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The technological innovation of the blockchain and its impact on the energy sector

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Abstract

The blockchain application is a technological innovation that promises to revolutionize the way to negotiate the raw materials of the oil sector, through the use of cryptographic techniques that allow the streamlining of complex transactions that are being applied in trade and business. Companies can use a new generation of transactional applications in a safe and immediate way, based on the concept and application of blockchain technology, allowing accelerating the time to value for business and business initiatives. The objective of this article is to generate reflective analysis and discussion, through the combination of an analytical methodology, structural-causal, on technological innovation called blockchain, its application and repercussions, which have the capacity to improve transactions in the energy sector thanks to its decentralized and incorruptible system. At the present, innovation and technology are important instruments to establish improvements in the growth and economic development of the energy sector, the main foundation of the global economy in many respects, since this sector is strategic for reasons of national security in all the countries of the world.

Keywords: Blockchain, technological innovation, goods market, energy sector, algorithmic trust.
JEL classification: 031,033, Q43

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La innovación tecnologica del blockchain y su impacto en el sector energético

Resumen

La aplicación blockchain es una innovación tecnológica que promete revolucionar la forma de negociar las materias primas del sector petrolero, mediante el uso de técnicas criptográficas que permiten la racionalización de transacciones complejas que se están aplicando en el comercio y los negocios. Las empresas pueden usar una nueva generación de aplicaciones transaccionales de una manera segura e inmediata, basada en el concepto y la aplicación de la tecnología de cadena de bloques, lo que permite acelerar el valor en el tiempo para las iniciativas comerciales y empresariales. El objetivo de este artículo es generar el análisis reflexivo y la discusión, a través de la combinación de una metodología analítica, estructural-causal, sobre la innovación tecnológica llamada blockchain, su aplicación y repercusiones, que tienen la capacidad de mejorar las transacciones en el sector energético gracias a su sistema descentralizado e incorruptible. En la actualidad, la innovación y la tecnología son instrumentos importantes para establecer mejoras en el crecimiento y desarrollo económico del sector de la energía, la base principal de la economía mundial en muchos aspectos, ya que este sector es estratégico por razones de seguridad nacional en todos los países del mundo.

Palabras clave: blockchain, innovación tecnológica, mercado de bienes, sector energético, confianza algorítmica.
Clasificación JEL: 031,033, Q43

1. Introduction

Elaborating an academic article of a technological innovation such as blockchain and its impacts, has represented a challenge for this research. This is mainly due to the fact that it is something so novel and it is difficult to establish its scientific character, and for this reach it has been necessary to start with its theoretical foundations; start from there and then follow the

research until you reach the practical aspects. These last ones include their applications in the markets and in the energy sector. To establish the theoretical foundations of something so innovative and pragmatic has been a task in which it was necessary to carry out research from several aspects. One of them, as relevant as the conceptual theme and another of even greater relevance as the metaphilosophical theme; both are essential for an understanding of the foundational and theoretical dimensions. First, we analyze how it was its emergence, and then establish how it was the process of its development, to reach the applications of technological innovation of blockchain in the markets, which are generating structural changes, thanks to cryptography and Value transfer with blocks, which promise to found a new era in business processes, towards decentralized, distributed, safe and incorruptible processes, and that in practice, they manage to shorten the times and the distances, the paperwork, the bureaucracies for all the commercial processes that use them, such is the case of the energy market. Promising a future that looms as the new engine of the technological economy, increasing its potential and possible uses for problem solving.

2. Methodology

Considering the importance of establishing the scientific foundation of this technological innovation called blockchain, a causal structural analytical methodological process was chosen. First, we made a review of the literature to establish the conceptual aspect of both innovation and technological innovation. Secondly, we analyze the reference to blockchain, on the one hand in its conceptual form and on the other in the metaphilosophical aspect of it. Thirdly, we made the analysis of both, the technological aspects and the application of the blockchain in the markets, industry and in the energy sector trade.

