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The technological roadmap of Cisco's business ecosystem

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ABSTRACT

A business ecosystem provides a new perspective for repositioning a company's strategy in order to aggressively further its own interests and to promote its overall ecosystem health. Analyzing a business ecosystem is not an easy task, and therefore only a few studies have been made, even though some scholars and managers accept this concept from ecology since value creation is achieved by establishing a platform that other members of the ecosystem can use to enhance their performance. This paper presents a case study based on both qualitative and quantitative data, by explaining how Cisco Systems has been so successful in utilizing its strategy of mergers and acquisitions (M&A) for corporate growth based on a business ecosystem, especially from a technological perspective. We use US patent data from 1993 to 2005 to illustrate Cisco's technological roadmap. Finally, implications of symbiosis, platform, and co-evolution are provided for managers to challenge the contemporary business environment.

1. Introduction

Business ecosystem is an emerging concept for scholars and managers nowadays. However, making strategic choices to compete between and within ecosystems is now an increasing focus of a firm's business strategy. A business can create much value through a healthy ecosystem in order to face the fierce competition beyond the issues of R&D—intensive, higher value-added, shortening life-cycle, and globalization. A firm that takes action without understanding the impact on the ecosystem as a whole is ignoring the reality of the network environment in which it operates (Iansiti and Levien, 2004). An ecosystem can also provide an emerging orientation to create novelty in business operations (Adner, 2006; Singer, 2006; Horn, 2005). Successful innovations usually depend on cooperation among firms and potential adopters, but describing a complete case of a firm's evolution path to an ecosystem is not easy in research. Only a few studies in the literature have paid attention to such a complex analysis. Therefore, this paper demonstrates a case study on how Cisco Systems has been successful in utilizing the strategy of mergers and acquisitions (M&A), resulting in its impressive corporate growth.

Companies in recent years that focus primarily on their internal capabilities have pursued strategies that not only aggressively further their own interests but also promote their overall ecosystem health—that is to say, networking capabilities enhance the creation and delivery of a company's own offerings. Successful firms also have done this by creating a "platform"–services, tools, or technologies–that other members of the ecosystem can use to enhance their own performance (Moore, 1993; Iansiti and Levien, 2004). Chesbrough and Schwartz (2007) also emphasize the co-development strategy that has been important for a company like Intel, which provides core complementary microprocessor technology for Microsoft software.

Cisco Systems has developed a scalable business model that enables the company to meet the challenges posed by continued explosive business growth. It has created a form of enterprise--termed an "ecosystem"–which seamlessly links together customers, employees, contract manufacturers, and other supply chain partners into a multisite, multilocation electronic network based on practices and technology of the Internet. Cisco relies on a complex network of external assets and has moved to directly gain assets which the company needs through mergers and acquisitions. In order to analyze its M&A formations, we attempt to utilize a business ecology viewpoint to spread out the progress of its technology development.

To complement this qualitative study, we find some useful information by the text mining technique. In this paper, we analyze technology development by collecting all US patents filed by Cisco and its 120 acquisition targets during 1993–2005 from an ecosystem perspective. Finally, we provide some explorative discussions for this case study.

2. Business ecosystem as an emerging strategic logic

The present precarious and highly competitive market environment is threatening industries with unprecedented challenges.

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Internet communication technology and globalization not only provide the energy for growth but also furnish fierce competitive environments. Therefore, most companies seek suitable repositioning beyond pure mergers & acquisitions and co-operations to gain further competitive advantages. In particular, fostering collaborative relationships among vertical channel partners to achieve symbolic synergy is a key factor for success. Therefore, the concept of a business ecosystem provides an emerging logic to crafting managers' strategy (Moore, 1993; Iansiti and Levien, 2004; Horn, 2005; Chesbrough, 2007).

2.1. Analogy to ecosystem

In over 40 years of strategic research, a diversity of partly competitive and partly supplementary perspectives has emerged. Researchers on strategy have tended to come from other disciplines (economics, sociology, psychology, etc.). However, the market and hierarchies have dominated our thinking about an economic organization (Moore, 2006). A business ecosystem is an emerging concept analogized from biology. Business ecosystems move beyond market positioning and industrial structure by having three major characteristics: symbiosis, platform, and co-evolution.

The first characteristic for an ecosystem is that business ecosystems have a loose network of suppliers, distributors, outsourcing firms, makers of related products or services, technology providers, and a host of other organizations, and are affected by the creation and delivery of a company's own offerings (Iansiti and Levien, 2004). Prendergast and Berthon (2000) regard that loose relationships enhance the necessary symbiosis to assure the ecotone for marketing. Compared to blocked embeddedness, the wobbly relationships also provide flexibility for partner selection and system design. Moore (1993) regards Apple, IBM, Ford, Wal-Mart, and Merck as leaders of business ecosystems, but the center is valued by the rest of the whole community. The leadership enables all members to invest toward a shared future. Therefore, the competition is not limited to company to company, but it is ecosystem to ecosystem. Hearn and Pace (2006) argue that the next-generation business system should shift from simple cooperation to a complex cooperation. For example, the network of consumers using compatible products or services influences the benefit of consumption such as the telephone system or home video game industry (Shankar and Bayus, 2003). Gossain and Kandiah (1998) comment that the relationship within an ecosystem is beyond a traditional value chain due to fluid boundaries between customers, suppliers, partners, information, and goods. The blur has a significant impact on the economics supporting the ecosystems. Therefore, the survival of each firm is built on the benefit of an overall business ecosystem.

