The Business Model Tested by the Digital Paradigm

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The accelerated digitization of an economy based on the exploitation of massive data and systems interoperability is reconfiguring the way in which new forms of digital organizations - "multisided platforms" - create value. However, little work has tested the business model (BM) concept with this new digital paradigm. In many respects, the new digital BMs (DBM) form a specific research object that requires an in-depth analysis of the new logics of creating, co-creating, shaping and capturing value within digital ecosystems. Our proposal in this paper is to analyze, at the theoretical level, the specificities associated with DBMs, in particular through an analytical reading of the main actors and value-generating mechanisms associated with them. We propose the conceptualization of a generic DBM and put forward a number of proposals for practitioners to "design" a DBM.

Keywords: Business model platform technical infrastructure value creation

INTRODUCTION

BMs, as a strategic conceptualization, are value creation tools (Amit & Zott, 2001; Zott & al., 2011). The different analyses of the BM have made it possible, over time, to circumscribe their roles, states and implications, depending on a more or less stabilised market context (Balland & al., 2015). From now on, intensive innovation and the creation of new products and markets is an economic imperative. To accelerate the pace of innovation, companies' R&D offices are opening up to the ideas and innovation projects of other companies (Chesbrough & Appleyard, 2007). Within these business weds, each company focuses on its core business and cooperates with other companies in different sectors (Tapscott et al 2000). Technologies and industries in the digital economy are constantly evolving, offering new value creation and sharing opportunities created around new kinds of value networks. Thus, the BM's main approaches do not seem to

exhaustively represent the recent value network creation dynamics (Chanal & al., 2007) observed in the digital realm.

While the different dynamic (Demil & Lecocq, 2010) and transformational analyses of the BM (Aversa et al. 2015; Furnari 2015; Hlady-Rispal & Servantie, 2017) have identified the different transformation and reconfiguration activities of a BM. These analyses have not, however, exhaustively identified the way in which these activities can be articulated within digital ecosystems[1] in the form of " multisided platforms" (Choudary, 2016).

The BM development process for multisided platforms (Hagiu, & Wright 2015; Evans & Schmalensee, 2016) can be seen as a succession of iterative developments with the market, aimed at continuously reconfiguring their value architecture. Artificial Intelligence (AI) technologies are now increasingly feeding the effectual dynamics imposed by digital strategy. Analysing the traces of use from the different data collected from the platforms allows the continuous reconfiguration of the BMs associated with them (Aspara & al. 2013). Platforms such as Mozilla or Google build their strategic approaches based on processing massive volumes of data to continuously create new sources of value. They use the interoperability of their technical infrastructure to create new value architectures in order to percolate their value propositions to the markets.

Now, all market platforms, Google, Apple, Amazon, etc. are creating new DBMs by renewing the way they generate, capture and share value (Hlady-Rispal & Servantie, 2018). At the scale of the value proposition, the digital components underpinning an innovative service and/or product can evolve very rapidly. Connected objects are becoming increasingly compatible with each other. As a result, platforms are building connected product lines, which become integrated consumer environments. At the value architecture level, the interoperability of systems, through shared interfaces with other actors, increases the number of external contributions and de facto possible innovations (Acquatella & al., 2019). At the capture value level, the revenue sources seem to be multiplied tenfold by the multitude of value propositions offered.

The ecosystem logics in which BMs are articulated are at the centre of a new paradigm of value development (Muzellec & al., 2015). Through this article therefore, we propose to participate in the effort to understand this complex phenomenon. In this perspective, we define the DBM as a process where value originates from a strong interdependence between two or more sides of a market (Hagiu, & Wright 2015) in which the value proposition is not exclusively the result of a company but of the aggregated offer of an ecosystem in a platform model.

Concretely, it is a question of analysing how platforms influence the design and trajectory of DBMs. Thus, our problematic takes the form of three central questions: *What are the technological and market evolutions influencing the design and trajectory of DBMs? How are they structured within digital ecosystems? Finally, what are the value-generating mechanisms within DBMs?*

The work on DBMs shows hyper-specialised research on this subject (Wirtz, & al., 2016). Despite their legitimacy, the fragmentation of DBM readings can dilute the weight of these approaches and their cross-fertilisation. When facing the complexity of these recent value architectures, it is appropriate to describe the strategic issues related to digital ecosystems in order to better understand the strategic role of data - its mediation by AI - the network effect externalities it generates and ultimately their management in DBMs.

We propose, in the first part, to review the main approaches that emerge from the relevant literature. In a second part, we present an overview of the main value-creating technologies, on which the observed ecosystem logic is based. In a third part, we present a modeling of DBMs based on value-creating mechanisms. We put forward several proposals for modelling a DBM. Finally, we participate in a scientific conversation on the synergy between technical infrastructure concepts and business modeling.

