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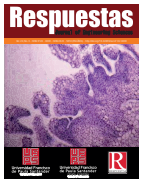

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Big data, key factor for the knowledge society

Big data, factor clave para la sociedad del conocimiento

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ABSTRACT

We are currently in an era of information explosion that affects our life in one way or another. Because of this, the transformation of huge databases into knowledge has become one of the tasks of greatest interest to society in general. Big Data was born as an instrument for knowledge due to the inability of current computer systems to store and process large volumes of data. The knowledge society arises from the use of technologies such as Big Data. The purpose of this article is to analyze the influence of Big Data on the knowledge society through a review of the state of the art supported by research articles and books published in the last 15 years, which allow us to put these two terms into context, understand their relationship and highlight the influence of Big Data as a generator of knowledge for today's society. The concept of Big Data, and its main applications to society will be defined. The concept of the Information Society is addressed and the main challenges it has are established. The relationship between both concepts is determined. And finally the conclusions are established. In order to reduce the digital divide, it is imperative to make profound long-term changes in educational models and public policies on investment, technology and employment that allow the inclusion of all social classes. In this sense, knowledge societies with the help of Big Data are called to be integrative elements and transform the way they are taught and learned, the way they are investigated, new social and economic scenarios are simulated, the brand decisions in Companies and share knowledge.

Palabras clave:

Big Data,
Conocimiento,
Gestión del conocimiento,
Información,
Sociedad.

RESUMEN

Actualmente estamos en una época de explosión de información que afecta de una u otra manera nuestra vida. Debido a esto, la transformación de enormes bases de datos en conocimiento se ha convertido en una de las tareas de mayor interés para la sociedad en general. Big Data nace como instrumento para el conocimiento ante la incapacidad de los sistemas informáticos actuales para almacenar y procesar grandes volúmenes de datos. La sociedad de conocimiento surge del uso de tecnologías como del Big Data. El presente artículo tiene por objetivo analizar la influencia del Big Data sobre la sociedad del conocimiento por medio de una revisión del estado del arte soportada en artículos de investigación y libros publicados en los últimos 15 años, que permitan colocar en contexto estos dos términos, entender su relación y poner de manifiesto la influencia del Big Data como generador de conocimiento para la sociedad actual. Se definirá el concepto de Big Data, y sus principales aplicaciones a la sociedad. Se aborda el concepto de Sociedad de la Información y se establecen los principales desafíos que esta posee. Se determina la relación entre ambos conceptos. Y Finalmente se establecen las conclusiones. A fin de disminuir la brecha digital, es imperativo realizar cambios profundos a largo plazo en los modelos educativos y las políticas públicas sobre inversión, tecnología y empleo que permitan la inclusión de todas las clases sociales. En este sentido, las sociedades del conocimiento con la ayuda de Big Data están llamadas a ser elementos integradores y a transformar la forma en que se enseñan y aprenden, la forma en que se investigan, se simulan nuevos escenarios sociales y económicos, la marca decisiones en empresas y compartir conocimiento.

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Introduction

Often, the concepts of information society and knowledge society are used interchangeably to refer to the influence that information currently has, along with the use of Information and Communication Technologies (ICT) in society, which It allows improving the quality of life of people, information and services offered by organizations at a general level. For some scholars, the large volume of information that is currently generated and that is necessarily involved with the advancement of technology producing acceleration in interactions and social dynamics is called the Knowledge Society, digital society, or information society. [1]. The Knowledge Society or Network Society, has as a material and technological basis to the Internet, which has generated new forms of social relationship [2]. With the transition to the Knowledge Society we are witnessing how the weight of science and technology has grown in the solution of problems and has given us a planetary vision when approaching peoples that once seemed distant and even antagonistic. The dissemination of knowledge has reached the Internet at heights never imagined, and today each of its users has the largest library ever dreamed by students and researchers of the past [3].