The second characteristic is a "platform" – services, tools, or technologies – that other members of the ecosystem can use to enhance their own performance (Moore, 1993). For example, Microsoft's development tools allow software companies to easily design programs on the basis of the Windows operating system—that is to say, software companies provide Microsoft Windows with a steady stream of new applications (Iansiti and Levien, 2004). Intel and Microsoft are strong leaders and play the role of central ecological contributor (Moore, 1993). Iansiti and Richards (2006) also show that the platform providers perform a critical role in an ecosystem generally enhancing innovation and productivity. Dobson (2006) says such companies labeled "hubs," "steward," or "keystone companies" play central roles in the systems, exerting their influence and power not only on those that they directly trade with but also on those other players in the system on whose existence they depend. Of course, this derives some antitrust concerns in policy that is out of this paper's interest. However, those companies play a central role through platforms complementing other products or services. This means the value of a business ecosystem shifts from product to network value (Hearn and Pace, 2006). Gawer and Henderson (2007) also find Intel did indeed experience incentives to enter and/or subsidize the market to complement its platform that supports its leadership in the industry.

For the third characteristic, business ecosystem evolves participants to a new landscape. Business ecology entails a broad community of firms and individuals that add value to a technology standard by supplying complementary assets to the core product (Moore, 1993). Moore (1998) regards today's leaders shift from conceiving their business as hierarchical organizations to envisioning themselves as participants in a world of complex evolving systems. For the successful product iPod as an example, none of its parts and accessories is produced by Apple—the hard drive is produced by Toshiba, the CPU by PortalPlayer, and RAM by Samsung (Linden et al., 2007). However, entertainment companies license content through iTune and iPod, which connect to music downloading sites, as well as the consumers who purchase and enjoy the music (Moore, 2006). Therefore, a new business ecosystem has evolved around the music player. Adner (2006) clearly indicates that business ecosystems allow firms to create value that no single firm could create alone. With a vision that extends beyond their current business operations or technical specifications of one product, the synergic cooperational value of an industry ecosystem is greater than the sum of the parts. Only some firms have a strong relationship to the platform (Kraemer and Dedrick, 2002) that can avoid the inertia of firms that also support keystone companies to envision the co-evolution process on the basis of a second characteristic. This is an important phenomenon throughout the cases of business ecosystem.

2.2. Business ecosystem and other debatable issues

Taxonomies are also inspired by ecology such as industrial ecosystem, evolutionary economics, and ecological organization. All of those perspectives have different focuses in research questions.

Korhonen et al. (2004) discuss industrial ecology (IE) as an emerging research agenda for management and policy. Using the natural ecosystem as a metaphorical model, IE is based on a sustainable use of renewable natural resources and by-product utilization. For example, Ehrenfeld and Gertler (1997) propose the Kalundborg as a case study to illustrate the experiences in practice. Following the concept of product utilization, Lowe (1997), Heeres et al. (2004), and van Beers et al. (2007) argue the ways to enhance the resource exchange in the eco-industrial region.

Second, the focus of evolutionary economics follows Nelson and Winter (1982) to explain the movement of something over time and the random elements that generate or renew some variation in the variables in question (Dosi and Nelson, 1994). Therefore, several studies are interesting with the source and process within innovation systems, e.g. Cooke et al. (1997), Malerba (2002), and Martin and Sunley (2006).

Third, there is an impressive volume of works on organizational ecology conducted starting with Hannan and Freeman (1977). Amburgey and Rao (1996) review the key issues of organizational ecology: density dependence, organizational founding, organizational mortality, adaptation and selection, and the diversified organization. The school inspired by population ecology pays more attention to studying the environment in which organizations compete and adapt. However, the business

Table 1
Taxonomies of related issues.

Taxonomies	Research questions
Industrial ecology	Sustainable use of renewable natural resources and waste, and by-product utilization
Evolutionary economics	The movement of something over time and the random elements that generate or renew some variation
Organizational ecology	Density dependence, organizational founding, organizational mortality, adaption and selection, and the diversified organization
Open innovation	Embrace ideas and knowledge in conjunction with internal R&D

ecosystem looks at the strategic level for business, as proposed by Moore (1993) and Iansiti and Levien (2004), and is about how to take down from the above networks among businesses as a business strategy.

