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CREATION PROCESS OF RESEARCH-BASED SPIN-OFFS:

AN EMPIRICAL ANALYSIS

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CREATION PROCESS OF RESEARCH-BASED SPIN-OFFS:

AN EMPIRICAL ANALYSIS

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CHAPTER 1

INTRODUCTION

University spin-off has increasingly become an interesting concern in contemporary life. This represented in both the increase in the number of the new ventures over past decades and their contributions in many economies. From 1996 to 2001, 554 spin-offs were created in The United Kingdom (Wright, Vohora, & Lockett, 2002). In The United States, between 1980 and 2000, only 3,376 new spin-offs were established, but these companies, on average, achieved extreme success (Pressman, 2001). By analyzing new spin-offs that entered the American market from 1980 to 1986, Shane and Stuart (2002) found that 18 percent of those companies were from the Massachusetts Institute of Technology (MIT). These spin-offs obtained initial public offering (IPO) over 257 times higher than the average. Furthermore, a university spin-off represents an important firm formation as an economically powerful subset of high-technology start-ups in many industries such as biotechnology, chemistry, and information technology. Many scholars have studied the success of those spin-offs through the influences of internal-factor and external-factor approaches. Although an entrepreneurship process comprises both foundation and development phases, most of the scholars have focused on the later stage. Several scholars have studied the influences of a new firm's capabilities on its performance, but have omitted to show how social capital and entrepreneurial capabilities of the entrepreneurial teams contribute to entrepreneurship processes. In this study, we analyzed the influences of the social networks and the capabilities of entrepreneurial teams on the success of spin-off creations and on the current performance of the firms. The results revealed direct effects of entrepreneurial capabilities and indirect influences of social networks on the spin-off's

performance, as well the contributions of social elements on the spin-off creations. These lead us to understand how the pre-established factors of a firm determine its market entry and performance.

1.1. Spin-off definition

Merriam-Webster's Collegiate Dictionary describes a spin-off as a collateral or derived product or effect that is an imitation or derivation of an earlier work. Based upon the relationships between the spin-off's products and the previous activities of its parental organization, a spin-off refers to a new firm formation. This new company creates new economic activities by offering distinct products or services from their parental organizations (Ito, 1995). The independence of spin-offs is represented in the management, risk control, and benefit distribution. In large organizations, spin-off formation is also a device to restructure a firm's operations (Cornell, 1998; Markides, 1995). This formation depends on the levels of support or encouragement from the parental organizations to create and to shift to new entrepreneurial activities. Spin-offs are the products of the technology transfers, and are determined by various levels of the parent-organization's ownership.

In this study, a university spin-off refers to a new company that was founded by current students or faculties of universities to exploit their inventions. This definition differs from other previous relative research. Roberts (1991) defines a spin-off as a company that was founded by anyone who has studied or worked at a university. According to this, the university spin-offs will include a wide range of new companies that were founded by former students or faculties of the universities in many earlier years. Eventually, the investigations cannot handle the huge number of objects, and this leads to theoretically meaningless results. Other scholars define that spin-offs also include the companies in which academic scientists work as scientific advisors. This is an obscure definition because there has been a huge number of scientists who worked in the advisory board of the faculty, and this definition focuses neither on the founders of spin-offs nor on exploitation of the potential

opportunities. Thus, this study considered a university spin-off as a new firm that is created by current students or faculties, and was based on the formal or informal transfers of invented technologies or knowledge (Smilor, 1990).

1.2. Classification of university spin-offs

The classification of spin-offs has been based on a variety of conceptual perspectives. Several scholars have studied the institutional environment of spin-offs, and others have used a resource-based approach to study spin-offs. By basing their studies upon the business and venture models, most of the scholars have classified the spin-offs as the following.

The resource-based perspective

The resource-based theory has become one of the most influential frameworks in strategic management researches regarding to the organizational resources and capabilities (Barney, Wright, & Ketchen, 2001). This theory defines organizational resources as all tangible and intangible assets of firms. Tangible resources comprise financial capital and physical assets, such as all equipment and factories of the firms. Brand name and the reputation of the firms constitute the intangible assets. Resources of the companies also include personal-based resources such as technical know-how, organizational culture, employee training, and loyalty, etc. (Grant, 1991). In another study, firm's resources comprise physical, human, and capital resources (Barney, 1991). The growth of a new venture requires a combination of capital, organizational system, managerial knowledge, employees, reputation, technologies, physical resources, leaderships, and organizational structure and culture of the firms (Lichtenstein & Brush, 2001). Thus, spin-offs can be classified by looking at four principal categories, which comprise technological, social, human, and financial resources.

Technology resource is associated with the specific products and technologies of the firms (Borch, Huse, & Senneseth, 1999). Spin-offs can be classified based upon the *degrees of innovativeness*, scope of used technologies, company's positions in the product-development cycles. The degrees of innovativeness are determined by whether the technology-based of spin-offs are disruptive, or if their new technologies have the potential to outperform completely the old technologies (Christensen, 1997). These companies are called VC-backed (venture capitalist) spin-offs if they initiate and become pioneers. These spin-offs offer *new products or services* that are in extremely early development process and unknown in the market. These companies need to develop their products or services, and have to perform first market test to collect initial customer's feedback. Furthermore, those start-ups need to look for ways of raising capital such as soft loans, R&D subsidies or business angel money (Autio, 1997; Heirman & Clarysse, 2004). The consulting start-ups normally already have a customer to start with while the manufacturing start-ups commence by developing a beta version of their products or services (Autio & Lumme, 1998). The spin-offs are faced with diversity of risks and potential customers because of the breadth of their new technology. However, the spin-offs require more capital, and the market knowledge is likely to be more important than technology (Hindle & Yencken, 2004).

The financial resources mainly refer to amounts and types of fundraising, which can be from personal or external funds. The levels of *venture capitalist involvements* are different in each start-up because of the distinct attractions of each spin-off's proposal. Venture capitalists only invest in potential projects, and this determines the business and growth models. These investments are not only from public VCs but also from larger VC companies. These venture capitalists usually belong and commit themselves to one consortium as financial providers. At least, one venture capitalist specializes in the technology domain of the start-ups, and provides finance in the first round of

fundraising. Based upon the proposals and financial demands, the spin-offs will select and focus themselves on a specific financial resource such as public funds, university funds, business angel funds, or individual business angels (Heirman & Clarysse, 2004). Each investor has different expectations of the existing and potential success of these start-ups. A project of higher risk with non-financial motivation can be supported by the public funds, university pressed funds, and business angles. However, the spin-offs must build their organizational structures, and illustrate their strategies and sustainable growth.

Financing mix is another broader form of financial resources that includes soft loans and debts from the banks, and subsidies from R&D-granting institutes. To obtain this redundant external capital on the market, the spin-offs must be received with the substantial credibility evaluations from the investors. In the first period, the financial suppliers carefully evaluate their business relationships with spin-offs in terms of payment period or leasing contract. The spin-offs insufficiently convince the banks about their debts (Mustar, 1997; Wright, Birley, & Mosey, 2004; Wright, Vohora, & Lockett, 2004) and this leads to limitation in the financing mix of spin-offs.

The entrepreneurial teams need to be *balanced* in terms of the functional background and business experience. The venture capitalists are likely to invest in the spin-offs of balanced teams. The entrepreneurs must cooperate with their partners or find surrogate entrepreneurs as partner-ups. In specific circumstances, before the venture capitalists invest in the proposal projects, they request the entrepreneurs to complement the teams by recruiting managers. The quality and experience of the entrepreneurial teams must meet the requirements of the venture capitalists (Shane & Stuart, 2002; Radosevich, 1995; Franklin, Wright, & Lockett, 2001). In some circumstances, the surrogate entrepreneurs receive payment from companies, incubators, or an appropriate management fee according to industry standards.

Most of the entrepreneurial teams possess a limited experience in specific sectors, which is an important factor in human-resource category. Although the managers of spin-offs are surrogate entrepreneurs or external recruitments their experience and relationships in the industries are rarely sufficient to guarantee a success afterward (Fontes, 2001; Hindle & Yencken, 2004; Pirnay, Surlemont, & Nlemvo, 2003).

Social resources refer to the relationships of spin-offs with others in industries and in financial networks (Brush, Greene, & Hart, 2001). Generally, the spin-offs lack these resources, and focus solely on the opportunities to sell their products or services. In the early stages, the spin-offs difficultly balance their budgets with difficulty by satisfying their customers and achieving returns from the markets. Networks are likely to be an important device to obtain financial supports and to increase their capital for development stages. The prestige of the research departments is an important principle to increase the credibility and to attract more investors (Lindelof & Lofsten, 2004; Nicolaou & Birley, 2003; Westhead & Storey, 1995).

The business model perspective

The business model perspective is the identification that emphasizes market segments, and is the articulation of the value proposition among the value chain, estimated cost structure, and profit margin (Chesbrough & Rosenbloom, 2002). This model is based upon undertaken activities that comprise consultants, product orientation, and technology asset oriented modes (Stankiewicz, 1994). Other studies classify university spin-offs into two principal types namely service and product orientation (Chiesa & Piccaluga, 2000; Pirnay, Surlemont, & Nlemvo, 2003). By examining the transformation approaches that emphasize the methods of technology or knowledge commercialization, many studies classify spin-offs into infrastructure or platform companies

(Branscomb & Auerswald, 2001; Heirman & Clarysse, 2004; Druilhe & Garnsey, 2004), product or service companies (Chesbrough & Rosenbloom, 2002; Bhide, 1992; Aggarwal & Bayus, 2002; Bower, 2003), companies moved from products to platforms (Heirman & Clarysse, 2004; Chiesa & Piccaluga, 2000), and prospector companies (Druilhe & Garnsey, 2004; Heirman & Clarysse, 2004). Others classify spin-offs by analyzing their growth, and introduce fast, slow and transitional growers (Tiler, Metcalfe, & Connell, 1993). Autio and Lumme (1998) failed to find the growth of most of the high-tech spin-offs in Finland. This resulted from their limited ambitions to grow, or from the lacks of clear commercial strategies.

The institutional perspective

Institutional perspective emphasizes the spin-off's exploitation of the intellectual properties that were invented by scientific activities of parent organizations. Each parent organization maintains the connections with their spin-offs in distinct ways. This is caused by the diversity of their own culture, incentive systems, rules and procedures (Moray & Clarysse, 2005). In this perspective, most of the scholars emphasize how institutional contexts determine the commencement's configurations, and motivate the spin-off's development (Dacin, 1997). Based upon the degree of dependence on resources of technologies, Roberts (1991) introduced three categories included direct, partial and vague. “Direct” category means technologies transferred directly to the spin-offs from their parent institutions. “Partial” category describes spin-offs founded by formal transfers of Intellectual Property rights, but necessitated expanding the know-how with other know-how sources. “Vague” refers to the spin-offs that were founded for reasons other than formal technology transfers. Informal technology transfers refer to non-institutionalized relationships while formal ones imply spin-offs had relationships with parent organizations through various kinds of licenses.

Meyer (2003) indicated that the policy choices of parent organizations not only influence the number of spin-offs, but also create spin-off types. According to Clarysse *et al.* (2005), at the parent organization level, organizational modes comprise low selective, supportive, and incubator styles. The low selective mode refers to maximizing the entrepreneurial ventures in terms of start-up sizes and configurations. The supportive mode implies university spin-offs that are created with average resource intensity to alter the licensing. The incubator mode is associated with university spin-offs of tradable assets. Moreover, the physical property-based context is an important dimension regarding to the institutional links between spin-offs and their parent organizations. To facilitate the university spin-off's creations and developments, universities use incubators and science parks as environment (Phan, Siegel, & Wright, 2005; Siegel & Phan, 2005). However, the physical relations differ in each organization mode (Clarysse, et al., 2005). In the low selective mode, parent organizations offer office spaces and infrastructures with very limited technical, financial, or human capitals. Regarding to the supportive mode, in technology transfer offices, parent organizations set up restricted facilities, pre-seed capital funds, and permanent staffs to support spin-offs. The incubator mode describes the extensive incubator facilities and networks, and the forms of access to financial resources and specialist human capital.

1.2. Importance of university spin-offs

University spin-offs with society

University spin-offs generate significant economic values. These companies directly or indirectly influence the economy in terms of financial contributions. They normally indirectly affect the economic development rather than directly affect it (Goldman, 1984; Mustar, 1997). University spin-offs enhance the stability of local economies through increasing the diversification and reducing the dependent on old industries (McQueen & Wallmark, 1991). They improve quality of products and

services, and generate new innovative products and services more than other kinds of start-ups (Blair & Hitchens, 1998; Dahlstrand, 1997). University spin-offs find solutions for unsatisfied customers, but other firms offer their products or services to satisfy the needs of important clients. In the life sciences, university spin-offs generate new products or services to enhance the quality of human life.

University spin-offs importantly contribute to the economic development by *creating more jobs*, especially for highly educated employees. For some scholars, university spin-offs averagely offer more jobs than small business ventures in many countries (Blair & Hitchens, 1998; Kobus, 1992). According to Pessman *et al.* (1995), the job-creating values created by university spin-offs are likely to be more important than the number of jobs. University spin-offs create more knowledge-intensive jobs for highly educated people than other technology-based new ventures (Blair & Hitchens, 1998).

University spin-offs induce investments in academic institutions. Most of the academic institutions ache to attract more investments from diverse resources because of their reputation, which derives from their prior successful spin-offs, to improve their researches and to develop their proposals. The study of Pressman *et al.* (1995) also found that university spin-offs attract investments to develop and to commercialize new knowledge or technologies more effectively than other start-ups.

University spin-offs improve local economic development. The academic entrepreneurship processes transfer new knowledge and technologies into business opportunities. University spin-offs have significant multiplier influences on the local economic activities because of their region-based activities such as hiring, sourcing of supply, and production. New technology companies tend to cluster, but university spin-offs magnify the economies. Lowe (2002) believes that spin-offs become catalysts for the geographic cluster formation of new firms.

Other new start-ups contribute to the local economic development less than university spin-offs, which are close to the laboratories from where technologies emerged. Towards established firm licenses, there are three reasons for greater geographic localization of spin-offs. Entrepreneurs usually utilize the laboratories to keep the inventors involved by conducting additional contracts for research (Wilson & Szygenda, 1991). The geographic localization helps the inventor-entrepreneurs keep their participations after spinning off (Zucker, Darby, & Armstrong, 1998). The other established company licensees normally already had the geographical base of their operations, and they are hardly to move to other locations (Wright, Vohora, & Lockett, 2002; Wallmark, 1997). Therefore, the university spin-offs are geographically more localized than other new ventures. Roberts (1991) found that these spin-offs tend to be established in the same city or state where their laboratories and parental universities are located.

Spin-offs and universities

A university spin-off represents an *effective commercialization device for uncertain technologies*. In early stages, technologies of academic institutions cannot license because the external firms are unwilling to invest in these inventions. Most of the existing companies prefer licensing in later stages of academic inventions (Thursby & Thursby, 2000; Thursby, Jensen, & Thursby, 2001). Academic institutions found new spin-offs because they ache to commercialize and develop their inventions that existing companies could not license (Matkin, 1990).

University spin-offs effectively encourage inventor's involvements that are needed in the processes of technology commercialization. The technological commercialization requires these commitments for additional developments (Jensen & Thursby, 2001). The inventors prefer committing to university spin-offs to being involved in the existing companies. Most of the scientists believe that

the university spin-offs contain more interesting and challenging projects than existing companies (Kenney, 1986). Researchers believe that they properly work in the university spin-offs rather than work in established companies. Spin-offs focus their attention on technological developments rather than on the business aspects. Researchers prefer contributing more to the technology development processes. Moreover, spin-offs can provide holding equity to inventors more easily than established companies. In other words, the holding equity is easily distributed to research projects without transferring equity from someone else. Thus, to ensure inventor's involvements in spin-offs, using equity is more effective than others (Jensen & Thursby, 2001).

Spin-offs promote university operations. University spin-offs significantly enhance their institution's investigations by supporting the scholars. Louis *et al.* (2001) found that researching productivities of the faculty positively relate to their entrepreneurial activities. The university spin-offs provide funds for investigators in the forms of grants, financial supports for the development of laboratories, donate equipment, and pay for education of PhD students (Hsu & Berstein, 1997). With successful spin-offs, universities improve their reputation led to attract more productive scientists. By financial support through faculty's salaries, universities can maintain their scientists and engineering faculties (Matkin, 1990). University spin-offs represent the effective mechanism to protect the faculties from the attacks of industry with higher payment jobs (Powell & Owen-Smith, 1998).

University spin-offs also provide facilities for *student training*. Entrepreneurial activities have become increasingly common in the universities. The knowledge about start-up creations provides useful experience for education (Richter, 1986). Students mostly work in private companies after graduating rather than continuing research in the universities. The experiences of technological commercialization and developing start-ups in the market provide more practical knowledge for student's careers (Etzkowitz, 2003). Furthermore, university spin-offs are more helpful to learn the

commercial usages for new technologies than to provide scholarly articles for university inventors (McQueen & Wallmark, 1991).

1.3. Problem definition

There has been a prominence in researches related to entrepreneurship over the past decades (Welter & Lasch, 2008). Numerous studies in entrepreneurship have been published in handbooks and journal issues. According to Welter and Lasch (2008) and Hisrich and Drnovsek (2002), most of the European research focuses on the environment that influences spin-offs. Schumude, Welter, and Humann (2008) and Blackburn and Smallbone (2008) founded similar results from Germany and The United Kingdom. Furthermore, in the environmental aspect, the discussions on social dimensions of entrepreneurship were initially published in Europe (Landstrom, 2005). O'Donnell et al. (2001) generally classified entrepreneurial networks into inter-organizational networks and personal networks. This topic has increased in empirical studies, but most have focused on the structural elements of network players (Boissevain, 1974; Bryson, Wood, & Keeble, 1993; Larson & Starr, 1993; Ostgaard & Birley, 1994). These studies have almost neglected content and governance dimensions of networks.

This study involved the capabilities and social capital of the entrepreneurial teams in the entrepreneurship to know how these resources influence the successes of foundations and performances of spin-offs. We considered their capabilities as a multi-dimensional factor comprising of technology, human resource, strategy, and organizational and commercial capabilities. To study the social network factors, we analyzed their characteristics in three dimensions that include network structure, network governance, and network content.