The centrality of science and technology in modern societies is a topic that emerged in the nineteenth century. However, the representation of the real existence of "a knowledge society" does not appear until the second half of the twentieth century. Immediately after the Second World War, and the resurgence of European industry, they give rise to a new look at science, which is assigned a new role in the development of societies [4]. The name of the Knowledge Society expresses the transition from an economy that produces products to a service-based economy, which for the purpose demands highly qualified professionals where knowledge and the generation of ideas become the main source of innovation and development of new technology [5]. In this regard, several countries have transcended the information society to give way to the Knowledge Society that, from a humanistic and complex perspective, focuses on solving problems based on the collaboration of ICTs, and universal values such as respect, honesty and fairness [6].

Manuel Castells, recognized university professor of Sociology and Urbanism of the University of California, states that, in the present there is a bridge between the information society and the knowledge society that is distinguished in two scenarios; the first, a space of information, is essential for the present and that, at the same time, has been fundamental for all times, where what is intended is to communicate or make knowledge public; the second scenario, the informational, involves not only the communication of this, but also the work it represents, as production, processing and distribution of it, where knowledge is a product and producer of power, as an attribute of the new historical conditions of today's society, since it incorporates science, technology and private agents into the processes of communication and economic capital [7]. In this sense, it is important to understand that the concepts of information and knowledge, although they are related, have differences. The adequate meaning of the information concept necessarily depends on the epistemic context in which it is used. On the other hand, its intra-theoretical and polysemic character has multiplied the senses in which it has been used, as it is the case of the theory of the information, the network society, the societies of the knowledge, the theory of systems, the cognitive psychology, among others areas [8]. A general definition according to the context of the article, would be: Information is known the result of applying computational and administrative techniques to all those data that are susceptible to storage for further processing, with the purpose of generating knowledge that is valuable, for example, in pro of the development of the human being and improvement of his life, or for making better decisions in organizations.

The impact on society in general is unquestionable, with knowledge and information in conjunction with ICTs to transform economies and societies [9]. The technological revolution that humanity is currently experiencing and that gives birth to this new society, is due in large part to the significant advances in the use of new ICTs, helping the rapid scientific development and the massification of information [10]. Such a transformation is supported by one of the most important emerging technologies of our decade, Big Data. The growth in the volume of data generated by different systems in society has forged the need to optimize data storage and treatment

models that overcome the shortcomings of traditional databases. That's when we talk about Big Data [11]. According to Gartner, an information technology consulting and research company based in the United States, Big Data technologies are information assets that require revolutionary and low-cost forms of processing to improve the decision-making and understanding process [12].

Materials and methods

This article aims to analyze the influence of Big Data on the knowledge society. This is intended to be achieved through a review of the state of the art supported by research articles and books published in the last 15 years in databases such as: Scopus, Computer Science, Computer Source, ScienceDirect, SpringerLink and Journal of Big Data, which allow us to put these two terms in context, understand their relationship and highlight the influence of Big Data as a generator of knowledge for today's society. First, the concept of Big Data, and its main applications to society will be defined. Second, the concept of the Information Society is addressed and the main challenges it has are established. Third, the relationship between the two concepts is determined. And fourth, the conclusions are established.

Results and Discussion

Definition of big data

In mid-1998, John Mashey at the "Big Data and NextWave of InfraStress" conference was the first to use the term Big Data [13]. The United Nations in 2012 defined Big Data, as the set of structured and unstructured data of large size and high processing complexity, surpassing the capabilities of typical database tools to manage data [14-15]. The data managed by Big Data range from simple hypertext, video files, audio, data supplied by sensors, results of surveys and questionnaires, databases, etc., to geo-location and geo-reference metadata. To give us an idea of the concept of large volumes of data, it is estimated that since 2012, 2.5 exabytes of data is produced every day, doubling every 40 months [16]. International Data Corporation (IDC), predicts that by 2020 the volume of data worldwide will increase from 130 Exabyte to 40,000 Exabyte representing twice the growth every two years [17]. For International Business Machines Corporation (IBM), by 2020, 40 zettabytes of data will be created, an increase of 300 times since 2005. On average the vast majority of US companies will generate 100 terabytes of data, and the New York Stock Exchange stores for Business session about 1 Terabyte of data [18]. Similarly, it is estimated that, in the last two years, 2.5 quintillion bytes of data are created daily, mostly from a large number of users of social networks such as Facebook (750 million), LinkedIn (110 million), Twitter (250 million) [17], the more than one billion queries per day to Google and the more than 4 billion visits per day to YouTube [13].

