and Romania. The value of B2B (business-to-business) e-commerce, used primarily by distributors and wholesalers, was estimated at USD 12.4 billion in 2012 [45–47]. Since 2012, sales have increased considerably in every country in the world; in Romania, online sales have increased considerably in 2013, and then stagnated and even decreased, until 2018, when sales began to grow again. Figure 6 shows the evolution of companies that have adopted online commerce in the last decade, from the fastest growing European countries in recent years.

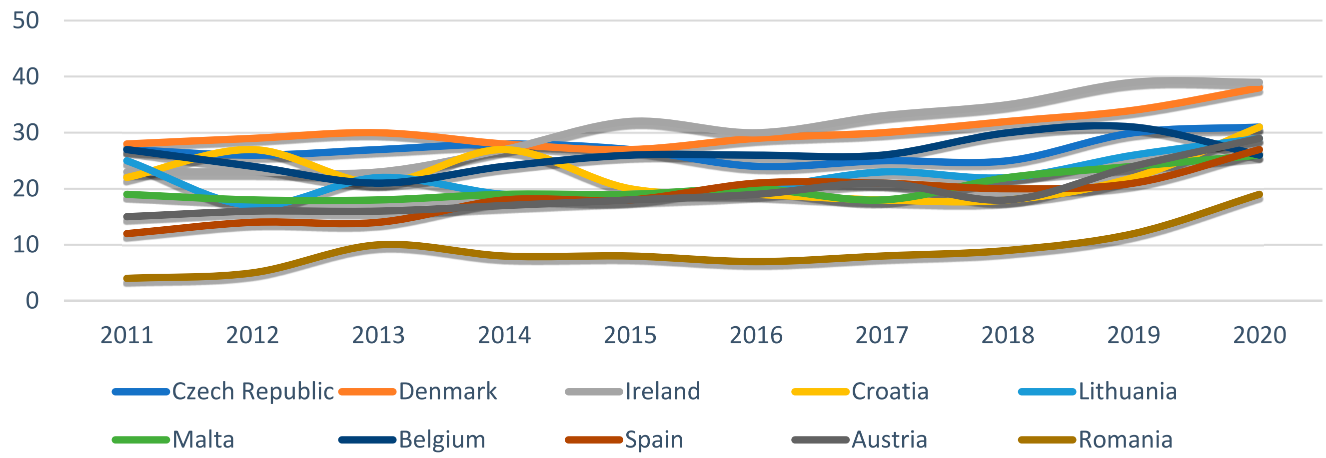

Figure 6. Evolution of online sales of European companies.

Therefore, online sales have increased year by year in most European countries, with decreases in some periods but then continuing a rapid evolution. Among the biggest increases in online commerce were the Czech Republic and Denmark, starting at 27% and 28%, respectively, in 2011 and reaching 39% in the Czech Republic and Denmark at 38%. On the other hand, the country with the slowest evolution was Romania, starting from 4% in 2011 and reaching only 19%, compared to other European countries, which reached over 25% by 2020. In addition, in terms of the evolution of online business-to-business (B2B) sales, through the delivery of products and services from one company to another, Ireland has seen the biggest evolution over the last decade, starting at 23% in 2011 and continuing up to 39% [48,49]. In terms of the evolution of B2B online sales, Denmark is similar to Ireland, starting at 28% in 2011 and continuing to grow to 38% in 2020 (Eurostat, 2020). At the same time, countries such as the Czech Republic, Croatia, Lithuania, Malta, Belgium, Spain, and Austria have made clear progress, reaching over 25%. Romania has evolved in the same way as the other countries, but the course has been much slower. It started at 4% and continued to grow to 19% in 2020, so the last year's increase was caused by the COVID-19 pandemic, when states of emergency were declared in the territory of the country and among consumers [50,51]. Companies have also opted for the online version of the trade, proving to be much more satisfactory, see Table 6.

Table 6. Evolution of enterprise B2B online sales (percentage %).