Our intellectual path is part of a theoretical structure of an explanatory and prescriptive type (Gregor, 2006). This methodological approach allows us to make the BM concept (from the value theory point of view) dialogue with that of platforms (from the point of view of technical infrastructures) in order to identify a contingency and a complementarity between interpretations that are often compartmentalized. Thus, this mutual enrichment seemed necessary to us for the framing and understanding of a complex phenomenon where dyadic interactions between ecosystems and BMs continuously configure and reconfigure a BMN.

Indeed, ecosystems, by their very nature, generate and transform value flows. Understanding the new logics of co-construction, value shaping and capture within DBMs raises the question of the BM ontological status in its most traditional configuration when facing new value architectures; which implies, at the theoretical level, describing the mechanisms that control the development of a DBM.

DIVERSITY OF DBM

The traditional analyses of the BM do not characterize that the value created is no longer intrinsic to products and services (Amit & Zott, 2001) but that it results from the way it is organized within new value networks (Baden-Fuller & al., 2017). Contributors, competitors, and users are intertwined, adding complexity to market forms whose contours are constantly reshaping (Muzellec, et al., 2015). Ecosystemic logics surpass sector logics and sectors that make less and less sense in a digital world (Lecocq et al., 2019).

Recent research on the emergence, functioning or performance of platform ecosystems (Maucuer et al., 2018) mobilizes various conceptual approaches, some of which consider DBMs as a reality of heterogeneous practices (Maucuer & Renaud, 2019), notably by presenting various strategic experiments carried out by keystones (Bojovic et al., 2018). Others are more in line with the BM's narrative approach to accompany a business's innovation process (Doganova & Eyquem-Renault, 2009). Some focus on emerging interaction forms between platform model organizations and so-called traditional companies (Snihur et al., 2018). The work of Soh, & Markus (2016); Täuscher K & al., (2018), proposes a taxonomy of DBMs related to marketplaces, which does not follow a holistic approach necessary to understand DBM value flows in their generic nature. Finally, the contributions of De Oliveira and Nogueira Cortimiglia (2017) on the processes of value co-creation within multisided platforms and of Oskam et al. (2018) on value shaping contribute to the understanding of the business modeling phenomenon by articulating the concepts of multisided platforms and value theory. However, this work does not present the main value-generating mechanisms identified within a DBM.

While a significant part of this research underlines the central role of digital ecosystems in the definition of new value creation, generation and capture logics (Teece, 2010; Baden-Fuller & Haefliger, 2013), it does not present a consensual reading of the levers and mechanisms generating these value flows (Bharti & al, 2015). The majority of the analyses are based on new coordination and complementarities forms between actors, which are primarily related to specific market mechanisms and industrial sectors (Foss & Saebi, 2017; Snihur & Zott, 2019). The platform model on which these mechanisms are based would be formed on the basis of simultaneous valorisation, making it possible, through incentive effects, to initiate a co-evolution of players with the aim of creating value (Tiwana, 2014; Teece, 2018). Moreover, this description of platforms, in the complementary interaction form, does not show precisely that technological elements are at the origin of a DBM's development (Acquatella & al., 2019). Indeed, the dynamics of interrelationships within a platform leveraging their technical infrastructure, on the very evolution of the DBMs of which it is composed, remains little explained (Sorescu, 2017; Maucuer, 2019).

Although more recently, the analyses favour an analytical approach to technology around the "data strategy" (Lloyd, & al. 2012), they do not delve deeply enough into the question of the technical infrastructure scope that characterises the platforms and therefore the network interactions that they carry. Technical infrastructures are described as new information system (IS) architectures (Tilson & al., 2010; Henfridsson & al., 2013) and the platforms are presented as a set of technical resources enabling value-creating interactions based on new processes for sharing information (Yoo & al. 2010; Parker & al. 2016, 2017). This purely modular approach to the technical infrastructure of platforms, in the form of complementary components and functionalities (Baldwin & Woodard, 2009), does not point to certain market mechanisms that have been at the origin of a recently observed phenomenon and does not really analyse the technical infrastructure scope as a fundamental element characterising the value-generating mechanisms of ecosystems and their associated DBMs.

Given this contribution diversity, a cross-fertilisation of related approaches in IS management and value theory could make it possible to initiate a new dialogue between these complementary analyses in order to proceed from a holistic approach useful for framing and understanding DBMs (Maucuer & Renaud,

2019).The study of the interrelationships between technologies, actors and markets reveals the importance of the ecosystem environment as the constituent element of value flows within the DBMs. In other words, the complementarity and technical interdependencies between the sides of a platform have a direct influence on the creation and development methods of value networks and associated value propositions. Also, the scientific capital structuring the literature on DBMs does not seem to have focused enough on DBM modeling (Veit et al. 2014).

Digital Value Architectures

These platforms possess an ecosystemic logic based on a network of digital value, the network effects generated on several market aspects of which one or more pay (Asadullah & al., 2018), a constituent part of value creation. A value chain composed of two structuring variables: firstly, a technological infrastructure materialized by a set of interconnected components, such as software, applications, connected objects, etc., by means of a programming interface (API) (Thomas & al., 2014; Kazan data exchanged on the platform & al. 2018). Secondly, an AI system that multiplies and facilitates system connectivity by the data processing speed and precision (Acquatella & al., 2019).

