Open Innovation within Business Ecosystems:
A Tale from Amazon.com

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Abstract: Open innovation refers to the ability of 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 are supportive instruments of relations between firms. This paper analyzes how Amazon managed openness thanks to ICT infrastructure. In this paper, we address the challenge of managing open innovation within business ecosystems, especially those abetted by a new generation of technologies called Web services. We will draw lessons from Amazon.com to understand how this keystone organization is becoming nimble 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.

Key words: open innovation, business ecosystem, platform, web service, business models, interoperability, value.

A central characteristic of the transformation of innovation in today's business world is the emergence of an open innovation model (CHESBROUGH, 2003). Open innovation refers to the techniques used by firms to open up and strengthen their ability to investigate their external environment for innovation purpose. The head-on competition of the industrial era, where companies exhibiting the best assets usually won, is being replaced by a more holistic model, where competition mixes with cooperation to create greater value for an entire collection of organizations. In this context, the open innovation paradigm transcends the necessity of managing business ecosystems (MOORE, 1993, 1996) to explore pathways to innovation while fostering value creation for a large number of loosely interconnected participants relying on each other for their mutual effectiveness and survival.

Beyond the boundaries of the firm, a community of organizations and stakeholders compete and collaborate to deliver specific goods and services issued from the innovation process. The evolution from business environment to business ecosystem results from cooperation: both companies and other organizations leverage new ideas, satisfy customers, and create new products and services through open innovation systems. This increasingly networked structure has shifted the focus of competition away from the management of internal resources, to the management of capabilities outside the direct ownership and control of the firm. Here precisely lies the challenge of open innovation.

The framework depicted by CHESBROUGH (2003) underlines a new way to improve the innovation process, relying on both internal and external resources. Nevertheless, it misses exploring the very nature of the relationships between the numerous players evolving in the surrounding environment. The ICTs role in supporting open innovation is implicit but not clearly analysed.

Our work is not theoretic but it searches for conditions making a particular business ecosystem conducive to open innovation in ICT-based sectors. The very purpose of this paper is to draw some lessons from the case study of a particular firm: Amazon.com. The case 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. It sheds light on the role of ICTs in sustaining Amazon's approach to open innovation. Platform strategy and web services are the cornerstone of Amazon's open innovation model since they allow and foster application-to-application interactions within its business ecosystem. Amazon Web Services (AWS) have helped achieve loosely-coupled networks that support collaboration between business partners. Even if we cannot generalize the findings of the case study, lessons can be drawn about open innovation in the context of an ICT-based business ecosystem.

The following Section reviews the theoretical background underlying open innovation and business ecosystems. It clarifies also the role of open innovation enablers such as platforms and interoperability. The Section after analyzes the role played by ICTs and especially Web services in the open innovation strategy of Amazon.com. We then conclude with further considerations.

■ Open innovation within business ecosystems: Theoretical background

In his seminal book, Henry CHESBROUGH (2006a) describes a new paradigm of open innovation in contrast with the traditional closed model. Innovation process was traditionally conducted internally and firms rarely share their innovative results as a means to generate new competitive advantages. In this 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, this internally-focused logic has burnt huge amounts of innovation cash, sometimes in an inefficient way.

In this "do it yourself" vision, both value creation and value capture depend heavily on in-house resources and knowledge shaped through an internally-oriented business model. This model seems not viable anymore (CHESBROUGH, 2006a). Forward-looking organisations have therefore 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 emerges: innovation itself is a commodity bought and sold, loaned, licensed. The possibilities for tapping into this global knowledge base are getting bigger day after day. Corporate innovation has hence opened its doors to the world and firms move increasingly to a more open innovation model based on both exploration and exploitation of their external environment (RADJOU, 2006). In such a model, firms leverage the discovery of others and are also willing to commercialize their innovation through third party entities exhibiting well-fitted innovation business models (CHESBROUGH, 2006b). Thus, firms are able to bring new products or services to the market more efficiently, sustaining the health of their business community thanks to 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 the surrounding environment. From this point of view, open innovation refers explicitly to the establishment of network structures

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between different business partners. Those networks depend on the collaborative efforts of highly-specialized companies providing complementary intermediate goods and services (Iansiti and Levien, 2004). Since open innovation relies on a deep and wide network of business partners (SIMARD & WEST, 2006) co-creating value at the network level, the understanding of inter-organizational coordination is necessary to better appreciate the dynamic of open innovation at a global level.

