



BLOCKCHAIN ET INNOVATION OUVERTE: UNE REVUE DE LITTERATURE

BLOCKCHAIN AND OPEN INNOVATION: A LITERATURE REVIEW.

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Résumé

L'objectif de cet article est de comprendre comment une technologie bouleversante comme la Blockchain peut impacter le processus de l'innovation ouverte. Pour y parvenir, nous avons exploité une recherche documentaire très riche des deux champs disciplinaires différents, qui permettent de donner lieu à une littérature fructueuse. En fait, la littérature sur l'innovation ouverte comprend deux courants principaux en fonction du point de vue de l'entreprise ou de celui de l'interface entre l'entreprise et ses partenaires externes. Dans ce travail on s'est intéressé au deuxième volet, celui de l'interface d'innovation ouverte, pour analyser les apports de la technologie Blockchain à ce paradigme. Cet article constitue un cadre théorique pour les entreprises Marocaines surtout dans cette conjoncture caractérisée par la transformation digitale.

Mots clés :

La technologie de la Blockchain; Ecosystème; Innovation ouverte; les modèles interactifs de l'innovation; Propriétés intellectuelles.

Abstract

The objective of this article is to understand how a groundbreaking technology like Blockchain can impact the process of open innovation. To achieve this, we have used very rich documentary research of two different disciplinary fields to produce fruitful literature. In fact, the literature on open innovation has two main streams depending on the point of view of the company or that of the interface between the company and its external partners. In this work, we focused on the second part, that of the open innovation interface, to analyze the contributions of Blockchain technology to this paradigm. This article constitutes a theoretical framework for Moroccan companies especially in this conjuncture characterized by the digital transformation.

Keywords:

Blockchain technology; Ecosystem; Open innovation; interactive models of innovation; Intellectual properties.



Introduction

Everyone must have heard of “Bitcoin”, and the up heal that this virtual currency or this new payment medium can generate in financial transactions. However, its contribution to different areas can redefine the principles of the business world. Nowadays, many organizations are interested in this trusted technology “Blockchain” - including Federal American Reserve and other banks (bank of France that initiated a laboratory for the development of this technology, the bank of England in partnership with Ripple, etc.). In fact, this technology can go beyond its financial use, Blockchain1.0, to different domains, including open innovation practices. The aim of this communication is to understand the potential contributions that Blockchain technology can bring to open innovation practices. This research is, therefore, based on a multidisciplinary theoretical framework of interactive models of innovation. The literature review has enabled us to discuss the possible contributions of this emerging technology to open innovation, in order to present a perspective framework on this technology and to introduce Moroccan companies to open innovation practices under the theme of trusted technology “Blockchain”. what are the benefits of Blockchain technology for open innovation? After understanding the opportunities to overcome the possible obstacles of open innovation practices as a first point, we will deal with Blockchain technology; starting with the definition, fields of application and principles, and ending with the relationship between the two disciplinary fields in order to respond to our problematic.

1. Open Innovation: Literature Review

This part presents a brief history on open innovation (1.1) and the definition of open innovation paradigm (1.2).

1.1. Historical Reconciliation

During the last decades of the 20th century, it became evident that the paradigm of internal innovation was eroding and did not reflect reality. Hence, the emergence of the so-called interactive models of innovation that have redefined innovation as “the result of interaction and collaboration between organizations. They involve the research, selection, combination and integration of a wide variety of tangible and intangible resources incorporated in different organizational and technological contexts, and distributed within and outside the organization’s borders (Barbaroux and Attour, 2016) . Among these interactive models of innovation is the work of Eric Von HIPPEL (Hippel, 1988), Professor of Innovation at Sloan School of Management, who for the first time has theorized the importance of external actors in the innovation process of the company(Duval and Speidel, 2014). Hence the emergence of



the notion (Lead users), this current sheds light on users or consumers who innovate and create products and services they wish to see commercialized (Ruiz, 2017). The work of Von Hippel (1988) encouraged companies to involve pioneering users in the collection phase of new product ideas. However, the disadvantage here is that these lead users have expectations of a new product that is significantly different, or ahead of the rest of the world (Hippel, 1988) (Barbaroux and Attour, 2016). Then, the approaches to innovation as communities defended, in France, by Patrick Cohendet. The ecosystem approach and business models initiated by James Moore (Attour and Burger-Helmchen, 2014), the open innovation paradigm popularized by Chesbrough (Chesbrough, 2003)

