Open innovation within business ecosystems : lessons from Amazon.com

Thierry Isckia, Denis Lescop

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Thierry Isckia

Institut TELECOM – TELECOM & Management SudParis,
Evry, France.
E-mail: thierry.isckia@it-sudparis.eu

Denis Lescop

Institut TELECOM – TELECOM & Management SudParis,
Evry, France.
E-mail: denis.lescop@it-sudparis.eu

Abstract: Open innovation model refers to the ability for firms to open themselves up to external networks and relationships in order to gain the full potential of their investments in innovation. The development of ICTs has opened up new markets and ways of innovating. Today, platforms and Web services represent the foundation on which relationships between firms are organised. In this paper, we address the challenge of managing open innovation within business ecosystems, especially those aided by a new generation of technologies called Web services. We will draw lessons from Amazon.com to understand how this keystone organization is becoming adept at open innovation, leveraging the power of its platform thanks to its Web services package. The case study shows that by using Web services to enhance collaboration in business ecosystems, some companies could support open innovation and expand the value of the goods and services they deliver to customers. The paper concludes with a suggested research agenda dealing with the significant implications for both strategy and policy.

Keywords: open innovation; business ecosystem; platform; web service; business models; interoperability; value.

1 Introduction

A central characteristic of the transformation of innovation in today's business world is the emergence of an "open innovation" model [1]. The head-to-head competition of the industrial era, where the companies with the most assets usually won, is being replaced by a more holistic model, where competition is blended with cooperation to create greater value for an entire collection of organizations. In this context, the open innovation paradigm shows the necessity of managing business ecosystems [2,3] to explore pathways to innovation and foster value creation for a large number of loosely interconnected participants who depend on each other for their mutual effectiveness and survival.

When looking beyond the immediate boundaries of the firm, we can see a community of organizations and stakeholders competing and collaborating for the delivery of specific goods and services incorporated within the innovation process. This economic web of relationships is at the core of a business ecosystem and is one of the most important drivers of open innovation for years to come [4]. The evolution of the business environment to the business ecosystem results from companies working cooperatively with other organizations to leverage new ideas, satisfy customers, and create new products and services through open innovation models. Because of this increasingly networked industry structure, the focus of competition is now shifting away from the management of internal resources, to the management of capabilities that are outside the direct ownership and control of the firm. This is exactly what the challenge of open innovation is.

Obviously, open innovation and business ecosystem are parts of the same framework describing the new face of competition in the network era. While an open innovation framework focusses on the innovation process at the firm's level, the ecosystem-based view offers a complementary insight of the coordination mechanisms at a global level [5]. In addition, the rapid diffusion and development of information and communication technologies (ICTs) has opened up new markets and ways of innovating. Within this framework, platforms and Web services represent the foundation on which relationships between firms are now organised. This extension of the enterprise opens up the possibility that leveraging and managing a complex set of relationships can be a competitive advantage. The framework depicted by Chesbrough [1] underlines a new way to improve the innovation process, capitalizing on both internal and external resources, but it doesn't explore the very nature of the relationships between the numerous players operating in the surrounding environment. Moreover, the role played by ICTs - especially Web services - in supporting open innovation is implicitly assumed but not clearly analysed. In Section 2, we bring together the concept of open innovation and business ecosystems as parts of the same paradigm. In Section 3, we describe open innovation enablers such as platforms and Web services, to better understand how they support open innovation models. Section 4 of the paper sheds light on the case of Amazon to illustrate the role played by ICTs and especially Web services in open innovation initiatives carried out by the company. Finally, in section 5 we discuss the significant implications for both strategy and policy.

2   Open innovation within business ecosystems: Two parts of the same framework

In his book, Henry Chesbrough [6] describes a new paradigm of open innovation that is in contrast to the traditional closed model. As pointed out by Chesbrough, innovation processes were traditionally conducted internally and firms rarely shared their innovative results as a means to generate new competitive advantages. In this closed innovation model the firm generates, develops, and commercializes its own ideas, products or services. In such a context, the resources available within the firm's environment are neither explored nor exploited, depriving the firm of innovation opportunities. For years, innovating companies have burnt large sums of money to fuel innovation processes using an internally focused logic only.