For the beginning, it is important to note that in the Oslo Handbook (OECD, 2018, p. 20) "Innovation is understood as the conception and implementation of significant changes in the product, process, marketing or organization of the company with the purpose of improving the results". Innovation, and the changes that precede it, are realized through the application of new knowledge and technology that can be developed both, internally, as in external collaboration or acquired through advisory services or by the

purchase of Technology. Innovation activities include all scientific, technological, organizational, financial and commercial actions that lead to innovation. In the manual are considered both, the activities that have produced success, and those that are in progress or those carried out in projects cancelled due to lack of viability. Innovation implies the use of a new knowledge or a new combination of existing knowledge (López-Isaza, 2013).

Quintero's research (2013, p. 34) points out that "innovation" is part of two situations, the first as a concept and the second in the use that is made of it. The term innovation has been used to refer to technological innovations (Nelson and Rosenberg, 1993 in Quintero 2013). In this way, the author reiterates to us how "the definition of "innovation" has been configured from two great perspectives: as a process and as a product" (Quintero, 2010, p. 59). In the same way and in line with another document by Quintero (2013, p. 31) the strategies for innovation are mentioned: on one hand it affirms that the innovation in the product is not the result of a systematic investigation but of the exploration from the Empirical experience. On the other, he points out that the research is relatively decentralized, developed by a group of postgraduate professionals; have a methodology for research and development of new products.

As for technological innovation Networks (1996) enunciates that conception has changed dramatically in recent years. In the OECD countries, the essentials of innovation occur both in enterprises, as in university laboratories, governmental research centers and non-profit organizations, all these contribute significantly, and sometimes decisive, to scientific and technological advances. Universities and other long-term scientific research laboratories, and therefore the public authorities that finance and support their work, continue to be extremely important actors in national innovation systems and good relations between science and technology are crucial to their success.

Technological change implies important cumulative learning processes. These processes include learning by practice, learning by use and learning by interaction. Research institutions and companies represent the institutional basis of this learning process. The technologies are subject to complex selection processes, their use and application depend on a wide spectrum of economic factors (relative prices, profit distribution), social values and arbitrations on the part of the main actors involved. "The notion of "rising yields of adoption" accounts for the fact that technologies are not necessarily

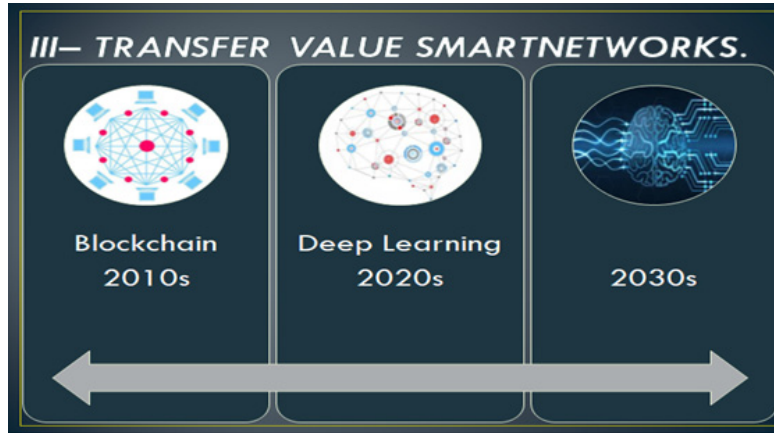
chosen because of their superior efficiency but that they become effective precisely from the fact that they have been chosen" (REDES, 1996, p. 133). The chain of innovation follows a path whose origin is the perception of a new possibility and/or a new invention based on science and technology. This perception follows, necessarily, the elaboration of the analytical conception of a new product or a new process and leads subsequently to development, production and marketing (Ibid, 1996).

In order to achieve the scientific character of technological innovation, it is necessary to establish its theoretical aspects. Establishing them for something so innovative and pragmatic and investigating the metaphilosophical theme involves creating a philosophy of technological innovation, and also, specifically, a subject as new as the blockchain is not entirely straightforward. However, for the establishment of a thematic with a scientific basis, this is more than essential. To this end, it is of considerable importance the treatment that gives Swan (2017b) to the metaphilosophically and philosophical aspect of the blockchain, which is added to its own definition as a financial and digital accounting software underlying the cryptocurrency. Blockchain is also an application that, through cryptographic tests, serves as the basis for making secure transfers and transactions of money, assets and information without the need of an external intermediary (Swan, 2015, p. IX) that include mathematical models of reality, the significance and the economic-financial and sociopolitical institutions that structure human life and its interactions. In addition, conceptual resources are elaborated to contribute to a philosophical understanding of blockchain technology. Showing that philosophy as a metaphilosophical approach is capable of providing an understanding of the conceptual, theoretical and foundational dimensions of innovation and its emergence in the world of blockchain (Swan, 2017a).