1.4. Study's objectives

Research overviews

The overall goal of this study is to examine the influences of the factors before establishing a spin-off that comprise entrepreneurial capabilities and social networks on the success of the processes of spin-off's foundations and their performances. To delineate the research's goals, we determined the Spanish university spin-offs as the study's subjects. To analyze the entrepreneurial capabilities, we involved the technology, organizational capability, human resource, strategy, and commercial capability of founding teams. We divided these capabilities into two groups comprising original and necessary supplemental capabilities. We considered the network's characteristics in structure, governance, and content dimensions as the social capital of the teams before establishing the spin-offs. Additionally, this study analyzed the indirect effects of network factors on spin-off's performances through their influences on the entrepreneurial capabilities.

Contributions

The results reinforced the entrepreneurship theories toward the resource-based and social network approaches. Distinctively to the prior scholars, the capabilities of the founding teams considered both original entrepreneurial resources, and the necessary supplemental resources erected to transform the process into the next step. We measured the successes of foundation processes through evaluating the abilities of spin-offs in keeping the existing investors and attracting new investments because investors are solely interested in the potential proposals and start-ups with sustainable returns. This research also studied the social network in all dimensions that were neglected by prior scholars in entrepreneurship. We measured the performances of spin-offs in both financial and non-financial performances differently from previous entrepreneurial studies, which focused solely on

one of these factors. In general, this study supports the entrepreneurship theory through another approach. The topic of this study has been investigated in other countries, but is new in Spain with the distinctions in social activities, faculty's capabilities of universities, and market characteristics.

Organization of the study

This study is organized in five principal sections comprising introduction, literature review, methodology, analysis, and discussion and conclusion. The introduction part mostly describes overviews of entrepreneurship, and its impacts on the reality. The second part, literature review, represents entrepreneurship and social network theories. The entrepreneurial theory focuses on the foundation process of a spin-off and all internal and external influences. The social network theory explicates the structure, content, and mechanism of the networks. The hypotheses of this study were erected based upon the entrepreneurship and network theories, and the gaps from prior studies. To examine these hypotheses, an accurate method was deployed and expounded in the methodology part which also represents the process of data collection. To obtain necessary data for analysis, this study undertook the population definition, measurement construction, internet-based survey, and initially statistics. The analysis of this study deployed both exploratory and confirmatory factor analysis to adduce the hypotheses. Finally, the discussion and conclusion parts focus on advantages and disadvantages of the study, including its contributions to current theories, limitations, and additional suggestions for future researches.

CHAPTER 2

LITERATURE REVIEW

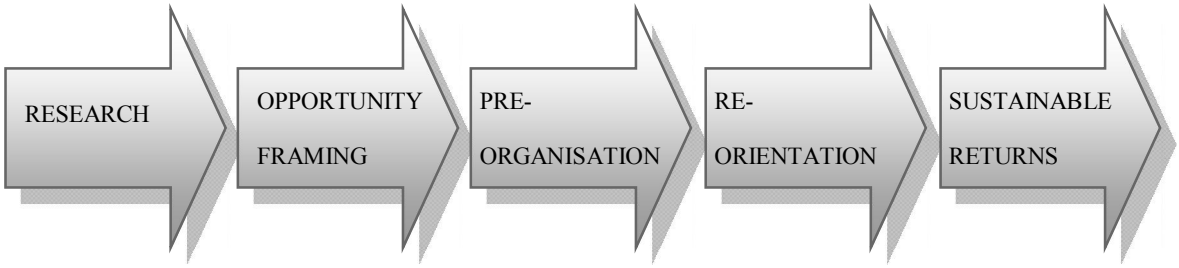
2.1. Entrepreneurship theory

Most of the current researches on spin-offs have assumed that the entrepreneurship includes the period of spin-off's foundation, and growth or development. The period of foundation involves all stages from incubations to launch of new ventures. Mustar et al. (2006) and Shane (2004) evaluated the period of development through the entry of spin-offs into the market and their positioning. The processes of spin-off's creations pass through five stages comprising the usage of research's funds, creation and disclosure of inventions, decisions to seek intellectual properties, marketing the technologies, and licensing decisions (Shane, 2004). In another study, Vohora, Wright, and Lockett (2004) indicated that the spin-off's foundation processes comprise five phases of research, opportunity-framing, pre-organization, re-orientation, and sustainable returns. Each period requires different activities and strategies of which entrepreneurs must focus on to develop from this phase to the other, although, in fact, these processes are non-linear and go through successive stages.

This study employed the foundation process model of Vohora, Wright, and Lockett (2002) (Figure 1). Initially, the universities utilize the financial supports from organizations, individuals, or government for their research projects that can be non-profit or for business purposes. In the second step, these researchers will concentrate on and pursue their investigations with projects or ideas for new inventions. The results from these investigations become opportunities for entrepreneurs, who know how to commercialize these inventions and generate financial returns. In the third step, the entrepreneurs pursue a spin-off's creation when they recognize the business opportunity from these

inventions. In the following step, entrepreneurs have to transfer their inventions to market and perform special surveys on their commercial potentialities. Otherwise, some of these inventions were licensed to the private companies because the results of researching projects are uncertain values, and because they rarely disclose the potential market values.

Figure 1: The Foundation's Process of Spin-offs



Source: Adapted from Vohora, Wright, and Lockett (2002)

Research phase

The researchers utilize financial supports to pursue their investigations. These resources can be from their own organizations, the government, or private supporters. In universities, the research support can be scholarships or fellowships, but in public research organizations, these projects are based on research budgets. Research projects in public research organizations are ordered by their own institutions with the purpose of new technologies or sciences to serve the society with or without profitable intention. However, most of the university research projects are initiated for non-business purposes. Universities must represent their significantly talented human resources and sufficient abilities to fundraise for determined research projects. The majority of scholars from universities receive the supports from industry or private firms who expect that the results will represent a problem's solution or will create potential developments. The federal government mostly provides

funds for universities through major government organizations such as National Institutes of Health, Department of Defense, and other agencies.

According to Lowe (2002), most of the academic institutions require their faculty, staff, and students to disclose their inventions as asserted property rights. To obtain the disclosures, the inventions must be new technologies that are novel, non-obvious, and valuable rather than real research results. Moreover, to be disclosed, the inventors must believe that their inventions will be under intellectual property protections for the technologies, and will be resources of institutions. Most of the academic entrepreneurs mainly focus on how to accomplish perfect scholarly articles and publish them to specific communities. In this phase, researchers involve getting records and rewards and creating the valuable intellectual properties contained the potential opportunities. Technology-based spin-offs were typically launched by the successful scientists who face problems in obtaining strong intellectual property protections if they are not experts in their field (Shane, 2004). The perfectly researching results will provide intellectual properties to drive new ventures.

Opportunity framing phase

By working independently or together, the academic technology transfer officers must recognize opportunities of researching results, and examine whether these opportunities are valuable to pursue commercialization in the future. However, before framing opportunities, the officers will evaluate the disclosures to decide whether their institutions should seek patents or copyrights for the inventions (Roberts & Malone, 1996). The investors can exploit their inventions for their own projects unless the universities claim to license them. Only the inventions that obtain the patents can be considered for next stages of the spin-off's creation processes. After obtaining intellectual property protections, inventions can be commercialized for new university spin-off's creations.

The inventions can fail to indicate an opportunity and to obtain the patents for commercialization. In some cases, the technology-licensing officers determine that the research results are not inventions because of failures in satisfying criteria of non-obviousness, novelties, and values. In other cases, the results meet these criteria but these officers believe that the financial returns are much lower than the costs to patent these inventions. The officers, thus, pass these inventions to the public.

In this process, the entrepreneurs and technology transfer officers evaluate the new technologies to ensure that they are workable and potential to apply outside the laboratories. Then these entrepreneurs attempt to determine potential markets and to learn how to access to customers for their business goals although the project evaluations can present various degrees of successes. The entrepreneurs can confront the insurmountable barriers in commercializing their technologies. These inventors might be lack acknowledge and experience to know how to create the commercial value, and to maximize the financial returns. The technology might lack suitable applications to develop, expertise to commercialize, or available routes to access to alternative markets. Those lead to pursue a project of imprecise definition and ambitious target, or an impracticable project.

The entrepreneurs might spend a few months or even a year framing opportunities because they failed to seek for suitable models to commercialize the new technologies. Thus, they must acquire other complementary resources such as the human, physical, financial, and technology. In some circumstances, they scrutinize the opportunities with prospective investors, customers, and other individuals in the industry to discover and to manage the potential risks from inherent weakness, deficiencies, and inadequacies. They must re-frame their commercial patents to decide to license or to co-develop toward profitable returns. A new venture is likely to be the best device to exploit opportunities despite the requirements to assemble the necessary resources and capabilities.

Pre-organization phase

The entrepreneurs must initiate their strategic plans that delineate what they need, where they get those needs, and what they do to exploit the resources and to form the new firms. They must identify their existing resources and capabilities, and supplementary resources and knowledge now and future. In this early stage, the entrepreneurs confront the challenges in recognizing the impacts of these elements on the successes of the new ventures. However, the defects in gathering necessary resources will negatively affect the future successes of the ventures. In this stage, the founders need to assess resources of prior entrepreneurial experience, human capital, and networks of expertise. The academic entrepreneurs must improve their activities in target industries, and the relationships with business people, surrogate entrepreneurs, and venture capitalists. To assemble these capabilities, they must spend more time and efforts developing their existing resources and capabilities, and gathering new necessary resources and knowledge. To achieve the goals, it requires the commitments of the key individuals who provide the initial resources and knowledge. In some cases, entrepreneurs inadequately obtain requirements so that they generate insufficient resources, capabilities, and social liabilities in growth stages. They should cooperate with their mentors, advisors, and other experts to reduce these potential mistakes to gather sufficient resources.

Re-orientation phase

The entrepreneurs must identify and assemble the capabilities that will be represented in the returns from values offered to customers. However, they must change these activities to accommodate to the uncertain environment. Thus, they must surmount and re-configure the challenges of the continuousness of resource's identification, acquisition, and integration (Galunic & Eisenhardt, 2001; Teece, Pisano, & Shuen, 1997). They must re-configure frequently to acquire sufficient resources

and expertise to fulfill deficits, and to integrate these new components into the firms. Entrepreneurs determine the solutions for the changes by interactions with their customers, competitors, suppliers, and potential investors. The inadequate and insufficient resources and knowledge in the previous phase might create problems and crises. With imprudent decisions and reluctant exploitations in earlier phases, the entrepreneurs might improperly pursue their projects. Insufficient-talent entrepreneurs will be unable to develop their inventions and to generate the maximum values from assets. These insufficiencies derive from the over-focusing on the technological developments and the neglecting concerns on identifying, accessing, and targeting key customers in the value chains. These entrepreneurs might have access to inadequate resources, information, and knowledge in the pre-organization phase. They might impossibly create proper solutions to exploit the technologies, to improve their market entries, and to access and acquire further resources. The reorganization and corrections motivate the entrepreneurs to reassemble and to rebuild their resources and capabilities, as well to improve continuously their technologies. These activities enhance entrepreneur's experience in testing the size of markets or adequacies of competitive technologies or methods. The entrepreneurs surmount better the adversities or the strategic uncertainties if they had adequate decisions in opportunity framing and pre-organization phases. The spin-off's founders must compromise adequately and sufficiently the tasks in prior phases to advance the creation processes.

Sustainable returns phase

The entrepreneurs must represent the signals that promise sufficient returns from their productive activities. They can develop their projects to the next stages only when they continuously receive financial support from existing and new investors. The potential investors evaluate the professional managements and commercial experience of the founding teams in developing and exploiting the technology platforms. Moreover, the financial providers require the spin-offs to move off the

incubators or the university campuses to business environments or the university-affiliated science parks. However, even moving off, the spin-offs still maintain the proximity to their universities with at least one academic inventor working as a technical advisor.

2.2. Social network theory

Traditionally, networking studies were discussed mostly in strategic management and business administration theories that considered the long-term relationships between companies, co-operations, strategic alliances, and joint ventures (Johansson & Mattson, 1987; McGee, Dowling, & Megginson, 1995; Witt, 1999; Lechner, 2001). The entrepreneurial networks and their effects on the successes of spin-offs were studied in long tradition as well (Birley, 1985; Aldrich & Zimmer, 1986; Johannisson, 1988). However, in this study, we analyzed the influences of networks on successes of spin-off' foundation and new venture's performances in perspective of other intermediate elements.

The sociological theories defined that the nodes of the networks are individual persons, and communication or information links are the relationships between these nodes (Bavelas, 1948; Granovetter, 1973; Freeman, 1978). As a definition of Walker (1988), a network includes single nodes (actors) and linkages between these nodes (dyads), and both of them are a whole form and structure of a network. The linkages, relationships, or dyads are process-based, and process is dynamic rather than static (Larson & Starr, 1993; Hoang & Antoncic, 2003; Hite & Hesterly, 2001). According to Larson and Starr (1993), relationships develop from simple and unidimensional dyadic exchanges to a dense set of multidimensional and multilayered organizational relationships. Similarly, in the study of Niemeijer (1973), the attributes of density characterize the whole networks. The network relationships comprise feeling of gratitude, reciprocities, respects, and friendships (Bourdieu, 1985). The relationships can be the bilateral or dyadic ties between two nodes within a

network, and these relationships contain attributes such as strengths, symmetries, and reciprocities (Lincoln, 1982).

Coleman (1988) and Burt (2000) defined social capital as the importance of networks that contain personal relationships, and provide the basis of trust, cooperation and collective actions. Burt (1992) and Loury (1977) described social capital as a set of embedded in relationships of individuals, communities, networks or societies. Social capital is formally defined as "the sum of actual and potential resources embedded within, available through, and derived from the networks of relationships possessed by individual social units" (Nahapiet & Ghoshal, 1998). In general, social capital was classified in three principal dimensions comprising structure capital, relational capital, and cognitive capital. The structure dimension of social capital refers to the overall pattern of connections among actors (Granovetter, 1992; Nahapiet & Ghoshal, 1998; Burt R. S., 1992; Wasserman & Faust, 1994; Krackhardt, 1992). The relational capital of social capital refers to the kinds of relationships which were developed in a history of interaction by actors. Relational capital was described as relational content, tie strength, and relational trust that especially focus on the respect, trust, and trustfulness and friendliness (Burt, 1992; 1997b; Tsai & Ghoshal, 1998). Cognitive capital refers to resources providing "shared representations, interpretations, and systems of meaning among parties" (Nahapiet & Ghoshal, 1998).

According to Dubini and Aldrich (1991), entrepreneurship is an inherently networking activity. Additionally, entrepreneurship is relational tasks because activities and interactions with other social or organizational partners generate resources of organizations and coordination (Bruderl & Preisendorfer, 1998). However, Kogut (1989) disagreed that managing networks is a difficult task. Therefore, the abilities of networking managements are required to utilize these external resources. There have been many scholars who have studied managerial abilities of firms, which relate to both

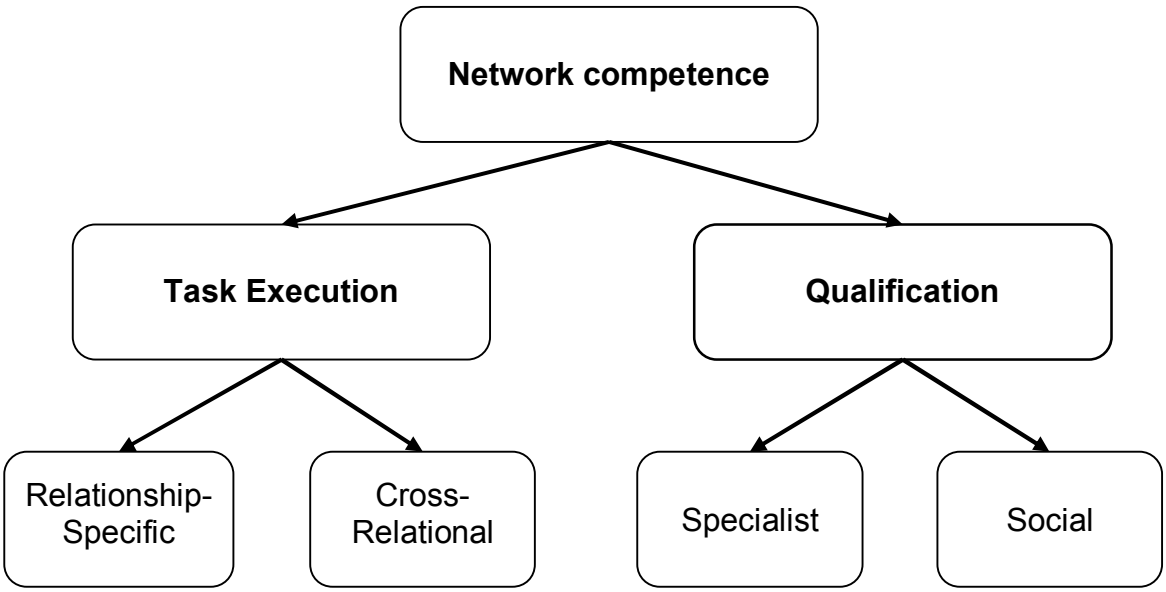
network and management fields. For instance, Simonin (1997) was concerned with collaborative know-how. Gemunden and Ritter (1997) focused on network competences. Gulati (1999) investigated alliance formation capabilities. Dyer, Kale, and Singh (2001) presented alliance management capabilities. Kale, Dyer, and Singh (2002) researched about alliance capabilities. Lambe, Spekman, and Hunt (2002) were interested in alliance competences. Walter, Auer, and Ritter (2006) studied network capabilities.

Cohen and Levinthal (1990) indicated that absorptive capital is the integration of information by an organization, and the abilities to exploit this information. The individual members in organizations strongly affect the organization's absorptive capabilities that grow over time. Alliance management capabilities refer to abilities to capture alliance-related knowledge derived from previous alliance experiences of firms, and to functions of centralized coordination activities mainly related to the evaluating alliance performances. Employing the absorptive capacity concept of Cohen and Levinthal (1990), Sivadas and Dwyer (2000) indicated that cooperative competences comprise three interrelated facets: trust, communication, and coordination, and positively influence new-product successes.

Alliance formation capabilities refer to a firm's abilities in forming alliances (Gulati, 1999). Companies mostly achieve these abilities through prior experiences, and these abilities will increase the possibilities of firms in entering new alliances in the future. In numerous ways, the alliances can enhance the abilities of a firm according to its market returns (Kale, Dyer, & Singh, 2002). Thus, companies can achieve greater successes with greater experiences towards actively steering, managing and controlling the dedicated alliance functions (Anand & Khanna, 2000).