Year	Czech Republic	Denmark	Ireland	Croatia	Lithuania	Malta	Belgium	Spain	Austria	Romania
2011	26	28	23	22	25	19	24	12	15	4
2012	27	29	23	27	17	18	27	14	16	5
2013	26	30	23	21	22	18	21	14	16	10
2014	28	28	27	27	19	19	24	18	17	8
2015	25	27	32	20	19	19	26	18	18	8
2016	27	29	30	19	20	20	26	21	19	7
2017	24	30	33	18	23	18	26	21	21	8
2018	25	32	35	18	22	22	31	20	18	9
2019	30	34	39	22	26	24	30	21	24	12
2020	31	38	39	31	29	26	26	27	29	19

Regarding the B2G (business to government) sales model, the evolution was increasing in the case of selected European countries, and this model, akin to B2B, has a hierarchical and secure evolution, starting from only 4% in 2011 in Romania and reaching up to 19% in 2020. As can be seen in the evolution of B2B trade, in the case of B2G online sales, the figures are similar, but in this case, the countries with the highest growth are Ireland and Denmark, reaching 2020 by 39 and 38%, respectively (Eurostat, 2020), see Figure 7.

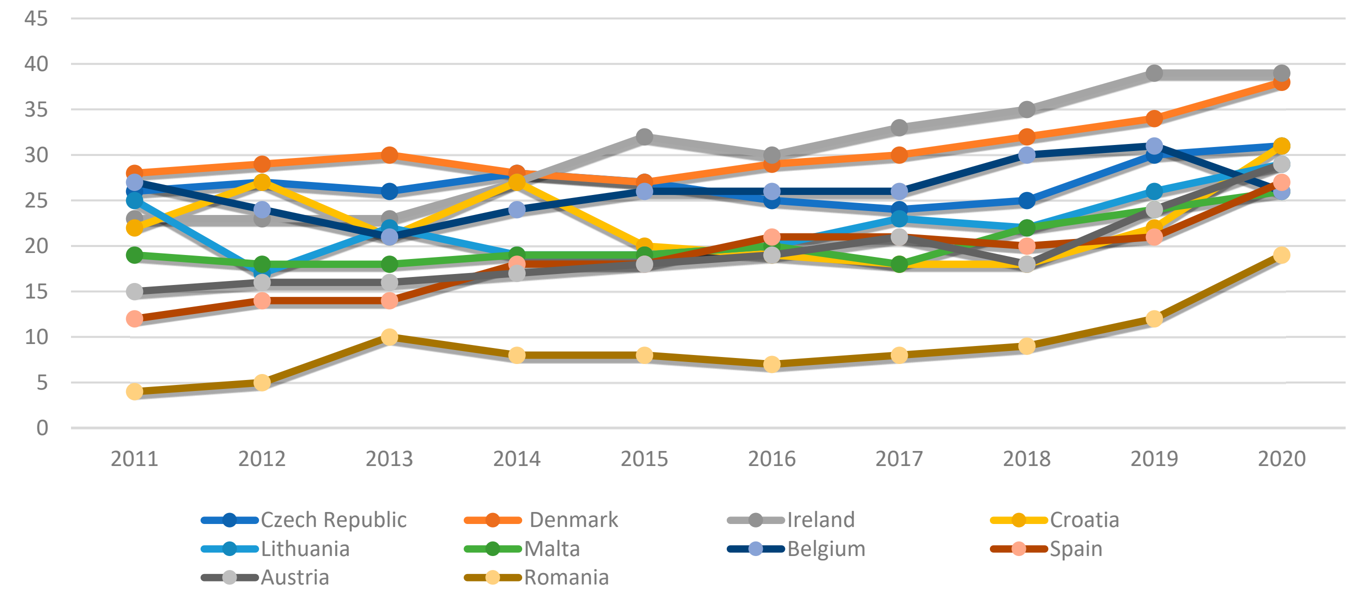

Figure 7. The evolution of B2B and B2G web sales companies.

The advancement of digitalization towards a technology-oriented economy has a role in fueling the necessary growth engine. By 2025, by increasing digitalization, the economies of northern European countries could be supplemented by 42 billion euros, and in the case of Romania, the digital economy could be 20% of GDP. This acceleration could lead to a percentage point in annual GDP growth. If this progress were not made, Romania could still reach 12% of GDP with the digital economy, but in this case, the country would be far from what the digital borders of northern Europe mean [52,53].