Technological innovations are transcendental elements for economic and sociopolitical development. The technological innovation called “Internet” is a transformative element that has emerged to change the world. Swan (2017b) mentions a philosophy of the web and a philosophical engineering quoting from origin to Halpin and Monnin (2014) who initiated a discussion of fundamentals aspects of an emergent technology. Swan (2017b) extends even more to current aspects of innovation considering philosophical issues of an emergent technology such as blockchain, which is promising to carry out the next technological revolution (see figure 1).

The advent of this technological innovation brings a new perspective or it was on the net. Blockchain technology generates transfers and financial and economic actions in real time, at any time and to anyone in the world. It manages to shorten the times and the distances for all the transactions that use this technological innovation, eliminating also the paperwork and the bureaucracies. And nowadays, it is already being used to establish a transaction log, to transfer, verify asset ownership, commercialization of goods, as well as to preserve the integrity of documents and confidential records of Governments, Industry, companies, etc.

The application of the blockchain generates the transfer of value with blocks, between pairs, through the confidence algorithmic that is safer than that was given with agents and intermediaries. Likewise, value transfers and contracts are automated for faster, easier, cheaper and less risky execution and could serve as an important technology for monetary applications and digital asset registries (PricewaterhouseCoopers (PWC), 2016). Title and property transfers could be more dynamically managed which would represent a major role in improving economic development. Blockchain-based networks could become a follow-up record for economic, legal and commercial activity in the world, a kind of social memory (Ibid, 2017b).



Source: own elaboration with support from Lezlye Mendoza, with data of Follow 2011 of wileyonlinelibrary.com and Swan 2017.

Figure 1
Three Fundamental eras of Network computing

For Swan (2017b), the internet era prompted us to rethink issues such as the self, the relationship between the physical world and the virtual world, the individual and society, and the concepts of materiality, temporality, spatiality and possibility. The blockchain also justifies the same degree of philosophical, ontological, epistemological and axiological question. As for the treatment of each science in reference to blockchain, we can state that ontology deals with issues of existence and from this point of view of the blockchain would provide a concise definition of what technology is, including its purpose, function and dimensions. The second area, epistemology, deals with knowledge, what the blockchain helps us to know or understand with regard to the new knowledge that generates this technological innovation. The third area, axiology, especially ethics and aesthetics, refers to how blockchain technology is valued, absorbed and considered by individuals and society. That new norms of behavior are arising due to the blockchain, who are adopting this technology and the reasons for it.

3. Blockchain Projects applied to the industry and the energy sector

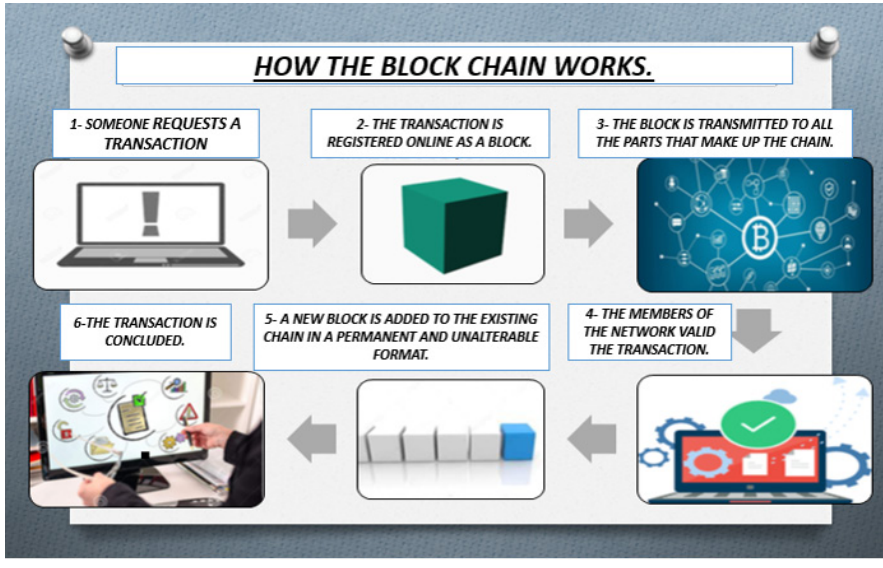
In 2015, Linux Foundation used blockchain in its new open source projects with the aim of creating an open cross-industry standard for the development of technologies through the blockchain application. And set it up with more than 130 members, including different types of industries. Within these projects, we find "the Hyperledger Fabric, which is the corporate blockchain network used by IBM to implement business solutions with its customers" (Duarte, 2017). Hyperledger Fabric of the blockchain application is a solution for trade and business that has two features: it is very safe and is immediate, High Security Business Network (HSBN). "This solution can be executed both in Bluemix and on-premise where all data traveled by the network and systems are encrypted" (Duarte, 2017), guaranteeing a maximum level of security for blockchain projects.