Collaborative know-how was defined as skills to identify, negotiate, manage, monitor, and terminate collaborations. These skills positively influence both tangible and intangible cooperative benefits. In terms of tangible benefits, these skills allow firms to achieve higher profits, market shares, and competitive advantages. In intangible term, these skills improve the learning skills of employees (Simonin, 1997). Lambe, Spekman, and Hunt (2002) found that alliance competences are abilities of firms to find, develop, and manage alliances. Especially, the greater degree of alliance successes increases the level of alliance competences, and partners in alliances assist firm to find a higher degree of complementary and idiosyncratic resources.

Figure 2: Elements of Network Competence



Sources: Adapted from Ritter, 1999

Network competences are resources and activities of actors in generating, developing, and managing networks to utilize the advantages of single relationships and the whole networks (Gemunden & Ritter, 1997). Ritter (1999) defined the degree of network competences as "degree of network

management task execution and the degree of network management qualification possessed by the people handling a company's relationships."

Network management tasks include relationship-specific tasks and cross-relational tasks. The relationship-specific tasks refer to activities to establish and maintain single relationships meanwhile the cross-relational tasks refer to internal tasks to support networking with partners. Network management qualifications imply the social and specific skills included technical, relationship, economic, and legal skills (Ritter & Gemunden, 2003).

Walter, Auer, and Ritter (2006) defined network capabilities of spin-offs as abilities to initiate, maintain, and utilize their relationships with other external partners. The network capabilities of spin-offs are higher-order resources, which include four principal components:

- Coordination between collaborating firms
- Relational skills to manage interpersonal exchange situations
- Market knowledge to understand and coordinate effectively with partners
- Internal communication to assimilate and disseminate information effectively with partners

The spin-offs with higher qualities of network management are likely to reduce effectively the negative impacts of technical uncertainties. Thus, most of the companies actively engage their participations in the networking relationships (Walter, Auer, & Ritter, 2006).

According to Dhanaraj and Parkhe (2006), the actors in the networks must orchestrate their network activities to ensure the creation and extraction of value from networks. These network activities include all tasks, which are necessary for actors to build, sustain, or extend the networks (Witt, 2004). The concept of network capabilities is all about coordination, which consists of activities to

connect themselves to other actors, and connect different individual relationships with a network of mutually supportive interactions (Walter, Auer, & Ritter, 2006). Coordination refers to the extent which overall successes were achieved through working together of activities, people, routines, and assignments (Sivadas & Dwyer, 2000).

The network activity theory analyzes the concept of boundary spanning activities employed from organizational behavior field (Adams, 1976), collaborative R&D projects, and product development processes (Katz, 1982; Ancona & Caldwell, 1990a). New-product development teams apply and describe boundary management as the set of interactions to deal with others. Other teams could be information or resource keepers, or subjects to coordinate for completing assignments (Ancona & Caldwell, 1990a; 1990b). Ancona and Caldwell (1990b) classified the set of interactions into four groups. Firstly, ambassador activities maintain and improve the political legitimacies of teams in the networks and the connections between actors and important resources. Secondly, task-coordinating activities coordinate the teams with external actors. Thirdly, scouting activities gather, acquire, and bring back information outside the groups. Finally, guarding activities protect internal know-how from externally spilling over. Anand and Khanna (2000), and Kogut and Zander (1996) suggest that companies should maintain a formally coordinative system to capture the experience from external partners, and tacit and explicit rules for coordination as well.

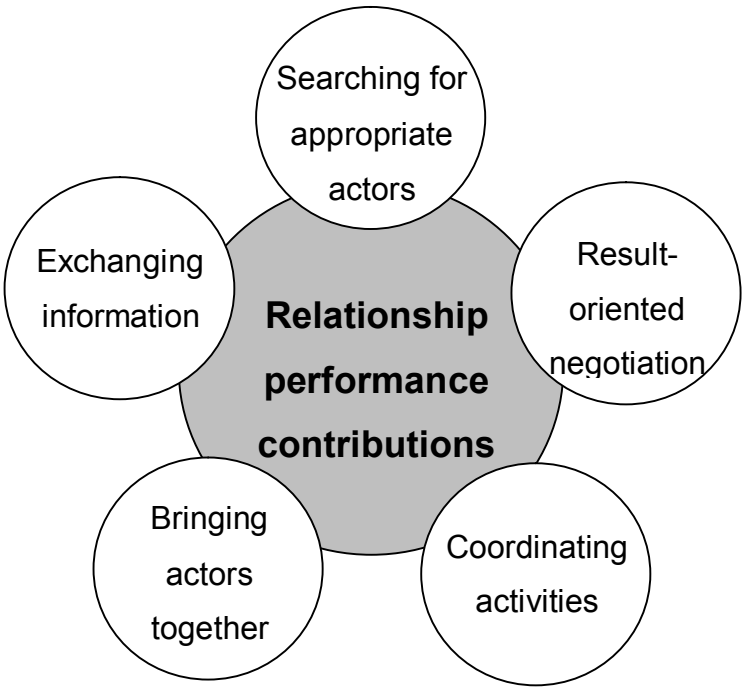
In network activities, Gary (2004) indicated that the controlling mechanism, such as alliance metrics or evaluation tools, plays an important role. For the effectively beneficial exploitations, Dyer *et al.* (2001), and Hakansson and Ford (2002) suggested companies to check regularly the satisfaction of partnership's objectives, and to evaluate the performances of their alliances.

Relational performance contributions refer to activities of actors to influence other people's attitudes, decisions, and behaviors (Walter, 1999). These contributions were classified in five activities. Firstly, with the exchanging information contribution, actors in networks are enabled to search, filter, judge, and store information of partners regarding to organizations, strategies, goals, potentials, and problems. The information will be transmitted purposefully to all relevant actors in the networks. This contribution partially depends on the communication qualities in terms of accuracy, timelines, adequacy and credibility (Mohr & Spekman, 1994). Secondly, searching for appropriate actors matching the requirements for a contribution to successful collaboration is necessary (Walter & Gemunden, 2000). Bringing actors together to improve the social ties and information exchanges is the third important contribution (Gemunden & Walter, 1997). Fourthly, actor's activities in the networks must be coordinating activities. Finally, within the networks, actors must surmount their conflicts productively and beneficially through result-oriented negotiations.

In the processes of searching for complementary resources, the participants were stressfully suggested to identify suitable partners before interacting and coordinating in collaboration (Walter, 1999; Das & Teng, 1998b; Doz, 1988; Ireland, Hitt, & Vaidyanath, 2002). The majority of young high-tech companies had relationships with other companies because these linkages provide necessary resources to complement and supplement the firm's operations (Lechner & Dowling, 1999; Rothwell & Dodgson, 1991).

Several researchers suggested that actors must not only focus on complementary abilities of resources, but also check their compatibilities in order to utilize effectively (Das & Teng, 2000; Dyer & Singh, 1998). Sarkar *et al.* (2001) found that the performances of alliances were influenced by the complementary abilities of partners' resources and compatibilities in cultural and operational norms. Therefore, actors must examine characteristics of their own resources and of potential partners.

Figure 3: Relationship Performance Contributions



Source: Adapted from Walter, 1999

2.3. Model development

2.3.1. Entrepreneurial capabilities

Sustainable return refers to a set of junctures in a spin-off's creation process to transform from the foundation phase to the growth period. These conjunctions involve initially important elements regarding financial capital (Shane, 2004). The entrepreneurs seek for the pre-seed capital from potential investors who require demonstrations of profitable returns. Entrepreneurs mostly prefer internal funding, but others explore external funding such as the bank debts and loans. Most banks evaluate the human resources rather than the evidence for credited returns (Cressy, 1996). However, the universities prefer capitalizing from alternative sources based on their reputation or networks (Roberts, 1991). The financial providers can be the industry sponsors, federal agencies, business

angels, and venture capitalists (Etzkowitz, 1998; OECD, 1998). According to Vohora *et al.* (2004), the entrepreneurial teams hardly obtain high credibility because their foundation processes were inhibited by insufficiencies, which are represented in forms of the following forms.

- Inability to attract and secure seed capital from investors
- Inability to secure quality human resources to build well-balanced managerial and scientific teams
- Inability to achieve proofs of concepts and evolve the technologies to states of market readiness
- Inability to demonstrate clear routes to revenues and profitability

Insufficiencies also involve the following lacks.

- Lack of depth and breadth in the technology portfolio for sufficiently commercialized long-term options
- Lack of receptivity of technologies for customers and distributors in the market
- Lack of locations outside the parent organization for the new ventures

To attract investors, the entrepreneurs must surmount difficulties derived from information asymmetries and uncertainties of new ventures (Shane, 2004). Entrepreneurs impossibly disclose all of their inventions that determine their competitive advances. Potential investors make their decisions based on the limited information (Shane, 2003; Casson, 1995). The information asymmetries also push the investors into risky choices leading them to pursue a project of commercial opportunities with potentially restricted values instead of choosing a talented project (Sahlman, 1990). The uncertainties yield difficulties to investors in opportunity evaluations (Shane & Stuart, 2002). The uncertainties also generate the disagreements between entrepreneurs and

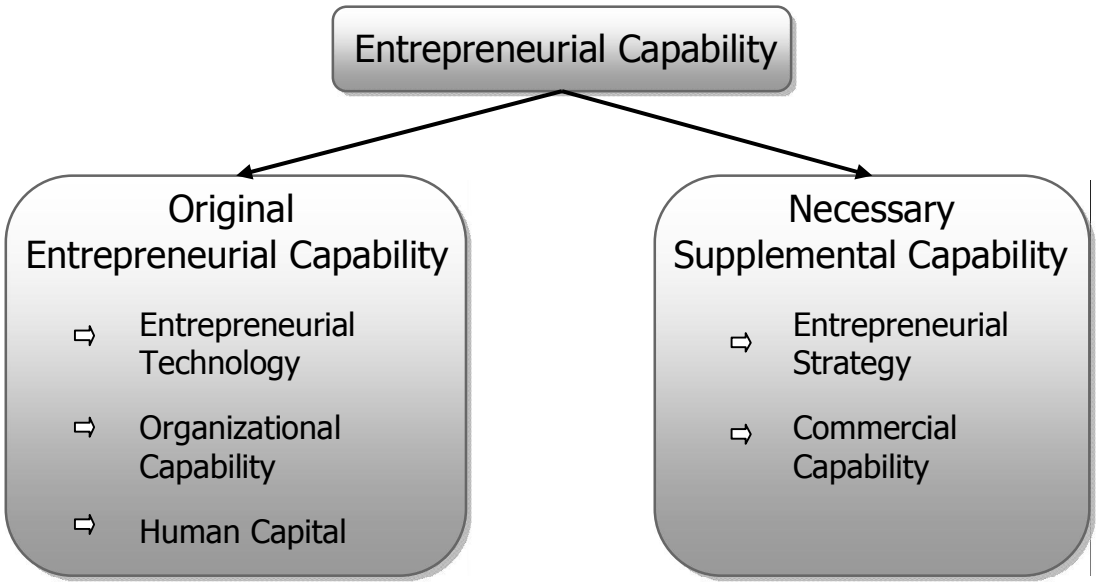
investors about the profitability of the opportunities (Wu, 1989). To surmount the information asymmetries and uncertainties, Shane (2004) suggested that entrepreneurs must demonstrate the spin-off's values and exploit social capital.

Investors seek for the signs of a venture's values in which entrepreneurs cannot control directly such as large markets, proprietary technologies, general-purposes of the technologies, and founder attributes (Carter & Van Auken, 1990; Amit, Glosten, & Muller, 1990; Lowe & Abrahamson, 1997; Kaplan & Stromberg, 2001; Shane, 2003). They prefer investing on the spin-offs with sizeable potential markets and with high costs but potentially achieve financial returns (Shane, 2004). Investors are concerned with the business projects with signals of competitive advantages derived from the high technology (Bhide, 2000). Based upon technology patents derived from the inventions, university spin-offs attract the financial providers more easily than other organizations (Shane, 2004). Moreover, strong patent protections that prevent the imitation from others within the industry also enhance financing capabilities of new ventures (Shane & Stuart, 2002). The entrepreneurs must innovate continuously because they do not know if they can produce new products or services, or these products or services will be accepted by the markets, or can be captured and imitated by competitors. In other words, the investors can reduce the investment risks by the marketing potential of new technologies (Shane, 2004). According to Vohora *et al.* (2002), entrepreneurs with richer managerial and industrial experiences obtain higher abilities to access the financial resources than others with limited experiences. Investors are concerned with projects founded by successfully historical entrepreneurs with knowledge of customer demands, which can reduce market risks.

The entrepreneurs have easy access to financial resources if they possess direct ties with the capitalists or business angels (Shane & Stuart, 2002; Venkataraman, 1997). The benefits from social ties motivate the relationships between entrepreneurs and investors (Gulati, 1995). Social capital

enhances information exchanges about entrepreneurs or opportunities (Burt, 1992), and makes people create more positive attributions to others (Stuart, Hoang, & Hybels, 1999; Podolny & Baron, 1997). Thus social capital diminishes challenges of asymmetry information and uncertainties on funding process of new ventures.

Figure 4: The Entrepreneurial Capability of Founding Team



Source: Adapted from Vohora, Wright, and Lockett (2002), Shane and Stuart (2002), and Shane (2004)

The sustainable returns of the projects represent in the resource-based view of the spin-offs in the initial stage, and these resources importantly contribute to the success of the spin-off's performances in the future (Vohora, Wright, & Lockett, 2002; Shane & Stuart, 2002; Shane, 2004). In this study, we analyzed the success of a spin-off's foundation and its performances in the influences of the capabilities of the founding team comprising entrepreneurial strategy, technological capital, institutional capital, commercial capital, human capital, and financial capital (Figure 2). We divided these capabilities into two groups of original entrepreneurial and necessary supplemental

capabilities. The original entrepreneurial capabilities comprise inherent abilities of the teams or from their parental organizations such as technology, organizational capability, and human capital during the technological investigation and invention periods. Then, to advance the process of foundation, the entrepreneurial teams must generate the necessary supplemental capabilities such as strategy and commercial capability to exploit and commercialize new technologies.

Original entrepreneurial capability

After inventing new technologies, entrepreneurs must mobilize initial resources (Garnsey, 2002) comprising human, financial, and organizational resources. The original resource's configuration is associated with the history of parent organizations (Heirman & Clarysse, 2004). Aspelund, Berg-Utby, and Skjevdal (2005) considered human and social capital of entrepreneurial teams as initial resources in earliest stage of the spin-offs. In this context, entrepreneurs transfer their personal resources to the new firm's resources (Brush, Greene, & Hart, 2001). The initial competencies of spin-offs are also competencies of founders regarding human resources (Cooper & Bruno, 1977). According to Wright *et al.* (2007), the initially entrepreneurial capabilities are required to commence the operations of the new ventures. These capabilities and the intellectual capital are original capabilities of the entrepreneurs.

> *H1: Original entrepreneurial capability is one of two significant and positive measurement indicators of the entrepreneurial capability construct.*

Entrepreneurial technology

New ventures are based upon technological real options, that create consistent assets to develop, complete, and commercialize the new technologies (McGrath, 1997). Thus, when mentioning about entrepreneurial technologies, McGrath (1997) considered four primary characteristics comprising the

degree of implicitness, the scope (breadth), the stage, and the continuity of technologies. The implicitness of technologies can be the important attribute of technologies in resource-based view. The scope of technologies is the platforms of technologies. The platforms refer to the wide range's application of technologies, and estimate potential values of real options. Stages of technology are associated with the knowledge implicitness in resource-based view. Technologies were considered whether they are in basic research, applied research, or development stages. Technologies are rarely in development stage when they transfer from universities to spin-offs. Thus, entrepreneurs must consider the continuity of technologies to know whether they are continuous or discontinuous (Tushman & Anderson, 1986).

To understand the technology capital of a new venture, this study analyzed the imitability and ability dimensions of technologies. Imitation occurs in concepts of direct duplication and substitution of technologies (Barney, 1996). Direct duplication of a patent without a license fee is illegal. The substitutions threaten the opportunism, but the direct duplications do not because of the intellectual property right protections. Ease of imitation refers to a high possibility of imitation or invention around (substitution) when someone looks at or hears about the detail of technologies (Gallini & Wright, 1990). The eases of imitations generate difficulties in technology commercialization. Moreover, Barney (1991) reckoned that the technologies of the spin-offs differ to imitate, they thus are the rare resources or institutional capitals of the spin-offs.

> *H1a: Entrepreneurial technology is one of three significant and positive measurement indicators of the original entrepreneurial capability construct.*

Organizational capability

According to Barney (1991) and Teece *et al*. (1997), the firm's rare resources derived from their unique histories. These resources determine the capabilities for a spin-off's future successes. The past activities of the parent organizations shape the unique histories of their spin-offs (Golub, 2003).

Nelson and Winter (1982) believe that the organizational routines as an entire system are a central importance of institutional capability. They play roles as important as genes do in biological evolutionary theory. The organizations with persistent, heritable, and selectable routines grow better than the other firms. The capabilities of a firm derive from a complex combination of complementary assets, knowledge and skills, and organizational routines. According to Leonard-Barton (1992), the institutional capabilities of a firm comprise internal communication mechanisms, formal control mechanisms and organizational supports.

Internal communication mechanisms refer to the method of information sharing and empowerment within a firm (Kanter, 1984; Burgelman, 1994). Entrepreneurs, who are involved in well-working internal communication mechanisms, can recognize and exploit the opportunities more easily than others because they comfortably gain access to the information exchanging within the firm. Dialogues are the most powerful form to exchange both messages and deeply interconnected meanings (Senge, 1990; Crossan, 1998). Good exchange of supportive information through formal or informal channels is important for the organization (Krueger, 2000). In the successful opportunity recognition and diffusion of a new venture, the communicational functions are associated with the direction, timing, amount and scope of exchanging information. Both horizontal and vertical communications are important for the opportunity recognitions and exploitations of new ventures (Leonard-Barton, 1992).

The formal controls refer to desirable patterns of behaviors in organizations, which institutionalized their rules, missions, routines, and regulations. The decentralizations of decision-making authority and structural layers characterize the level of the formal controls (Covin & Slevin, 1991). The formal controls with the combinations of entrepreneurial posture and organic structure contribute great benefits to the processes of opportunity recognitions and exploitations (Covin & Slevin, 1989). Organization routines influence the inspire actions by promoting plans, analyses, meetings and presentations (Pfeffer & Sutton, 1999).