To be successful and most of all acceptable for managers, open innovation requires therefore: partnerships for value creation and control for value capture. This relies heavily on finding the right level of openness.

Business ecosystems:
An inter-organizational context of open innovation

MOORE (1993) describes the concept of 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 rely on each other for their mutual effectiveness and survival (IANSITI & LEVIEN, 2004). Thus, the concept of business ecosystem clearly underlines loosely interdependence between partners within the community.

Many different actors compose them (MOORE, 1996): customers, market intermediaries (including agents, channels, and players selling complementary products and services), suppliers, lead producers, competitors and other stakeholders. These business communities embody the external context from which firms insource external ideas and market internal ideas, creating value for anyone within the community: they are the core of open innovation. Learning how to create and capture value through ties created between partners 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. The total value created in the network directly depends on the relations between the partners in the global value network that is the business ecosystem (MOORE, 1996; IANSITI & LEVIEN, 2004; SAWHNEY & PARIKH, 2001).

Within a business ecosystem, the activity of a firm relies on a mesh of relationships characterized by varying degrees of intensity that 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 and resources it creates for other companies. Business relationships give access to knowledge, technologies, and innovation potential, which makes an actor an attractive partner. Within this framework, the networks represent the foundation on which relationships between firms are organised (SHAPIRO & VARIAN, 1998). IANSITI & LEVIEN (2004) describe three types of actors within a business ecosystem:

- Dominator: on one hand, the "physical dominator" dominates all its ecosystem's niches via integration strategies and is able 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, the "value dominator" or "hub landlord" extracts the maximum value from the network without trying to dominate it. Both instances share a common goal: extracting the whole value of the network without redistribution to others. This results usually in a weakening of the business ecosystem.

- Keystone: they play an active and predominant role in both creation and redistribution of value within the network. They do not try to control the whole network but aim for leadership through positions on a few strategic nodes. The keystones often resort to platform strategies facilitating access to resources which give them the opportunity to take advantage of the other network players' contributions. They usually adopt a "win-win" attitude vis-à-vis the other members of their ecosystem.

- Niche players: they are small-sized [1], highly specialized and differentiated actors. They support a large part of the value created within the ecosystem. They access necessary resources via the platform of keystone players who give them an opportunity to develop new products or services. Indeed, they maintain very close relationship with the keystone, by actively contributing to the platform's evolution and hence to the dynamics of the ecosystem.

Dominator strategies are not effective from an ecosystem perspective. A physical dominator generally misses innovation and business opportunities because it doesn't enable niches and uncontrolled innovation process. Value dominator allows niche creation, but extracts too much value from the network weakening its business ecosystem partners and their ability to innovate. The keystone player is usually a firm which has been able to

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[1] "Small" can also be understood as "having a small role" or having a "small part of their activity" involved in the innovation process of the business ecosystem. A niche player in a particular ecosystem can be a subsidiary of a focal player of another ecosystem.

identify and implement the terms of collaboration that are best suited to each member of the community. The objective of the leader is the ecosystem's overall performance rather than that of a single actor (POWELL, 1990). To become a keystone, the firm must be an attractive player. In this sense, it should have bargaining or market power, good reputation, commercial success or trust. A keystone has then the aptitude to organize innovation in an open fashion in order to maximize the innovation opportunities.

Platform and interoperability

Business ecosystems do not rely on a transaction or ownership logic but to on an access and usage logic (RIFKIN, 2000). In many business ecosystems, transactions are not associated with the transfer of property rights on tangible commodity, but instead with access to intangible services. This is especially true in ICT sectors where business ecosystems depend heavily on business partners (for instance, independent developers) and other ICT companies. The links between members are used by the focal firm to enrich and to strengthen its platform. In this sense, platforms become open architectures enabling members of an ecosystem to access and use resources to develop new services that may interact and enhance those already available on the platform. This approach gives incentives for 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 platform in coordinating partners' relationships within business ecosystems. All these arguments tend to show that a business ecosystem managed by a keystone player is well-fitted for open innovation purposes.