In this "do it yourself" vision of the innovation process, both value creation and value capture depend on internal resources and knowledge shaped through a specific business model, based on pure in-house capabilities. Due to several erosion factors [6] this model is no longer viable. As a result, forward-looking organisations have sought ways to transform the innovation process itself in order to create differentiation and sustainable value.

Open innovation: Leveraging the external environment

Today, a global innovation marketplace has emerged where innovation itself is a commodity that can be bought and sold, loaned or licensed. The possibilities for tapping into this global knowledge base are getting bigger day after day. As a consequence, corporate innovation has opened its doors to the world and firms have moved increasingly to a more open innovation model based on both the exploration and exploitation of their external environment [7]. In such a model, firms leverage the discoveries of others and are also willing to commercialize their innovation by using third party firms whose business models might be better suited to bringing the innovation to the market [8]. Thus, firms are able to bring to the market new products or services more efficiently, sustaining the health of their business community through the web of relationships with their partners. The main source of differentiation within open innovation models depends on the ability to mix both internal and external sources of innovation available in its surrounding environment. From this point of view, open innovation refers explicitly to the establishment of network structures between different business partners. These networks are based on the collaborative efforts of specialist companies, each providing complementary intermediate goods and services [9]. Since open innovation relies on a deep and wide network of business partners [10] co-creating value at the network level, we have to understand how coordination is realized at the inter-organizational level to better appreciate the dynamic of open innovation at a global level.

Business ecosystems are the inter-organizational context nurturing open innovation. They are made up of customers, market intermediaries (including agents, channels, and those who sell complementary products and services), suppliers, producers, competitors and other stakeholders [11]. These business communities are at the very heart of the open innovation phenomenon since they represent the external context from which firms insource external ideas and market internal ideas, creating value both for themselves and for the whole community. Moore [2] describes the concept of the business ecosystem as an economic community crossing many industries working cooperatively and competitively in production, customer service and innovation. Business ecosystems are characterized by a large number of loosely interconnected participants who depend on each other for their mutual effectiveness and survival [9]. Thus, the concept of a business ecosystem clearly underlines the interdependence between partners within the community. In this context, learning how to create and capture value is a very important issue. Indeed, when firms are highly dependent on each other, value creation doesn't depend on a single firm but is co-produced by the whole network. As pointed out by many authors [3,12,9] the total value created in the network directly depends on the relations between the partners in the global value network, which is the business ecosystem.

For this purpose, the ecosystem-based view seems to be a very suitable framework to analyse open innovation and appreciate coordination mechanisms which shape total value creation and appropriation within the global network.

Business ecosystems: The Inter-organizational context of open innovation

Within a business ecosystem, the activity of a firm relies on a mesh of relationships characterised by varying degrees of intensity with other partner firms which take a more or less significant part in the innovation process. However, a company may be in a central position because of the business potential it creates for other companies. Business relationships give access to knowledge, technologies, and innovation potential, which make it an attractive partner. Within this framework, the networks represent the foundation on which relationships between firms are organised [13]. Iansiti & Levien [9] distinguish three types of actors within a business ecosystem:

- The Dominators: one can distinguish on one hand the "physical dominator", whose role consists in dominating all of its ecosystem's niches via integration strategies enabling it to control the maximum number of nodes within its network, and thereby to capture the value created for its own benefit. On the other hand, there is a "value dominator" or "hub landlord" whose role is to extract the maximum value from the network without trying to dominate it. In both instances, the objective pursued is to extract the maximum value without redistributing it to other actors. The resulting effect is usually a weakening of the business ecosystem. .