Furthermore, another similar taxonomy is open innovation proposed by Chesbrough (2003), but it is not inspired from ecology. The basic issue of open innovation is to break "not invent here" to embrace ideas and knowledge in conjunction with internal R&D. Compared to business ecosystems, open innovation is an R&D-level strategy. Obviously, the unit of analysis is different, but they are also similar when a firm is intensive R&D. Therefore, a business ecosystem can be a specific case in Chesbrough's idea—for example, Chesbrough (2003) proposes open innovation that has three primary areas: funding innovation, generation innovation, and commercializing innovation. The innovation architects, such as Nokia's global system for mobile communication (GSM) and Boeing's lead in aircraft platforms, are one of the four types that primarily generate innovation. Open innovation pays more attention to using outside talents and knowledge such as in Henkel (2006), who explores the commercial development of open source software for embedded systems. Even the open business mode proposed by Chesbrough (2007) focuses on cost and time saving from leveraging external development to profit more. The strategic intents and research questions are obviously different from a business ecosystem. Similar taxonomies are summarized in Table 1.

3. Case study: Cisco

According to Yin (2003), the case study method focuses on a phenomenon within its context by obtaining data in order to comprehensively investigate and analyze indepth the phenomenon itself. Thus, the selection of cases in a qualitative case study research is purposeful and involves the use of replication rather than sampling logic (Eisenhardt, 1989; Yin, 2003). This paper selects Cisco as it has been successful in developing its ecosystem by information-oriented sampling as opposed to random sampling. This research creates a patent database including M&A activities to maintain a chain of evidence. In order to cope with the considerable quantities of patent data, text mining is useful to offer the capabilities for illustrating the complicated relationships among patents (Porter, 2005; Tseng et al., 2007; Yoon et al., 2008). Keywords in the patent documents are extracted by a threshold of document frequency or co-frequency, and then the relationships can be further analyzed by statistics and visualization. For example, Porter (2005) uses the technique to automate routines to generate technology information, Tseng et al. (2007) use it to generate the patent map, and Yoon et al. (2008) also use keywords by text mining for further morphology analysis. The text mining technique is used to illustrate Cisco's technology roadmap since only a few attempts have so far been made, especially based on patent information.

3.1. Background of Cisco

The decade of 1980s marked the debut of networking technology that went on to invigorate the computer industry, but before that stage it was dominated by mainframe or minicomputers. Around that time, Ethernet and TCP/IP began to emerge as computer networking technologies. As a result, much capital and resources were poured into the journey of discovery of networking technology.

Two computer specialists at Stanford University in 1984 took the idea of the router (developed at Stanford) and subsequently commercialized the product. In the early 1990s, the switch was developed and though less functional than a router, it was faster and generally less expensive. It soon became clear that switching would be a significant new market and might prove to be a disruptive technology (Christensen, 1997). In 1993, Boeing decided to develop a network using switches by Crescendo, rather than the routers of Cisco. Cisco then bought Crescendo (U$95 million in stock) and therefore obtained Boeing as a client by default. Cisco was no longer a router producer, but now a full networking equipment company.

Cisco Systems has since become the premier technology leader in the Internet infrastructure market. It has established its standards in the market by creating a business-ecology where network engineers are trained in Cisco technologies, hardware companies build products based on the Cisco standard, and software developers build complementary applications to Cisco's products (Kraemer and Dedrick, 2002). Cisco is one of the important players in the Internet equipment industry, and one of the challenging tasks is how to be a keystone player when the Internet is becoming one of life's necessities. Cisco funded its capital requirements for M&A activities mainly by issuing new stock and also with a small portion of retained earnings. From 1995 to 2000, Cisco maintained its growth in the fast-changing Internet industry, along with a steady rise in annual income. Fig. 1 shows that the fiscal year 1999 was quite good for Cisco Systems with a 43% increase in revenue over the fiscal year 1998. The bursting of the Internet bubble stopped its rapid growth in

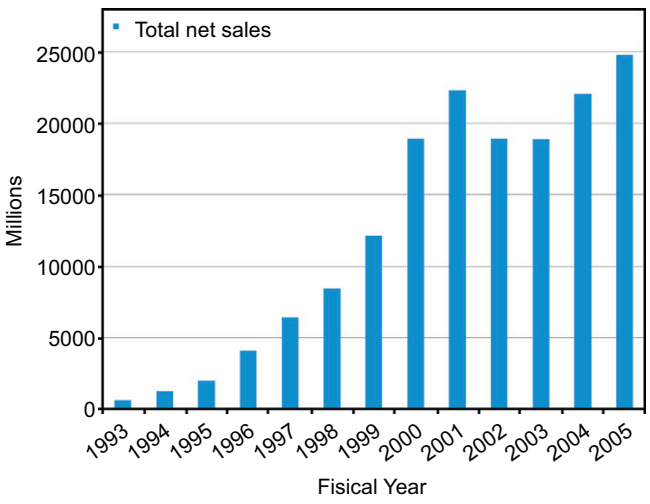

Fig. 1. Cisco's Net Income. *Note:* The data source is from Mergent Online (http://www.mergentonline.com).