The blockchain is the chain of blocks (see figure 2) that marks the beginning of a revolution based on technological innovation, succeeding in transforming itself into one of the most important technologies for the development of technological goods and services and its marketing. Defined by (Getso, 2017) "The Blockchain is an incorruptible digital book of economic transactions. At this you can program to register not only financial

transactions, but virtually everything that has value. "The Blockchain technology also allows the verification of the information to validate any type of edition.

Blockchain is a database distributed through a large sequence of data or blocks, which have been duplicated thousands of times in an interconnected network of computers through a network of nodes that form a shared database and stored in different locations, whose design is based on regular data stream updates and have the following features:

- Records are public and highly verifiable (security)
- Information decentralization (distribution)
- Accessible by anyone on the internet (transparency)
- Cannot be altered, is a system without faults (incorruptible)

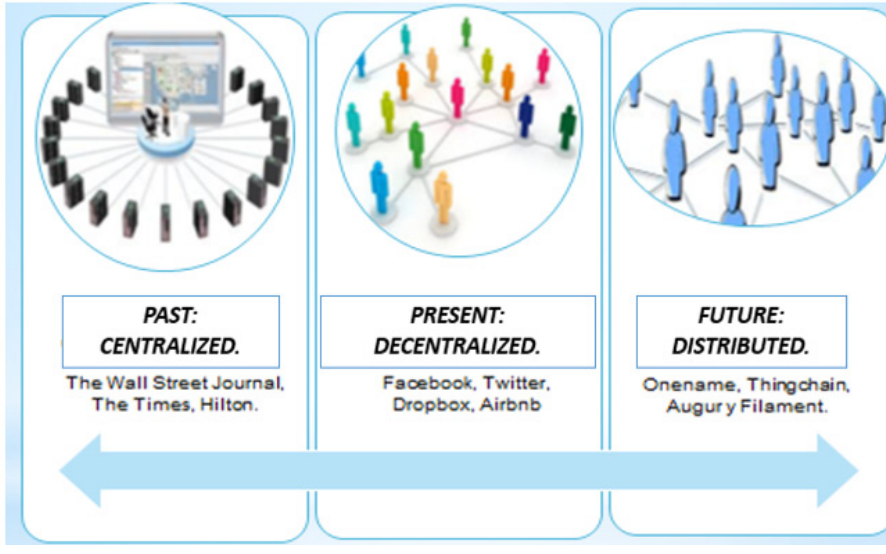


Source: own elaboration with support from Lezlye Mendoza with data from the Financial Times, and PWC United States of America.

Figure 2
How the block chain works

The structure of the blockchain stores identical blocks of information through nodes, and the more you share the more secure database becomes. When the network blocks are verified, they achieve certain characteristics such as distribution and non-centralization (figure 3) because the application works with synchronizing data at the same time as a whole that cannot be centralized and these data can be public and stored without depending on a regulatory organization (Tapcott, 2019). Swan (2015) considers that the next big step in the technological wave will be the decentralized and distributed networks.

For the blockchain network it is necessary to go through a consensus state to modify the data. This consensus would have to validate the modification, and it will be checked automatically over an established period of time. In Order to broadcasts corrupt or alter any unit of information in the blockchain system, it would be necessary a great power of computation, power that does not exist yet and cannot be generated with the current technological level.