DBMs position platforms within a digital value architecture (Lambert, & Schaeffer, 2014) in which technology becomes the substrate for all value creation (Hartmann & al., 2014; Hofman & al., 2013). Indeed, all the platforms on the market are based on interdependent and interconnected technological strata that form the basis of their value architecture. The bottom layer is the data (Schroeder, 2016); the middle layer is represented by the algorithms that exploit the data; the top layer redistributes the information to the end user (Chatbot, search engine).

Digital technologies have shaken up value architectures in that they are seen as a tool for data management and optimisation on the one hand, to improve the performance of the value proposition (in the case of an incremental innovation logic) and on the other hand, to generate new value propositions (in the case of a disruptive innovation logic). Concretely speaking, AI technologies (machine learning, deep learning, etc.) associated with big data "learn and then understand" via the extraction of voluminous data (LeCun, & Al., 2015). Thus, the increased performance of algorithms in actions to capture knowledge about users refines the perception of consumer behaviour and needs, to enable better segmentation of the offer placing these technologies at the centre of a value creation process.

Technical Infrastructure, Architects of Platform Ecosystems

Technical infrastructures represent the technical substrate through which a set of systems communicate and share data on the basis of their interoperability. They are supported by AI mechanisms for controlling and transmitting digital information, renewing the value creation dynamics within ecosystems (De Reuver & al., 2017; Constantinides et al., 2018).

By means of APIs (application programming interfaces) and/or middleware, the platforms multiply the technical interdependencies between actors carrying different components. For example, the "Apple Store Connect API" increases end-user value through the multiple third-party applications added on to iPhone/iTunes, while expanding market opportunities for satellite players using the operating system or "iOS" (Tiwana, 2015). Indeed, the growth of an ecosystem is characterized by its generativity, i.e. the greater or lesser capacity of its technical infrastructure to produce developments through contributions from a diversity of contributors (Tilson & al., 2010); Baldwin, & Woodard 2009). Faced with this digital development paradigm, it would seem that all platforms on the market are likely to turn to the development of their technical infrastructure as levers for the development of their ecosystem. For example, many MOOC (massive open online courses) platforms around the world use "OpenEDX" interfaces. These platforms, including "FUN" (France Université Numérique), which are less efficient in terms of audience, are not financially robust enough to develop all the functional interfaces required for e-learning on their own. They use ready-to-use technical systems and are part of the “edX” ecosystem while becoming dependent on the strategic and pedagogical orientations applied by the platform that manages the interfaces they use.

This technological model is becoming all the more important as AI develops and facilitates the connectivity of objects, thus generalizing the interoperability strategies of the interfaces to the connected objects. The Technical Infrastructure establishes the transition from a BM centred on simple connectivity to a BMN based on intelligent connectivity in which the connected object is both a support for the services offered by a platform, but also a generator of data sharing and positive network externalities. The Google platform through its Android operating system and AI recommendation system (Google home) is continually redefining its ecosystem perimeter.

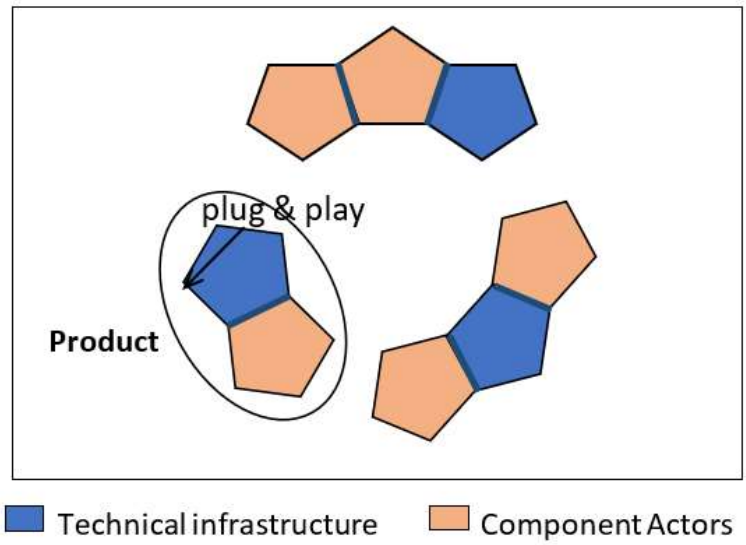
Market Factors Influencing BMs

New market factors, such as the competitive environment, the presentation of new offers influence BM design and trajectory by continuously pushing long-established industries to structure themselves within digital ecosystems (Rai & al., 2019). The development of new value propositions, leveraging technical interdependencies between players with different technological components (Baldwin and Woodard, 2009), results in a reconfiguration of markets (Parker & al., 2016). Producers, contributors and beneficiaries are often joined in the design of modular products, which has the effect of reconfiguring the competition stakes of the markets (Lecocq & al., 2019).