Since platforms are repositories of knowledge (both tacit and explicit), potential contributors need access to build their own business model and value proposition. As ICT-based collaborations become the rule, 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 share information and knowledge in a reciprocal way (GASSER & PALFREY, 2007). Interoperability should be considered as prerequisite for 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.

Technically, platforms are composed of subsystems and interfaces on which an organization and its external partners can build specific applications or services targeting different users. They are modular systems. BALDWIN & CLARK (2000) argue that the decomposition 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:
- an architecture specifying which modules will be part of the systems and what their function will be,
- interfaces describing how the modules will interact and communicate,
- standards ensuring module's conformity with other modules.

The 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 doesn't 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 nor access to the source code used to build this module or component. In many cases, the interfaces between subsystems - such as APIs (Application Programming Interface) - 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 around access to bundle of services and contents tuned for communities, strengthening collaboration and knowledge between partners.

GAWER & CUSUMANO (2002) have documented platforms' strategies based on archetypal examples, suggesting a normative model to achieve leadership. They identified three stages leading 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 or exploiting are the three main stages of the whole process. Later, IANSITI & LEVIEN (2004) have discussed the role of platforms in business ecosystems development, especially for keystones. For them, platforms enable partners to interact efficiently, and to create their own value proposition while fostering 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 which strives to share its commercial philosophy or its technological standard in order to attract the ecosystem's members. The role of the leader is to encourage the convergence of all community members' vision and ensure that their efforts

will promote the development of beneficial synergies for the customers. This shared vision structures innovation efforts and ensures coordination amongst complementary innovators within the ecosystem. The focal firm or the keystone acts then as a value architect, choosing whether to open the platform or not, when, what to open and what to integrate, and finally improving 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 its most valuable services in order to seduce more complementors and partners. Thus, the leader doesn't only shape the global value network; he also reduces uncertainty in the ecosystem standardizing its partners' business models. In addition, since the growth of the periphery relies on a decentralised process, the more the leader will facilitate openness and access and the more he will 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 supporting open innovation and value creation.

■ The Amazon way

Amazon Bookshop was set up in 1994 and has since evolved to become a software company. Figure 1 offers a synthetic view of the major evolution of Amazon (ISCKIA, 2006, 2007).

As a US online retailer of books, Amazon was clearly in its early stage of development a niche player with somewhat disruptive technology (its platform) and business model. It offered its customers compelling value through innovative use of technology (customers experience), broad selection (use of the long tail logic), high quality content, competitive pricing and personalized services.

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 [2]. This program was primarily a means to acquire new customers and thereby boost traffic and product sales on Amazon's site. In return, Amazon gave its affiliates a revenue share. From 1994 to 2002, Amazon developed numerous partnerships and created its own business ecosystem

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[2] Source: Amazon Annual reports.

through the attractiveness, the success and the growing reputation of its e-retailer platform. Amazon became progressively a cybermarket allowing new businesses to offer products on its own website or alternatively allowing new businesses to use its existing technology and features under their own brand name to develop their online activities. Amazon became a true keystone player in its ecosystem, but innovation was still in-house oriented.