Table 2
UPC rank of issued patents.

UPC rank	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1	348	348	348	348	370	370	370	370	370	370	370	370	370
2	375	380	380	725	348	348	348	709	709	709	709	709	709
3	380	725	370	370	725	725	709	348	348	375	379	379	379
4	725	455	725	379	375	709	375	379	714	348	375	714	455
5	455	370	375	380	379	375	725	455	455	361	714	375	711

Note: The table shows the top 5 UPC (US patent classification) from 1993 to 2005. For example, Class 709 means electrical computers and digital processing systems. Here, the authors provide the technological descriptions of the top 5 classes, and more information can be searched on the USPTO website (http://www.uspto.gov). The classifications used in Table 1 have the following explanations.

348: television;
361: electricity: electrical systems and devices;
370: multiplex communications;
375: Pulse or digital communications;
379: telephonic communications;
380: cryptography;
455: telecommunications;
709: electrical computers and digital processing systems: multicomputer data transferring;
711: electrical computers and digital processing systems: memory;
714: error detection/correction and fault detection/recovery;
725: interactive video distribution systems.

2002–2003, but after that Cisco continued to grow in 2004–2005 (Table 2).

3.2. Cisco's M&A activities

Most of the successful companies like IBM and Intel are very proud of their innovations since they concentrate their resources on internal R&D. As an emerging company in the early 1990s, Cisco adopted a new thinking of managing innovation by acquisition in order to fulfill its dream of growth, favoring reasons for external growth. Between 1993 and 2005, Cisco acquired 106 companies (as shown in Table 3).

Most Internet start-up companies were unable to survive during the path leading up to and following the Internet bubble. They faced not only market obsolescence but also financial problems. However, Cisco made acquisitions when it wanted to expand its product offerings' capabilities into different areas or when it wanted to pick up technologies that, when linked in a hybrid network, might be a substitute for its routers (Cusumano and Gawer, 2002). Such an M&A process has enabled Cisco to diversify its technological capabilities into telecommunications and other businesses.

4. Analysis of business ecosystem

An ecosystem provides an emerging landscape for business operations. It is different from industrial standards or a patent pool since business ecosystems pay more emphasis on symbiosis and co-evolution. With the iPod as an example, before its introduction there were too many MP3 players already in the market, but none of them could successfully tie into consumers, entertainment companies, and other manufacturers. The well-known case of VHS and Beta is also an example of how to recruit past and future participants to cooperation (Howells, 2005). In the case of Microsoft, the company's performance depends on the health of independent software vendors and systems integrators (Iansiti and Levien, 2004). For the case of Cisco, it develops its own technological roadmap by an M&A strategy and creates business

Table 3
Cisco's acquisitions, 1993–2005.

Year	Companies
1993	Crescendo Communications
1994	Newport Systems Solutions, LightStream, Kalpan
1995	Combinet, Internet Junction, Grand Junction Networks, Network Translation
1996	TGV Software, StrataCom, Nashoba Networks, Telebit Corp., Granite Systems, NETSYS Technologies, Metaplex, Inc.
1998	PipeLinks, Inc., Selsius Systems, Inc., Clarity Wireless Corp., American Internet Corp., Summa Four, Inc., Class Data System, Precept Software, Inc., NetSpeed, Inc., WheelGroup Corporation
1999	Fibex Systems, Sentient Networks, GeoTel Communications, Amteva Technology, Transmedia, StratumOne, Calista, Inc., MaxComm Technology, Monterey Networks, Cerent Corp., Cocom A/S of Copenhagen, Webline Communications, Tasmania Network Systems, Aironet Wireless, Worldwide Data Systems, V-Bits, Inc., Internet Engineering, Group, L.L.C., Pirelli Optical Systems
2000	Compatible Systems, Altiga Networks, Growth Networks, Inc., Atlantech Technologies, JetCell, Inc., InfoGear Technology, SightPath, Inc., Pentacom Ltd., Subsidiary of Seagull, Semiconductor Ltd., ArrowPoint, Qeyton Systems, HyNEX Ltd., Netiverse Ltd., Komodo Tech., Inc., NuSpeed Internet Systems, IPmobile, Inc., PixStream, Inc., IPCell Technologies, Inc., Vovida Networks, Inc., CAIS Software Solutions, Active Voice Corporation, Radiata, Inc., ExiO Communications
2001	Allegro Systems, Inc., AuroraNetics, Inc.
2002	Hammerhead Networks, Navarro Networks, Inc., AYR Networks, Inc., Andiamo Systems, Inc., Psionic Software, Inc.
2003	Okena, Inc., SignalWorks, Inc., Linksys Group, Inc., Latitude Communications
2004	Andiamo Systems, Twingo Systems, Riverhead Networks, Porket Networks, Actona Technologies, Parc Technology, P-Culb, NetSolve, Inc., Dynamicsoft, Inc., Perfigo, Jahi Networks, Inc., BCN Systems, Inc., Protego Networks, Inc.
2005	Airespace, Inc., Topspin Communciations, Sipura Technology, Inc., Vihana, Inc., FineGround, M.I. Secure, NetSift, Inc., Kiss TechnologyA/S, Sheer Networks, Inc., NemoSystem Scientific—Alanta, Intellishield Alert Manager

Note: The data source is the website of Cisco systems, Inc.