At the product level, the technological progress of certain global firms (Amazon, Google, Apple, Microsoft, Nokia, etc.) demands that manufacturers open up, through interfaces, to external developers via "app stores", or else end up directly integrating the Apple, Android or Nokia platforms interfaces. This is now the case for the car manufacturers BMW, Audi and Mercedes, who have integrated the Nokia "Here" cartography into the dashboard of their vehicles.

On a multi-product scale, a vehicle is now a connected product like any other. Any component manufacturer can now invent a product that will interface with a vehicle through its technical infrastructure.

FIGURE 1
MODULAR PRODUCTS



- The platform develops modular products (PC, phone, car or software).
- A product consists of components, which interact with each other.
- The technical infrastructure of the platform manages the "interfaces" between all these components in a "plug & play" way.

Thus, all products are transformed very quickly, allowing pivotal companies (Iansiti, 2004) (e.g. Apple, Google) to benefit not only from their own internal R&D, but also from the efforts of external contributors. Value generation is no longer the work of one company in one market but of a multitude of players in

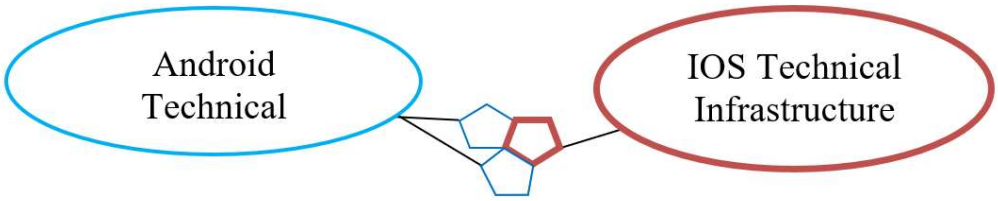
multisided markets. The possibilities seem infinite in that platforms are by their very nature carriers of multiple value propositions. The value generated is redirected as the target group for which the value is intended changes (Benkler, 2006). The trigger for this change lies in understanding the needs of multiple stakeholders. Thus, the platform supports a global solution that brings mutual value to multiple stakeholders in multisided markets, thereby transforming the linkages between players, the competitive conditions in the markets and inevitably the BMs that support them.

Cooperating Ecosystems Founding DBMs Interdependencies

Platforms have largely changed the competition between objects. Launching connected products is no longer enough. It is necessary to launch connected ranges. Some proprietary technology perimeters evolve too slowly or do not achieve the required level of performance if they are not open to technologies from other competing ecosystems. For example, the Google Maps application will allow motorists to report an incident on the road, thus informing other drivers. Present on Android (Google), this reporting function is opening itself to the iOS infrastructure (Apple).

What is new is that competing ecosystems are now cooperating on a win-win basis; however, this cooperation has a strategic ambition of technological pervasiveness (Cabanes & al., 2015). This strategic model consists in draining all the market competition stakes towards a technological offer instigated and controlled by the platform. Google distributes a set of technologies on the market to subvert all the technical systems of other players, particularly those of competing ecosystems (e.g. Apple). A strategy of technological pervasiveness implies determining the insertion conditions for a technological environment in order to better control the innovation direction in different markets. Google's ability to structure different markets depends on the ability of its technical innovations (Car Play Google Android Home) to transform and reorganise other technical systems by continuously increasing the number of relationships between different systems. It has become very intuitive for everyone to use Google Map navigation to get the desired information. In fact, for billions of people around the world, the use of Google has become a preferable tool to other search modes, to the point where it has become a near-obvious practice. Maximizing the user experience is part of a system that both motivates and engages users to use the platform. In fact, the Google platform has become a prescriber of digital practices based on a technological infrastructure that "organizes" ecosystems and associated markets. It is clear that Apple Map technology has not been able to counterbalance user preferences, forcing the Apple platform to use Google technology in order to remain competitive in some of these offers, to open its DBM. Also, Apple, Amazon, Google and Zigbee have developed an IoT consortium to allow any component player to use their standard to multiply the use of their products/services tenfold.

FIGURE 2
OPEN TO COMPETING INTERFACES



The key stages of increasing the value logic:

- The platform is based on in-house innovations
- The platform's technical infrastructure enables it to broaden the scope of its positioning by articulating a series of complementary offers on multisided markets. The combination of the data enables the service offered to be increased and enriches the platform's value proposition. The initial value proposition evolves in that it becomes a support to offer various services operated by the platform.

- New partners join the platform (via its APIs); they can thus offer various complementary components to enrich the services offered. The process of increasing value is therefore improved, since it is no longer the responsibility of the core business, but rather the result of technological interdependencies that underpin the construction of a technical infrastructure with an "organizing" reach of ecosystems and associated markets.
- In the end, these value propositions have such spill-over effects on markets that they force entire ecosystems to open their interfaces to connect to more efficient competing technology. As a result, the latter are in a position to undergo a subversion of their technical infrastructure by the increasing number of relationships between competing systems.