Type of data

For the current business sector, it is essential to manage not only structured data, but also unstructured data such as videos, images, audio and those from social networks that allow it to analyze and cover new commercial demands [19]. Similarly, the development of electronic systems and automation have increased data capture in various sectors of security, economy, finance, education, health, among others, giving rise to the concept of Internet of things (IoT), but where still captured data are ambiguous due to noise, incompleteness and inconsistency [20].

Characteristic

Gartner analyst Doug Lancy, was the first one talking about 3v's in Big Data management, which is a model that allows describing the distinctive characteristics of the data stored: [13]. (1) Volume: refers to the amount of data. Typically, it is measured in bytes (megabytes, gigabytes, terabytes, petabytes) (2) Velocity: is the velocity with which new data is generated and the speed with which they are processed. Some measures used are batch processing, periodic, near real time, real time. (3) Variety: number of different data types stored by systems such as audio, video, image, text, etc. Subsequently, they were added to the model definition: (4) Veracity – describes the completeness, accuracy and quality of data. The veracity allows Big Data to take into account the uncertainty in the data and this can be managed by tagging the data correctly. (5) Value: describes the benefits achieved by organizations by acquiring knowledge of the data resulting in the improvement of processes [21].

Big Data analytical methods

Big Data offers many sectors of society the potential to analyze a large volume of data and take advantage of it in their own and common good. However, for example, data from social networks, business, biomedicine, astronomy, transportation or education systems, reveal a huge computational challenge to understand the relationship between data, which is why algorithms are required and advanced methods of data mining analysis for predicting future situations [22].

Advanced technologies of analysis of Databases like NoSQL, BigQuery, MapReduce and Hadoop, among others, allow to improve the planning, the process of decision and prediction in critical sectors such as health, economy, banking, energy or natural risks [23].

To provide Big Data with the capacity to create knowledge, it is necessary to use methods that address the problem of processing from several approaches. In general, these methods can be classified into five categories (Fig 1): (1) Descriptive analysis: allows analyzing the data to define the current state of a situation and produce early alerts. (2) Inquisitive analytics: try to explore the data to certify / reject some kind of decision. (3) Predictive analysis: focused on predicting future events through statistical methods. (4) Prescriptive analysis: aimed at optimizing and improving service levels, while reducing costs. (5) Preventive analysis: related to precautionary measures in events that can negatively influence the performance of an organization [24].

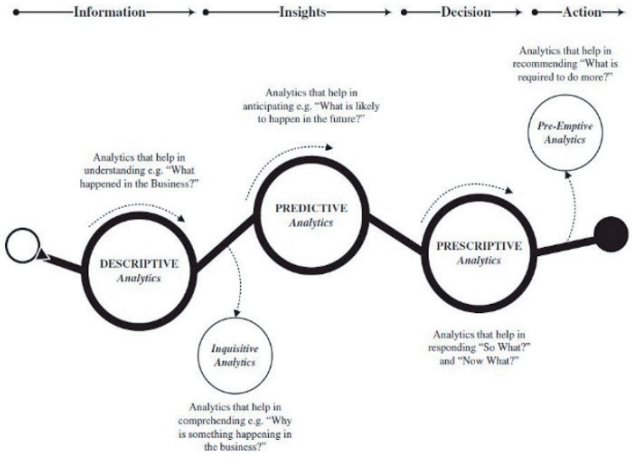

Figure 1. Big Data analytical methods
Source: [24]