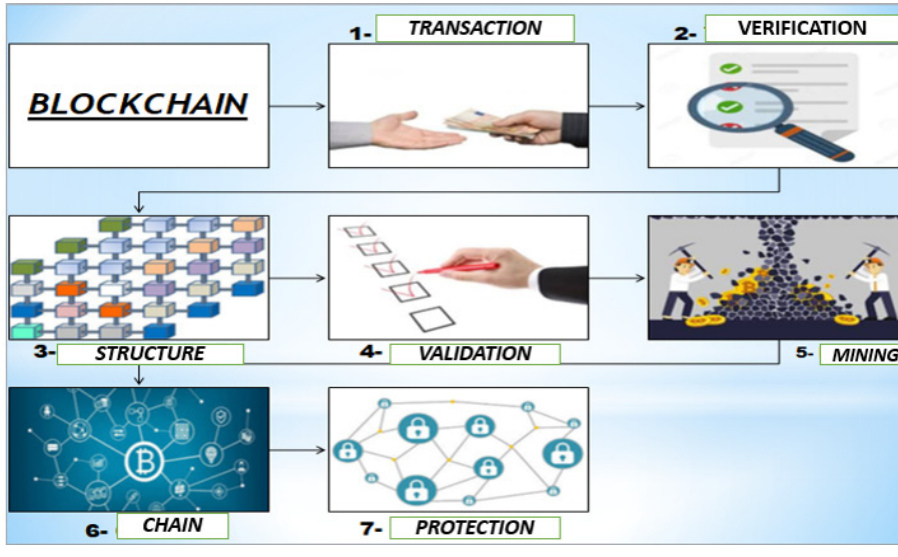


Source: own elaboration with support from Lezlye Mendoza with data from Clarke and elpetro.org

Figure 3
Progress towards decentralization and a distributed future

To use the blockchain application, we need a series of elements that work in an integrated way to ensure and validate the data of the chain. Among these elements we have the following:

1) Blocks: the blocks are formed as well as the links of a chain, and these include data, modifications and confirmed transactions (figure 4). There is a generatrix block which initiates the chain. All the blocks are composed of an alphanumeric code that serves as a link to the previous block (with the exception of the generatrix block) and a closing block that links it to the next block.
2) Miners: they are the ones that process the information and it is necessary of a computer of computers, chips and integrated systems whose computational power allows to generate and to verify the transactions carried out.
3) Nodes: it is a series of computers or chips called nodes that serve to store and distribute the information in real time and ensure the integration of the whole system.



Source: own elaboration with the support of Lezlye Mendoza with data from Clarke and elpetro.org.

Figure 4
Operation of the blockchain

In terms of safety, it is important to highlight that the blockchain network is incorruptible because it lacks vulnerabilities and uses encryption technology, as well as verification. We witness the emergence of a new era in the commercial transactions of the energy sector and in the way of negotiating, from the web itself, because at the moment there is no technology that has promised a wider revolution and more fundamental than the technology blockchain, with time to value transactions, in a very safe and immediate way. For the application of the blockchain can be used in processes and businesses there are several basic criteria. The first is that its applicability is ideal in extremely complex (and slow) processes that maintain a validation chain on several levels; second, when transactions require traceability, require unique records and these cannot be altered; third, where identity processes are necessary and a trust relationship must be established between the members of the business network; fourth, it is applicable to new forms of negotiation or to renew, expedite and improve the ways of negotiating and established (Duarte, 2017).

The blockchain technology is based on four basic aspects:

- The transaction sharing record (ledger),
- The consensus to verify transactions,
- A contract that determines the rules of operation of transactions
- And finally, cryptography, which is the foundation of everything.

Once the commercial process in which the application will be used is chosen, an adaptation process is carried out and "blockchain is included as an intermediate layer of transactions between the systems of insight layer and the bequeathed structure layer" (Duarte, 2017). They must be programmed in the application of the blockchain, on the one hand the contract, which will be the business rules applied to the systems, and on the other the levels of access of the members of the network to the information contained in the ledger. "From there, all new transactions will be registered and operated in accordance with the schedule" (Ibid, 2017).