In the example presented, Google increases the capture tenfold of information from different sources (connected objects, applications) all technologically synchronized with its Android system, increasing the platform's technological power now in a position to subvert other systems such as those of Apple.

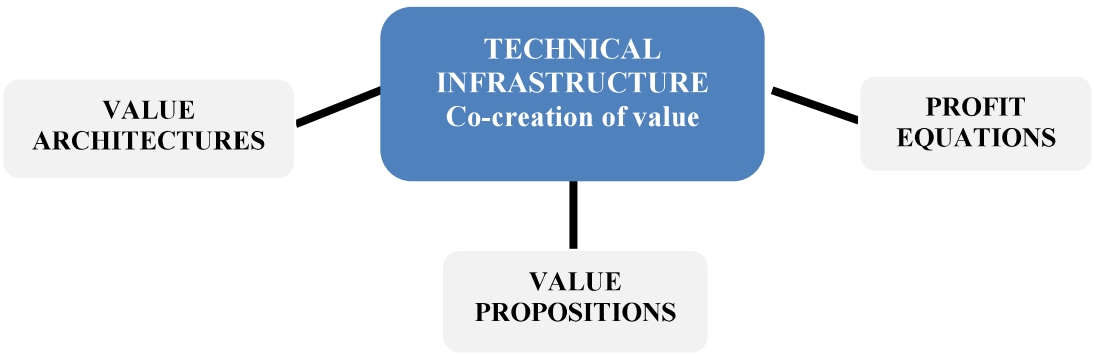
A Triptych-Value Proposition, Value Architecture, Profit Equation in Constant Evolution

Installed products are quickly copied or become obsolete. Technologies advance at an exponential rate and combine together. Patents are being circumvented or outdated. The triptych value proposition, value architecture and profit equation continually transform and are permanently out of balance. The Amazon platform case illustrates this dynamic. Originally a book seller, it is now a discount hypermarket, a leader in cloud services, a music broadcaster, a logistics specialist, a tablet seller and a producer of web series.

The traditional BM concept of defining key elements to set a course and stick to it no longer makes sense when faced with hyperactive ecosystem strategies. The life of a platform's ecosystem stems from a strategic challenge to continuously articulate an innovation dynamic in order to broaden the scope of its competitive positioning and percolate into new markets at the same time.

In this perspective, the BM and technology are closely linked in that they enable the platform to multiply synergies tenfold, with a view to multiplying their value but also to survive as they face competing ecosystems. In DBMs, value ensues from a strong interdependence between two or more market sides in which the value propositions are not exclusively the work of one company but an ecosystem's aggregate offer based on its technical infrastructure. It is no longer a question of talking about the value proposition but about value propositions. It is no longer a question of talking about value architecture, but about value architectures, nor about a profit equation, but about profit equations.

FIGURE 3
GENERIC DBM BASED ON TECHNOLOGICAL INTERDEPENDENCIES



CO-CREATION PROCESS

The co-creation principles of value in DBMs are based on stakeholders in constant relationship with a keystone, value-generating mechanisms that impact the nature of the value flows created.

A Keystone in Close Contact with Different Sides

The keystone aggregates the sides in an ecosystem based on externalities (network effects). It acts as an intermediary between the combined sides and can thus, through its intermediation position, control, manage and stimulate the sharing of value between the sides (Gawer, 2010). For example, the Google, Amazon and Microsoft platforms, through investments in innovation, create interdependencies between the different sides of their ecosystems, increase their access to data tenfold while refining their processing by algorithms. For these platforms, the keystones bear the challenges of centralized governance, and therefore the stakes of market domination and concentration by controlling innovation/technology direction (Rai et al., 2019).

The platform simultaneously offers a usage interest for two (or more) categories of agents (sides). Digital markets are therefore made up of "sides" such as users and suppliers, customers and advertisers. The different combined sides form the platform's ecosystem (Weyl, 2010; Hagiu & Wright 2015). The interactions and synchronizations between the different sides of the platform reflect a value creation process in that the aggregation of new sides allows a whole ecosystem to address new markets.

Value-Generating Mechanisms

An innovation dynamic is a first value generation mechanism. The platform relies on in-house technical innovations (services, solutions, products, etc.) as the foundation of its value propositions and a lever for conquering and controlling different markets (Steiber, & Alänge, 2013). For example, by offering a plurality of services (e.g. Google cloud) and connected products (e.g. Google play), the Google platform vitalises an innovation path in the form of "path dependency" in that the offers proposed create new market opportunities for third parties who come to connect to it. For example, the various services based on the Google Cloud service allow the platform to articulate a series of complementary offers in several markets such as content management systems (e.g. WordPress) or databases (e.g. Datastax). By offering complementary services, these third parties aggregated in Google's ecosystem enrich the platform value for users.