- Keystones: this type of actor plays a significant role in both the creation and the redistribution of value created within the network. Contrary to a "dominator", it does not try to control the whole network and its actors, but tries to position itself on a few nodes and assume leadership. The keystones often resort to platform strategies which give them the opportunity to take advantage of the other network actors' contributions by facilitating access to some resources. They usually adopt a "win-win" attitude vis-à-vis the other members of their ecosystem..

- Niche players: there are many such actors, small in size and pursuing a specialisation strategy in order to differentiate themselves from the others. They account for a large part of the value created within the ecosystem. The resources they access via the platform made available to them by the keystone give them an opportunity to develop new products or services. Indeed, they maintain very close relationships with the keystone, by actively contributing to the platform's evolution and the dynamics of the ecosystem.

As a consequence, any highly-linked company providing a platform is not a keystone company. Dominator strategies are not very effective from an ecosystem perspective. A physical dominator generally fails to create business opportunities for other companies because it doesn't enable niche creation, performing all operations by itself. Value dominator allows niche creation, but extracts too much value from the network, weakening its business ecosystem. In business ecosystems, leadership is usually assumed by the firm which has been able to identify and implement the terms of collaboration that are best suited to each member of the community. The objective is the ecosystem's overall performance rather than that of a single actor [14]. Therein lies the difference between keystone and dominator strategies.

Wal-Mart's ecosystem development illustrates a dominator strategy: in the stage that followed its ecosystem's development and the increase in its number of sales outlets, Wal-Mart strove to reinforce its negotiating position versus its suppliers by forcing them to charge low prices and to use its own supply-chain management tools [15]. In this model, suppliers have little autonomy and react to the guidance of a pilot: Wal-Mart. Wal-Mart is therefore more akin to a *physical dominator* than a *keystone*, and primarily seeks to control its network for the purpose of extracting the maximum amount of value. This attitude is also reflected in Wal-Mart's information system, which includes proprietary applications providing suppliers with real-time information on their products. If Wal-Mart's platform, like Amazon's, promotes the coordination of actors within its ecosystem, it relies on a proprietary architecture which does not enable its partners to innovate and find new interaction terms with existing services [16].

Business ecosystems are networks of interdependent actors. They are different from traditional network structures such as distribution networks or subcontracting networks. In the first case, the network is built on a set of independent organisations involved in a process whose purpose is to make a product or service available for consumption. Because of this independence, each member of the network will follow a self-maximisation logic leading to a sub-optimal situation [17]. In the second case, the network results from massive outsourcing and is made up of autonomous firms linked through a succession of more or less recurring transactions based on authority-mode relationships. Since business ecosystems are based on mutual dependence, behavioral rules do not merely rely on the principle of self-maximisation [14]. Players have to "act local and think global", being aware that network objectives can only be reached collectively. In this context, the real winners will be those who don't get bogged down in demanding a fair share of the value, but who understand that collaborative relationships result in value creation for the whole community including consumers. Moreover, business ecosystems don't lead directly to a transaction logic – and transaction costs – and thus of ownership, but to an access and usage logic [18]. In business ecosystems, transactions are not associated with the transfer of property rights on a tangible commodity, but instead with access to an intangible service. In this sense, platforms correspond to open architectures which enable members of an ecosystem to access resources and use them to develop new services that may interact with those already available on the same platform. This approach enables some firms to explore new strategic options and implement very innovative business models. Thus, shifting the focus from ownership to the concept of openness requires a special attention to the technological devices such as the platform, in coordinating the partners' relationships within business ecosystems.

3   Open innovation enablers: Platforms and Web Services

Innovations in ICTs hold tremendous promise for achieving open innovation strategies. The sources of value creation are proliferating in business ecosystems, and open, interoperable standards and infrastructures are replacing outdated proprietary systems and technologies. In this context, platforms and Web services are the levers that powered open innovation models. To explore value creation potential both platforms and Web services must be open in order to ensure interoperability.