Parental supports are critically important for processes of entrepreneurship because the entrepreneurial opportunities cannot be judged right or wrong. These supports will defuse the potential detractions of entrepreneurs by providing tangible resources through networks of individuals, multiple perspectives, and schemas (Krueger, 2000). According to Zahra (1993) and Hornsby *et al.* (1993), the inherent policies of training and rewarding employees, work discretion, time availability, and loose intra-organizational boundaries will generate great supports to entrepreneurial activities.

> *H1b: Organizational capability is one of three significant and positive measurement indicators of the original entrepreneurial capability construct.*

Entrepreneurial human capital

Coleman (1988) defined human capital as capabilities comprising knowledge and skills that enable persons to act in new ways. At the individual level, education and training determine the human capital (Carter, Williams, & Reynolds, 1997). In organizational level, human capital derives from the combination of knowledge, skills, innovativeness, and abilities of firm's individual employees (Edvinsson & Malone, 1997). In entrepreneurship studies, human capital focuses on the capabilities

of entrepreneurial teams (Gartner, Starr, & Bhat, 1998). Similarly, Welbourne and Andrews (1996) believe that human resource of a spin-off generally derives from founders. According to Penrose (1959), initial human resource includes entrepreneurial skills and management skills of founding teams. In another conception, the initial human resource refers to founder human capital and employee human capital (Alvarez & Busenitz, 2001; McKelvie & Davidsson, 2009). In the founder level, the human capital refers to the experience, education, industrial experiences while the employee level focuses skills, knowledge, and abilities. In this research, initial human capital of new venture refers to the capabilities of entrepreneurial teams, which include level of education, work experiences, managerial experiences, entrepreneurial experiences, and industrial experiences.

The formal education significantly improves entrepreneurial activities that lead to a better performance compared to less-educated entrepreneurs (Cooper, Gimeno-Gascon, & Woo, 1994; Bates, 1995; Hatch & Dyer, 2004). The spin-offs of the higher-level scientists obtain more successes than the others because they can develop the cutting-edge technologies in superior ways with their expert knowledge and talents (Powers & McDougall, 2005; Zucker, Darby, & Armstrong, 1998). DiGregorio and Shane (2003) indicated that the spin-offs can assemble the resources more easily if they are from organizations with members from the top-tier organizations because of their high credibility. The entrepreneur's education attainment influences abilities to recognize opportunities (Davidsson & Honig, 2003; Arenius & De Clercq, 2005). However, the nascent entrepreneurs with higher levels of education mostly focus on opportunity recognition instead of pursuing identified opportunities.

Human capital also includes the prior working experiences that can increase abilities to access to business and social capital when combining with other skills. Some scholars have considered work experience as the most important indicator of general human capital (Castanias & Helfat, 2001).

Others believe that work experience is the key elements of human capital for entrepreneurs (Bruderl, Preisendorfer, & Zeigler, 1992). Working experiences commonly refer to the amount of an individual's working time (Evans & Leighton, 1989; Bruderl, Preisendorfer, & Zeigler, 1992). Gimeno *et al.* (1997) divided working experiences into two indicators comprising breadth of different experiences and the quality. More job setting exposures increase the diverse range of knowledge and skills, but probably lead to poor knowledge and skills, and diminish returns (Mincer, 1974). Higher positions in prior jobs can upgrade levels of general human capital for a higher possibility of success in business opportunity's identification and pursuing (Bates, 1990). Good working experiences can increase abilities to integrate and accumulate new technology, and to adapt to uncertain circumstances, and thus lead to improved productivity (Davidsson & Honig, 2003). Bates (1990) and Gimeno *et al.* (1997) believe that work experience improve the entrepreneurial abilities.

According to Wiklund and Shepherd (2003), entrepreneurship-specific human capital focuses on the capabilities in operating a small business, and increases the expected performances. Gimeno *et al.* (1997), and Chandler and Hanks (1998) indicated that prior business ownership experience is the key element of entrepreneurial experiences. These experiences comprise an entrepreneurial mind-set and a set of finely honed skills (McGrath & MacMillan, 2000). The founders with entrepreneurial experiences identify business opportunities more clearly and more focused on the key issues compared with novice entrepreneurs (Baron & Ensley, 2006). Entrepreneurs with more experiences obtain higher abilities in opportunity recognition and resource-required determination (Westhead, Ucbasaran, & Wright, 2005). However, founders with start-up experiences uncertainly predict the new venture's performances (Cooper, Gimeno-Gascon, & Woo, 1994; Gartner, Starr, & Bhat, 1998).

Firm-specific human capital focuses on knowledge about routines and procedures inside the firms, and influences survival of well-established firms (Pennings, Lee, & Witteloostuijin, 1998). Founders with managerial experiences easily manipulate the business activities of the new ventures. In the study of Cooper *et al.* (1994), the management know-how of the parent organizations influences solely the survival, and dissociate from the growths of the spin-offs.

Industry-specific human capital refers to special tacit and knowledge derived from working time of individuals in an industry and from specific training (Reuber & Fischer, 1999). Industrial experiences critically contribute to the growths and performances of small firms (Box, White, & Barr, 1993; Siegel, Siegel, & MacMillan, 1993). Industry experiences measure working experiences of the top management teams in the industries (Pennings, Lee, & Witteloostuijin, 1998). Industrial experiences increase abilities in which emerge opportunity's identifications and assess, design properly strategies, and positioning new products and services (Castanias & Helfat, 2001; Schefczyk & Gerpott, 2001). Experiences in industrial conditions and relationships degrade the liability of newness derived from lacks of legitimacy of well-established firms, and from struggles for development in supplier's and customer's connections (Cooper, Gimeno-Gascon, & Woo, 1994).

> *H1c: Entrepreneurial human capital is one of three significant and positive measurement indicators of the original entrepreneurial capability construct.*

Necessary supplemental capability

Entrepreneurs cannot create spin-offs of sustainable returns in the future solely with the initial resources. According to Wright *et al.* (2007) and Shane (2004), to develop the foundation processes, the entrepreneurs must attract and mobilize supplementary resources. These resources comprise the

necessary resources to ensure the right paths for the new venture's functions, and to enhance the initial resources to accommodate to the uncertain environment during the process of foundation.

H2: Necessary supplemental capability is one of two significant and positive measurement indicators of the entrepreneurial capability construct.

Entrepreneurial strategy

Entrepreneurial strategy-making is a distinct process characterized by proactiveness, innovativeness, risk taking, autonomy, and competitive aggressiveness (Lumpkin & Dess, 1996), experimentation, proactive assertiveness (Dess, Lumpkin, & Eisner, 2007), achievement motivation (Sterwart, et al., 1998), and proactive, innovative, and risk-taking strategy (Morrison, 2000). Proactiveness refers to first-mover advantage seeking and is the best strategy to be the first introducing unknown products, services, and administrative technologies (Lyon, Lumpkin, & Dess, 2000). Eventually, the spin-offs obtain unexpectedly high profits and good brand recognition. Miles and Snow (1978) also introduced ideas of a prospector type that is very similar to proactiveness. Prospectors attempt to search actively for new opportunities while reactors react after environmental changes (Masters & Miles, 2002).

According to Hitt *et al.* (2002), innovation is the essence of entrepreneurship. Entrepreneurs utilize their innovative capabilities to create and develop new products and services. Thus, innovativeness refers to the tendency of entrepreneurs to engage in and support new ideals, novelties, experimentations, and creative processes leading to new products, services, or technology processes (Lumpkin & Dess, 1996).

Risk-taking refers to entrepreneurs who prefer high-risk projects with high possibilities of big returns than low-risk projects with smaller and more certain returns, and refers to how aggressively

they take actions to exploit and achieve opportunities as well (Covin & Slevin, 1989). In strategic context, Baird and Thomas (1985) considered entrepreneurial risks as venturing into the unknown, committing to a relatively large portion of assets, and borrowing heavily. However, Lumpkin and Dess (1996) classified them into personal risks, social risks, psychological risks, financial risks, and risks of negative outcomes.

Competitive aggressiveness is the intensity of a firm's efforts to challenge its competitors for entry and position improvement in the marketplace (Lumpkin & Dess, 1996). In the entrepreneurial context, this aggressiveness is likely to be survival and success of a new entrant because of the high failure possibility of start-ups (Porter, 1985). Lumpkin and Dess (1996) stated that the proactiveness refers to how entrepreneurs meet demands, and the competitive aggressiveness determines competition.

Lumpkin and Dess (1996) believe that autonomy is part of entrepreneurial orientation construct. Autonomy occurs when entrepreneurs obtain free rights to act independently, to make important decision, and to proceed. Most of the entrepreneurial companies have autonomous leaders in terms of centralization of leadership and managers' delegation of authority (Miller, 1983). Nonaka, Toyama, and Byosiere (2003) believe that autonomy is an important motivation in new knowledge creation of organizational members.

> *H2a: Entrepreneurial strategy is one of two significant and positive measurement indicators of the necessary supplemental capability construct.*

Commercial capability

The commercial capability of the spin-offs demonstrates in the profitability of the projects through their business plans and feasibility studies, and implies the surmounting relative risks from the

market and various levels of competitors (Shepherd, Ettenson, & Crouch, 2000). Meseri and Maital (2001) believe that the demonstrated market demands and abilities to penetrate markets are two of criteria that venture capitalists use to evaluate the potential of projects.

Keen (1993) indicated that firms must integrate business with business logistics and practices such as supplier logistics, business process design, and IT planning. Powell & Dent-Micallef (1997) believe that commercial capability of a firm includes supplier relationships, IT training, business process design, team orientation, benchmarking, and IT planning. In this research, we consider commercial capability of new ventures based upon supplier relationships, customer relationships, new technology training, business process design, and team orientation.

Supplier relationships play a central role in the commercial capability of a firm (Holland, Lockett, & Blackman, 1992). They not only add values to the process of value chain, but also create new values for consumers. Information exchanged between firms and customers is basically required, but the supplier's participations in the supply chains are also important. Open and trust relationships are fixed-requirements in the process of operations. A magnifying of capabilities of suppliers can lead to the suspicions and fracture tenuous relationships (Johnston & Vitale, 1988; Holland, Lockett, & Blackman, 1992). The capabilities to create and maintain trustful and valuable supplier relationships require tacit, complex coordination and communication skills from the firms (Hall, 1993). Firms must build long-term relationships with their customers based on personalization (Nadherny, 1998). These relationships allow the firms to understand their customers, and this leads to them being able to satisfy the personal demands of each client. Thus, firms must focus on lifetime values of customers for potential consumption instead of a single purchase.

A modern business requires a high level of collaboration between technical and business staffs. These relationships improve the mutual confidences, harmony of purposes, and good communications within the firms (Feeny & Willcocks, 1998). These relationships increase the capabilities of the firms to avoid the mistakes in daily business activities. Thus, other departments within firms have to learn new technologies to cooperate successfully with the technical staffs and generate smooth operations.

According to Cross, Earl, and Sampler (1997), the success of new technology applications requires a high level of cooperation of both technical and business expertises. Teamwork facilitates competitive advantage for firms because it is difficult to imitate teams from other organizations with their unique motivation of their own personnel and culture (Cross, Earl, & Sampler, 1997). Team-based structures are a major trend in organizational conductions (Jasinowski & Hamrin, 1995) because the integration of the teams and the technologies will increase the firm performances (Manz & Sims, 1993; Nolan & Croson, 1995). In the processes of spin-off's foundation, the teamwork plays a special role in new product developments. According to Minguela-Rata and Arias-Aranda (2009), new-product development teams significantly contribute to the product successes by reducing time and cost of developments and increasing product qualities.

The firms must improve their business processes for to accommodate to the uncertain business environment for survival and developments. The transformations from technological concepts to consumable products are complicated processes, which require various tests, changes, and improvements. The new technologies contain both inherent advantages and disadvantages, thus managements must emphasize the technology's integrations into business processes. Firms must focus on the business process reengineering, which re-evaluate their existing business processes to adapt with requirements from market and to add more values for their customers (Hammer &

Champy, 1993). Many scholars agreed that new technologies alone are insufficient to increase the productivities lead to firms must integrate organizational changes with business processes (Benjamin & Levinson, 1993; Beckhard & Harris, 1987).

H2b: Commercial capability is one of two significant and positive measurement indicators of the necessary supplemental capability construct.

2.3.2. Social network characteristics

According to O'Donnell *et al*. (2001), the principal components of networks are nodes and connections. The concept of connections defined as social ties or bonds, and concept of nodes replaced by actors possibly included individuals or integrations of individuals (Davern, 1997). Additionally, there have been many researchers who have analyzed the dimensions or elements of networks. However, in order to analyze the impacts of networks on the creation processes of university spin-offs, this research employed the network concepts of Amit and Zott (2001) in terms of classifying networks into three perspectives comprising network content, network governance, and network structure.

Network structure

The history of the network models has developed from the strength of the weak tie model of Granovetter (1973) to communication network model of Rogers and Kincaid (1981), and to the structural equivalence model of Burt (1987). Consequently, the concepts of network structure vary along the evolution of social network studies. In current years, network structure refers to properties of set of relations and impersonal configuration of relationships among actors. The absences and presences of network ties, network configurations, and network morphologies are the most important facets of the structural dimension (Scott, 1991; Wasserman & Faust, 1994; Tichy, Tushman, &

Fombrun, 1979). These facets describe the pattern of relationships as density, connectivity, and hierarchy (Amit & Zott, 2001). In another approach, Hoang and Antoncic (2003) defined network structure as "the pattern of direct and indirect ties between actors". The different positions of actors also influence resource flows. Similarly, many prior scholars concerned the network structure concepts in the centrality of actor´s positions (Brass & Burkhardt, 1993), or structural holes (Burt, 1992). In this study, network structure is considered on nature of ties (Scott, 1991; Wasserman & Faust, 1994), network configuration (Krackhardt, 1989). The characteristics of the networks, associated with entrepreneurship, mostly focus on dynamics of social structures and their influences on entrepreneurial processes (Hoang & Antoncic, 2003).

H3: Network structure is one of three significant and positive measurement indicators of the social network construct.

Network ties

A network tie connects a pair of actors by one or more relationships. A pair of actors can have only one tie or a multiplex tie with density of relationships such as information sharing, financial support, joining the same conferences, and so on. Because network ties vary in contents, directions, and strength, ties can be classified into strong or weak ties (even these definitions of ties vary depending on particular contexts) (Marsden & Campbell, 1984). Hoang and Antoncic (2003) stated that network structure includes direct and indirect ties between actors. Network structure also includes the degree of connectivity or absences of connections between actors as structural hole theory of Burt (1992).

The network relationships were classified under two groups comprising strong and weak ties (Granovetter, 1973). The strong ties were described as high levels of emotion in the relationships

such as relations among family members or friends. Meanwhile, the weak ties are based on more rationally dominated relations namely colleagues, bosses, business partners and the like. Granovetter (1973) also believes that strong ties are very reliable but also contain a large degree of redundancies regarding to exchanging information meanwhile weak ties are less reliable but offer better access to information sources. In another study, Dubini and Aldrich (1991) classified network ties into two types. Personal ties are about the non-business relationships namely families or relatives, friends, neighborhoods, classmates in universities and social club members. Clients, suppliers, colleagues and business associates are business ties, which initially base on work-related functions. Scott (1991) indicated that nodes in networks also know each other from other networks. In other words, networks are interconnections and clusters. Depending on the relative social position of nodes (such as cultural, political or economic), nodes can be parts of few or many networks.

As a fundamental proposition of social networks, network ties supply access to the resources specially information and advices. Coleman (1988) indicated that it is costly to gather information for decision-making but networks provide information channels with reducing in time and investments. Ghoshal, Korine, and Szulanski (1994) also found that network relationships importantly contribute to the diffusion of new ideas within corporations. In the level of interpersonal networks, entrepreneurs utilize their personal networks to achieve environmental resources needed for the growths, and to carry out venture missions (Liao & Welsch, 2005). In the organizational network approach (Katz & Gartner, 1988), institutional ties will be the resource suppliers, business generators, market expanders, and reputation enhancers to support the new venture´s activities (Jack, 2005). The interactional intensity of entrepreneurial firms with their partners positively relates to business-relevant information exchanges (Larson, 1992). Generally, social network ties have

important roles in the growth and development of new ventures even there is a complexity in definitions of network ties.

The actors with stronger relationships, as a significant factor in actor´s decisions, highly commit with their partners (Uzzi, 1997). Granovetter (1973) and Hansen (1999) found that the complex knowledge needs the supports of strong ties to enhance transferences. To confirm this discovery, Uzzi (1996) and Rowley, Behrens, and Krackhardt (2000) indicated that the benefits of weak ties represent on the purposes of exploitations and on the preventions of the network insulations from market pressures. The strong ties positively influence firm performances towards the demands of high degree of exploitations. Moreover, Soda, Usai, and Zaheer (2004) found that among the project members, based on past joint-experiences, the multitude of current weak ties covers the complementary resources. The strong ties relate to the best performances of project teams. Bakker *et al.* (2006) also found that the long-lived team memberships significantly affect the density and speed of knowledge transfers. The entrepreneurs exploit strong ties from the previous established relationships to start their own business in a small circle of closed contacts (Birley, 1985; Larson, 1992; Steier & Greenwood, 1999). Jack (2005) also found that family members importantly contribute in helping entrepreneurs to recognize potential opportunity and to provide continuous supports.

The strongly symmetrical ties influence on the effective relationships' development, and thus affect the individual motivations in social interaction engagements and knowledge exchanges (Krackhardt, 1992). According to Hansen (1999), weak ties facilitate searching resources but impede the transfers of knowledge. A common partner can contribute to the processes of bringing together two unconnected actors. This referral agent encourages the cooperation, reciprocities, and sharing between both parties. Deeply embedded networks also enhance the processes of information

transfers and problems solving (Gulati, 1995; Uzzi, 1997). According to Burt (1992), structural holes are the gaps of information flows between two actors possessed the same links to another actor but not link to each other. Thus, the actors in each side of one structural hole can access to the different flows of information (Hargadon & Sutton, 1997). The more structural holes contained in ego networks, the more unconnected partners and distinct information flows are accessed. In general, network configuration including density, connectivity, and hierarchy influences the level of contact and accessibility provided to other network's members, and affects the flexibility and ease of information exchanges (Krackhardt, 1989; Ibarra, 1992).

H3a: Network tie is one of three significant and positive measurement indicators of the network structure construct.