4. Results and discussion

The blockchain has wide applications in the markets of different sectors, including the energy sector. Moreover, it is an innovation that is generating

a new era and is looming as the new engine of the technological economy. On the one hand, there are other sectors in which blockchain technology has been innovating. This is why, it is expected to continue to increase its potential and possible uses for problem-solving. And on the other hand, each time new startups are born, looking to implement it in their business model. In addition, blockchain has a wide potential to be applied in commodity markets by the way it manages its data structure, in a transparent, decentralized, distributed and incorruptible way. Among the potentials of application and management of the blockchain are the next ones:

-File Storage:
Through blockchain companies like Storage develop a way to offer data storage in a distributed way. There by increasing the security and independence of the service.
-Smart Contracts:
There are systems like Ethereum that allow the codification of simple contracts to be fulfilled when they have the specific conditions. Generating a concept called smart contracts.
-Supply Chain Audit.
Through the development of distributed accounting books provides an easy way to certify purchases. In turn, through a transparent system we will be able to identify the life time and the location of the product (Clarke, 2017).

Nowadays blockchain's activities are spreading all over the world at high speed in different markets, both at the commercial level, as well as raw materials and commodities, and so is the case with regard to the energy sector market. Thanks to the enormous innovation potential of blockchain technology and its use in finance, transactions in the wholesale energy markets can be simplified with process optimization in the short term; and in the long term a structural revolution of the entire energy market is looming (PWC and Energy Web Foundation, 2018).

As for the energy sector, the technology of the blockchain with its chain of blocks is developed in projects like those of Energy: through a computer program that allows operations (peer-to-peer or P2P), between peers, represented by two agents without the need of a third party and without any intermediary.

Blockchain has five key features that apply to different cases of the energy sector ensures:

-Absolute transparency in transactions, allowing liquidation speeds almost in real time, which builds a base of trust among the actors involved.
-Shared reading in the block chain, further generating confidence increase and eliminating intermediaries.
-By increasing efficiency, costs are reduced and, with the advantage of eliminating intermediaries, both processes and infrastructure are simplified, thus increasing operational efficiency.
-Increased control and security are inherent because thanks to the high level of codification of blockchain technology, data protection is higher and there is low risk at the time of liquidation; which results in more efficient and reliable transactions.
-Decentralization eliminates monopolies and therefore avoids the abuse of market power; requiring less legislation, costs and regulatory oversight (PWC and Energy Web Foundation, 2018).

There are organizations such as the Energy Web Foundation (EWF) (2018) that rapidly promotes blockchain technology in the energy sector through the Energy Web Platform (EWP) which is a scalable and open source blockchain platform designed specifically for the regulatory, operational and market needs of the energy sector. It serves as a shared and fundamental digital infrastructure so that the energy and blockchain community can build and execute their market operations that help and support solutions. It should be noted that thanks to the innovation and the potential of the blockchain for the energy sector, the transition to a decentralized, democratized, decarbonized and resistant energy system is accelerating.

EWP is an innovation that was born with the aim of developing market improvements that guarantee inter-operability, reduce costs, simplify complexity, and facilitate the implementation of technology through applications blockchain to be easy to use. In a such way that blockchain technology is comparable to a "distributed, replicated and shared accounting book to manage and record transactions between multiple participants" so that transactions are stored among participants (nodes) and the applications of this technology use each one of the elements with a different extension according to the requirements that each business requires, leaving behind the

old storage based on centralization (PWC and Energy Web Foundation, 2018).

Although the case studies for blockchain in energy management and raw materials are several, we want to highlight the following:

1. A transformation project is the One used for Bill of Landing (BL) or cargo guide, which is used for shipping, receiving and delivering at the loading and unloading port; Description of goods, companies involved, and everything related to the sector of embarkation and disembarkation (Dütsch, 2017).