As defined by Chesbrough & Appleyard [19], openness is "the pooling of knowledge for innovative purposes where the contributors have access to the inputs of others and cannot exert exclusive rights over the resultant innovation". The platform is a repository of knowledge (both tacit and explicit) that the contributors can access via Web services to build their own business model and value proposition. As ICT-based collaborations become the rules of thumb, interoperability between business partners has become a necessity for many ecosystems. Basically, interoperability refers to the ability of various ICT systems and organizations to exchange data and to enable the sharing of information and knowledge [20]. Interoperability can be considered as an antecedent of open innovation, it enables enterprises to build collaborative relationships, access useful knowledge, develop and deliver new products and services, strengthening the development of business ecosystems.

Platforms: The architecture of open innovation

Platforms are composed of subsystems and interfaces on which an organization and its external partners can build specific applications or services targeted at different users. Platforms are modular systems in design. Baldwin & Clark [21] argue that the breakdown of a system into modules (or subsystems) relies on the partitioning of information into *visible design rules* and *hidden design rules*. The *visible design* rules are made up of:

- An architecture that specifies which modules will be part of the systems and what their function will be,

- Interfaces that describe how the modules will interact and communicate,

- Standards that ensure the module's conformity with other modules.

These *visible design rules* consist of explicit knowledge that needs to be shared and communicated. In contrast, the *hidden design rules* consist of tacit knowledge that is encapsulated within the modules (as software) and do not need to be communicated. It is very important to understand that accessing the core of the platform - *hidden design rules* - make it possible for the partners to execute software as a service but doesn't give them property rights on that module or access to the source code used to build this module or component. In many cases, the interfaces between subsystems - such as APIs[1] - are more important than the subsystems themselves. Today's platforms aren't about controlling hardware resources, applications and information. Instead, they are going to be about access to a bundle of services and contents tuned for communities, strengthening collaboration and knowledge between partners.

Gawer & Cusumano [22] have documented the platform strategies based on archetypal examples, suggesting a normative model to achieve leadership. For these authors, there are three stages that lead to a successful platform strategy: the building of the core, the opening up of the core, and the subsequent growth of the periphery. Building, opening and exploring-exploiting are the three main stages of the whole process. Later, Iansiti & Levien [9] shed light on the role of platforms in the development of business ecosystems, especially for keystones.

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[1] *Application Programming Interface*

For these authors, platforms enable partners to interact efficiently, and to create their own value proposition while nurturing the whole ecosystem. In their view, platforms serve as an embodiment of functionalities or services that partners can access via a set of common interfaces.

These works indicate that platforms need a leader who strives to share his commercial philosophy or its technological standard in order to attract members to the ecosystem. The role of the leader is to encourage the convergence of all other community members' vision and ensure that their efforts will enable the development of beneficial synergies for the customers. This shared vision is a way of structuring innovation efforts and ensuring coordination amongst complementary innovators within the ecosystem. Moreover, it clearly appears that the focal firm or the keystone acts as a "value architect", choosing whether to open the platform or not, when to open it, what to open and what to integrate, and finally improves the global value of the platform. The global value of the platform depends on positive network externalities which offer incentives for the leader to expose his most valuable services in order to seduce more complementors and partners that will build their business models on it. Thus, the leader doesn't only shape the global value network; he also reduces uncertainty in the ecosystem by standardizing its partners' business models. In addition, since the growth of the periphery relies on a decentralised process, the more the leader facilitates openness and access, the more he will be able to explore and exploit the knowledge landscape. If the leader builds and clearly communicates methods or techniques (such as APIs) by which other partners can access modules and operate services via the platform, he will have the opportunity to become a hub that will support open innovation and value creation.

Web services: A bridge between business partners

Web services mostly refer to the ability for remote software components to communicate with each other. They rely on a set of open Web standards that allow developers to implement distributed applications in order to join together software modules from different companies. This is nothing new since it was the purpose of Corba[2] or DCom[3] architectures. However, the deployment of these architectures turned out to be very complex and unsuited to Web-based exchanges. Some software publishers (Microsoft, Sun, IBM, Hewlett-Packard, etc.) soon decided to coordinate their efforts in order to enable application servers to directly process partners' components via HTTP. This gave birth to Web services in the early 2000s, which soon became the new technological focal point within the ICT industry.