Density

Network size refers to the number of direct links between a focal actor and others within a network. Analyses of network size are associated with the study of capability to access resources at the levels of both entrepreneurs (Aldrich & Reese, 1993) and organizations (Katila, 1997). The size of networks not only positively contributes to the diversity of resources but also leads to issues for actors who must spend a lot of time trying to coordinate with many actors (Staber, 1998; Faerman, McCaffey, & Van Slyke, 2001). The large number of links between the actors characterizes a dense network. Network density refers to the proportion of possible relationships and is the first interested property of networks (Marsden, 1990). The densely interconnected networks improve the speed of diffusions of information, knowledge, and organizational strategies (Black, 1966). Dense relationships among partners can encourage the development of shared norms and explicit knowledge-sharing routines (Berg, Duncan, & Friedman, 1982; Uzzi, 1997; Dyer & Nobeoka,

Creating and managing a high performance knowledge-sharing network: The Toyota case, 2000). Dense networks facilitate strong relationships with investors and maximize benefits from collaborations (Walker, Kogut, & Shan, 1997). The networks with dense relationships and high level of interactions contribute to the enhancement of social capital (Boisot, 1995; Orr, 1990).

In dense networks, information about opportunistic actions of one actor will spread rapidly to others and lead to creation of sanctions for deviate behaviors (Walker, Kogut, & Shan, 1997). Thus, the density of ties between actors increases possibilities of curbing opportunism (Coleman, 1988; Rowley, Behrens, & Krackhardt, 2000).

> *H3b: Network density is one of three significant and positive measurement indicators of the network structure construct.*

Centrality

Traditionally, the concept of centralities mostly describes the actors in networks (Bavelas, 1948; Freeman, 1978). There are many directed connections ("connectedness") between central persons and others in the networks. The centralities of actors quicken their communication with others within networks, and lead to use few or no intermediate persons ("closeness"), or this communication can be frequently located on the information paths between other persons ("betweenness") (Freeman, 1978).

According to Freeman (1979), the centrality is the most important property of actors in the networks. The high level of centrality refers to a large number of connections with an actor, or to the occupation of a significantly strategic position within the networks (Scott, 1991). Centrality indicates the extent of organizational interactions to seek for access to potential resources (Pfeffer & Salancik, 1978). Sparrowe *et al.* (2001) and Ibarra (1993) defined centrality as the strategic position in a

network of an individual possessing many significant ties of benefits from resource accessibility. The firm's position within a network is more meaningful in explaining its performances than its market position (Gulati, Nohria, & Zaheer, 2000).

The degree of connections and relationships of one actor with others construct the centrality of that actor. Degree of centrality refers to the number of ties an actor possessed (Degenne & Forse, 1999). The actors involved with many others in networks were supposed to possess high centrality (Freeman, 1979). Centrality improves abilities of actors to influence the flows of resources with others leading to receive a diversity of resources from the bridging ties (Granovetter, 1973; Burt, 2004). Centrality, however, is not always the reason for higher influences because, in some cases, the individuals possessed formal authority but necessary favorable positions also have strong influences on others.

The different positions of actors within a network have various impacts on resources flows, and consequently, on entrepreneurial outcomes (Hoang & Antoncic, 2003). The structure of the networks and the actor's positions influence the behaviors and performances of these actors (Wellman, 1988). The centralization negatively impacts the intra-corporate knowledge sharing towards timely costs (Tsai, 2002). Focusing on the effects of network centrality on the degree of access to resources through both interpersonal approach (Brajkovich, 1994) and inter-organizational approach (Powell, Koput, & Smith-Doerr, 1996); Johannison *et al.,* 1994), these scholars considered the degree of centrality as the abilities of actors to reach other actors through intermediaries within networks.

The actors with high level of centrality are more likely to receive information earlier than the others do (Burkhardt & Brass, 1990). The information flows rapidly in the highly centralized networks, which have a small number of central actors (Valente, 1995). The actor's centralities associate with

the quantity of critically available resources (Galaskiewicz, 1979). In the centre of the networks, actors have advantages in influencing others, and thus have more opportunities to access valuable information (Degenne & Forse, 1999).

The actors with many relationships feel obligated to please all or most of their partners, thus they were compelled to take more actions (Frank & Yasumoto, 1998). High network centrality positively correlates with abilities to solve simple problems while solving complex problems requiring diverse structures (Leavitt, 1951). This type of centrality motivates the actor's abilities to prioritize and coordinate activities, and lead to improving the resources management. The degrees of centrality may differently impact the resources management depending on the phases of processes. Especially, higher degrees of centrality improve conductivities of actor's mobilization and coordination at start processes.

H3c: Network centrality is one of three significant and positive measurement indicators of the network structure construct.

Network governance

Network governance was defined as the mechanisms that govern relationships between actors, the legal forms of actors, and the incentives for participations in networks (Amit & Zott, 2001). Jones, Hesterly, and Borgati (1997) stated that "network form of governance is a response to exchange conditions of asset specificity, demand uncertainty, task complexity, and frequency." Other researchers such as Brass (1984), Thorelli (1986), Krackhardt (1990), and Jones, Hesterly, and Borgatti (1997) defined network governance as “implicit and open-ended” reliance. Social mechanisms, which include powers, influences, and threats of reputation losses and ostracisms, support the reliance more than legal enforcement.

Different actors with distinct capabilities generate relationships of various meanings (Borgatti & Foster, 2003). When studying the evolution of network ties, we must consider the network characteristic of heterogeneity (Contractor, Wasserman, & Faust, 2006). In the innovation studies, there have been some evidence illustrating the importance of diversity in types of actors in the networks. Different partner's types associate with various types of innovation occurring (Kash & Rycroft, 2000; Biemens, 1991; Hausler, Holn, & Lutz, 1994). Thus, each type of partners with distinct concerns differently influences on the relevant actors towards the knowledge, decisions, and performances (Conway, 1995; Cooke, 1996; Liyanage, 1995; Verspagen, 1999). The differences in types of partners also variously influence on the collaborative managements and kinds of achieved innovations (Whitley, 2002).

Networks characterized by heterogeneity and diversity of actors provide sources of rich information (Rogers & Kincaid, 1981). Network heterogeneity positively associates with firm's flexibility (Madhavan & Grover, 1998). The large social networks improve the heterogeneity of actors' attributes and network's complex structures (Wellman & Potter, 1997). Actors receive more beneficial interaction from diverse background partners than from similar background partners (Marsden, 1987). A network of partners from various environments contains more distinct sources of perceptions, ideals, strategies, etc. than a network of actors with homogenous characteristics (Soetanto & Geenhuizen, 2009).

H4: Network governance is one of three significant and positive measurement indicators of the social network construct.

Reciprocity

Reciprocity refers to the probability that two actors in a directed network connect each other, and is usually measured solely in directed networks (Scott, 2000; Wasserman & Faust, 1994). Network reciprocity based upon trust in the relationships is an important element of social capital (Putnam, 2000).

Relationship reciprocity importantly influences the types of sharing knowledge (Muthusamy & White, 2005). Brass *et al.* (2004), and Hammond and Glenn (2004) believe that the similar individuals tend to share knowledge with each other based on the mutual trust and reciprocity. The norms of reciprocity also positively influence the quality of exchanges in the relationships and lead to better performances of individuals (Wayne & Ferris, 1994; Konovsky & Pugh, 1994). The norms of reciprocity not only enable successful exchanges today but also facilitate mutually beneficial transactions in the future (Woolcock, 1998).

> *H4a: Network reciprocity is one of two significant and positive measurement indicators of the network governance construct.*

Reputation

The benefits from the networking are not only the exchanges of resources but also provide actors *reputational* or signaling contents (Deeds, DeCarolis, & Coombs, 1997; Stuart, Hoang, & Hybels, 1999). Reputation refers to the information about the past performances of an individual (Podolny J. M., Market uncertainty and the social character of economic exchange, 1994). Investors are likely to evaluate the potential of spin-offs because investing on spin-offs in early stage of the creation process is a risk taking decision. By associating with well-regarded individuals and organizations, entrepreneurs are able to increase their reputation to attract and convince more investors for their business projects. Networks are also the environment of which reputational information of actors

flows and reaches the attentions of potential investors (Calabrese, Baum, & Silverman, 2000). Investors prefer funding to positive reputation entrepreneurs who possess abilities to implement the new ventures. Actors in the networks tend to share their knowledge when they believe that exchanges will improve their professional reputation (Wasko & Faraj, 2005).

Another facet of network governance, obligation, refers to the commitments or duties of participants in undertaking some activities in the future (Coleman, 1990). Similarly, the network activities, actor's norms and obligations are likely to influence on both access to and combining exchanged resources. Moreover, identification was defined as processes whereby actors can see themselves as one with others in the networks. In the processes of exchanges, actors take values or standards of others as comparative frames of references (Tajfel, 1982). The identification in the network governance has both sides of influences on the entrepreneurial processes. It may enhance the perceived opportunities and actual frequencies of cooperation (Lewicki & Bunker, 1996). It also constitutes significant barriers to resources sharing when contradictory occurred (Child & Rodrigues, 1996; Simon & Davies, 1996).

H4b: Network reputation is one of two significant and positive measurement indicators of the network governance construct.

Network content

According to Amit and Zott (2001), network content refers to resources that are being exchanged and to resources and capabilities that are required to enable the exchanges. Interpersonal and inter-organizational relationships are instruments, which enable actors to gain access to a variety of resources held by other actors. In network concept, most of the researchers have focused on the abilities of entrepreneurs towards access to intangible resources (Light, 1984; Zimmer & Aldrich,

1987). For instances, Bruderl and Preisendorfer (1998), and Gimeno *et al.* (1997) believed that network relationships provide emotional support for entrepreneurs in terms of taking risks, and thus enhance persistence to remain in business. However, the most important role of networks is accessible resources for information and advices.

H5: Network content is one of three significant and positive measurement indicators of the social network construct.

Quality of information

Freeman (1999) indicated that relationships with venture capitalists generate opportunities for entrepreneurs to achieve key talent and market information. Moreover, networks contain potential resources of ideas and information, which contribute to entrepreneurial opportunity recognition (Smeltzer, Van Hook, & Hutt, 1991; Birley, 1985). Johannison *et al*. (1994) indicated that the actors not only obtain benefits from access to resources but also reply to networks their business information, advices, and problems solving. Thus, when entrepreneurs seek for a network, they must consider and measure the potential resources, which other actors in networks can provide to match their needs.

H5a: Quality of information is one of three significant and positive measurement indicators of the network content construct.

Diversity of information

According to Cohen and Levinthal (1990), the development of absorptive capability, in some specific circumstances, necessitate the network redundancy. Richer patterns of relationships and interaction are more important than the relatively unproblematic meaning of information. The

meaning of information is uncertain and ambiguous, or information is from parties with different prior knowledge. The redundancy can be both effective and efficient for the information transfer.

Actors should actively protect internal know-how and prevent its transfers to networking partners (Das & Teng, 1998a). Although the relational capital is about all information exchanged cross a firm's borders, sensitive information and know-how need to be protected (Kale, Singh, & Perlmutter, 2000). Thus, actors need to consider which information of core competences and know-how can be shared with networking partners (Conway, 1995).

H5b: Diversity of information is one of three significant and positive measurement indicators of the network content construct.

Trust

Trust between actors refers to the belief that the "results of somebody's intended action will be appropriate from our point of view" (Misztal, 1996). Trust was usually applied as critical elements of network exchanges towards enhancing the qualities of flowing resources (Larson, 1992; Lorenzoni & Lipparini, 1999). A large number of researches agreed that actors are more willing to engage in cooperative interactions when relationships are in high levels of trust (Gambetta, 1988; Ring & Van de Ven, 1992; Putnam, 1995; Fukuyama, 1995; Tyler & Kramer, 1996). According to Mishira (1996), trust is multidimensional and willingness of actors in terms of cooperating with other actors. The willingness appears in four dimensions such as (1) belief on other actors in terms of their intent and concerning (Ring & Van de Ven, 1994), (2) belief on competences and capabilities of partners (Szulanski, 1996), (3) belief on reliabilities of partners (Giddens, 1990), and (4) belief on perceived openness of other actors in networks (Ouchi, 1981). Based upon the trust, each party in a relationship is assumed to take predictable and mutually acceptable actions (Uzzi, 1997; Das &

Teng, 1998b). Trust also allows actors to exchange deep and rich resources, especially information (Saxenian, 1991; Lorenzoni & Lipparini, 1999).

Trust and cooperation have an interaction relationship that appears as trust lubricates cooperation and cooperation breeds trust. Thus, it may lead to development of generalized norms increasing the willingness of actors in the networks (Putnam, 1993). Norms of networks exist when "the socially defined right to control an action is held not by the actor but by others" (Coleman, 1990). Thus, network norms represent the consensus of the networks. Norms also significantly influence on the exchanging processes, open up access to parties for exchanges, and ensure the exchanging motivation (Putnam, 1993; Kramer & Goldman, 1995). The actors possessed existing contacts within rich information networks receive more useful information and provide reliable flows of information. The trusted actors will provide more information benefits even when they are in sparse networks with few redundant contacts (Burt, 1992).

H5c: Trust is one of three significant and positive measurement indicators of the network content construct.

2.3.3. Success of spin-off's foundation

Fundraising skills importantly attribute the successes of entrepreneurship comprising both launching and developing the new ventures. Fundraising necessitates more time and energy than entrepreneurs think. Undercapitalization can be one of the consistent causes of failures not only in the stage of foundation but also in the growth period of new ventures. Seed money, adventure capital, or injection capital are the initial fund for a spin-off's foundation (Zimmerer & Scarborough, 1996). Blumentral *et al*. (1996) believe that good fundraising assists entrepreneurs to be more commercially productive than others because the organizations with the bigger amounts of expenditures on the

R&D activities are more effective in their spin-off's operations (Powers & McDougall, 2005). Based upon types of sources, Doty and Glick (1994) classified financial sources into two groups comprising non-institutional sources (e.g. personal-friend-family, and private investors or angels), and institutional sources (e.g. venture capital firms, strategic partners, and corporate parents). However, Zimmerer and Scarborough (1996) identified these resources based on the three types of capital required by business such as fixed capital, working capital, and growth capital. Fixed capital covers the needs of a business's permanent or fixed assets such as buildings, land, computers, equipments, and so on. These assets are unable to convert to other forms during the normal business operations. Working capital refers to business's temporary funds, which need to support common short-term operations of the new ventures. After establishing, start-ups need a growth capital to expand or change their business directions. The spin-off's capabilities in access to growth capital resources are the successful levels of foundation's processes (Shane, 2004). In other words, the capabilities to access the financial resources, included investments from existing and new investors after establishing, illustrate the success of spin-off's foundation (Vohora, Wright, & Lockett, 2002; 2004).

Returning investments refer to the financial sources from existing investors who invested to the new ventures as seed capital resources. The availabilities of seed capital to access are the particular values in the initial explorations and commercialization of new technologies (Gompers & Lerner, 1999). In current entrepreneurial theory, the sources of seed capital for start-ups comprise of venture capital, government grants, and private equities. Besides these resources, professional venture capital investors also provide the managerial guidance as adding values (Sapienza, 1992; Hellman & Puri, 2002). In other scholars, entrepreneurial firms initially seek their seed and start-up capital from family, venture capital, and governmental sources (Aldrich, 1999; Lerner, 2000). They, then, issue

initial public offerings (IPOs), and contact strategic partners and banks to raise their capital for growth and development (Deeds, DeCarolis, & Coombs, 1997; Robbins-Roth, 2000).

H6a: Returning investment is one of two significant and positive measurement indicators of success of spin-off's foundation construct.

Venture capitalists capitalize from appropriate sources to invest in companies on particular markets, sectors, or technology opportunities. In the capital agents, the senior managers who raise the funds become general partners while the external financial providers are the limited partners. These funds are fixed-terms and have limited liability partners of new ventures (Sahlman, 1990). The venture capitalists abandon the seed capital of early-stage investments and prefer later-stage investments because of the risks in the investments with information asymmetry (Amit, Brander, & Zott, 1998).

According to Wright *et al.* (2007), business angels "are wealthy private individuals, typically with entrepreneurial or business backgrounds, who provide modest amounts of equity finance to businesses in which they have no family connection." Business angels concern providing finance at the start-up and early stage of new ventures. Business angels may have experiences in markets where they have invested, but they still face to the symmetry of information. They must find the right entrepreneurs who they can trust and cooperate in less-cost conditions (Fiet, 1995).

H6b: New investment is one of two significant and positive measurement indicators of success of spin-off's foundation construct.

The entrepreneurial capabilities are also expected to impact the foundation processes of new ventures. Wang and Ang (2004) suggested that "venture capitalists should recognize that resources and capabilities of the firm are the basis for strategy and corporate profitability." These resources can be acquired through various methods and channels. In university spin-off's creation, van Burg *et*

al. (2008) suggested that universities must build infrastructures, collaborative networks of investors, managers, and advisors to assist starters in obtaining access to resources, and developing their social capital.

The entrepreneurial teams can obtain the necessary resources directly from their own parental organizations or indirectly from other partners in their networks. The teams with doctoral degree holders are more likely to be funded from direct ties. Their firms were evaluated as higher valuations lead to positively influence decisions of external resource providers (Hsu, 2007). The entrepreneurial capabilities, comprising both original entrepreneurial capabilities and necessary supplementary capabilities, impact the successes of the spin-off's foundation processes measured by the capabilities of the new start-ups in financing. The venture capitalists prefer investing on startups with strong technology and human capital towards management skills (Baum & Silverman, 2004). "A faster technology acquisition via technology alliance has a positive influence on the firms' IPO" and "concentrating on core technology, instead of diversifying can mature the startup firms faster" (Kim & Heshmati, 2010). Investors require entrepreneurs to represent minimum markets from the technology-based projects rather than local markets (Murray & Lott, 1995). Roffe (2007) stated that "competitive strategy is a major influence on an entrepreneur and value chain investments." Hindle and Yencken (2004) suggested wider analyses in which the tacit knowledge (technological, managerial, risk management, financial, etc.) together generates effective mechanisms for the success of research commercialization.

H7: Entrepreneurial capabilities predict success of spin-off's foundation.