Applications

In recent years there has been an accelerated evolution of ICT, highlighting the increase in user interaction with them, which has led to the generation of large amounts of data that until recently did not exist [25]. Additionally, the lowering of IoT electronic devices makes data an important source of knowledge that small and large companies in many market sectors see as a fundamental item in marketing strategies, customer tracking and other market areas. Some cases are; Amazon's Artificial Intelligence personal assistant known as Alexa, Smart TVs with Netflix, the Internet search engine, and even connected refrigerators, generate millions of data that are then used with Big Data techniques to obtain consumption patterns or behaviors, which today have immense economic value. A recent study by Vidhia Analytics predicts that by 2020 there will be 50 billion connected devices, constantly collecting data [26].

Here are some examples of Big Data application.

Predicting results

During the last decade, the emergence of Big Data Analytics tools such as Google Trends, have allowed the analysis of data online, being also a great help in fields such as research, finance, education, environment and politics, where it is essential for the government and other sectors, predict the results of elections and referendums. In this sense, the article "Prediction of results of the referendum in the era of Big Data" shows a methodology to predict such results using Google Trends, which has been applied in the Scottish referendum of 2014, the Greek referendum of 2015, the referendum 2016 British, the 2016 Hungarian referendum, the 2016 Italian referendum and the 2017 Turkish referendum [27].

Informatic security

With the recent increase in data managed by organizations, security has gained special importance. Systems such as intruder detection (IDS) monitor and analyze data on a network in search of malicious or suspicious data, but that, due to the great variety, volume and speed of them, have made such an analysis a process difficult by conventional techniques. That is why IDS use Big Data analysis

techniques to make this process more accurate and effective, reducing system computing time [28].

Fraud detection in the state health insurance system

Fraud detection in health systems is one of the most important priorities for governments today due to the high associated costs. Historically, fraud detection is carried out manually by auditors who search numerous records for possibly suspicious or fraudulent behavior, which is a tedious and inefficient process. Currently, in the US Thanks to the technological advances that allow the storage of a high volume of data as in the Electronic Health Records (EHR), the Medicare Service Centers (CMS) are using a series of Big Data analysis techniques with more automated approaches to data mining and machine learning to detect fraud in medical services and insurance, allowing to substantially improve the quality of service and the distribution of economic resources [29].

Improve the decision-making process

At present, the data culture is not very developed in Colombia, which prevents an optimal use of a substantial asset such as data. For example, it is estimated that in the country, only 65% of data is collected effectively and of these only 58.87% is relevant [30]. For this reason, in 2017 with the Big Data public policy, the national government headed by the National Planning Department (DNP), put into operation the Center of Excellence in Big Data and Data Analytics (Alliance CAOBA), which is co-financed by the Ministry of Information Technology and Communications (MinTic), in conjunction with Colciencias, and which will operate as a Center of Excellence and Appropriation. CAOBA has as an executing agency the Pontificia Universidad Javeriana, and has the participation of the Grupo Nutresa, Bancolombia, Universidad ICESI, Universidad EAFIT, Universidad de los Andes, IBM, EMC, SAS and the Cluster Creatic as a strategic ally, which joined forces with the purpose of strengthening the generation of data analysis solutions, and to make the public function more efficient and the State's resources better, taking into account that it is estimated that the total volume of data in the DNP will be 12,100 DVDs, which represents an increase of 40% between 2014 and 2015. Additionally, if the 16 ministries are added, approximately their information represents a volume of 1,000 terabytes, equivalent to the storage capacity of 222,000 DVD units.

An example of the effectiveness of Big Data is the inventory of the Beneficiaries Selection System for Social Programs (SISBEN), which, when crossing two databases, the DNP detected in 2015, 653,000 cases of inconsistencies. Likewise, it is estimated that with the use of Big Data in conjunction with energy efficiency systems, it can contribute to savings of up to 9.2 billion pesos per year due to unproductive consumption. In health, the Health Promoting Entities (EPS) invest 2.7 trillion pesos in administration per year, a figure that can be optimized by implementing analysis solutions with more than 300 million annual data records managed by the health system [15].