1.2. Definition of Open Innovation

The early work of Chesbrough (2003), of which he presents the first rudiments by what he calls open innovation in opposition to the old internal innovation, where he distinguishes between the main characteristics of internal innovation (see table 1).

Table n° 1: Principles of Open and Closed Innovation

Principles of closed innovation	Principles of open innovation
1. We have a competent team in our company we make it relatively autonomous to achieve our objectives.	1. Not all qualified people are in our companies. We need to identify them and invite them to work or collaborate with us.
2. The greatest benefits of R&D come mainly from our efforts to discover, develop and commercialize ourselves.	2. R&D performed by partners can be of a significant value. Internal R and D then helps to capture part of that value.
3. If we are the first to make a discovery, then we will be the first to Market it.	3. We don't have to reinvent the wheel to take advantage of different discoveries. It is possible to take advantage of it if we know how to fit in with the dynamics of the market
4. The company that is the first to introduce its innovation is in the best position to compete.	4. Developing a better business model is better than being first in the market
5. If we have the best ideas, we will be one step ahead of the competition.	5. If we know how to exploit our ideas and those of collaborators, we will be ahead of the competition.
6. We must rigorously control our intellectual proprietary, so that our competitors cannot benefit from our ideas and work	6. We need to leverage our intellectual proprietary sales and acquire the intellectual proprietary of others to strengthen and energize our own business model.

Source : (Chesbrough, 2003)



The table shows clearly that open innovation is based on the organization's openness to research and development and to opt for a new Open Business Model; how? through the integration of employees. Thus, as an essential point, on which Chesbrough relies on, is of the new way or vision of having intellectual property rights managed in a financial extension -of purchase/sale, in order to ensure competitiveness. As Chesbrough tried to present forms of this open innovation in his work (2003), he has focused only on the outside in and inside out that are recorded in transactional relations, as well as on the third mode which is the "coupled" in his work (2006) (Chesbrough, 2006)

- **INSIDE OUT** in the external form: the initiator of open innovation opens its organizational boundaries to use external ideas and technologies.
- **OUTSIDE IN** in the internal form: openness refers to situations in which the initiator of open innovation unlocks its own resources so that external people, e.g. developers, can use them. In this way, unused innovations are made available to others.
- **EXTERNAL-IN COUPLED** and Open Innovation can also be combined in a coupled process in which organizations work in alliances involving both donations.

In short, we can say that Open Innovation is a business model developed by external agents to the company. In other words, it is the contribution of knowledge or expertise from agents external to the firm and whose aim is to increase the value of their offer, reduce the production costs of products, shorten time to market and maximize the profit generated by these products and/or services (Bekono and Bekolo, 2020)

2. Models of Open Innovation

Today, the question is no longer whether to innovate solo or with other people, but rather about the ways or methods of innovation with different people (Fabbri and Charue-Duboc, 2016).

The literature on open innovation includes two main streams (Fabbri and Charue-Duboc, 2016), depending on how it approaches the phenomenon from the point of view of the enterprise or the interface between the enterprise and its external partners. This part focuses on open innovation interface to analyze the contributions of Blockchain technology to this paradigm. The work of Pénin (Pénin et al., 2013) has provided the basis for the diversification of forms presented by Chesbrough a distinction of modalities.