4.4. The Digitization Process in Romania

Many Romanian companies are still reluctant to adopt new digital tools and also develop staff skills in this direction. In other words, in order to reach the borders of digitalization, Romania should double its cloud computing means. At the same time, a number of digital tools could be integrated into the public sector to facilitate and improve the services provided to customers or businesses. Online services remain among the lowest in the population compared to the European Union, and to improve this, investing in education, skills, and labor will identify new opportunities for development. The SWOT analysis from Figure 8 presents the main strengths of digitalization in Romania, including the developed ICT sector, which makes significant contributions to the country's GDP, as well as cluster organizations that have formed centers of excellence in various fields. In addition, as weaknesses, we can identify a mismatch between the educational process and the needs of the labor market, the poor results of digitization in relation to the EU, as well as a high bureaucracy [54]. As opportunities, we identified the potential for the development of the digitalization of the industry, the adaptation of the industry to EU standards, as well as the emergence of new production chains. At the same time, as threats, it can be said that there is no national strategy for the digitalization of the industry, Romania does not have a regulatory framework adapted to the digital age, and the workforce is still not sufficiently prepared for the digital economy [55].

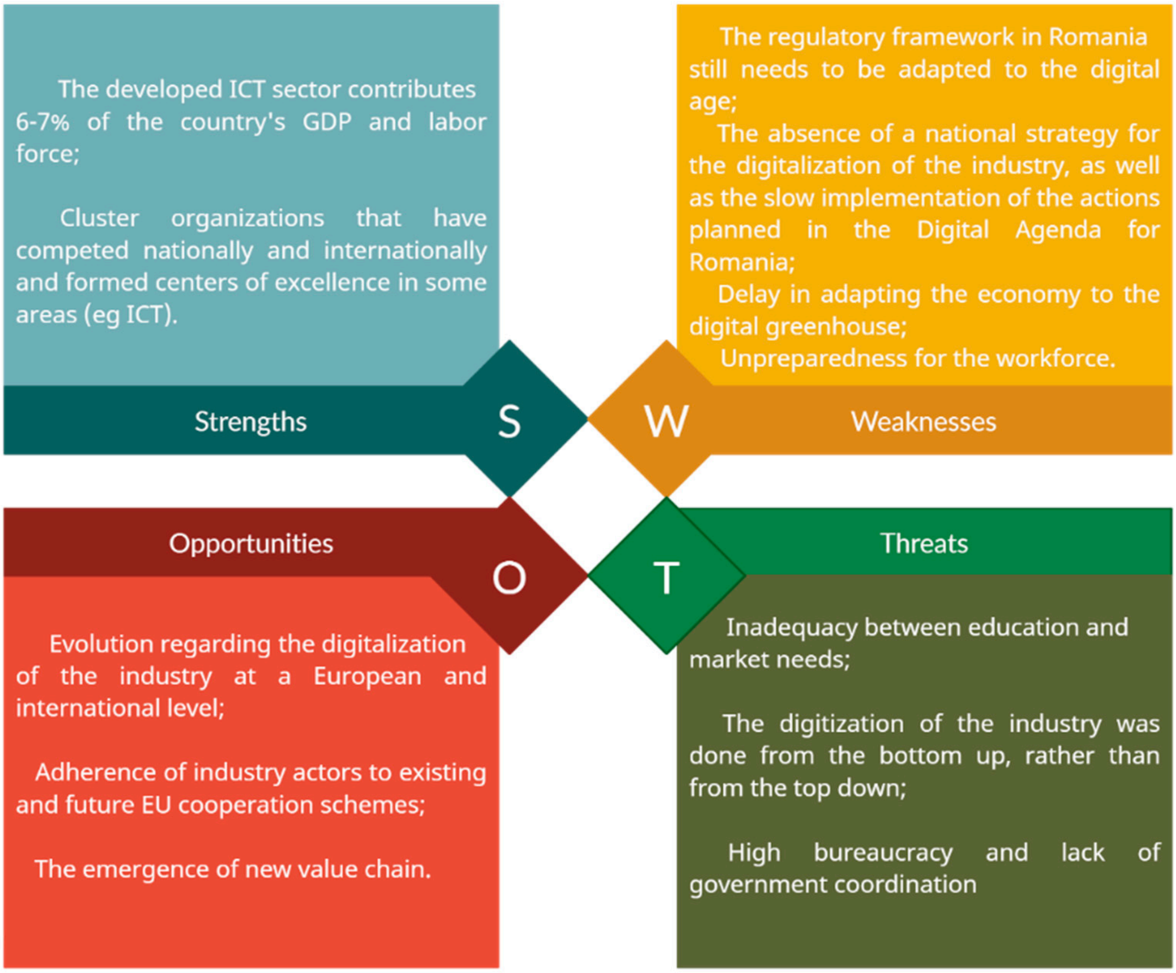

Figure 8. SWOT analysis of digitization in Romania.