Figure 1 - The evolution of Amazon business model
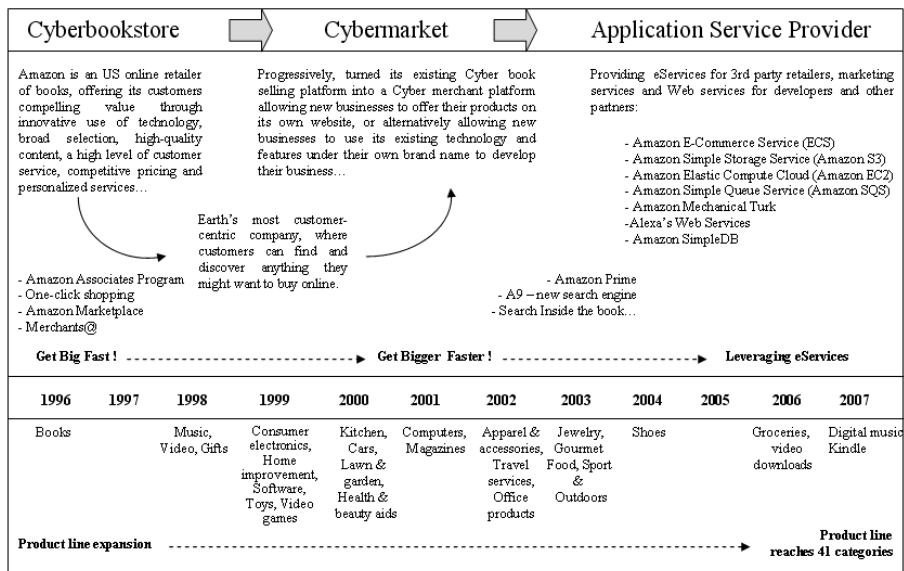
Year 2002 marked a new stage in the history of the firm as well as a significant evolution of its business model: the launch of Amazon Web Services (AWS). While pursuing its historical E-retailer business, Amazon transformed itself into a true application service provider and decided to make its knowledge in the development of e-commerce services available to its partners, opening up his innovation process.

Today, many firms, independent developers and middleware integrators use these Web services to interact with Amazon's platform, creating a business ecosystem 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 not only improving the way both sides interact and collaborate, but also transforming the way they develop, make, and distribute products. The Amazon case study provides powerful insights into ICT-based open innovation models.

Three layers appear in the open innovation strategy of Amazon. First, Amazon opened up its platform and ICT infrastructure through Web services. Secondly, it acts as an incubator for e-businness. Thirdly, the company expands the use and finally the reputation of its platform thanks to Amazon certified integrators. This enhances the attractiveness of the whole platform and hence value creation opportunities.

Web services: A bridge between business partners

Amazon Web Services (AWS) came into existence thanks to the work of internal developers, who had started in the 90's to think about ways to improve the affiliates' access to Amazon's online catalogue. Year 2002 witnessed a significant evolution of its core business model mainly thanks to the use of XML.

Web services mostly refer to the ability of 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 (Common Object Request Broker Architecture) or DCom (Distributed Component Object Model) 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) 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 (NATIS, 2003; BUGHIN & MANYIKA, 2007).

The Web services' objective is to simplify access to software applications between business partners and support information system integration. 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.

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. The purpose was to develop an XML-based API enabling direct queries onto the Amazon database. For Amazon, the use of XML meant a total rethinking of its platform, and hence a risky bet (ROUSH, 2005). Finally, the project was approved and the generalised use of XML allowed Amazon to launch its first Web service in early 2002: Amazon E-Commerce Service (ECS). This Web service is win-win for both the affiliates and Amazon, but it is also an interesting solution for other Amazon partners. Today the company offers about ten different Web services to help them build a real e-business site from scratch: infrastructure services (Amazon Elastic, Compute Cloud, Amazon SimpleDB, Amazon Simple Storage Service, Amazon Simple Queue Service), payments and billing services (Amazon Flexible, Payments Service, Amazon DevPay), Amazon Fulfillment and Associates Services (Amazon Fulfillment Web Service, Amazon Associates Web Service), Web Search and Information Services (Alexa Web Search, Alexa Web Information Service, Alexa Top Sites, Alexa Site Thumbnail), On-Demand Workforce (Amazon Mechanical Turk).

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 fulfilment (packaging and shipping), payment service (Amazon FPS) and customer service for e-mail and phone inquiries (Amazon TextBuyIt). These services follow a usage principle: 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.

For CHESBROUGH & APPLEYARD (2007), 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 success of Amazon.com shows that the company probably finds the right balance between openness and business opportunities. The openness of the system is limited to what is necessary and sufficient to ensure the business ecosystem development. The questions on what to open and to whom appear central: too much openness will lead to an uncontrolled and unstable system in terms of value capture for the keystone, not enough openness will lead to less attractiveness, less innovation opportunities, that is less value creation.