Financial sector

The banking sector is one of the largest data generators, such as customer information, commercial transactions and financial products, which together with external data are used to improve the decision-making process [31]. In addition to the above, the financial sector observes that the use of Big Data can be a potential forecasting and prediction tool to support macroeconomic and financial stability analyzes, analyzing the different environmental variables [32]. Indeed, in the last 5 years the market associated with Big Data has increased by $ 48 billion. For Capgemini Consulting, every dollar spent on BD has an average return of 55 cents [33].

Thanks to the evolution of new data analysis techniques, we are currently talking about Big Data Finance (FBD), which is called to make one of the most important management fields in the banking sector, is being managed to find new business models of analysis and handle traditional financial problems such as high frequency trading, feelings, credit risk, financial analysis, monetize data, prediction of customer actions, among others [34].

Smart cities and Sustainable Development

More and more cities are acquiring a role within the sustainable development plans, where even,

within the United Nations Sustainable Development Goals (DGE) in their 2030 agenda, they have declared that cities should be more sustainable and Resilient, relying on ICT as a tool for socioeconomic development, environmental protection, increased resource efficiency and knowledge generation in society [35]. Thanks to trends such as the Internet of Things, Big Data and analytics, today it is possible to track air quality in all cities of the world, and that the data is received and processed in real time, delivering graphics of results sensitive to variations of interest by researchers [36].

The concept of smart city was studied by the UN in its report "Big Data and the 2030 Agenda for Sustainable Development", where it defined 17 Sustainable Development Goals. In order to achieve these objectives, it is established that an inclusive and participatory development action is necessary that addresses social, environmental and economic challenges, and whose fundamental tool is the analysis of big data, which can reveal inequalities in society that were previously hidden by society. accumulation of general data on the population [37].

Fears

It is indisputable the great contribution that information technologies such as Big Data provide to the generation of knowledge, improving the quality of life of society in general. However, despite the great potential of large data, much of society believes that this data collection is nothing more than an intrusion to your privacy [14]. Similarly, for some authors and human rights organizations that are really concerned about the mass of data that houses large private companies such as Facebook and Google, to mention just a few, and government agencies of which there is evidence of invasion of privacy and data manipulation for own benefits, the risks of the misuse of Big Data are latent and subject of study.

Two of the areas of greatest concern are:

Privacy

Although new regulations have now been created such as the European Parliament resolution of March 14, 2017 on the implications of Big Data on fundamental rights specifically to address the challenges regarding data privacy, there are still associated risks, such as inference and aggregation that makes it possible to re-identify people even after removing identifiers from a data set, or even more, there are cases where regulations result in a violation of privacy, such as storing email data for periods of up to 5 years [38]. Also, in the medical data, it is not clear who owns them, and that their use, without regulated laws or the patient's consent can cause legal problems [39].

Likewise, the processing of large amounts of data by commercial companies suggests that this data will be used in a way that creates a digital profile of consumers with a purely marketing objective. In this sense, reports of bad practices of the main companies that use Big Data, such as Facebook and Google, that compromise user privacy, in addition to Edward Snowden's revelation that the US government was using surveillance programs on a global scale in complicity with technology companies, showing that Big Data is not the solution for all the problems of society and industry. Instead, Big Data may be widening the gaps in different sectors of society [40].

Discrimination

Big Data analytics leads to organizations' creating and sharing new knowledge about individuals. The new knowledge from aggregated data might reveal sensitive and unwanted information about individuals, create discomfort for them, and possibly have unintended consequences such as discrimination [41].

Recently, a 2014 White House report strongly warned that discrimination could be the unintended result of Big Data technologies, which implement classification and scoring algorithms that can yield discriminatory results. In the United States, for example, it was discovered that a system technology used to assess the future risk of recidivism among defendants discriminated against black people. In the United Kingdom, it was found that an algorithm used to make custody decisions discriminated against people with lower incomes [42].