The Web services' objective is to simplify access to software applications between business partners and support information system integration. A Web service is a component implemented in any language, ported on any platform and embedded in a layer of standards derived from XML[4]. It must be able to be discovered and dynamically activated through other services. In this context, a service is an application that exposes its functionality through an API. This service exposes its functionality through an interface (API) that hides the inner workings of the application.

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[2] *Common Object Request Broker Architecture*
[3] *Distributed Component Object Model*
[4] *eXtensible Markup Language*

Thus, a client application doesn't need to understand how the service actually performs its work. All it needs to understand is how to use the interface. An application needs to know what programmatic functions are available, and it needs to know how to structure and interpret the data being exchanged. APIs define these programmatic functions and data structures in a completely unambiguous way. In short, a Web service is an application that provides an API. This API lets the applications communicate using XML and the Web standards. Web Services are based on three components[5]:

- SOAP (*Simple Object Access Protocol*) is an XML-based inter-application exchange protocol which is independent from any specific platform. A SOAP service call takes the form of an ASCII[6] flow framed by XML embedded commands and transported via HTTP.

- WSDL (*Web Services Description Language*) provides the description of the Web service in XML format by specifying which methods may be called upon, their signature and entry point (URI, port, etc.).

- UDDI (*Universal Description, Discovery and Integration*) standardises a Web services distributed directory solution, which simultaneously permits publishing and browsing. UDDI behaves like a Web service whose methods are called via the SOAP protocol.

This architecture highlights three roles: the service provider, the service requester and the service registry. The objects acted upon are the service and service description. Moreover, all the operations performed by the actors on these objects are published, discovered and linked. In such an architecture, a service provider (Amazon for example) creates a Web service and its services definition and then exposes the service with a service registry based on UDDI. The partner (a third party seller for example) looks for a Web Service that meets its needs in a UDDI directory. The UDDI registry recovers this service's description in WSDL format and provides a URI[7] pointing to the service itself (Amazon EC2 or Amazon S3). The partner may then use this information to directly bind to the service, invoke it and perform it. Finally, as competition intensifies firms are looking for new sources of advantage and the boundaries that separate firms from each other are now becoming the main source of innovation and value creation. In such a context, Web services are a gateway that permits businesses to connect their existing systems to other businesses' systems more flexibly.

4   Open innovation: The Amazon way

Amazon Bookshop was set up in 1994 and has since evolved to become a software company. Indeed, in 2002, the launch of *Amazon Web Services* (AWS) marked a new stage in the history of the firm as well as a significant evolution of its business model. In addition to its well-known E-retailer business, Amazon transformed itself into a true ASP as the company decided to make its knowledge in the development of e-commerce services available to its partners.

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[5] For further details see the W3C recommendations: http://www.w3.org/2002/ws/

[6] *American Standard Code for Information Interchange*

[7] *Uniform Resource Identifier*

Today, many firms, independent developers and middleware integrators use these Web services to interact with Amazon's platform, creating a business ecosystem which is very suitable for open innovation. In 2005, Amazon also decided to expand the scope of its Web services delivering storage capacity and computing power to other companies. Amazon's partners can rent space on Amazon's platform to run a business, or rent out its transaction capabilities to sell things and collect money, or rent pieces of its warehouses and distribution system to store and ship items - or all of the above. What this means for business is that a company like Amazon will be able to connect its own services to those of its partners improving the way both sides interact and collaborate but also transforming the way they develop, make, and distribute products. The Amazon case study [23,24,16] provides powerful insights into ICT-based open innovation models.

Opening up the platform: The birth of Amazon E-Commerce Service

AWS came into existence thanks to the work of internal developers, who had started in the '90s to think about how to improve the way affiliates can access Amazon's online catalog. At the end of 1996, Amazon launched its *Amazon Associates Program*. Within ten years, the number of associates jumped from 4,000 to 1,000,000[8]. This program was primarily a means to acquire new customers and thereby boost traffic and product sales on Amazon's site. In return, Amazon gives its affiliates a revenue share. The year 2002 witnessed a significant evolution of its core business model mainly thanks to the use of XML (Figure 1).