Adapting technology can lead to strong economic development, especially in the labor market, by allowing employees to focus on more valuable assessment activities. For example, in the case of doctors and nurses, through the process of adapting technology, they would be able to spend more time with patients than with administrative tasks. Regarding internet access, in Romanian households in 2020, about 78% benefited from internet access. This percentage increased by 2.5%, compared to 2019, so that 60.9% of urban households had internet access, while in rural areas, only 39.1% had an internet connection. Therefore, internet access is determined not only by the financial position of each household, but also by the opportunities that providers offer at the territorial level [56,57]. Figure 9 shows the gap between rural and urban areas in terms of internet access.

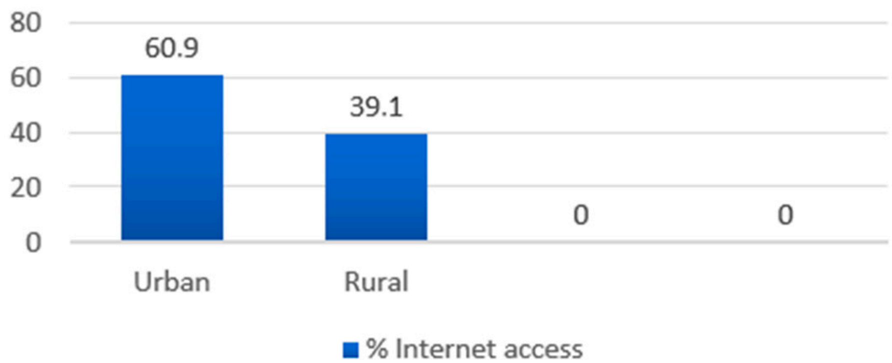

Figure 9. Households equipped with a computer at home, by the sources of origin (2020).

Therefore, at the level of development regions, internet access within households has had an upward trend in each region, but with some gaps between them. These are generated by the income of households related to each region, but also by the degree of digitization. Thus, the region with the most widespread internet connection in Romania is Bucharest-Ilfov, which has increased since 2017, from 82.6% to 98.3% in 2020. The Western Region and the Northwest follow this region. On the other hand, the North-East Region started shyly in 2017, having a proportion of only 57.8%, but due to the ascending evolution, in 2020 it reached 73.6%, even surpassing the South-East Region. Table 7 shows the evolution of households that benefit from the Internet at home, at the level of development regions, from 2017 to 2020 [58].

Table 7. The evolution of households that have access to the Internet at home, at the level of development regions.

Year	Development Regions	Internet Acces %
2020	Northeast region	73.6
2019		70.6
2018		65.1
2017		57.8
2020	Southeast Region	72.4
2019		71.2
2018		65.2
2017		60.2
2020	South Muntenia region	74.3
2019		70.9
2018		66.6
2017		58.6
2020	Southwest Oltenia region	76.1
2019		74.6
2018		70.7
2017		63.7
2020	West Region	84.9
2019		81.9
2018		79.8
2017		73.2
2020	Northwest region	81.9
2019		79.6
2018		79.8
2017		70
2020	Central Region	76.8
2019		76.2
2018		68.7
2017		62.4
2020	Bucharest—Ilfov region	89.3
2019		84.6
2018		88.8
2017		82.6

In terms of employment status, the highest share of the Internet is found among employees, while the lowest rate of Internet access is found in households that include retirees. The Internet is a whole body of knowledge, proposing a series of information designed to continuously develop humanity and offer the opportunity for online interaction to its consumers. The level of training is very important when the interest in internet access is increased in order to exploit this means of communication (INSSE, 2020) [59]. People with a higher level of education are frequently connected to the internet, so 9 out of 10 such people have access to the internet, while seven out of eight people with average training have this knowledge technology. On the other hand, the low level of education of a person with a low level determines that only one in two people is connected to the internet. Figure 10 shows the percentage of people's access to the Internet depending on their level of education, as follows: high, medium, and low.