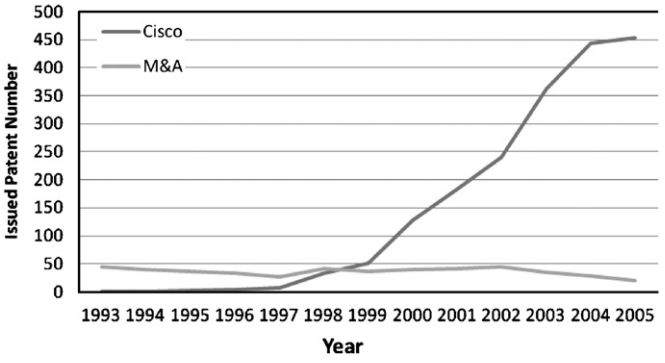

Fig. 2. Cisco's Issued Patent Number.

ecology around its own technology standards. Cisco not only builds its standards, but also works hard to help others to achieve their own benefits. As shown in Fig. 2, Cisco has kept a stable number of patents from its M&A firms. The number of issued patents from its M&A firms surpasses the number of patents issued to Cisco before 1999. Here, one gets a glimpse into the secret background of Cisco's patent strategy. Patent data are used to assist our discussion over Cisco's ecosystem in the following sections.

4.1. Cisco's technological path

Cisco has developed scalable business models that enable the company to meet the challenges posed by its continued explosive growth through an M&A strategy. From Cisco's issued patents