Regarding to the previous discussions, to exploit the entrepreneurial opportunities, entrepreneurs must gather other resources at the early stage of the creation processes. However, the high

uncertainties and information asymmetries impede the fundraising in the capital market (Mason & Stark, 2004). In this perspective, the benefits of entrepreneur's networks in securing investment were highlighted as important elements (Batjargal & Liu, 2004; Starr & MacMillan, 1990). Shane and Cable (2002), and Shane and Stuart (2002) believed that networks are the solutions for market failure in the risk-capital market. Shane and Stuart (2002) found that the entrepreneurs are likely to receive funds if they have direct or indirect relationships with investors. Moreover, according to Ostgaard and Birley (1996), networks connect entrepreneurs with resources that contain opportunities to be successful and to increase credibility of new ventures.

Dyer and Singh (1998) indicated that the potentials for the firms to generate their competitive advantages depend not only on their resources, but also on the relationships with other firms. Thus, the potential growths of the spin-offs depend not only on the resource endowments, but also on their social networks which open access to complement resources for new spin-offs. Moreover, the relationships with other actors can be exploited for needed resources, influences and sponsorships (Adler & Kwon, 2002). The entrepreneurs connect with critical opportunities (Bull & Willard, 1993; Ellis, 2000), and, more importantly, connect with supporters (Ostgaard & Birley, 1996) through networks to be successful. New ventures connected with each other is not only to obtain access to resources but also enhance their reputations (Chetty & Wilson, 2003). Putnam (1995) believed that if entrepreneurs belong to large social aggregates, which have historical roots, they can be given external endowments.

Networks with weak and strong ties can provide to entrepreneurs with access to finance resources and thus positively influence on the spin-offs (Granovetter, 1973; Aldrich & Zimmer, 1986; Krackhardt, 1992; Davidsson & Honig, 2003; Jenssen, 2001). According to Reynolds (1991), to create new successful ventures, social networks are important prerequisites such as venture

capitalists, business angels and incubators (Thornton, 1999). Therefore, networks can be a substitute for or can complement other resources such as financial and human capitals because of superior connections (Adler & Kwon, 2002).

To explain how networks influence on the fundraising of entrepreneurs, many researchers have focused their studies on two principal standpoints. Firstly, the concept "social obligation" from the "social embeddedness" theory of Granovetter (1985) explains why investors commit financial capitals with non-economic aims. Instead being guided by short-term, selfish, and profit-maximizing motivation, the investors focus on their market relationships with network ties embedded into economic exchanges with the expectation of trust and reciprocity interjections (Uzzi, 1999). Secondly, according to Shane and Cable (2002), networks are resources where prospective investors gather superior information regarding to the capabilities of entrepreneurs, and technologies and potential markets of new ventures. Many prior scholars indicated that entrepreneurs with strong ties such as family members, friends, previous colleagues, and business associates are more likely to be invested or receive recommendations about the investor's information. Other actors in networks introduce entrepreneurs to whom they knew as investors because they believe in entrepreneur's capabilities and integrity (Bruno & Tyebjee, 1985; Witt, 2004). These recommendations will be more valuable and increase the financing probabilities of entrepreneurs in cases where these actors are reputable experts. These prestigious referrer's recommendations, as worthy signals for entrepreneurs, influence significantly on the decisions of investors (Stuart, Hoang, & Hybels, 1999). Thus, social ties, including weak and strong ties, are assumed to influence positively on the process of spin-off's creation though providing access to the financial resources (Granovetter, 1973; Aldrich & Zimmer, 1986; Krackhardt, 1992; Jenssen, 2001).

As conduits to external resources, networks contribute significantly to the growths of new ventures (Penrose, 1959; Jarillo, 1989; Donckels & Lambrecht, 1995), and the growths of the firms are associated with the network developments (Golden & Dollinger, 1993; Brown & Butler, 1995; Hansen E. L., 1995; Ostgaard & Birley, 1996). Network ties become an important component of the successful foundation and development of spin-offs through providing access to resources (Saxenian, 1990; Larson, 1992). Network ties influence decisions of investors financing ventures via information transfers (Shane & Cable, 2002).

In the entrepreneurial networks, there is one leading entrepreneur with entrepreneurial visions and self-confidence to turn visions to reality (Ensley, Carland, & Carland, 2000). The spin-off's experiences and reputation positively relate to the 1-year stock price returns (Arthurs & Busenitz, 2006). Entrepreneurs with experience in the creation of spin-offs and of financial successes in their start-ups are more likely to receive funding from direct ties and higher firm's evaluation (Hsu, 2007). The regional networks provide a source of particular knowledge and expertise to enhance the process of new technology-based start-ups (Collinson & Gregson, 2003). From these prior discussions, we suppose that the social networks advance the spin-offs' foundation.

H8: Social network characteristics predict success of spin-off's foundation.

2.3.4. Spin-off's performance

The theory of organizational effectiveness has developed and is concerned with the competing theories, values, and views about management. The rational goal model, open system model, internal process model, and participant satisfaction model have been four key effectiveness models (Pennings & Goodman, 1977; Ostroff & Schmitt, 1993). In other words, the organizational effectiveness cannot be one universal model (Cameron & Whetten, 1983) and must be

multidimensional (Wiklund & Shepherd, 2005). The effectiveness comprises trade-offs and management of paradoxes (Cameron, 1986) or include growth and financial performances (Wiklund, 1999). To measure the spin-off's performances, the entrepreneurship theory employed all models of organizational effectiveness (Cooper, 1993; Cooper & Artz, 1995; Chandler & Hanks, 1993). The measurements of entrepreneurial performances vary at the points of the venture's life cycle in these objectives (Zahra, 1996). The spin-off's performances comprise financial performance (Minor, Hensley, & Wood, 1994; Kotha & Swamidass, 2000; Brush, Bromiley, & Hendrickx, 2000; Markman & Gartner, 2002), operational performance (Venkatraman & Grant, 1986), and venture longevity (Baron & Markman, 2003). In this study, we utilized financial and operational performance factors to measure performances of entrepreneurship (Murphy, Trailer, & Hill, 1996).

The financial performances are very important aspects in entrepreneurial business because maximizing profits is the primary and principal goals of new ventures (Hisrich & Peters, 1989). These performances mostly refer to the firm's profitability and growths (Venkatraman, 1989; Kathuria, 2000; Chandler & Jansen, 1992). Financial growth of the firms is associated with better firm's performance (Box, White, & Barr, 1993). Other researchers utilize sale revenues or cost ratios to measure a firm's financial performances (Hitt & Brynjolfsson, 1996; Brynjolfsson & Hitt, 2000).

> *H9a: Financial performance is one of two significant and positive measurement indicators of a spin-off's performance construct.*

Numerous studies measure the growth indicators by utilizing the number of employees (Garnsey, 2002). However, other authors indicated that the number of employees factor is a non-financial performance measurement. Non-financial performances known as operational performances are also important aspects of firm's performances (Ittner & Larcker, 2003). Non-financial performances

measure the developments in products, market, and employees, and effectiveness in resource usages (Higashide & Birley, 2002). In the study of Hofer and Sandberg (1987) and Kaplan (1983), the operational performances comprising product qualities and market shares ultimately derive financial performance. To measure entrepreneurial performance, Stam and Elfring (2008) employed both instruments comprising multiple measures of financial performance (Wiklund & Shepherd, 2005) and subjective measures of non-financial performance (Dess & Robinson, 1984). Chandler and Hanks (1994) measured venture's performances by the growth factors comprising growth in market share, growth in cash flow, and growth in sales, and by business volume measures comprising sales, earnings, and net worth. Robinson (1998) utilized eight alternative measures comprising change in sales, sales level, net profit, earnings before interests and taxes, return on sales, return on assets, return on invested capital, and return on equity to examine new venture performances.

The operational performance instruments have become complementary indicators to measure the progresses of the business because of difficulties from financial measurements (Ittner & Larcker, 2003). Campbell (2007) believed that the operational performance factors complement the financial performance measurements to evaluate the firm's overall performances. Westerberg and Wincent (2008) measured a firm's performance by two-item financial performance (profitability and productivity) and two-item market performance (sales and market share) instruments. Similarly, Dimitratos, Lioukas, and Carter (2004) suggested that a firm's performance measurements must comprise two dimensions, financial performances and operational performances to get better results.

H9b: Operational performance is one of two significant and positive measurement indicators of spin-off's performance construct.

By offering better products or services, firms can build their competitive advantages representing firm's competencies (Conant, Smart, & Solano-Mendez, 1993). Arthurs and Busenitz (2006) indicated that greater dynamic capabilities are associated with product and management developments. Marketing competencies comprise valuable activities in creating information, making information quality, and using information (Porter & Millar, 1985). Firms can develop and sustain their competitive advantages by gathering unique resources and skills, which make firms distinctive from their competitors (Bharadwaj, Varadarajan, & Fahy, 1993). The skill advantages can be knowledge of customers, competitors, and industry trends. The abilities in segmenting markets, pricing, advertizing product lines also contribute to a firm's competencies (Conant, Smart, & Solano-Mendez, 1993). The most important aspect in development and maintaining the market competencies is that firms must be unique to customers (Porter, 1985; Conant, Smart, & Solano-Mendez, 1993). To maintain market competencies, firms need to adapt to the changes of customer demands. Firms must continuously innovate and update their knowledge related to the changes of social, demographic, technological, economic, and political trends before their competitors do (Bharadwaj, Varadarajan, & Fahy, 1993). The principal role of entrepreneurs is simultaneous performances of marketing, finance, production, administration, and human resources (Bird, 1989). The founders of the start-ups must manipulate effectively the entrepreneurial, managerial, and technical-functional roles (Mintzberg & Waters, 1982; Pavett & Lau, 1983).

Many prior studies have found that spin-off's initial resources positively relate to their subsequent performances (Laitinen, 1992; Cooper, Gimeno-Gascon, & Woo, 1994; Eisenhardt & Schoonhoven, 1990; Brush & Chaganti, 1999). Other entrepreneurship researchers propose that there are relationships between original resources and performances of new ventures (Stinchcombe, 1965; Baron, Hannan, & Burton, 2002). The spin-off's developments depend on how they interact with

their parental institutions and markets towards the initial resources (Heirman & Clarysse, 2004). Other authors argue that the organizational outcomes of the entrepreneurial processes are associated with the original resources (Aspelund, Berg-Utby, & Skjevdal, 2005).

The entrepreneurial strategy of entrepreneurs influences their financial performance (Zahra & Covin, 1995; Dess, Lumpkin, & Covin, 1997; Lumpkin & Dess, 2001). The formal education provides useful skills in entrepreneurial activities lead to a better financial performance compared to those less educated (Cooper, Gimeno-Gascon, & Woo, 1994; Bates, 1995).

Managerial experience positively relates to the performance (Teach, Tarpley, & Schwartz, 1986). Entrepreneur's experiences, venture capital investments, startup's technology sourcing, and technology portfolios positively influence the firm's performances before and after IPO (Kim & Heshmati, 2010). Deeds, DeCarolis, and Coombs (1999) stated that "Prior experience of CEO in managing a commercial research facility enhances a firm's new-product development capabilities." Carland and Carland (2003) stated that "The greater the level of planning intensity, the greater the level of financial performance." "A startup's efficient initial strategy is critical for its performance, and it enhances the credit and confidence of the market" (Kim & Heshmati, 2010). The adaptations for the successes of new technology-based spin-offs require human, technological, financial, and networking resources (Andries & Debackere, 2006). Entrepreneurs in higher socio-economic groups possess high endowments of human capital lead to obtain greater profitability and growth potential (Anderson & Miller, 2003).

The demographic diversity in terms of gender, age, and functional background is not important for an entrepreneurial team's effectiveness (Chowdhury, 2005). Education positively and significantly influences entrepreneurial performances (van der Sluis, van Praag, & Vijverberg, 2008).

Entrepreneurs with the higher educational levels tend to perceive opportunities rather than those with the lower educational levels (Arenius & De Clercq, 2005). Dees, DeCarolis, and Coombs (1999) suggested that the high-technology spin-offs need leaders with knowledge and experiences in processes of new-product developments. Westerberg and Wincent (2008) indicated that the entrepreneur's experiences and managerial controls, such as planning, internal, and customer orientations, influence business performances. Wang and Ang (2004) indicated that the resources-based capabilities, especially strategy, significantly influence the venture performances. Both knowledge and learning influence the growths of entrepreneurial firms through inter-organizational relationships. The resource's exchanges associate with the firm's performances (Sapienze, Parhankangas, & Autio, 2004). Successfully continuous growths of the new spin-offs require effectively organizational structures and co-developments of scientific and innovative knowledge systems (Lee, 2007).

Jin, Huixin, and Ruizhan (2010) indicated that human capital of entrepreneurial teams differently influences on business performances of new ventures in various industries. Human capital improves the social capital, and together positively influence on venture valuations (Hsu, 2007). Franklin, Wright, and Lockett (2001) found that "a combination of academic and surrogate entrepreneurship might be the best approach for universities that wish to develop successful technology-transfer based start-up companies." Gimeno *et al.* (1997) indicated that the entrepreneurs with more general human capital and entrepreneurial skills motivate both performance and survival of new ventures. The firms with various financial performances associated with the unique resources of each firm (Peteraf, 1993). Choi and Lee (2000) found that the abilities in access to technologies with low costs, and in solutions for technological problems improve the success of new ventures. However, fundraising uncertainly leads to products of higher qualities (Levesque, 2000).

The entrepreneurs with the combinations of entrepreneurial skills, motivations, and strategies are more successful than others because these combinations provide more credits to entrepreneurs in spin-off's evaluations of venture capitalists (Agarwal & Chatterjee, 2007). More capital positively relates to better performance of spin-offs (Cooper & Gimeno-Gascon, 1992).

H10: Entrepreneurial capabilities predict spin-off's performances.

Witt (2004) proposed that founders, who benefit from entrepreneurial networks, positively relate to successes of start-ups regarding to profitability, growth, and value creation. The information achievements of individuals depend on their collective behaviors and structure networks (Floyd & Wooldridge, 1999). The obtained information can be useful for various implications as knowledge. Explicit knowledge (know-what) is codified, efficiently shared, and transmittable in formal language, and tacit knowledge (know-how) associates with work routines and practices (Nonaka, 1994). This information motivates the strategic management of individuals (Floyd & Wooldridge, 1999). Empirical study of Rogers (1995) confirmed that interpersonal communications spread new ideas and practices. The interpersonal contacts play an important role in the diffusion of innovations, which contain new technologies (Valente & Davis, 1999). The networks importantly provide information and knowledge to the entrepreneurs (Floyd & Wooldridge, 1999; Brown & Butler, 1995). New ventures can gain their knowledge in terms of know-how through their relationships with others in the networks. Deakins (1996) believed that networks are also advantageous environments for entrepreneurs and spin-offs to learn crucial skills, especially managerial skills. The types of networks and networking experiences influence on the management capability of the new ventures through densely exchanging knowledge (Rothaermel & Deeds, 2006). Knowledge acquisitions positively associates with knowledge exploitation to enhance new-product development, technological distinctiveness, and cost efficiency and lead to competitive advantage (Yli-Renko,

Autio, & Sapienza, 2001). Spin-offs absorb more knowledge from local environment and lead to higher growths and performances (Gilbert, McDougall, & Audretsch, 2008).

Social networks open accesses to the opportunities of commercial trading, which generate incomes and develop the business. Yli-Renko, Autio, and Tontti (2002) indicated that external social capital positively influences on the market knowledge, and ultimately improves the growth of new ventures. Additionally, Gnyawali and Madhavan (2001) believed that entrepreneurs with the superior positions within the networks obtain resources in advantages, and eventually increase competitive actions of the new ventures.

According to Mian (1997), and Hu and Korneliussen (1997) business incubator environment offers direct contributions to entrepreneurs through business and advice ties such as relationships with consultants, other entrepreneurs, or investors. Networks contribute to the additional human capital, e.g. finding managers for new ventures. Arrow (2000) stated that "the motives for interaction are not economic. People may get jobs through networks of friendship or acquaintance, but they do not, in many cases, join the networks for that purpose." Davidsson and Honig (2003) indicated that the benefits of networks not only enable entrepreneurs to advance their start-up processes by acquiring financial capital but also are stronger and more consistent than benefits of human capital.

Network ties benefit spin-off's growths through innovative time reduction, access to complementary resources, transaction cost reduction, and new market entries and positioning (Lipparini & Sobrero, 1994). Staber (1994) suggested that for more resources, entrepreneurs must search for new relationships. Barney (1991) indicated that networks provided access to valuable, rare, inimitable, and non-substitutable resources will enhance the competitive advantages of the start-ups. Entrepreneurs utilize their weak ties for recruiting purposes, and thus networking activities associate

with business performances (Chell & Baines, 2000). Stam and Elfring (2008) found that "the combination of high network centrality and extensive bridging ties strengthened the relationship between entrepreneurial orientation and performance." Studying on cross-lagged correlation, Burkhardt and Brass (1990) found that the network centrality is an important component for company's changes. Gluckler and Armbruster (2003) considered network reputation as an intermediate mechanism addressed the firm growths. Baron and Markman (2003) indicated that social adaptability of entrepreneurs and accuracy in perceiving other members in the network associated with their financial successes.

Company systems correctly operate based upon brokers who emerged and spread good ideals in the networks (Burt, 2004). In virtual organizations, the task-routines and network structures predict perceived performances of the firms (Ahuja & Carley, 1999). For competitive strategy preparation, entrepreneurs must mind that the competitors may know information about sales and profits of their competitor's new ventures although this information is private (Brush & Vanderwerf, 1992).

Both internal and external social networks positively influence innovative capabilities of new ventures (Chen & Wang, 2008). The interactions of network ties and product and process niches enhance firm's performances (Echols & Tsai, 2005). Networking capability is central to firm's growths not only in the hi-tech sectors but also in low-tech sectors (Mort & Weerawardena, 2006). The prior research in academic community of entrepreneurs associates with their productivity in commercialization (Deeds, DeCarolis, & Coombs, 1999).