2. This technological innovation is also applied in the supply chain and logistics optimization, where blockchain can eliminate the costs of trade between countries and the errors of involving a financial intermediary to process the transactions, providing the maximum security for both parties.
3. Also, there is the case of instant matching and liquidation of operations. Under the figure of the accounting books, blockchain replaces the administrator or central data storage, for a consensual mechanism that validates transactions.
4. Another outstanding project is the direct trade between peers (P2P) to support the proper functioning of the electrical network. What we are looking for is the generation of renewable energy, which can be achieved with virtual power plants (VPP) based on blockchain technology.
5. Finally, there is the use of blockchain technology as a tool to simplify billing processes. For example, the use of electric vehicles (VE) could increase, only when its users gain access to charging stations anywhere, as with the gas stations. However, one of the problems facing the drivers of VE has to do with the time of recharging and billing. Thanks to this technology, users of this type of vehicle could leave their car recharging while shopping and, once the driver leaves, the charging station could generate, by the electricity received, the invoice automatically with the use of the blockchain technology (Ibid, 2017).

In addition, in the present and the future, blockchain technology has great potential, such as the development of patterns to create solutions at

the industrial level, such as the scope that the Internet Of Things could have (IOT for its acronym in English), "where the machines will be able to establish contact or communicate without any kind of human interaction. Machine-to-machine (M2M) communication could be managed through the blockchain, taking advantage of its speed and automation capabilities. This will redefine the way in which the human being relates, both personally and in business, giving rise to the increasing possibilities and opportunities of growth in the world "both industrial and commercial (PWC and Energy Web Foundation, 2018).

The oil sector had more than two hundred years with the same processes, which are expensive for the time and the bureaucracy involved, and now with the blockchain applied to the oil sector will be facilitated all the processes (Mercuria Energy Group in The Economist, 2018). Thanks to the blockchain application, the possibilities are given to innovate the administrative processes of the energy sector trade. Oil vessels supply nearly half of the world's demanded oil, supplying the most important raw material globally, transporting millions of barrels of crude oil and a document as valuable as its cargo and certifying the ownership of a raw material, the value of which can exceed 122 million dollars per boat.

The technological innovation of the blockchain application is influencing the change of the previous centralized and bureaucratic system, and promises to leave behind the usual loading documents and other registration forms required for each transaction, they consume a lot of time and money. Using an online registration through the block chain can reduce costs and increase profits. Online accounting books register transactions using encryption to ensure security and the user network can view the history of each operation.

The difference between the oil operations that use conventional digital technology to store their data and the blockchain, is that the latter obliges buyers and sellers to work from the same registry. This generates greater transparency and reliability in operations and eliminates the excessive documentation and human failures of the staff handling it.

There is evidence from a consortium (including oil producers BP, Royal Dutch Shell and Statoil, Gunvor Group, Mercuria and Koch Supply & trading, and credit institutions ING Groep, ABN Amro Bank and Société Générale) that has developed a blockchain platform for the physical operations of this type, and that tested the system with an oil tanker whose crude was sold three times before than the physical shipment reached the final owner in

China National chemical. The transaction verification took 25 minutes compared to the three hours it normally required. The process eliminated the risk of routine errors that take longer to resolve (Mercuria Global Energy in The Economist, 2018) transactions that took many hours or days, can now be done immediately from the Ipad or the cell phone with the blockchain system (Baddi in Brett, 2018).

The development of the first platform based on the blockchain application to finance the commercialization for all types of raw materials from oil to wheat was carried out by Komgo S.A., a startup that is headquartered in Geneva, Switzerland and that United to several global banks.[1] Financial Operators Project A secure platform based on the blockchain with the aim of optimizing the operational, logistics and commercial flow of commodities, innovation that is revolutionizing the commodities market at global level (Brett, 2018).

The Komgo Platform performs two phases for the application: The first phase will be used for the energy trading, using for its initial exchanges the traditional loads in the North Sea, a reference region for most of the world trade of raw. The second phase that will take place from the first months of the year 2019, incorporating the trade of raw materials to the derivatives of the agriculture and also to the metals. Komgo has established several partnerships with other companies to establish technological innovation in the processes of the energy sector thanks to blockchain technology and in partnership with the blockchain technology company ConsenSys, and in conjunction with the company Vakt, who develops the digital ecosystem for post-physical exchange processing of commodities leveraging blockchain technology. This in order to eliminate reconciliation and paper-based processes, this is expected to improve process efficiency and also create new financing opportunities for this type of trade (Brett, 2018). Whenever we are shown the use of the new technology and the uses and applications that derive from it, we can say that the new resolution is already in the door and there will be no turning back. This research evidences part of the development of this happening and what will come ahead, showing the present development and glimpsing a promising future for the application of this technological innovation in the energy sector.