Based on the possibility for corporate clients and/or partners to synchronize their technical systems, interoperability also creates value in that it allows for a tenfold increase in information capture from different technologically synchronized sources (Touzi, 2007). Interoperability multiplies the data volume collected and, by the same token, increases the analytical power of the algorithms that process this data (Bröring, & al., 2017). For example, the set of applications interconnected by means of programming interfaces (APIs) on Android, such as Messenger or Instagram, creates information repositories relating to user practices. By aggregating applications around a technological architecture, whose interdependencies it orchestrates, the platform refines its knowledge of user behaviour. It thus anticipates the wishes of Internet users and predicts future trends on different markets by controlling the data from the satellite applications it federates.

The data that can be used in the value creation process is therefore exhaustive, as are the associated challenges.

The data is the result of multiple interactions between users on the same sides and between different sides on the platforms (emails, cookies) (Hartmann, 2014; Schmidhuber, 2015). In addition to traditional sources, data automatically produced by connected objects, robots and autonomous sensors (e.g. home automation) is now added, which increases algorithm processing power tenfold.

Regardless of the value creation process based on the data, it results in a service to a user. Market places, music/film playlists or social network platforms, although different, all mobilize data and algorithms, allowing the variation of interfaces through which the value is returned to the user. Thus, the data value lies more in the processing algorithms than in the data itself (Isaac, 2016). Data processing is carried out through their mediation in machine learning and deep learning algorithms that make AI logic more accessible. These algorithms develop new possibilities for platforms to create and share value by developing and facilitating the connectivity of objects, thus generalizing platform interoperability strategies to connected objects.

Another mechanism for value creation is open innovation, as it concerns both businesses and consumer-related businesses.

Companies open up to the innovation ideas and projects of other companies through partnerships between companies known as: "outside-in" (Hunt, 2019). An emblematic example is the AppStore. Through its platform, Apple sells content developed by others to its customers: music and film producers, software and game publishers and developers. Companies and independent developers provide content that increases the value of the ecosystem.

By launching its Connect & Develop program, emblematic of "crowdsourcing", Procter & Gamble has opened up another strategy aimed at appealing to the general public and its creative potential. The platform thus outsources the creative phase activity and costs while benefiting from "positive network externalities". In fact, Internet users voting to designate the best ideas become platform prescribers to third parties. The innovative ideas of Internet users constitute useful databases for R&D and marketing departments. Procter & Gamble, for its part, minimizes the risk of failure inherent in launching a new innovation.

Platforms develop as keystones for linking several sides of a market. By developing highly elaborate algorithms for encounters, attendance levels and transactions, platforms develop externalities, i.e. the interdependence of utilities (Springel, 2016). The more rooms offered on Airbnb, the more travellers will be looking for rooms on that site and vice versa. The more searches made on an engine, the more the algorithm of this engine can be improved. These externalities function between two or more sides of a market that a platform connects: they allow the platform to capture value on different sides of the market.

The Value Flows Generated

The value proposition, value co-construction, value capture and value shaping concepts, in the specific context of the digital world, make it possible to capture the different value streams that enable the design and deployment of DBMs.

Value Propositions

In this dimension, the keystone levers a process aimed at delivering a value proposition (De Oliveira, D. T., & Cortimiglia, 2017). The value proposition is initially generated by an organizational system that will capture and combine resources to deliver the value proposition (Zott et al. 2011). In DBMs, the value proposition evolves in that products and services become a support for offering heterogeneous services operated by the platform. The data produced by the connected objects can be cross-referenced with other data produced by applications or other objects. The combination of the data makes it possible to increase the service offered and to enrich the platform value. In this way, the platform's value proposition continues to develop through interconnections. In conjunction with this process, new partners join the platform (via its APIs); allowing them to access data produced by all users. They can thus propose different complementary components to enrich the main value proposition but also to develop new value propositions, which the core company controls through its APIs.

Co-Construction and Value Shaping

This dimension includes the notion of joint development using collaboration as a means of interaction (Saarijärvi et al., 2013). At the heart of this dimension is the need for iteration between the sides and the keystone to share the resources and skills needed to jointly create value (Pera et al., 2016). This value co-creation enables new ecosystems to be shaped and the value initially created to be transformed (Dominguez, 2009). In this model, it is not just a matter of intensifying it, but of creating it differently. The value shaping process is linked to "business modeling". A transformation process in which the DBM is repeatedly/iteratively adjusted and improved. Value shaping also describes the interaction between the keystone and the sides over time. Business modeling refers to the mutually constitutive process of initial networking and improvement of the DBM that stimulates the expansion of the ecosystem (Oskam et al. 2018).

Value capture

This dimension refers to a company's ability to retain value (Bowman and Ambrosini 2000; McWilliams and Siegel 2011). The definition can now be enriched with the new logic of platforms that mobilise under-exploited assets (cars, houses, etc.), which, by being valued in a new way, generate externalities that contribute to capturing value on different sides of the market. The more users there are of a game console, the wider the choice of games there will be for that console. These cross-network effects help to enhance the platform's financial performance.