Another example was, the website that Wells Fargo created in 2000 to promote its housing loans. The site had a tool to find a room called community

calculator. This identified the postal code of the visitor and the predominant population in that sector; later, he directed it to neighborhoods that had the same population. In this way, the tool directed white people to neighborhoods of whites and black people to neighborhoods of blacks [43].

The societies of knowledge

The concept of the knowledge society was first used in 1969 by the sociologist Peter Drucker, and in the 1990s it was deepened in a series of studies published by researchers such as Robin Mansell or Nico Stehr. By the year 1960, changes in industrial societies led to sociologists like Drucker warning societies about the importance of rethinking, deconstructing and reconstructing new processes of knowledge production, logically characterized by economic and social structures, since the world at that time in a post-industrial era [44].

The society of knowledge, which has developed along with globalization, has as its main characteristics: the importance of information and communication technologies in economic processes; knowledge as a source of growth; production based on knowledge and services; the rapid production of knowledge and the importance of educational processes throughout life [45]. Likewise, knowledge societies are not reduced to the information society. The emergence of the information society as a result of the advancement in the new ICTs, is only an instrument for the emergence of true knowledge societies, and that information is an instrument of knowledge, but not knowledge itself [46].

Nowadays, the notion of the knowledge society has become a necessary framework for reflection not only for most of the countries of the Organization for Economic Cooperation and Development (OECD), but also for many nations of emerging economies and numerous developing countries, especially from East and South-East Asia, Sub-Saharan Africa, Central and Eastern Europe, the Arab States region and Latin America and the Caribbean [46]. It is this aspect that can be observed that several countries have transcended the information society to make way for the knowledge society that, from a humanistic and complex perspective, focuses on solving problems based on the collaboration of the ICT, and the Universal values such as respect, honesty and fairness [47].

For the United Nations Educational, Scientific and Cultural Organization (UNESCO), knowledge societies are based on four elements: freedom of expression, universal access to information and knowledge, respect for cultural and linguistic diversity, and quality education for all. In the same way for UNESCO, knowledge societies should include resources such as open access to scientific information, open educational resources, free and open source software, open training platforms, distance education and self-learning, since These resources help student researchers and professors to share data universally more efficiently [9].

Challenges

Educational field

As previously mentioned, the idea of the knowledge society, which is a topic of reflection in most of the developed countries of the OECD, is also an issue in emerging economies such as Brazil, Russia, India and China. The relevance of education shows that, in the task of building knowledge societies, the focus on technological media should not leave in the background the key role of schools, technical training institutes and universities [48]. It is important to point out that access to information does not guarantee the incorporation of knowledge, because although it is true that ICTs greatly support the knowledge society, another series of structural changes are required in order to take advantage of the information that is available to them. access. From this point, it is that education, plays an important role in the Knowledge Society, since it is required that the agents that are part of society have the ability and the criteria to select, discard and incorporate the elements that support knowledge from the little or much information to which they have access [49].

The generation of collective intelligence within the framework of a democratic society requires for its development to introduce important changes in education. The relationship between knowledge and education should not be understood as a form of cultural extension; according to which knowledge is produced by expert systems and simplified by educators and

disseminators for their socialization. Faced with this vision, the idea of knowledge is imposed as a shared task in which they can contribute, in addition to experts, students and the general public. Thus, the transition from the Knowledge Society to the democracy of knowledge requires trusting people as valid interlocutors in public deliberation processes [50].

Technological field

Access to technology is one of the most important challenges for the generation of knowledge, especially in developing countries, taking into account that access to computers, the network and knowing how to use them is increasingly important for the participation in social, economic and political life [45].

However, the lack of economic resources especially in developing countries highlights the shortcomings to use ICT effectively, creating what is commonly called the digital divide. This can be understood as the difference in basic aspects for everyday life that implies an inequality of opportunities in access to information, knowledge and education. The lack of access to ICT or its poor use causes an effect of exclusion, deprivation of the possibility of social, economic and human progress [51]. This distance is caused by various factors such as: lack of knowledge (no training, inadequate application and use of resources), as well as socio-economic factors (high costs, infrastructure) [52].