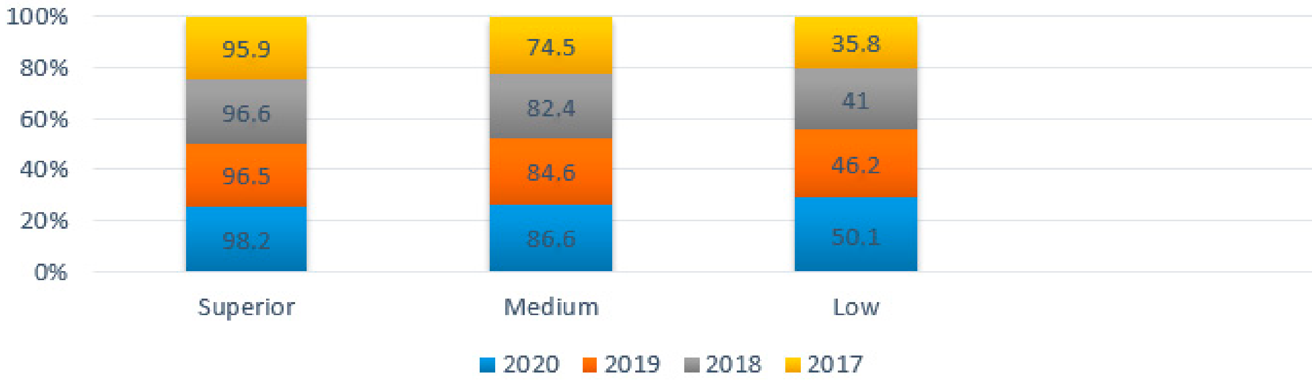

Figure 10. Internet access by the level of education (%).

Therefore, digital public services in Romania are below the European Union average, and digital skills are at a low level, although Romania ranks first in the EU in the use of social networks. At the regional level, in Romania, in the Central Region, about 13% of people use the Internet to get in touch with public authorities, and at the EU level, this indicator is more than four times higher. Although a citizen can interact with the local government online, many local governments do not have a digitized process. Therefore, small- and medium-sized enterprises are not always willing to adopt the digitization component in the development of their business, so the average adoption of the digital component is below the European Union average [60].

5. Discussion

Within the bibliographic analysis, the field of IoT technologies was structured into economics and media, so the analysis generated 11 clusters based on the literature, and the results highlighted the fact that the IoT economy is a complex field of research, which is in a continuous dynamic. The research structure focuses on a theoretical framework that is directly associated with IoT, being an ensemble consisting of input-action-output that presents the following criteria: concept (input), analysis (action), and the result (output). Thus, it presents the current stage of research in the field, possible research gaps, and finally, yet importantly, the future directions of research are identified. Given the interest shown in the IoT field in research, we can propose in Figure 11, a new research perspective in order to continue future analyzes.

The structure focuses on a theoretical framework in order to implement an IoT set, adapted in an input-analysis-result process so that the variables of the framework are given by the conceptualization of IoT, which performs an analysis (action) before generating a result and being implemented. This structure is comprised of a number of external factors that cause jamming within the model. The cluster research identified in the analysis forms one or more variables exposed in the model, while some of them have been ignored. The research highlights a number of shaping variables, which indirectly exacerbate an impact on input and output variables, such as the following: privacy, privacy, or social issues, which hinder the implementation of IoT. External factors, such as economic developments, uncertain political situations, legal ones, and the evolution of technological progress, have an impact on the variables within the model. Therefore, with the evolution of the digitization of all sectors that focus on the human factor, the IoT is a field in a continuous dynamic that requires increased attention from an academic point of view.

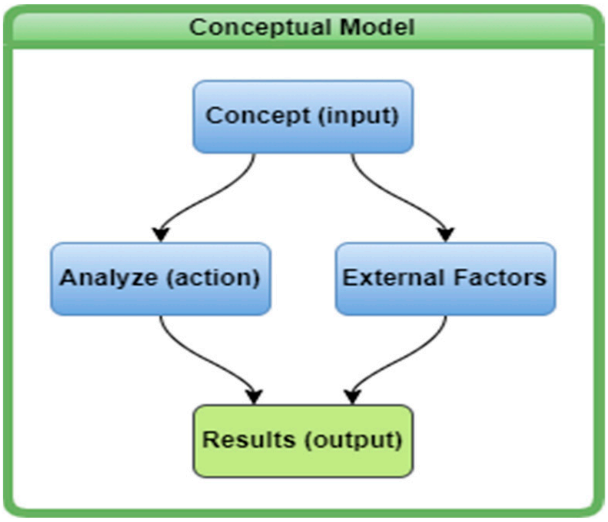

Figure 11. The structure of the conceptual model proposed.