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

By January 2008, more than 300,000 independent developers were using AWS [3]. Alan Taylor, a former Amazon developer and the creator of Amazon Light [4] 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 closer inspection reveals functionalities that are not available on Amazon's site. For instance, until 2007, 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 choice [5].

Dave Anderson, the founder of ScoutPal [6], 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

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[3] Sources: Amazon Press Releases, 2008.

[4] www.kokogiak.com/amazon4

[5] This service is only available in Australia, Canada and in the United States.

[6] www.scoutpal.com

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 a real incubator for e-Business.

Amazon certified integrators: the Amazon flagships

The breadth of AWS innovation over the last six 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 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 remove 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. Inter-organizational ties affect the nature and the outcome of the firms' actions and are their potential sources of efficiency, effectiveness and innovation (HÅKANSSON & SNEHOTA, 1995; WILKINSON & YOUNG, 2002). Such deep ties enable Amazon to capitalize on its existing core knowledge. In contrast to independent developers (wide ties) that offer Amazon opportunities to explore new 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 lays 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.

■ Further considerations

Over a decade, Amazon has spent $2 billion [7] building its ICT infrastructure and technical knowledge. Today, Amazon's core competencies rely on his 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" (SUBRAMANI & WALDEN, 1999). In this sense, these investments capture the dynamic capabilities of Amazon's platform. This questions our results: are all companies capable of pursuing an open innovation strategy? Until now, open innovation success stories generally refer to large companies with market power, trust and success. Of course, it doesn't mean that SMEs or even start-ups cannot achieve an open innovation strategy but it seems easier when carried out by 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

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[7] Source: Amazon annual reports.

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. Platforms strategies play a crucial role 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 enhance collaboration between business partners. These platforms generate more innovative opportunities for the business ecosystem when they rely on open and modular architecture rather than on 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 business that in turn will bolster Amazon's platform in a self-reinforcing cycle, spreading its knowledge into its ecosystem.

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 which hampers open innovation strategies is not possible. 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: platform as repository of knowledge, AWS as vectors of innovation.

The practice of open innovation, as shown by the Amazon case, involves a dark side. It is clearly implemented in a laissez faire under control environment. Ties between partners are created in a decentralized fashion but the focal firm of the business ecosystem, the keystone, manages to control all the new nodes: value capture imposes a constraint on the openness of the system. Being able to impose such a control on partners is a strategy available only to powerful firm. Therefore, the degree of openness of an innovation system probably relies on the power of the focal firm and the way this power is maintained throughout the ecosystem (contractual links, exclusive dealings, intellectual property rights management, etc.).

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" (VANHAVERBEKE, 2006).

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 (MOORE, 2006) 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 the analytical focus moves from the level of a focal firm to an inter-organizational level, other questions arise. Business ecosystem and open innovation raise public policy issues. Embracing mutual dependence requires an opening up of economic regulation design and tools, especially in antitrust policy and sector-specific regulation. Traditional analytic tools are clearly inefficient to describe the functioning of business ecosystem and to appreciate the underlying competitive situations: concepts like sectors and relevant markets do not fit the actual situation. This may create policy fallacies. What is the true level of competition? Where is the battlefield? The big issue appears clearly. For instance, is there a fierce competition between Apple, Microsoft and Google or between their own ecosystems? Business ecosystems could be defined as a new model of firms' organization, both vertically and horizontally disintegrated. Niche players in a business ecosystem serve the objectives of the focal firm: beating the competing business ecosystem or exploring the environment outside the ecosystems. In this sense, all the players in a particular business ecosystem loose a part of their autonomy: they act as a whole and unique entity. Inside the business ecosystems, non-economic factors, such as power structure and underlying history, play significant roles in driving the business ecosystem development: inter-organizational relationships are not fixed by market competition but rather by the will of the focal firm. Therefore, the actual level of competition should be between ecosystems. This change in the level of analysis requires a change in factors to be analysed and a new regulatory tool box for policy makers and regulation authorities.

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