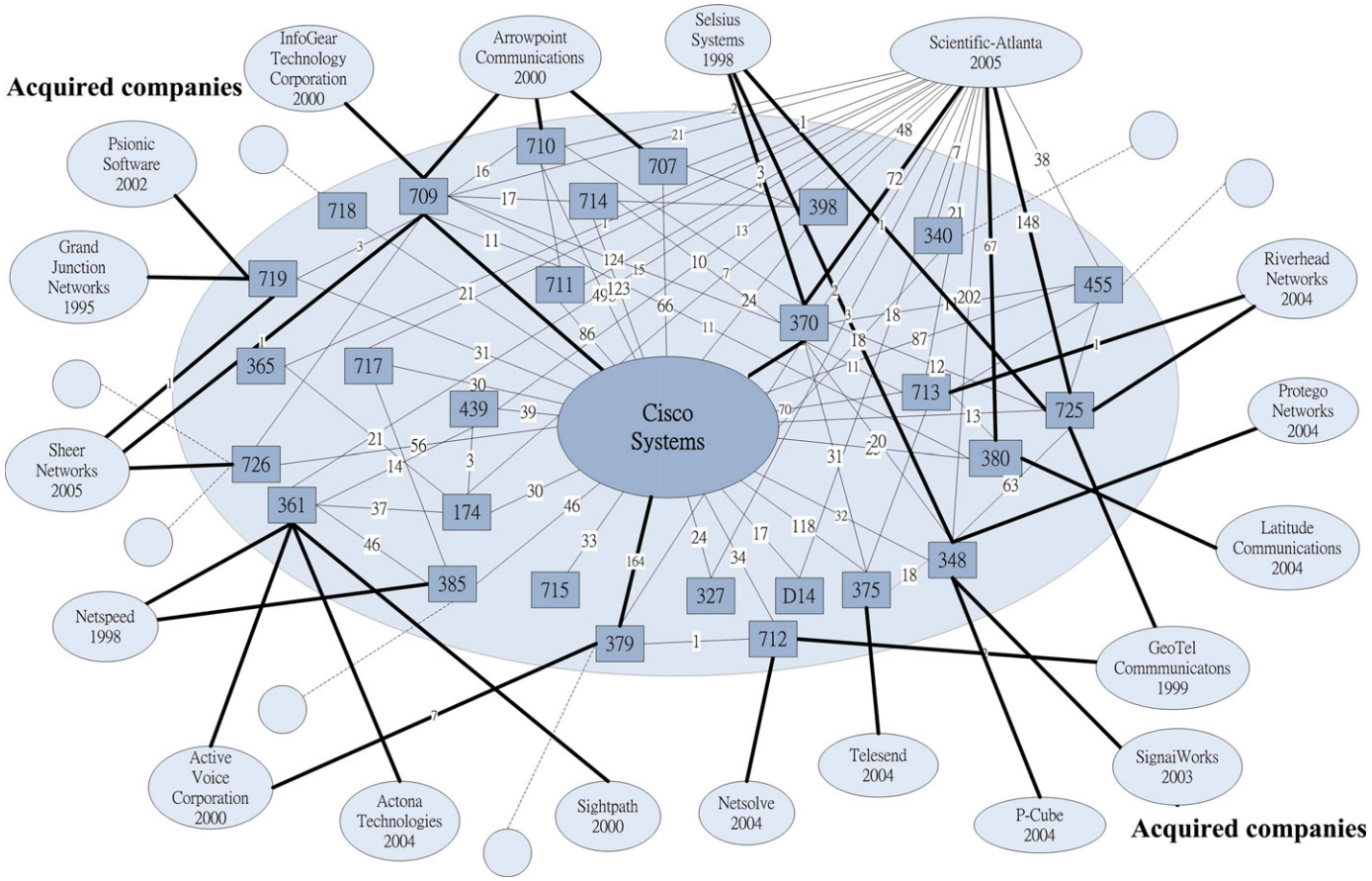

Fig. 3. Cisco's Ecosystem (I). *Note:* The numbers by the side of lines are the co-occurrence frequency between company and UPC. The numbers in the squares are the UPC that shows the technological domains. The threshold of frequency of UPC is set to 20 in order to reduce the complexity in the figure.

before and after 1999, it is quite clear that the M&A strategy has provided a growing list of patents for new product delivery. After 1999, Cisco's number of patents began to overpass its M&A firms. In order to further explain this complex ecosystem, the number of issued patents during 1993–2005 is used to demonstrate Cisco's technology roadmap.

This research collects 2374 US patents from Cisco and its 106 acquisitions. We use M&A targets (assignees) and technology classification (UPC) to draw the relationships as depicted in Fig. 3. By acquiring Scientific-Atlanta in 2005, Cisco enhanced the patent portfolio for running large-scale video networks such as UPC 398 (optical communications), UPC 713 (electrical computers and digital processing systems), UPC 348 (televisions), UPC 370 (multiplex communications), and UPC 725 (interactive video distribution systems). Fig. 3 indicates that Scientific-Atlanta is also important for network television and interactive video distribution systems.

Acquired firms such as GeoTel Communication in 1999 began to provide Cisco with a patent pool to commit to a new communications network, where data, voice, and video traffic travel over a single network infrastructure based on an open, standards-based Internet architecture. Acquisitions such as Signal Works (in 2003), Riverhead Networks (in 2004), Protego Networks (in 2004), P-Cube (in 2004), and Scientific-Atlanta (in 2005) provide complementary products and technologies for Cisco to lever its network business. The technologies from M&A also create emerging ecotones that are a transition area between two adjacent domains. The figure helps to understand how Cisco has established its ecosystem by an M&A strategy around its core, resulting in value creation from its ecotone.

Like an individual species in a biological ecosystem, each member of a business ecosystem ultimately shares the fate of the network as a whole. The platform offers know-how and services to enable other members to achieve synergistic effects on new product development. As a result, Cisco can use a price higher than what the market offers to acquire its targets. Cisco leads its acquired companies in creating platforms for services and technologies that other members of the ecosystem can use to enhance their own performance. Cisco focuses its resources on establishing a business ecosystem, and M&A is a major strategy that makes its value chains move toward value ecology through the incorporation of suppliers and business partners.

4.2. Business operation and ecosystem

Many ecological organizations fall outside the traditional value chain of suppliers and distributors that directly contribute to the creation and delivery of a product or service (Iansiti and Levien, 2004). M&A strategies usually fail to synergise the different cultures and organizations. Cisco's method is to maintain the culture and human resources of its acquired companies and only plays an integration role in connecting all members to a new technology portfolio. This strategy helps the members in the ecosystem to be independent, yet they co-evolve with Cisco's roadmap. Mayer and Kenney (2004) show that Cisco's turnover rate after an acquisition is under 10% as compared to 40–80% for an average acquisition (O'Reilly, 2000). Cisco's ecosystem strategy provides symbiosis opportunities between the next-generation