**Table 2: Modalities of Open Innovation**

	Open Innovation 1.0	Open innovation 2.0
«Outside-in» Pure	Licensing-in, Spin-in	Crowdsourcing
Partnership (mix of «Outside-in» and'« inside-out»)	Co-conception Co-development Research consortium Research joint venture	Innovation with Communities / Open source
«Inside-out » Pure	Licensing-out, Spin-out	online marketplaces/ e-bay ideas (Yet2.com)

Source : (Jullien and Pénin, 2014)

2.1. Crowdsourcing

Crowdsourcing is "the practice of needing services, ideas or content by soliciting contributions from a large group of people and in particular the online community rather than from traditional employees or suppliers". The word "Crowdsourcing" is a combination of "crowd" and "outsourcing", and the idea is to outsource the work to a crowd. For innovation, the crowd could consist of clients of the outsourcing organization, but it could include external developers or suppliers and partners.

2.2. Product Platform

A product platform consists of a toolkit and other resources that contributors can exploit, modify and expand. Examples of such platforms are mobile operating systems, which developers can use to build and distribute their mobile applications. Other examples are the SDK (Software Development Kits), such as the Eclipse platform, which provides environments for software design. Product platforms provide a common foundation around, which an organization and external contributors can work together and generate innovation. As platforms are generally sustainable, they offer opportunities for ongoing and deeply integrated cooperation.

2.3. Collaborative Innovation Network

A collaborative innovation network is a cyber-team of motivated people, with a collective vision, that allows the Web to collaborate to achieve a common goal by sharing ideas, information and work. The members of such a network collaborate and communicate directly with each other instead of using hierarchies. They are intrinsically motivated and work together to support a cause or advance an idea. By participating in innovation networks, an organization can both get ideas and innovations and share theirs from the network. Thus, innovation networks allow open innovation both outside and inside.



2.4. Innovation Competition

An innovation competition is an event in which an organizer invites participants and offers a price for submitting innovations in the form of ideas, prototypes, products or services.

3. Presentation of Blockchain Technology

This part presents the technologie of Blockchain:fields of application (3.1) and its principles (3.2).

3.1. the technology of Blockchain:fields of application

The literature on Blockchain technology is characterized by the dominance of works in conceptual sense; this is strongly judged by the new emergence of this technology. Even though Blockchain has existed since 2009 via Blockchain-Bitcoin, its emergence was only reinforced in 2014 by the exploitation of this technology in a separate way to virtual money, such as the platform-EUTEREUM. The main review on which we relied to bring this chapter is the journal “Annales des Mines - Réalités industrielles”, the edition of (August 2017), whose purpose is the Blockchain technology in general. The second edition (November 2017) treats the Blockchain as technology underlying Bitcoin and virtual currency.

Since this study tackles Blockchain technology in its entirety, the first edition -“Blockchains and smart contracts: trust technologies?”- is the most relevant. Likewise, this makes use of other books, articles and blogs of the main players in this field.

The end of December 1990 was marked as a point separating the past and the future, when TIM Berners-Lee invented a new information management system accessible to the public, the World, Wide, Web. Bernes Lee has published a paper explaining the conceptual and architectural concept of this new system. The goal then was to connect billions of people all around the world through what is called the INTERNET (Avdza, 2017). As a result of this revolution, the world was turned upside down, and it was the first step of the decentralized system (Wright and De Filippi, 2015).

In the same sense, history repeated itself in early 2009 for the Blockchain. Timestamp server (The previous name of the blockchain) began following the appearance of Bitcoin (2008) (Pavel, 2017) when an anonymous person registered under an alias ‘Satoshi Nakamoto’ wrote an article (Nakamoto, 2008) describing the principles of this electronic cash system carried by a peer-to-peer2 network (Collomb and Sok, 2017) Since then, we have been faced with the appearance of several cryptocurrencies (the site coin-marketcap.com with more than

5000 Cryptocurrencies)¹, which has made this fast-paced technology comparable to the Internet and its widespread deployment over twenty years ago (Collomb and Sok, 2017).