Entrepreneurs simply value the relationships with their friends and families who motivate the assembling assets and personnel's recruitments, and lead to success of their ventures (Dahl & Sorenson, 2009). Results of Lee's study (2007) revealed that social network explorations predict the

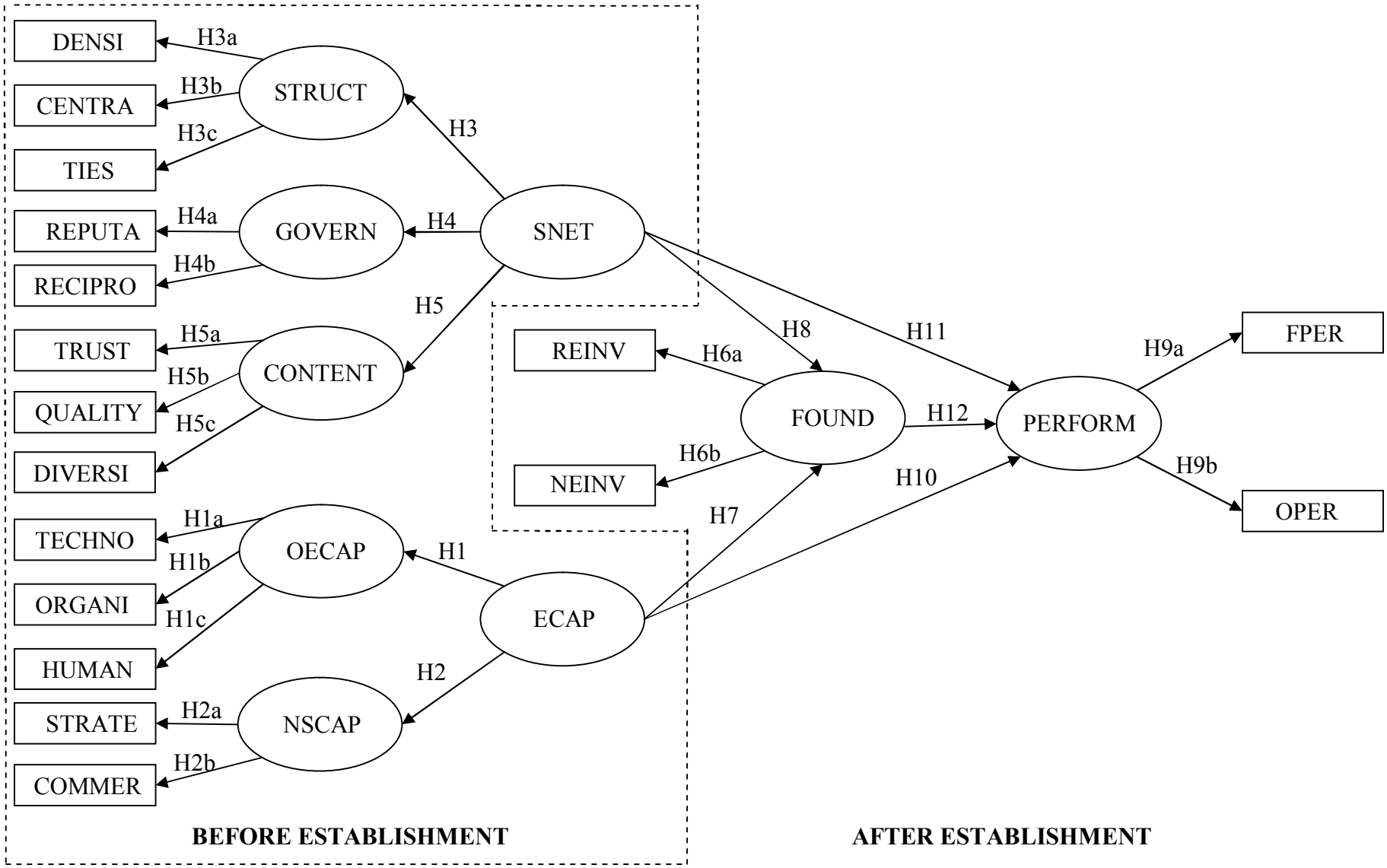
product's developments. Besides specific skills and knowledge, other networking characteristics such as effective communication, coordination, shared values, and trust motivate the success of commercializing technological products of new ventures (Lee, 2007). Networks and other factors such as cost factors and unique global resources also contribute to the successes of international entrepreneurship (Callaway, 2004). Thus, this study proposes that the social networks influence the managerial skills of entrepreneurs through achieved knowledge and lead to impact the performances of new ventures in following stages.

H11: Social network characteristics predict spin-off's performances.

Studying spin-offs of U.S. universities, O'Shea *et al.* (2005) found that "the size and nature of financial resources" influences on academic entrepreneurship. Moreover, the methods of funding of new startups engender different kinds of company's culture, which influences venture's long-term developments (Hamilton, 2001). Thus, the successes of spin-off's foundations were supposed to influence on the spin-off's performances in the later stages.

H12: Success of spin-off's foundation predicts spin-off's performances.

Figure 5: Conceptual Model



CHAPTER 3

METHODOLOGY

2.1. Sample

The population considered in this study comprised founders of spin-offs of all universities in Spain. Because of the study's specificities, the interviewees must be the founders even though they are managers or staffs of the companies. Commonly, the interviewees were professors or staffs of the university who had been involved in the entrepreneurial teams and partly created new spin-offs from universities. There have been many university spin-offs founded in Spain which were dead already. However, there have been many professors who were founders of the spin-offs but had ceased working in those spin-offs and are currently working in universities. Moreover, this study emphasizes the social network characteristics of founders during the process of spin-off creation. Thus, only founders, who were working in the existing university spin-offs at the time of the survey, were considered as interviewees. The information of spin-offs, including contact information of founders, was collected from the Technological Transfer Office (TTO) of 68 universities in Spain. We sent one letter to these organizations to ask for contact information of their spin-offs (Appendix A). From the replies and all websites of these TTO, a list of names and contact information of the founders of the spin-offs was created. However, we could not get necessary information from 27 universities because some of these universities had not created spin-offs and some universities neither responded nor posted information of their spin-offs on their websites. From all mentioned methods, we generated a list of 862 spin-offs from 34 Spanish universities with all emails of the founders including 396 given names of founders.

2.2. Instrument development

To measure the constructs in the model, we utilized a self-report questionnaire. We developed the instruments from existing scales and prior literatures. To test the hypotheses of the research, we employed structural equation analysis. In structural equation modeling (SEM), network structure, network governance, and network content are latent variables or constructs, which are not directly measurable (Kline, 1998; Vieira, 2011). To indicate these latent variables, we utilized observations or manifested instruments comprising ties, centrality, density, trust, reputation, reciprocity, information quality, and information diversity. Additionally, we employed observed variables comprising entrepreneurial technology, entrepreneurial strategy, commercial capital, human capital, organizational capability, and financial capital, to indicate original entrepreneurial capabilities and necessary supplementary capabilities for the foundation and performance of spin-offs.

The structure and representation of questionnaires importantly contribute to the successes in response rate optimization and completion of the entire survey (Dillman, 2000; Churchill & Iancobucci, 2002). For optimal results, we presented interesting questions in the first part of survey, more difficult questions placed in middle part, and sensitive and demographic measurements located at the end of the survey. Especially, questions regarding general information of the spin-offs were located in the first part, followed by questions related to social networks and entrepreneurial capabilities, and we ended with questions about evaluations of the success of creations and current performance of the spin-offs.

We translated the survey questionnaire into Spanish version (Appendix E) because interviewees were the Spanish and definitely preferred answering in Spanish. Before sending the questionnaire to interviewees, we performed a small test on the Spanish version with founders of spin-offs of the University of Granada. The questionnaire took 10 minutes to complete, and they understood all the

questions of the survey. This initial test partially proved that the questionnaire is understandable and the translation was accurate. A comprehensible questionnaire is one of the most important characteristics for a good web-based survey method.

This study employed web-based survey approach to collect data because of its advantages. The first advantage of the web-based surveys is comparatively low costs compared with other methods. Secondly, the surveys are also faster and more accurate than others. Web-based surveys can be posted up in a day, and we can quickly obtain the database. From the online questionnaires, responses can be automatically collected into databases. We not only save time and money, but also eliminate human errors in data collection and coding with this method. With this method we can avoid missing data with the prompts that alert interviewees if they skip or incorrectly answer questions. Moreover, geographical limitation is not a matter in the web-bases surveys (Fleming & Bowden, 2009).

2.2.1. Network structure

Network ties

The strength of ties measures the previous levels of mutual confidence in a relationship. The respondents evaluate the levels of willingness in private topic discussions comprising family matters and politics (Schaefer & Olson, 1981; Marsden & Campbell, 1984; Parks & Floyd, 1996; Frenzen & Nakamoto, 1993). Three questions (TIE1, TIE2, TIE3) were scaled from one to seven (from strong disagreements to strong agreements) to measure the strength of ties (Appendix D).

Density

Marsden (1993) defined density of a network as the number of ties among members compared with the possible number of ties in the network. In this study, we measured the density of networks by

adapting the concept of Burt (1987), Granovetter (1973), and Marsden (1993). The density instruments comprise three questions (DEN1, DEN2, and DEN3) that determine the degree of network members interacted with each other. The questions were scaled from one to seven corresponding to from strong disagreements to strong agreements (Appendix D).

Centrality

According to Rowley (1997) and Baldwin, Bedell, and Jonhson (1997), centrality of an entrepreneur refers to her central degree in the information flow in a network. Four questions were adapted from these studies to measure the central positions that respondents call and talk directly to other members. These questions (CEN1, CEN2, CEN3, and CEN4) were scaled from one (strongly disagree) to seven (strongly agree) (Appendix D).

2.2.2. Network governance

Reputation

Based on the self-evaluating survey, the reputation of the entrepreneurial teams was measured by asking their evaluation about their characteristics. The questions were adapted and employed from Shane and Cable (2002), Podolny and Stuart (1995), and Uzzi (1996). The measurement comprises four seven-point Likert scaled questions (REP1, REP2, REP3, and REP4) which ranged from strong disagreements to strong agreements (Appendix D).

Reciprocity

Reciprocity refers to level of support, accumulation of favors, and the fairness contained in the relationships among members (Frenzen & Davis, 1990; Miller & Kean, 1997). The four-question set

(REC1, REC2, REC3, and REC4) ranging from one (strongly disagree) to seven (strongly agree) was utilized to measure the reciprocity among the members in the networks (Appendix D).

2.2.3. Network content

Trust

This study measures trust by questions adapted from Tsai and Ghoshal (1998). The four-question set (TRU1, TRU2, TRU3, and TRU4) was scaled from one (strongly disagree) to seven (strongly agree) to measure how trustworthy the respondents perceive they are in the mind of other members in the network (Appendix D).

Diversity of information

Diversity of information refers to the redundancy of sorts of information that flows in the networks. This study measured the degree of availability of information related to business operations in the networks. The responders were asked to rate the level of each sort of information transferred between these interviewees and others in their own networks. Adapted from study of Gupta and Govindarajan (1991; 2000), a set of five questions (DIV1, DIV2, DIV3, DIV4, and DIV5) were created to measure diversity of information flow in the social networks comprising market data, product designs, process designs, marketing know-how, and packaging design or technology (Appendix D).

Information quality

To measure the information quality flew in the networks, this study utilized the four-question set (QUA1, QUA2, QUA3, and QUA4) developed by O'Reilly (1982). These seven-scale questions evaluate accuracy, relevancy, reliability, specificity, and timeliness of information (Appendix D).

2.2.4. Original entrepreneurial capabilities

Entrepreneurial technology

Entrepreneurial technology measures the ease of imitation, scope, continuity, and market signal of technology. The instruments with six questions (TEC1, TEC2, TEC3, TEC4, TEC5, and TEC6) on the license literature (Gallini & Wright, 1990; Contractor , 1985), market signal of technologies (Bird, Hayward, & Allen, 1993; Krueger, 1993), and continuity of technology (Tushman & Anderson, 1986) were employed (Appendix D).

Organizational capability

Organizational capability of a spin-off is measured by 7-point scales adapted from Hornsby et al. (1993), Kanter (1984), Zahra (1993), and Antoncic and Hisrich (2001). Four-question set (ORG1, ORG2, ORG3, and ORG4) was erected to measure organizational capability of the entrepreneurial teams in the period of spin-off's foundation (Appendix D).

Human capital

Human capital mostly measures industrial, managerial, and entrepreneurial experiences. Industrial experiences focused on the previously working experiences of the entrepreneurial teams in the industries or similar technologies (Cooper, Gimeno-Gascon, & Woo, 1994; Pennings, Lee, & Witteloostuijin, 1998). Managerial and entrepreneurial experiences are important elements of human capital for entrepreneurs (Cooper, Gimeno-Gascon, & Woo, 1994; Bates, 1990; 1995; Bruderl, Preisendorfer, & Zeigler, 1992). Experiences or knowledge of founders must compose the technical, functional, venture, industrial fields (Boyatzis, 1982). Three questions comprising HUM1, HUM2, and HUM3 were scaled to evaluate capabilities of individuals in the entrepreneurial teams at the foundation's period (Appendix D).

2.2.5. Necessary supplemental capabilities

Entrepreneurial strategy

To measure entrepreneurial strategy, this study employed the instruments from Covin and Slevin (1988), Naman and Slevin (1993), and Lumpkin and Dess (2001), which were developed from scholars of Miller and Friesen (1982), and Khandwalla (1977). This study utilized four questions (STR1, STR2, STR3, and STR4) to measure four dimensions of entrepreneurial strategy comprising innovation, proactiveness, risk-taking, and competitive aggressiveeness (Appendix D).

Commercial capability

The measurements of spin-off's commercial capability base on the customer relationships, technology training of staffs, and process redesigns (Powell & Dent-Micallef, 1997; Nadherny, 1998). Four questions comprising COM1, COM2, COM3, and COM4 were utilized to measure the commercial capability of the entrepreneurial team (Appendix D).

2.2.6. Success of spin-off's foundation

Established success measures the capability of the new venture to access the financial sources after spinning off. This study thus questioned the interviewees how easily their firms could access the financial sources right after launching the firms. The financial sources comprise private investors or angels, strategic partners, initial public offering, employees, and customers (Cooper, Gimeno-Gascon, & Woo, 1994; Greene & Brown, 1997). The investments on spin-offs right after launching comprise returning investments (from existing investors) and new investments (from new investors). This research utilized eight questions (RIN1, RIN2, RIN3, NIN1, NIN2, NIN3, NIN4, and NIN5) to measure the success of spin-off's foundation (Appendix D). These questions were administered on seven-point Likert scale ranging from one (not easy at all) to seven (very easy).

2.2.7. Performance

As discussed above, the performance measurement is multidimensional (Cameron, 1978; Chakravarthy, 1986). The comparisons of these dimensions of the new venture's performance with their principal competitors reveal meaningful and important information (Birley & Westhead, 1990). Murphy, Trailer, and Hill (1996) argued that the financial measurement is a better indicator and is the primary measure of the firm's performance. Typically, the entrepreneurship researchers have used the growth of sales, profits, net worth, and employments to measure the financial performance of the new venture (Chandler & Hanks, 1993). The financial performance of new ventures was measured by certain in time variables such as first sales, positive cash flow and profitability, or by continuous measurements of sales and profitability (Davidsson, 2006). The financial performance of new ventures was also measured by four items scale such as sales growth rate, return on sales, return on assets, and overall firm's success in comparison with their competitors (Garg, Walters, & Priem, 2003). Additionally, the operational performance measures the product quality and market share of the firms as used by Kaplan (1983), and Hofer and Sandberg (1987) utilized. However, in this study, we employed the spin-off's performance measurements of Murphy, Trailer, and Hill (1996). Therefore, respondents were asked to compare the development of their own firm over the past 3 years relative to their two most important competitors. The measurements compose four questions measuring financial performances (FPE1, FPE2, FPE3, and FPE4), and six questions evaluated operational performances (COP1, COP2, COP3, COP4, COP5, and COP6). The measurement applied seven-point scales ranging from much lower to much higher (Appendix D).

2.3. Data collection

To collect data, we sent two emails to interviewees comprising first an email of introduction and invitation to the survey, and then a second email to remind the interviewees. The first email (Appendix B) was sent to 862 spin-offs of Spanish universities comprising 396 given name and 466 unknown name subjects. The second email (Appendix C) was sent to those who had not responded after the first email. These emails contained a link to the survey webpage which employed the Google Survey application. This application provides an instrument to upload and to design the survey's questionnaire. Moreover, this application also assists researchers to collect data easily in many forms for later analyses.

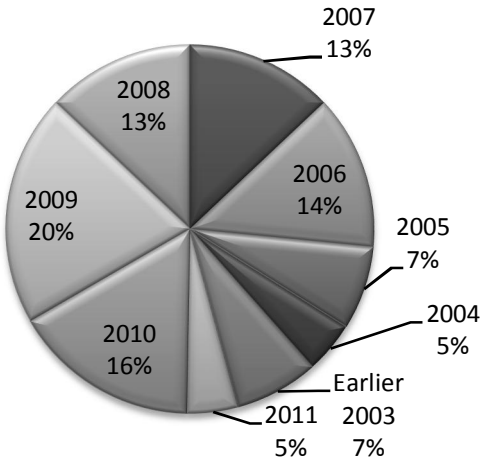
After one month from April to May of 2011, we received 83 responses from the interviewees with more than half of them from the given name interviewees. We then received 98 more responses after the second email. In total, from April to June of 2011, we obtained 181 responses with 65 percent of responses from given name founders. The rate of responses was 21 percent of the research population. It was acceptable because many unknown name interviews responded through emails that they are replacements for founders of the spin-offs, and they could not take this survey. The survey ensured that its subjects are founders of the spin-offs.

2.4. Sample description

We achieved a data set of 181 responses from founders of Spanish university spin-offs. To avoid duplicating responses, we ask interviewees their spin-offs' names and eliminated them from the receiver's list of recall emails. The Spanish university spin-offs are new entries on the markets. Most of the firms were established after 2004. It reasonably ensures that the interviewees are founders, and were still working in the firms during the survey time.

Because this survey focused on the individual relationships, the key members of the entrepreneurial teams were considered as interviewees. They could be professors or faculty staffs of the universities, thus, comprised various levels of education. Because the subjects of this study are university spin-offs, most of the key members of the entrepreneurial teams were post-graduated individuals with 51 % have doctorates, and 19 % have master degrees.

Figure 6: Established Year



CHAPTER 4

RESULTS

The conceptual model comprises a large number of observed variables. This causes this study to estimate many parameters, and it thus would produce an under-identified model. To optimize a solution, it is required a smaller number of latent constructs by averaging manifest indicators (Yuan, Bentler, & Kano, 1997).