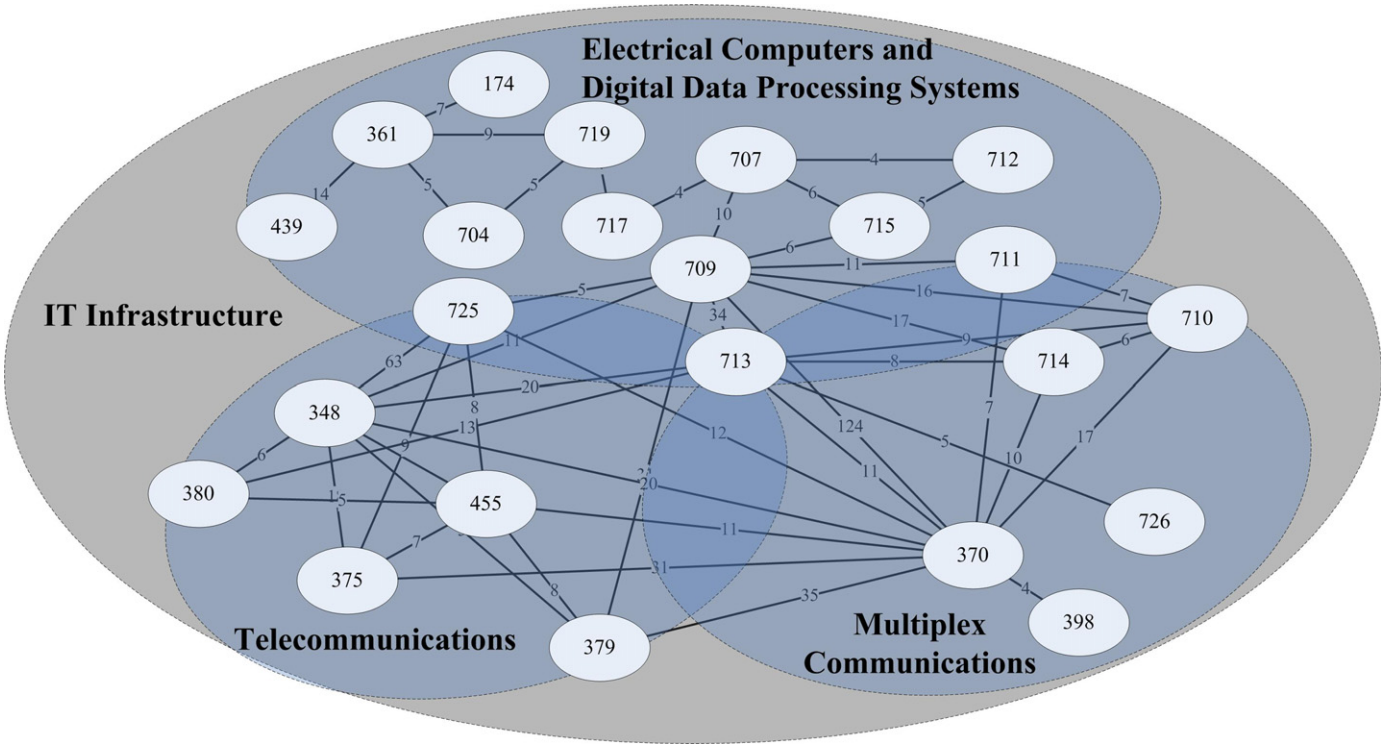

Fig. 4. Cisco's Ecosystem (II). *Note:* The relationships in Fig. 4 are by the diversification of UPC. The numbers by the side of lines are the co-occurrence frequency among UPCs. The numbers in the circles are the UPC that shows the technological domains.

products and Cisco's technological roadmap, which helps benefit not only the acquisition companies but also their employees.

By establishing a business ecosystem, Cisco dominated key networking standards and sustained high growth rates throughout the 1990s. In terms of product and technology strategies, Cisco consciously worked to establish its IOS (Internetwork Operating System) as a proprietary standard for network equipment. Treacy and Wiersema (1995) comment that Cisco has built a business ecology consisting of providers of complementary services attracting users to its ISO standard market by creating a business ecology that includes network engineers trained in Cisco technologies, hardware companies that build products based on the Cisco standard, and software developers that create complementary applications. To this end, Cisco had created its Partner e-Learning Connection (PEC) to increase productivity and revenue generation worldwide (Fig. 4).

Fig. 3 clusters the UPC numbers to conceptualize Cisco's ecosystem. There are three major clusters: electrical computers and digital data processing systems, multiplex communications, and telecommunications. Cusumano and Gawer (2002) show that a platform leader with vision should extend itself beyond current business operations or technical specifications of just one product because platform leaders can create an industry ecosystem greater than the sum of its parts. In this case, Cisco understands the impact of fierce competition in the contemporary business environment, and thus in-house R&D is inferior to leveraging excellent outside firms.

Kraemer and Dedrick (2002) study the problem of how to sustain a business ecosystem from the information system perspective. They regard that Cisco uses Internet and e-commerce technology to support its strategy in several ways: (1) to create a business ecosystem to reinforce its control of key technology standards in the networking market; (2) to create a virtual organization, outsourcing many operational and customer service functions and focusing its own resources on its core product innovation strategy; and (3) to showcase its own use of the Internet as a marketing tool. Within the high-tech market, technology standards move in a highly dynamic environment. As such, Cisco's strategy focus needs to maintain a platform for product innovation, such as external M&A to keep up competitive advantages and encourage internal cooperation for a product's timing to the network market. As shown in Table 4, M&A targets that have complemented Cisco's technology portfolio include UPCs 348, 398, 455, 713, and 725. In the five technological areas, Cisco owned fewer than two issued patents before 1999. The firm's M&A targets have not only provided a patent portfolio to complement Cisco's technology but also increased Cisco's patent pool significantly during 1999–2005.

Table 4
Technology capability between Cisco and M&A targets.