[1] ABN AMRO, BNP Paribas, Citi, Crédit Agricole Group, Gunvor, ING, Koch Supply & Trading, Macquarie, Mercuria, MUFG Bank, Natixis, Rabobank, Shell, SGS y Societe Generale, they are some of the banks and operators that are already testing the platform.

5. Conclusions and repercussions

Technological innovation, and the changes that precede it, are realized through the application of new knowledge, in such a way that the good relations between science and technology are crucial to the success of it. Technological change implies important cumulative learning processes. These processes include learning by practice, learning by use and learning by interaction. In companies, as well as in university laboratories, governmental research centers and non-profit organizations, significant and decisive contributions to scientific and technological advances are achieved. Similarly, and in conjunction with universities and scientific research laboratories, the public authorities that finance and support their work continue to be extremely important actors in national innovation systems.

The blockchain marks the beginning of a revolution based on technological innovation, managing to transform itself into one of the most important technologies for the development of goods and services and its commercialization. The structure of the blockchain stores identical blocks of information through nodes, and if more you share, more secure database becomes. When the blockchain network blocks are verified, they achieve certain characteristics such as distribution and non-centralization, since the application works with synchronizing data at the same time as a whole and these data can be public and stored without relying on a regulatory organization.

The advent of this technological innovation brings a new perspective on the web, because thanks to its technology are generated transfers and financial and economic actions in real time, at any time and anyone in the world, manages to shorten times and distances for all transactions that use it. Currently, it is already being used to establish a transaction log, to transfer, verify asset ownership, commercialization of goods, as well as to preserve the integrity of documents and confidential records of governments, the Industry, companies, among others.

The blockchain application is defined as an incorruptible digital book of economic transactions. In which you can program to register financial transactions, and virtually everything that has value. It generates the transfer of value with blocks, between pairs, through cryptography and algorithmic confidence that is more secure and reliable than that given with agents and intermediaries. Value transfers and contracts are automated for faster, easier, cheaper, lower-risk execution and could serve as an important technology for monetary

applications and digital asset records. Title and property transfers could be more dynamically managed which would represent a major role in improving economic development.

For the application, to be used in processes and businesses there are several basic criteria. Emphasizing that its applicability is ideal in extremely complex (and slow) processes that maintain a validation chain on several levels; when the transactions require traceability, require unique records and that these cannot be altered. Where identity processes are needed and a trust relationship must be established between the members of the business network. It is applicable to new forms of negotiation or to renew, streamline and improve the ways of negotiating already established.

The repercussions from the application of this technological innovation, mark the beginning of a new era in the commercial transactions for the energy sector and in the way to negotiate from the web, since until this moment there is no technology that has promised a wider and more fundamental revolution than blockchain technology, with time to value transactions, in a safe, incorruptible and immediate way.

For the energy sector, the blockchain technology with its chain of blocks is developed in projects through a computer program that allows operations (peer-to-peer or P2P), between peers, represented by two agents without the need of a third party and without any intermediary. Blockchain has five key features that apply to different cases in the energy sector.

Blockchain and its application in the energy sector have the objective of developing market improvements that guarantee inter-operability, reduce costs, simplify complexity, and facilitate the implementation of technology through applications easy to use. Through this innovation and its potential for the energy sector, the transition to a decentralized, democratized, decarbonized and resilient energy system is accelerating. There is no doubt that the positive repercussions, since one of the most benefited from the technological application, is the oil sector that has been in the two hundred years without change. Its processes are expensive for the time and the bureaucracy involved, and now thanks to the application of the blockchain will be facilitated all its processes, affecting for the change of the previous system centralized and bureaucratic; promising to leave behind the usual cargo documents and other registration forms required for each transaction that consume a lot of time and money. Using an online registration through the blockchain can reduce costs and increase profits. Online accounting books

register transactions using encryption to ensure security and the user network can view the history of each operation. The difference between the oil operations that use conventional digital technology to store their data and the blockchain, is that the blockchain obliges buyers and sellers to work from the same registry. This generates greater transparency, security and reliability in operations and eliminates excessive documentation and human failures.

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