Social and cultural field

The old knowledge societies were mostly based on different types of exclusions and reserved knowledge in large part to restricted circles of initiates or privileged. Likewise, the capacity for access and assimilation that allows dealing with this growing avalanche of information and knowledge is very unequal, according to social groups and countries. The most disadvantaged socio-economic categories not only have restricted access to information or knowledge (digital gap), but also assimilate information or knowledge worse than the categories located on the highest rungs of the social scale. This gap can also be observed among nations. Thus, an imbalance is created in the relationship with knowledge in itself (cognitive gap) [46].

In this order of ideas, reflection on the emergence of knowledge societies allows us to rethink the concept of development. The new valuation of human capital suggests that traditional development models are replaced by models based on knowledge, mutual cooperation and the strengthening of public services. The greater value of knowledge would lead to providing a new model of cooperative development, based on policies linked to the promotion of science and technology, which would play a relevant role in reducing inequalities [48].

Economic and political field

It is an undeniable reality that current organizations are part of the knowledge society and must face this reality in the most effective way possible, finding those differentiating elements that allow them to outdo their competitors. The dynamism of the economic activity of a contemporary company is evidently marked by the generation and sustenance of the assets dependent on its knowledge activities, so fundamental for its survival, production and success. For this reason, companies must dedicate themselves to the continuous reinvention of their competitive possibilities, assuming dynamics of innovation and creation, adopting good development practices supported in knowledge management [53]. Likewise, the strategic importance of knowledge is fully illustrated by the brain drain from the countries of the South towards the countries of the North, which is still the cause and consequence of the serious economic imbalances that exist between both hemispheres. It is also illustrated by the increasing increase in secrecy, including in democratic societies (military secrecy, industrial or commercial secrecy, secret protocols, confidential reports or confidential notes) [46].

Linguistic field

Machine translation systems - still deficient, despite the considerable progress they have made - offer a means of preserving linguistic diversity. The translation introduces an agreement or an understanding where only tumult and confusion reigned. Now, translation does not mean that diversity disappears because it does not produce identity, but only equivalences. Translation is the mediator par excellence between cultural diversity

and the universality of knowledge. In the absence of a universal language, exchanges between different cultural and spiritual legacies enable the concrete emergence of a common language after a long effort. To guard against the pitfalls of false universalism and relativism - which are sources of incomprehension and conflicts - knowledge societies will have to be translation societies [46].

Big data and the knowledge society

Throughout history, human beings have always been eager for new cooking that allows them to know the past, understand the present and predict the future. In this regard, the use of methods to store and process large amounts of data, coupled with the enormous advances in the fields of computer science, electronics and nanotechnology, have allowed the implementation of information systems such as the Big Data, as a massive storage mechanism for all types of data, simple or complex, that today are the food for the generation of knowledge, both for business organizations, educational institutions, research, governmental and economic sector, and social, among others. But not only the knowledge will be the result of human activities, so will the IoT, which according to the Mobile Economy annual report of Groupe Speciale Mobile (GSM) of 2017, predicts that the number of IoT connections will increase more than three times between 2017 and 2025, driven by a proliferation of cases of use of smart homes, cities, buildings and businesses, which means a massive amount of new data to obtain, new knowledge. In this aspect, today's society is observing how information management has driven the growth of a fourth industrial revolution based on data and information, which from the way to acquire new knowledge and how to share, analyze, criticize has revolutionized the way and the learning background [54].

As proof of the importance that the use of Big Data technologies is achieving is the education sector, where institutions are exploring the advantages for the improvement in administrative processes, and teaching-learning [55], for example; allowing more accurate and automatic monitoring of compliance with curricular achievements and addressing academic deficiencies early.