UPC	CISCO 1993–1998	M&A target 1993–1999	CISCO 1999–2005	M&A target 1999–2005
370	31	27	913↑	38↑
348	1	112	31↑	97↓
713	1	8	70↑	16↑
725	0	62	21↑	63↑
398	0	19	20↑	26↑
455	0	24	88↑	16↓

Note: M&A target means GeoTel communications, Scientific-Atlanta, Riverhead networks, and Signal works.

5. Discussion

A business ecosystem as a strategic logic is an emerging issue, but not one of the new taxonomy. The most debatable question is

why is it important to business managers? Or: are other supply-chain systems like the automakers not a business ecosystem? In Section 2 we also distinguish these concepts from other similar forms such as industrial ecosystem, organizational ecology, and evolutionary economics.

For the first question, we have plenty of discussion already about what characteristics comprise a business ecosystem—symbiosis, platform, and co-evolution. A business today is positioned within a complex industrial system, much like that which drives Cisco to collaborate with other M&A companies to gain profits together. Each company can be a part of a robust ecosystem that enjoys relative predictability, and the relationships among members of the ecosystem are buffered against external shocks (Iansiti and Levien, 2004). The symbiosis of a business ecosystem shares the fate of the network as a whole, regardless of the network members' apparent strength. Admittedly, standards are important to high-tech companies. Nevertheless, a platform has a strong impact within a business ecosystem.

In this paper, Cisco strives for technical excellence, creating a culture that encourages engineers over the world to actively solve industry-wide problems that envision the whole system toward a co-evolution. Such a platform not only is built on the basis of intellectual properties but is also a development portal for all of its partners. An M&A strategy helps Cisco to concentrate on internal partners to provide the necessary capabilities in complementary areas that support them, which are far too complex to be completely developed by a single company. Mayer and Kenney (2004) compare Cisco with its competitors such as Nortel, Ericsson, and Lucent (they are all aggressive acquirers), but the performances are quite different. Evidence can be seen in Cisco providing not only the technological standards for product development but also the learning portals for platform users. As Moore (2006) shows, markets, hierarchies, and ecosystems are the three pillars of modern business thinking and should provide the foundation for competition. These discussions lead us to envision more possibilities of a business ecosystem under contemporary strategy theories.

The second question is: are other supply-chain systems like automakers not a business ecosystem? The question is whether anything that has a system is usually called an ecosystem. Therefore, Moore (1993) and Iansiti and Levien (2004) use "business ecology" or "business ecosystem" to distinguish between other taxonomies. Horn (2005) mentions that the automakers produce cars today, but they do not make many of the underlying components that go into them as Ford did in 1920. For example, Ford was planting rubber trees in Brazil to ensure its supply for tires. Admittedly, automakers nowadays have changed the way they operate the business. Thus, Moore (2006) comments that there indeed are automobile business ecosystems. Therefore, the newness is the comprehensive conceptual ecosystem approach to that business and not the term itself.

Finally, industries have their own systems that are not yet a business ecosystem. A business ecosystem transfers the business strategies from a single co-work to synergic and systematic cooperation (the first characteristic), from product competition to platform competition (the second characteristic), and from single growth to co-evolution (the third characteristic). Those characteristics allow us to use a business ecosystem as a new paradigmatic strategy to examine the methods of Cisco's success.

6. Conclusions

Some researchers assert that the business ecosystem enables an emerging growth strategy, but only a few papers support this perspective. This study is important as it not only demonstrates Cisco's ecosystem, but also introduces its technological path through patent data. For managers, the inspiration they can get from Cisco is that a firm which relies on external partners can indeed provide the necessary capabilities for the health of its ecosystem. An M&A strategy provides a speed-up approach to complement a firm's core technological portfolio. On the other hand, those companies that are acquired can expand the boundaries of their own business within the emerging ecosystem. As a leader in the ecosystem, a firm should focus on product innovation in order to leverage a partner's advantage. Thus, knowledge created from ecotone between different technological domains and knowledge shared on the platform are two important factors.

In this paper, we use patent data to present the complex relationships between M&A targets and technology development. Cisco uses M&A as one of its major corporate strategies to generate its own business ecosystem and continues to build up technology inventory in anticipation of maintaining its growth rate. The empirical data show that Cisco's development has continuously established its core technology through an M&A strategy. Symbiosis, platform, and co-evolution are three characteristics of a business ecosystem that can be used to analyze Cisco's growth opportunities.

We believe that this paper provides a sophisticated beginning about how Cisco has grown its ecosystem, yet more case studies should be raised by researchers for further discussion in the future. Having acknowledged the limitations of the case study using patent and M&A data, we nevertheless confirm partial relationships within a business ecosystem. Despite the patent and M&A data being important, further data such as strategic alliance, co-development, joint company, subsidiary company, network externality, and geographical agglomeration should been used to enhance our understanding in different cases. For example, how physical proximity (Porter, 1998; Cooke, 2001; Takeda et al., 2008) affects the cooperation in a business ecosystem and how network externality (Katz and Shapiro, 1986; Dranove and Gandal, 2003; Dew and Read, 2007) enhances the relationships in a business ecosystem are two potential and interesting issues for us.

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