Figure 1 The evolution of Amazon business model.

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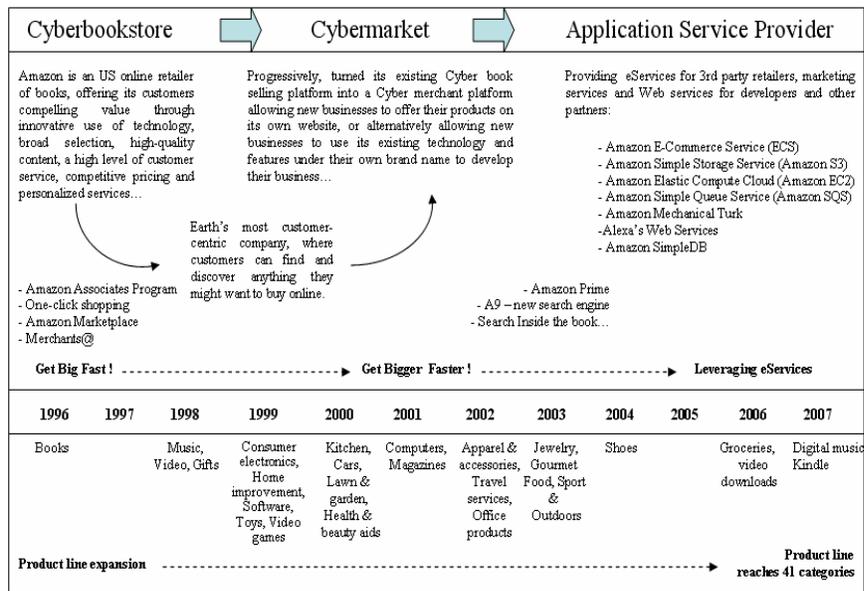
[8] Source: Annual report.

Indeed as early as 2000, Amazon's developers were testing XML-based services, a prelude to what would become AWS. The objective was to allow Amazon affiliates to easily incorporate Amazon content and features (product description, picture, price etc.) into their Web sites. In concrete terms, the purpose was to develop an XML-based API enabling direct queries onto the Amazon database. Yet for Amazon, the use of XML meant a total rethinking of its platform, a risky bet [25]. Finally, the project was approved and the generalised use of XML made it possible for Amazon to launch its first Web service in early 2002: *Amazon E-Commerce Service* (ECS). This Web service is a win-win situation for both the affiliates and Amazon, but it is also an interesting solution for other Amazon partners. Indeed, today Amazon offers about ten different Web services to help them build a real e-business site from scratch (Figure 2).

Figure 2: Amazon Web services

Amazon can offer retailers a complete, turnkey e-commerce service (Amazon WebStore), or any part of that service: access to Amazon's 76 million active customers, the Web front end for online buying and other customer activities, order fulfillment (packaging and shipping), payment service (Amazon FPS) and customer service for e-mail and phone inquiries (Amazon TextBuyIt). With such services, partners only pay for what they use. For Amazon, these eServices are an opportunity to build a real value network sharing the corporate "crown jewels", that is its ICT infrastructure. Thanks to this initiative, Amazon's platform clearly stands out as a dominant design or a *de facto* standard in e-Business. However, the impact of Web services is not only limited to the syndication of content and the creation of a network of partners. Opening up its platform has also enabled Amazon to tap into new value deposits: the innovative applications dreamed up by external developers. Today, these applications have vastly increased Amazon's reach.