Regarding the development of the IoT sector in Romania, it has experienced a fruitful development, which has been fueled by foreign investment, European funds, and the growing workforce. Lately, however, these determinants have begun to decline more and more compared to European economies. Romania has also started to lose ground due to the increase in labor prices, but also with its decrease, reaching an unemployment rate of 4.9% in 2017. The advance of digitalization towards an economy focused on the technological side plays a role in the potential for powering the engine of growth needed. By 2025, by increasing digitalization, the economies of northern European countries could be supplemented by 42 billion euros, and in the case of Romania, the digital economy could be 20% of GDP. This acceleration could lead to a percentage point in annual GDP growth. If this progress were not made, Romania could still reach 12% of GDP with the digital economy, but in this case, the country would be far from what the digital borders of northern Europe mean. In order to achieve an optimistic scenario in the field of digitalization, Romania needs a series of contributions from all the following factors that could bring the necessary growth: the government, the labor force, as well as the entrepreneurs.

6. Conclusions

This paper provides an overview of the IoT terminology and the most important authors in the field, as well as a perspective on what the IoT sector represents in the development of the media in Romania. One of the main conclusions of this paper is the determination, but also the assessment of the current state of knowledge about the IoT economy, which highlights the sectors in this field that are studied through a deductive analysis of the content. Therefore, this is a point of interest for researchers because it highlights those areas of knowledge that are not intensively analyzed, and which require further deepening.

Research in the field of the IoT has increased since 2017, so the most significant publications that have emerged are those in China, after the corpus of researched scientific articles that have been identified in the Web of Science database in this field of research. In other words, research on the IoT economy is young, and further research is needed in this area. Through the bibliographic analysis carried out in this paper, a number of 1501 articles exported from WOS resulted in a series of 38 terms used more frequently in the field of the IoT economics, and the deductive analysis found that the most common topics in the IoT economy focus on what it means for businesses at the microeconomic level. In this context, both the IoT and the economy are shaped by innovation, technological innovation, opportunities, economic development, or production.

Therefore, thorough research is needed in this area, given that it has gained significant momentum in the last five years, and the limitations of this study have been the use of a single database (Web of Science), analyzing a total of 1501 publications. Next, an analysis could be made of the structure of the findings, using terms, keywords, and subclusters of the least addressed topics, referring to social or geographical clusters, so that the results can be differentiated according to the specific context.

Through the bibliometric analysis, it was possible to answer all the questions (Q) addressed in the introduction, proving that studies on the estimation of the IoT economy on the media are relatively recent, requiring development and in-depth research. Regarding the implementation of the IoT technologies, there are states that have distinguished themselves in the literature by researching this field. This research, which has grown considerably in the last 5 years, is expected to have an upward trend in the coming years. Thus, these questions can highlight future research trends in various innovative environments.

Regarding the analysis of broadcasting licenses obtained in Romania, after 2010, 2739 audiovisual licenses were registered since 1992, both for satellite and terrestrial broadcasting, but also through various electronic communications networks, but as of the end of 2019, there are only 967 licenses still active, which are in the possession of about 350 companies. If the radio needed 38 years to integrate perfectly, television took 13 years, and the Internet only 5 years, the latter being the fastest and fastest-growing form of communication in history.

Thus, companies should adapt to digitization tools and new opportunities that allow for the expansion of new customers as well as markets. Many Romanian companies are still reluctant to adopt new digital tools and also develop staff skills in this direction. In other words, in order to reach the borders of digitalization, Romania should double its cloud computing means. At the same time, several digital tools could be integrated into the public sector to facilitate and improve the services provided to customers or businesses. Online services remain among the lowest in the population compared to the EEC, and to improve this, investing in education, skills, and labor will identify new development opportunities.

Lack of employment as well as sustained economic growth highlight the need for a number of elements to increase productivity. Increasing digitization can combat the lack of an existing workforce, and by 2030, more than 50% of activities could be automated using existing technology. This also represents an increase in productivity and a transition to finding new jobs. The digital economy in this case could focus on a precise organizational structure in terms of regulations, policies, and guiding principles. Thus, in order to materialize Romania's digital development potential, collaboration between the public and the private sector becomes indispensable, but also inter-sectoral and intra-sectoral collaboration.

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