Figure 1: Representations of a Centralized and a Decentralized System



Source: authors

The fundamental issue, then, of the Blockchain is the definition of solutions to answer the question of trust (Collomb and Sok, 2017), which was previously held by actors (State, bank, notary...). These third parties of trust maintain a register depending on the type of transaction. But, as Figure1 presents, the latter have a monopoly on updating these registers (Berbain, 2017), from where comes the interest of a new technical tool which induces and participates in the digital transformation by a collaborative management of a register (Figure1), "distributed register", in order to eliminate the monopoly of trusted third parties in the old system (Berbain, 2017).

Indeed, this new technical tool induces and participates in the digital transformation of many sectors, and it makes it possible to find solutions on the issues of trust and security. This tool is based on the technology of the Distributed Ledger DTL or distributed registers, the best known is the Blockchain (Collomb and Sok, 2017). This is used in particular by Bitcoin, where the data is organized in the form of a block chain describes the transactions linked by cryptographic techniques

(Berbain, 2017). These affirmations of evolutions are confirmed by international organizations like the American Federal Reserve and certain banks (bank of France initiated a laboratory for the development of this technology, the bank of England in partnership with Ripple,...etc.). The use of this technology then goes beyond the simple financial mode, which is limited to virtual currencies, (Blockchain 1.0), to reach other branches of the financial sector (Blockchain 2.0) with an investment of 210 billion estimated in 2016(Berbain, 2017); thus, to be exploited in other areas (Blockchain3.0) like energy and

¹ Site consulted on 08/06/2020



trade, transport logistics (Hug, 2017), digital rights management, health (Bourjij, 2016), and administration ((Berbain, 2017), (Pavel, 2017)).

Here is a global definition of Blockchain (PWC, 2017) “Blockchain is a technology allowing the storage and exchange of information / value of peer-to-peer² (P2P) is a computer network model in which each user is a server”. It is structurally accessible, shared and secure because of the consensus algorithms -"Computer program through which the different nodes agree on a result: first, each computer checks information, then sends it to the others. Once all the information has been received, everyone runs the same algorithm to choose the right result”. It is, thus, used in a decentralized manner and allows disintermediation or the replacement of "trusted third parties". Regarding the identification of network users, it is done by a private address (Marin-Dagannaud, 2017).

3.2. The principals of the technologie Blockchain

The principles of Blockchain technology are presented in the book by Tapscott and Tapscott (2016) in seven main points: Network Integrity, Distributed Power, Value as Incentive, Security, Privacy, Rights Preserved, and Inclusion.

3.2.1. Network Integrity, Distributed Power

These principles are based on the resilience of Blockchain technology. It relies on a solid and integrated network which is opposed to that of a client-server network which, in the event of a malfunction from the central server, everything will be impacted. But rather a distributed network -which is a set of independent computers which connect on a network and can communicate- like Internet, without the existence of a central principal member. A server failure does not interrupt other users. The Blockchain network is a P2P distributed system "by the entire network and among all members”. This network can be public or restricted to some actors; this avoids third-party trusts, thus avoiding the double expense of the virtuel money. ((Collomb and Sok, 2017) (Tapscott and Tapscott, 2018))

There is only one opportunity to damage the network or overwrite Blockchain, it is known as the 51% attack, as it requires more than half of the network to approve the Blockchain Changes. (Tapscott and Tapscott, 2016-P49). In other words, a minor³ or a group of ill-intentioned minors with a large computing capacity could take control of the blockchain (Pavel, 2017). This is an old problem in distributed computing which is the Byzantine

² Peer-to-peer network of nodes: All the nodes are in charge of validating and storing a record in the ledger of all the transactions made by the different participants

³ People (individuals or companies) who connect one or more machines equipped to mine on the network. Each minor is remunerated in proportion to the computing power he brings to the network.



generals (Collomb and Sok, 2017). It was properly resolved thanks to a proof-of-work mechanism and proof-of-stake.