Leveraging external developers: Amazon as an incubator for e-business

By January 2008, more than 300,000 independent developers were using AWS. Alan Taylor, a former Amazon developer and the creator of Amazon Light[9] was one of them. His website offers only a simple search box for finding and buying any product available on Amazon.com. After clicking on the selected product, the web surfer sees the picture of the product and information about it, its price, consumers' advice and naturally, the ability to purchase it on-line. This is nothing out of the ordinary, but upon closer inspection, one can find functionalities that are not available on Amazon's site. For instance, until last year, it was possible when searching for a DVD to check whether the movie was also available for rent on the Netflix website, the leader of video-on-demand in the U.S. Likewise, when searching for a CD, it was possible with one single click to check if it could be downloaded from Apple's iTunes platform. For books, Amazon Light also tells the Internet users whether the book they are looking for is available in the bookstore of their choice10. Dave Anderson, the founder of ScoutPal[11], is another example of the innovative efforts carried out by independent developers. ScoutPal is an application based on AWS that makes it possible to look for used books, CDs, DVDs, video tapes or collectible items on Amazon Marketplace via cell phones or any other wireless device. After entering the ISBNs or UPCs, the program returns information, including a summary of market prices and quantities, sales rank, editions and availability, and other details. ScoutPal also reports marketplace prices from abebooks.com and PriceGrabber.com.

The most salient feature illustrated by these examples is the creativity expressed by Amazon Light and ScoutPal and their experimentation with new services based on AWS. With this approach, Amazon fosters "co-creation" of new services and encourages innovative effort by independent developers, demonstrating its commitment to delivering innovation to its partners and customers. Yet the foremost advantage is to make available to Amazon the work of thousands of independent developers, thus turning its platform into a true lab. The contribution of independent developers to the innovation effort is very important. They act as "complementors" working on the development of new services, which may one day be incorporated into the platform. From this point of view, Amazon is acting as an incubator for e-Business.

Amazon certified integrators: The Amazon flagships

The breadth of AWS innovation over the last 6 years is evidence of Amazon's continued technology leadership in e-Commerce. During that time, Amazon has delivered about ten different Web services that have created significant opportunities for their business partners, and offer customers real business value. However, using AWS requires a deep knowledge of software development and application integration solutions. The tasks involved with seamlessly interoperating with Amazon's API and keeping current with the new Web services being developed by the company can be provided by Amazon

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[9] www.kokogiak.com/amazon4
[10] This service is only available in Australia, Canada and in the United States.
[11] www.scoutpal.com

Certified Integrators (ACI). Basically, these ACIs automate the e-Commerce process, providing a streamlined and efficient business operation for merchants integrating with Amazon's platform. Today, some of these ACIs specialize in developing innovative solutions based on a particular AWS such as FreshBooks (Amazon FPS), RightScale (Amazon EC2) or ElasticDrive (Amazon S3).

The main advantage of integrators is to removes the complexity of integration making it simple, fast and cost-effective to add Amazon.com as a channel. Thanks to these integrators, Amazon can draw on external resource and best practices to amplify the value of its own innovation assets, spreading its technology within its business ecosystem. Amazon can tap into these external technology sources to strengthen its two businesses: e-retailer and ASP. ACIs are inter-organizational ties that bring to market internal ideas through external market channels outside Amazon's current businesses [26]. Inter-organizational ties affect the nature and the outcome of the firms' actions and are their potential sources of efficiency, effectiveness and innovation [27,28]. Such deep ties enable Amazon to capitalize on its existing core knowledge [10]. In contrast to independent developers (wide ties) that offer Amazon opportunities to explore news services, ACIs (deep ties) are associated with the exploitation of existing services.

All these middleware integrators can be considered as Amazon flagships promoting Amazon core technology. Herein lies the value delivered by integrators such as MorseBest (a Mercent spin-off), Mercent or Monsoon (a Mercent spin-out). Moreover, since they help other companies to build their own value proposition based on Amazon technology, they potentially create opportunities for these partners to innovate their business models in search for new value deposits.