DBM VALUE FLOWS

On the basis of our demonstration, we offer 5 proposals to develop a DBM that will capture the value associated with shared value flows within an ecosystem.

Consider Market Sides as a Lever for Value Multiplication

Historical product and service industries make a margin on the difference between the price and the cost of their offers. They are in a position to be rapidly overtaken by ecosystems that articulate multiple market sides to co-create and shape value (Oskam et al. 2018). The platform model is based on an offer that is simultaneously of interest for two (or more) categories of agents (sides), representing as many sides of a market. The value of the service is proportional to the number of players present on each side of the market. The platform therefore feeds on the externalities of direct and cross network effects. It facilitates transactions between agents and controls various moving flows (data, resources) enabling it to capture value. Service industries such as record companies, taxi companies, travel agencies are literally disrupted by the Uber, Booking and Airbnb platforms which multiply value flows thanks to aggregated sides. It therefore becomes very profitable to offer services for free on one side of the market despite a very high development cost as long as value is captured on the other sides. Nest has developed a free standard that allows all objects in the company to communicate, including those of competitors. This keystone has capitalized on the externalities generated on the other side of its market because the more "complementaries" there are, the more the platform grows and the more customers will buy their products; thus Nest will capture more value on one side of the market. This is the new logic of business modeling - determining two or more sides of the market in advance to generate iterations and ripple effects on the other sides (Oliveira & al., 2017).

Let the Sides Develop the Value Proposition

In order to build a BM, the pivotal company must let the different sides arrange a certain number of components to exist and develop in an environment nourished by externalities. By articulating a dynamic of innovation internally, the platform does not determine the shape of the final product or service that it will exploit. Thus, the perimeter of the platform is not determined in advance and can evolve in particular thanks to the externalities generated by the sides of the ecosystem. Focusing too much on its value proposition means giving too much importance to the favourable evolution of the market and in particular to the market acceptance of the new solution developed by the company. The greatest successes in the digital world have met their audience following major readjustments to their value proposition. You tube, for example, was initially conceived as a dating site where singles could introduce themselves through videos. The lack of traction on this first product from the front quickly led the founders to re-evaluate their value proposition in line with market aspirations.

Offering New Value Propositions Through Continuous Innovation

In their generic nature, the platforms rely on innovations (services, solutions, products, etc.) as a lever for conquering and mastering different markets. By offering a plurality of connected services and products, the platforms direct an innovation path in the form of "path dependency", in that the proposed offers create new market opportunities for third parties who connect to them and, at the same time, new value propositions for end users. From now on, the strategy must have a "dynamic capacity" (Teece, 2007, 2012)

that finely orchestrates two major evolutions. Firstly, it is becoming necessary to constantly launch new offers to increase platform attractiveness, or in other words, its value. And this, even if the existing products are performing well. At the same time, it is becoming necessary to build and renew assets to exploit opportunities. In a few months, a platform can impose its notoriety on new territories such as shared mobility, connected health, or virtual reality... Each innovation launch gives the company a competitive advantage, allowing it to open new markets that it can quickly exploit. For example, the iPhone 5S initiated the Touch ID technology, which has been perfected and subsequently deployed on many applications that were not necessarily planned for at the outset.

Putting Technical Infrastructure at the Heart of the Ecosystem to Shape Use Value of Tomorrow's Products

By aggregating applications and connected objects around a technical architecture whose interdependencies it orchestrates, the platform refines its knowledge of user behavior. It thus anticipates Internet users' desires and predicts future trends on different markets by controlling the data from the satellite applications it federates. Through AI, the platform can thus offer its users predictive and prescriptive recommendations. The technical infrastructure is the "organiser" of the ecosystems and markets. It contributes to the continuous value shaping at the ecosystem's heart and serves the markets.

Sharing Interfaces With Other Companies for Value Co-Construction

Platforms that opt for an "open source" interface development solutions offer a so-called "standardised" architecture (Gawer, 2009), allowing them to outsource their platform development processes. These standard architectures generate value in that they enable: firstly, savings on design and development costs by being partially or totally outsourced; secondly, efficiency gains due to increased production capacity; and lastly, greater technical flexibility in the design of new product ranges. One of the main objectives is for the platforms to create value through the possibility of increasing the capacity of the proposed offers, while limiting the costs associated with these design processes. Dozens of standard interfaces allow components to be connected to each other, and thus products to each other also; for example: communication protocols, programming languages or toolkits for developers. In other words, it becomes possible to open up new opportunities to innovate, whether at the level of a component or a product, and to capture the value created and transform it into profits.