3.2.2. Value as Incentive

It is based on the encouragement of minors in order to calculate, validate and secure transactions with remuneration. But this principle is relative, and it can be modified according to the need, necessity, and the way of organization of a distributed network, for example "the case of private Blockchain and public Blockchain "-which we will deal with later- also it depends on each technology.(Tapscott, 2016) P-51

3.2.3. Security

Asymmetric CA cryptography (as opposed to symmetric cryptography) allows users who do not know each other to exchange information in an encrypted manner. The system is based on the concept of public and private key. The public key can be known by everyone, and the private key, as its name indicates, is completely private. They have specific mathematical properties "RSA algorithm"; without detailing the technical side", but it is a system that provides high security. The public key can be compared to an RIB (PWC, 2017), communicated to everyone. The private key, kept secret, would then correspond to the password of the same bank account.(Tapscott, 2016) P 54-55.

3.2.4. Privacy

(Tapscott and Tapscott, 2016-) is in fact the anonymity of the nodes that makes it possible not to exploit their personal information for commercial purposes. The nodes then are identified by a coding, and a powerful system to have a unique identifier for each member. This also is imperatively relative because this anonymity has been criticized by actors amidst the appearance of new modes of use such as Ripple (Tapscott, 2016) P56.

4. Blockchain and Open Innovation

The first initiative to understand this relationship, that of the Linux foundation by the project Hperledger 2016, was to make Blockchain technology at the service of companies, whose purpose was to change the perception of companies and the business world. Thanks to the Blockchain, certain practices are managerial (collaborative innovation and open innovation), commercial (smart contract), and financial (electronic currencies).The ambitions of using Blockchain for open innovation will have an appropriate impetus to activate and serve the OSS communities and create open innovation platforms for all types of users with security and confidence during the period (2016-2025). The main point cited in the report is that



Blockchain seems naturally related to distributed open innovation platforms and collaborative online innovation. The benefits of applying Blockchain to improve open innovation networks are enormous and most of them are still in an embryonic phase that deserves to be explored for exciting new steps of innovation in the platform dimension of Blockchain and open innovation, where no good idea will be left.

It is clear that the open innovation will benefit from the distributed registry technology by providing this technology as a secure means to identify the flow of knowledge primarily related to the management of Intellectual Property. The management of intellectual proprietary, then, is the main beneficiary of the use of Blockchain technology in the practices of the open innovation, as the latter is under the most serious attack of the modern Internet. A fundamental challenge of the Internet is that if you are a creator, you get a raw deal. When you put your business on the Internet, you are probably not going to get paid, or, at best, you are only getting a fraction of its value; ads are a solution to monetization that doesn't pay for innovation. And for SMEs (small and medium

enterprises), it has a great concern and a barrier to adopting collaborative innovation with any company that could flee the consortium with its intellectual property and profit from extraterrestrial work.

As a conclusion, the prospective survey (Josep et al., 2017) asserts that Blockchain is a dominant technology for open innovation ecosystems on the basis of its current integral distribution capacities which encourage openness and collaboration around the world. Blockchain will provide enough technical capacity to make open innovation a sustainable platform and widespread adoption, as it will reduce barriers to adoption through better management of intellectual property, greater transparency, good knowledge management, greater autonomy of collaboration and new liquidity to finance innovation (Crowdfunding).



Conclusion

The analysis of the literature allowed us to customize the risk of open innovation. This work provides a representative framework for the use of blockchain for open innovation. The exploitation of Blockchain technology functionalities are either technical, psychological, or for management (to end the intermediation); the technology represents a numerous solution that requires, first of all, a digital maturation on the part of Moroccan companies in order to exploit the advantages that this overwhelming technology bring. Concerning the perspectives, which open the way to new research perspectives, several extensions are possible:

- A study projected to another field: The contribution of Blockchain 3.0 technology affects as well other fields, including the interbank market, which was raised by several authors, and also at the level of transfer of money to the stranger. Blockchain technology offers several solutions on the issue of traceability trust and suddenly we can even ask the question that will be the role of the commercial banks of tomorrow with this overwhelming technology.
- A comparative study: This comparative study will make it possible to study this technology in comparison with other developing countries in order to benefit from their developments in this field; therefore, it will allow us to accelerate the rate of development for this technology and to be among the countries that exploit and benefit from this technology.



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