In the business sector, we talk about the era of smart companies, such as those that are capable of generating knowledge resulting from the processing through Big Data and analytical tools of their internal and external data that at some time are presented as opportunities to offer a sustainable value, improve business performance and provide competitive advantage or identify early threats that affect it [56]. As can be seen, the time when organizations were only production units has been left behind. Currently the processes of innovation, creation and creativity are the real keys for the generation of differential value and this is where knowledge becomes a strategic element [53]. Proof of this is that, large companies are investing and training their staff to become familiar with Big Data, since 1.5 million managers and analysts understand in depth how Big Data can be applied [16].

In the field of research, Big Data is bringing great benefits, since during the last decade and with the increasing use of the Internet, the evaluation of health problems using online search traffic data has been become an integral part of health informatics [57]. The Big Data analysis is becoming for the medical staff a fundamental tool in the development of new techniques and practices in medical care, converging in what is called "Big Data in Healthcare" [58].

Internet data in general and Google Trends in particular have been shown to be valid and valuable in predictions, forecasts; and in the detection and monitoring of disease outbreaks and epidemics. In this regard, recent studies have implemented methods to predict the prevalence of Acquired Immunodeficiency Syndrome (AIDS) in the United States by observing with Google Trends the search terms in Google related to AIDS and analyzing the relationship of official health data between 2004-2015 to identify significant correlations, which leads to the discovery of a logarithmic relationship between the data [57].

On the other hand, in the financial system, with the help of Big Data, Deep Learning and natural language processing methods, the technique called market sentiment is being used, which allows predicting the predominant attitude of investors in

terms of anticipating the price development in a market, this in relation to global, environmental, economic factors, among others [59].

Finally, one more case that demonstrates the influence of Big Data on the generation of knowledge in society, is the field of journalism, which currently attends a profound process of reconversion marked, among other things, by the digital environment that has given place to new business models, new techniques and new specialties. One of them is the so-called data journalism, whose philosophy is based on the use of Big Data techniques to find stories that are of interest to society. It is a journalistic proposal that emerges from the web and is characterized by the methodological rigor of the social sciences when it comes to extracting, systematizing and processing data that will later be used to publish journalistic stories. In this sense, Big Data can offer a fresh look and new perceptions, because it is not compromised by conventional thinking and the inherent biases of each field. One of its possibilities is to discover stories of social interest thanks to the statistical exploitation of large databases that leave aside traditional theoretical or normative constraints [60].

Conclusions

A new society is emerging as a result of the implementation of revolutionary technologies, which have novel tools that make it possible to expand the horizon towards new knowledge and skills. Areas such as education, research, management of organizations, politics, science, economics and humanities, are being affected in a significant way due to the use, increasingly, of information and communication technologies, leading I get huge benefits to individuals and organizations that find new ways of dealing with the tasks and problems of today.

We are talking about a new knowledge society immersed in large amounts of data that need to be processed for its use and understanding. In this sense, according to the research, it is clear that the amount of information currently available to us does not necessarily imply having more knowledge. Hence the importance of having data management models and technologies such as Big Data that, in conjunction with data mining, analytics and cloud processing, allow us to obtain knowledge where only raw data existed. It is also clear that the use of these new technologies implies: (1) training of personnel in charge of the development of software systems that adapt and meet the precise needs of all sectors present in the productive, economic and educational chain, (2) training of the actors that will use the technology and (3) creation of policies that will allow mass connectivity to 5G high-speed networks and ICT, and a tax reduction in technological components such as smartphones, laptops, tablets and wearables that allow cheapen the technology in order to mass use (4) that government policies in technology should be focused on the long term, beyond a presidential period, highlighting in areas such as science, technology and innovation, fundamental characteristics to reduce the digital divide.

Finally, to say that for true knowledge societies to exist, the use of these new technologies is not enough. It is imperative to make profound changes in educational models and public policies on investment, technology and employment, for example, that allow the inclusion of all social classes without discrimination. In this sense, knowledge societies with the help of Big Data are called to be integrating elements, and to transform the way in which they are taught and learned, the way in which they are researched, new social and economic scenarios are simulated, the make decisions in companies and share knowledge.

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