TABLE 1
DESIGNING DBM

Dimension	Actors	Value Generating Mechanisms	Key Resources	Descriptions	Propositions
Value Proposition	Keystone	Dynamic for innovations	Internal	Drives a dynamic of in-house innovation Aggregates, manages and activates transactions between faces	Continually Innovate
Co-construction and Value Shaping	Sides	Open-innovation	Companies	Principe Outside-in	Think in terms of sides of a market
		Open-innovation	Users	Calls on the multitudes on the web	Lets the sides seize its offer

		Interoperability	Data-IA	Multiplies data capture from different interoperating systems	Thinks about platforms in terms of technical infrastructure
Value Capture	Sides	Externalities		Facilitates the addressing of different markets	Shares its interfaces

DISCUSSION AND CONCLUSION

The demonstration identifies the different mechanisms inherent to platforms that allow the new construction and value shaping logics to be apprehended within these new objects that are DBMs. While the recent work of Oliveira & al. (2017) exhaustively determines the principles and effects contributing to the co-creation of value, it does not present the different value-generating mechanisms within digital ecosystems. Building on current work, our paper explains the synergy between technology development and business modeling, which continually redefines the roles of the different aggregated sides of a platform, generating new ways of integrating resources to create and shape value (Staykova, & Damsgaard, 2015).

Firstly, we show that the traditional value creation, deployment and capture logic (Amit, & Zott, 2001) is being challenged by new forms of interaction mediated by digital technologies, most notably big data and AI. Traditional and dynamic approaches in terms of BMs are based on competitive processes that no longer make sense in the digital paradigm. The recent concepts manipulated in the analysis are linked to market developments and an analysis of the mechanisms of cooperation.

Secondly, while the main dynamics of value creation within ecosystems are clearly identified in the literature (Clauss & al., 2019; Oliveira & al., 2017), they are mainly analyzed through the prism of the new market mechanisms they characterize. The question of the technological infrastructure underlying them is little addressed, even though it underpins the ecosystems that make up a platform's universe (Reuver et al., 2018) and the articulation of the BMs within them. Our analysis of the technological dimension, more specifically through the technical infrastructures, in that they participate in the ecosystems' architectures, makes it possible to apprehend the mutually constitutive processes of DBM development and ecosystem expansion. In many respects, the literature on digital ecosystems does not go into the question of technical infrastructure scope as a substrate for digital ecosystem development and the associated value construction. We postulate that platforms are to be analysed, first and foremost, as technological artefacts whose technical element ultimately catalyzes the tenfold value increase process, since it is based on technical interdependencies between different interoperating systems. Thus, the proposed dialogue between recent approaches on ecosystems (De Reuver & Al., 2017; Constantinides et al., 2018) and those on value flows within BMs (Oskam et al. 2018) and BMs (de Nogueira Cortimiglia 2017) has enabled us to identify the main mechanisms generating distinctive value sources in these digital objects. The proposed demonstration of value creation processes within DBMs is based on an analytical synergy between a description of ecosystem logic under the prism of technology and that of business modeling. In this perspective, contrasting these different analyses has led us to advance the outlines of a generic DBM model by identifying the reciprocal prescription mechanisms and the importance of simultaneous valorisation in multisided markets.

In summary, our contribution provides a better understanding of the technological and market developments influencing the design and trajectory of DBMs and how they are structured within digital ecosystems. Firstly, we show that digital technologies are renewing the DBM value architectures. Platforms, leveraged by AI technologies, continuously redefine the perimeter of their value architecture and, by the same token, their multiple sources of value. Through the interconnection of their systems (APIs), the platforms increase the technical interdependencies between different players, carrying different technological components (Tiwana, 2015), representing as many new sources of value to be exploited.

Secondly, our approach continues the effort to understand ecosystems and how DBMs are linked within them, pointing out that platforms are essentially technical infrastructures (Constantinides & al., 2019) or

new opportunities for value creation, either by activating new resources (AI) or by enhancing under-exploited resources (cars, houses) which, when networked, shape the value of a DBM. In line with our reasoning, we point out that ecosystems transform competition conditions, the links between actors and DBMs (Parker & al., 2016). Henceforth, the value created results from the interaction between the different components' actors (sides) aggregated in an ecosystem so that contributors and users are intermingled, making markets more complex and renewing their contours (Lecocq & al., 2019). Thirdly, we also demonstrate that the principles of co-construction and value shaping (Oskam et al. 2018) are based on the articulation of value-generating mechanisms that we identify by: innovation dynamics, interoperability, open innovation and externalities. These elements form the basis of a new attempt to test analytical tools by applying a more ecosystem-based modeling approach from which companies can question their DBM and, if necessary, transform their strategic approach to evolve into a platform model. In this perspective, this leads us to define the prerequisites of a DBM, a creator of flows of shared values within ecosystems, through proposals that highlight in a theoretical and managerial way the complementarity between ecosystem approaches and those of value flows.

Finally, a platform is part of several ecosystems developing interrelationships with other platforms that also participate in the co-construction of value. The proposed demonstration therefore opens the way to understanding the phenomenon of interdependency construction between DBMs on the basis of technology.

ENDNOTES

1. The platform is based on an ecosystem logic characterized by interrelationships between the different sides that make up the platform. This ecosystem logic supports and complements the positive externalities of the networks at the origin of the platform.

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