5   Discussion and conclusion

To orchestrate open innovation strategy, a company can take advantage of ICTs to develop relationships within external partners. In this connection, Amazon.com is an interesting case of open innovation in practice. It sheds light on the role of ICTs in sustaining Amazon's approach to open innovation. Web services are the cornerstone of Amazon's open innovation model since they foster application-to-application interactions within its business ecosystem. AWS have helped achieve loosely-coupled networks that support collaboration between business partners. Even if we cannot generalize from this case study, we can draw lessons about ICTs and open innovation.

First, the case stresses the importance of platforms strategies in open innovation. The development of platforms shapes the nature of relationships between partners engaged in an open innovation process. The more the platform is open, the more it will improve collaboration between business partners. These platforms generate many more innovative opportunities for the business ecosystem when they rely on open and modular architecture rather than a monolithic one. In this context, network externalities are at the very core of the open innovation dynamic. Platforms combine software stacks that can be used by other companies to innovate their businesses, that in turn will bolster Amazon's platform in a self-reinforcing cycle, spreading its knowledge into its ecosystem.

Secondly, Web services technologies provide both a language-neutral and environment-neutral programming model that accelerates application integration inside and outside the enterprise. Application integration through Web services yields flexible loosely coupled business systems well suited for open innovation. Web services are a powerful response to the issue of system interoperability between business partners. In this context, the growth of Web services oriented architectures (WSOA) helps enterprises to build open innovation models. Without such interoperability, communication between applications is not possible which hampers open innovation strategies. AWS are used by independent developers to explore new services while they are used by certified integrators to exploit existing services. This duality is an important dimension of Amazon's open innovation strategy.

The Amazon case study pointed out interesting research questions. Over a decade, Amazon has spent $2 billion building its ICT infrastructure and technical knowledge. Today, Amazon's core competencies rely on this expertise in building e-Business solutions. From a resource-based view: "These initiatives are advantages not only because they drive the firm up the learning curve in the activity but also because the path dependent resources created over time, organizational experience and understanding of e-commerce markets, are likely to provide the firm competitive advantage in future periods" [29]. In this sense, these investments capture the dynamic capabilities of Amazon's platform. But then a question arises: are all the companies capable of pursuing an open innovation strategy? At the moment, open innovation success stories generally refer to large companies with a big market power. Of course, it doesn't mean that SMEs or even startups cannot achieve an open innovation strategy but it seems that they are less facilitated than established companies with well-known brands and a robust knowledge base from which they can build a value network. It is not yet clear what should be the open innovation strategy for the "small fishes", neither is it completely clear how to set-up an open business model for newcomers.

Another question concerns the level of analysis to explore open innovation strategies. Indeed, open innovation refers to a holistic approach in which inter-organizational networks play a central role. Thus, the structure of this network and the nature of relationships between business partners require further analysis: "When companies are highly dependent on other organizations for their supply of new technologies or when they need the support of others to bring a new technology to the market, it seems logical that open innovation has to put an emphasis on the management of external networks to be successful" [5]. In this sense, the ecosystem-based view offers a complementary framework to better appreciate how value is created and shared amongst ecosystem members. It also helps better understand each partner's incentives to join the network and choices regarding their business models. Business ecosystems are the governance structure [30] that shapes behavioural rules between actors aware that network objectives can only be reached collectively. Explaining how this mutual dependence evolves and shapes open innovation strategies is of crucial importance for future research.

When we move the analytical focus from the level of a focal firm to an inter-organizational level, another research question arises: How to regulate business ecosystems in order to improve the output of open innovation strategies? Indeed, since open innovation increases the extent of business and technological interdependencies

between firms, it is necessary to understand what approaches may be most useful to sustain innovation and what should be the government interventions.

Embracing mutual dependence requires an opening up of regulation design. Indeed, within the traditional analytical concepts of industrial organization and competitive strategy, each business has its market, and the market competition more or less defines how the business should be run and developed if the changes are limited to those within the business itself. However, since non-economic factors, such as power structure and underlying history, play significant roles in driving the ecosystem development; inter-organizational relationships cannot be fixed by market competition, because there is no common market between different businesses [31]. Thus, a change in the level of analysis means a change in factors to be analysed by the policy makers and the regulation authorities.

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