Reliability implies a consistency in the results over time and across situations. A reliable measure must be free from error and generate consistent results (Zikmund, 2000). In a survey, all measures must satisfy internal consistency of all items which means the individual items correlate with one another (Hatcher, 1994). Conbach's alpha is the contemporary measure of reliability presenting the degree of error variance in a scale (Cronbach, 1951; 1970; Peter, 1979). Cronbach's alpha positively relates to the number of items in the scale. An acceptable reliability coefficient is above 0.70 (Nunnally, 1978). However, Hatcher (1994) and Anderson *et al.* (1998) suggested that the social literatures sometimes accept the coefficient alpha reliability under 0.7 and even as low as 0.60. For a narrow construct, Cronbach's Alpha must be between 0.70 and 0.90, a moderately broad construct has alpha between 0.55 and 0.70, and alpha between 0.35 and 0.55 indicates a very broad construct (Van de Ven & Ferry, 1979; Powell , 1992).

Absolute fit tests the ability to reproduce the correlation/covariance matrix (Kelloway, 1998). In structural equation modeling, researchers introduced methods of estimation a single test statistic (distributed as χ^2) to test the null hypothesis.

$$\Sigma = \Sigma(©)$$

Where $\sum$ is the population covariance matrix and $\sum$ (©) is the covariance matrix implied by the model (Bollen & Long, 1993). In the traditional hypothesis testing, a non-significant (χ^2) implies non-significant discrepancy between the model covariance matrix and the population covariance matrix. In other words, the model "fits" the data in that the model can reproduce the population covariance matrix.

The test is distributed with degrees of freedom equal to

$$1/2(q)\ (q + 1) - k$$

Where q is the number of variables in the model, and k is the number of estimated parameters.

Because the problems occur in the assessing the absolute fit of a model, the assessment of comparative fit was developed in which the considering model will be compared with some competing models. Different from absolute fit, which compare against a model providing perfect fit to data, the comparative fit compares with a baseline model provided a poor fit to data. The baseline model is commonly the "null" or "independence" model.

A normed fit index (NFI) indicates the percentage improvement in the fit over the baseline independence model (Bentler & Bonett, 1980). However, because the NFI may underestimate the fit of the model in the small samples, the nonnormed fit index (NNFI) was generated. The NNFI is estimated by which is similar to the NFI but adjusts the normed fit index for the number of degrees of freedom in the model (Kelloway, 1998).

$$(\chi^2_{\text{indep}} - df_{\text{indep}}/\ df_{\text{model}}\ \chi^2_{\text{model}})/\ (\ \chi^2_{\text{indep}} - df_{\text{model}})$$

Higher values of the NNFI indicate a better fit of model and a good fit to the data is commonly accepted at equal or greater than 0.9.

In LISREL, the simplest index is root mean squared residual (RMR) which is the square root of the mean of squared discrepancies between the implied and observed covariance matrices. The index bound from 0 to 1, and lower value indicates a good fit, namely value less than 0.05 (Kelloway, 1998). Similar to RMR, the root mean squared error of approximation (RMSEA) is based on the analysis of residuals. According to Steiger (1990), the value below 0.10 indicates a good fit to the data, the value below 0.05 indicates a very good fit to the data, and the value below 0.01 indicates an outstanding fit to the data. Hair *et al.* (1998) suggested that value as high as 0.08 of RMSEA indicates a reasonable fit. Other researchers suggested a better cutoff for good fit at 0.06 (Hu & Bentler, 1995).

LISREL also introduces goodness-of-fit (GFI) and adjusted GFI (AGFI). The GFI is a ratio of sum of the squared discrepancies to the observed variance. The GFI is "a measure of the relative amount of variances and covariance jointly accounted for by the model", and "unlike χ^2, GFI is independent of the sample size" (Joreskog & Sorbom, 1981). The AGFI adjusts the GFI for degrees of freedom in the model. AGFI "corresponds to using mean squares instead of total sums of squares" (Joreskog & Sorbom, 1981). The GFI and AGFI range from 0 to 1 with values above 0.9 indicate good fits to the data (Kelloway, 1998; Byrne, 1998).

In the confirmatory factor analysis model with fewer than 200 observations, goodness-of-fit must be used as a way to assess the model fit (Berrett, 2007), or "GFI appears to perform better than any other stand-alone index" (Marsh, Balla, & MacDonald, 1988). In this study, we thus employed the combination of the ratio chi-square/degrees of freedom (<3), RMSEA (<0.08), GFI (>0.9), NFI (0.9), and CFI (0.9) to test the model fit (Bagozzi & Yi, 1988; MacCallum, Browne, & Sugawara, 1996; Ping, 2004).

The models with latent variables require at least a sample size of 100 observations (Marsh, Balla, & MacDonald, 1988). The sample size for the confirmatory factor analysis model with no missing data must be equal or greater than 150 respondents for normal distribution and 265 for non-normal distribution (Muthen & Muthen, 2002). In this study, all observed variables revealed significant kurtosis and skewness p-values, which satisfied the normality test of all variables. Moreover, the measure of relative multivariate kurtosis was 1.036. This value is relatively small, and it thus appears that the multivariate distribution is reasonably normal. The Maximum Likelihood can be used as estimation method for this research. With 181 observations, the sample size of this research satisfied the minimum requirement for confirmatory factor analysis according to Muthen and Muthen (2002).

3.1. Factor development

Before testing the hypotheses, we employed exploratory factor analysis on items to construct latent variables. We sought for items that uniquely and satisfactorily constructed prior defined factors based on the maximum likelihood method. In other words, we retained items that only loaded greater than 0.50 on a single factor. We applied program SPSS 18 to construct and load the factors of the research, and estimate their Cronbach's alphas.

3.1.1. Social network characteristics

As prior theory, social network measurements comprise three factors, namely network structure, network governance, and network content instruments. Following the previous requirements, the results of exploratory factor analysis revealed a three-item density scale, a three-item ties scale, and a four-item centrality scale in network structure measurements. The Cronbach's alphas of three factors of network structure were over 0.7, which satisfied the requirement of reliability of scales. All items in the network structure measurements loaded over 0.5. All items of the network governance instruments comprising a four-item reputation scale and a four-item reciprocity scale

also loaded over 0.5. The Cronbach's alphas of reciprocity were greater 0.7, but reputation scale was lower requirement. Because the reputation measurement was a quite new concept, the scale of 0.632 was acceptable (Hatcher, 1994). The measurements of network content which comprise a four-item trust scale, a six-item diversity of information scale, and a five-item quality of information scale revealed loadings greater 0.5 for all items. The Cronbach's alphas of three factors of network content measurements were also greater 0.7 and satisfied the requirement of reliability of scales (Appendix F).

3.1.2. Entrepreneurial capabilities

Employing the same method in the prior analyses, we constructed the measurements of entrepreneurial capabilities comprising original entrepreneurial capability and necessary supplementary capability factors. The results revealed that the original entrepreneurial capability factors content a six-item entrepreneurial technology scale, a five-item entrepreneurial organization scale, and a four-item human resource scale. The entrepreneurial technology, entrepreneurial organization, and human capital scales were constructed from items loaded over 0.5. The Cronbach's alphas of these measurements also satisfied the reliability scales. The construction of necessary supplementary capability measurements, comprising a five-item entrepreneurial strategy scale and a four-item commercial capability scale, also revealed a similar result. All items of entrepreneurial strategy and commercial capability scales were loaded greater 0.5, and their Cronbach's alphas were 0.702 for entrepreneurial strategy scale and 0.708 for commercial capability scale (Appendix F).

3.1.3. Success of spin-off's foundation and spin-off's performance

Based on the prior definition, the measurement of spin-off's foundation comprises a three-item returning investment scale and a five-item new investment scale. The result from factor loading revealed that all items loaded over 0.5 to satisfy the requirement. The Cronbach's alpha of returning

investment factor reached the requirement (0.714) meanwhile the reliability scale of the new investment factor was 0.655. Because the reliability scales from 0.6 to 0.7 are acceptable in cases of the measurements are new concepts (Hatcher, 1994). Thus, the Cronbach's alpha of the new investment factor is acceptable because the spin-off's foundation measurement based on this study's approach is a new concept.

To measure performance of the new venture, we employed a four-item financial performance scale and six-item marketing competence scale. The result of confirmatory factor analysis revealed that all items of two factors loaded over 0.5, and the Cronbach's alpha was satisfied the reliability of scale with 0.842 for financial performance measurement and 0.767 for marketing competence factor (Appendix F).

3.2. Confirmatory factor analysis

Previously, we utilized the exploratory factor analysis to construct the factors of the research. However, exploratory factor analysis is considered as an insufficient method of evaluation of dimensions. We cannot utilize the exploratory factor analysis to test the model with higher-order factors (Rubio, Berg-Weger, & Tebb, 2001). Thus, we utilized the confirmatory factor analysis to analyze and to test the research's hypothesis. The results from prior exploratory factor analysis suggested eight factors of network characteristic, five factors of entrepreneurial capability, a factor of success of foundation process, and two factors of performance, which are correlated each other and indicate higher-order constructs. The lower-order factors interpret higher-order factors (Rubio, Berg-Weger, & Tebb, 2001). In this study, lower-order factors comprising density, centrality, and ties indicate network structure as the higher-order factor. Similarly, trust, reputation, and reciprocity indicate network governance; quality of information and diversity of information interpret network content; and financial performance and marketing competence indicate spin-off's performance. In

this study, we utilized the first-order confirmatory factor analysis to construct the lower-order factors, and second-order confirmatory factor analysis to construct the higher-order factors. In this study, we applied LISREL 8.8, which based on the maximum likelihood method to test the hypotheses.

Utilizing the identified items in exploratory factor analysis, we tested the validity of entrepreneurial technology, entrepreneurial organization, entrepreneurial strategy, commercial capability, and human capital factors by applying first-order confirmatory factor analysis. Besides testing the entrepreneurial factors, we also utilized the first-order confirmatory factor analysis to test the network density, network centrality, and network tie factors in the network structure measurement, trust, reputation, and reciprocity factors in network governance measurement, and quality and diversity of information scales in the network content measurement. Then, we applied the second-order confirmatory factor analysis to test three identified network's characteristic factors (structure, governance, content). Before testing the hypothesis, we utilized the first-order confirmatory factor analysis to test the fit of two dependent variables comprising success of foundation and spin-off's performance.

3.2.1. Social network characteristics

3.2.1.1. Network structure

The network structure latent variable comprises three first-order factors, namely density in networks (DENSI), centrality of members in networks (CENTRA), and ties in networks (TIES). As prior exploratory factor analysis suggestion, three items (DEN1, DEN2, and DEN3) constructed the DENSI factor, four items (CEN1, CEN2, CEN3, and CEN4) indicated the CENTRA variable, and three items (TIE1, TIE2, and TIE3) interpreted the TIES construction. The result form first-order

confirmatory factor analysis of DENSI, CENTRA, and TIES revealed an acceptable fit (χ^2=62.80, df=32, RMSEA=0.073, NFI=0.94, CFI=0.97, GFI=0.93) (Table 1). The ratio chi-square/degrees of freedom is below 2 (χ^2/df = 1.96) indicated that the model was acceptable fit. All parameter estimates were significant at the 0.5 level suggesting that there was sufficient evidence of convergent validity. All items loaded on one factor each led to a verification of indicators passed the discriminant validity test.

Table 1: Parameter Estimates for First-order CFA for Network Structure

Path Label	**Parameter Estimate**	**t-value**	**Standardized Estimate**
DEN1, DENSI	1.28	10.35*	0.12
DEN2, DENSI	1.83	16.06*	0.11
DEN3, DENSI	1.81	15.97*	0.11
CEN1, CENTRA	0.80	7.42*	0.11
CEN2, CENTRA	0.88	9.40*	0.093
CEN3, CENTRA	1.06	9.54*	0.11
CEN4, CENTRA	0.88	7.78*	0.11
TIE1, TIES	1.09	9.55*	0.11
TIE2, TIES	1.71	14.25*	0.12
TIE3, TIES	1.53	12.67*	0.12
*p<0.05			
χ^2=62.80, df=32, n=181, p-value=0.00092, RMSEA=0.073, NFI=0.94, CFI=0.97, GFI=0.93			

Three first-order factors (DENSI, CENTRA, and TIES) indicated the second-order construction (STRUCT) as prior definition. The second-order confirmatory factor analysis of network structure measurement revealed a result of good fit (χ^2=64.05, df=35, RMSEA=0.068, NFI=0.94, CFI=0.97,

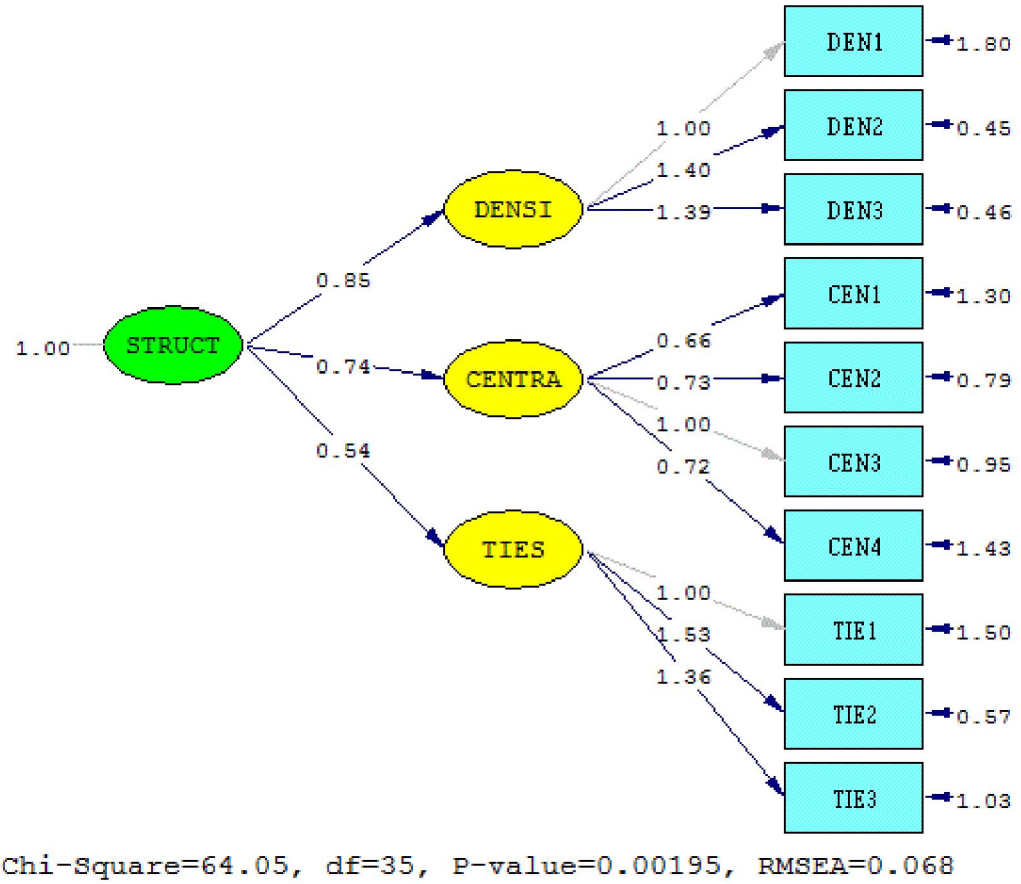
GFI=0.93) (Table 2). The ratio chi-square/degrees of freedom is below 2 (χ^2/df = 1.83) indicated that the model was acceptable fit. The evidence of convergent validity was passed because all parameter estimates were significant at the 0.5 level. All composite reliabilities of three factors were greater 0.70 means that the measurements passed the reliability test. All items satisfied the requirement of single loading on factors to verify the discriminant validity of indicators.

Table 2: Parameter Estimates for Second-order CFA for Network Structure

Construct	**Path Label**	**Parameter Estimate**	**t-value**	**Standardized Estimate**
	DEN1, DENSI	1.00		
	DEN2, DENSI	1.40	13.44*	0.10
Density	DEN3, DENSI	1.39	13.43*	0.10
	CEN1, CENTRA	0.66	7.31*	0.09
	CEN2, CENTRA	0.73	8.89*	0.82
	CEN3, CENTRA	1.00		
Centrality	CEN4, CENTRA	0.72	7.50*	0.096
	TIE1, TIES	1.00		
	TIE2, TIES	1.53	13.46*	0.11
Ties	TIE3, TIES	1.36	12.72*	0.11
Construct Equations				
DENSI, STRUCT		0.85	5.38*	0.16
CENTRA, STRUCT		0.74	5.09*	0.14
TIES, STRUCT		0.54	4.18*	0.13
*p<0.05				
χ^2=64.05, df=35, n=181, p-value=0.0020, RMSEA=0.068, NFI=0.94, CFI=0.97, GFI=0.93				

Variables	Composite Reliability
Density	0.888
Centrality	0.736
Ties	0.840

Figure 7: Second-order Confirmatory Factor Analysis of Network Structure



Basing on this result, the second-order network structure measurement was indicated by three first-order factors comprising a three-item density scale (DEN1, DEN2, and DEN3), a four-item centrality scale (CEN1, CEN2, CEN3, and CEN4), and a three-item tie scale (TIE1, TIE2, and TIE3) (Figure 7).

3.2.1.2. Network governance

According to the prior exploratory factor analysis, the reputation scale included four items (REP1, REP2, REP3, and REP4), and the reciprocity factor was constructed by four items (REC1, REC2, REC3, and REC4). The first-order confirmatory factor analysis of reputation and reciprocity factors (REPUTA and RECIPRO) revealed a good fit (χ^2=26.95, df=19, RMSEA=0.048, NFI=0.94, CFI=0.98, GFI=0.96) (Table 3). The ratio chi-square/degrees of freedom is below 2 (χ^2/df = 1.42) indicated that the model was acceptable fit. All parameter estimates were significant at the 0.5 level, and all items loaded on one factor each led to satisfaction on requirements of the evidence of convergent validity and the discriminant validity of indicators.

Table 3: Parameter Estimates for First-order CFA for Network Governance

Path Label	**Parameter Estimate**	**t-value**	**Standardized Estimate**
REP1, REPUTA	0.71	7.98*	0.089
REP2, REPUTA	0.46	4.47*	0.097
REP3, REPUTA	0.52	6.64*	0.078
REP4, REPUTA	0.44	6.82*	0.064
REC1, RECIPRO	0.71	10.25*	0.069
REC3, RECIPRO	0.85	8.14*	0.10
REC3, RECIPRO	1.09	10.34*	0.11
REC4, RECIPRO	1.03	15.02*	0.068
*p<0.05			
χ^2=26.95, df=19, n=181, p-value=0.11, RMSEA=0.048, NFI=0.94, CFI=0.98, GFI=0.96			

Two first-order factors, REPUTA and RECIPRO, interpreted the second-order variable GOVERN. The result from the second-order confirmatory factor analysis of GOVERN measurement also

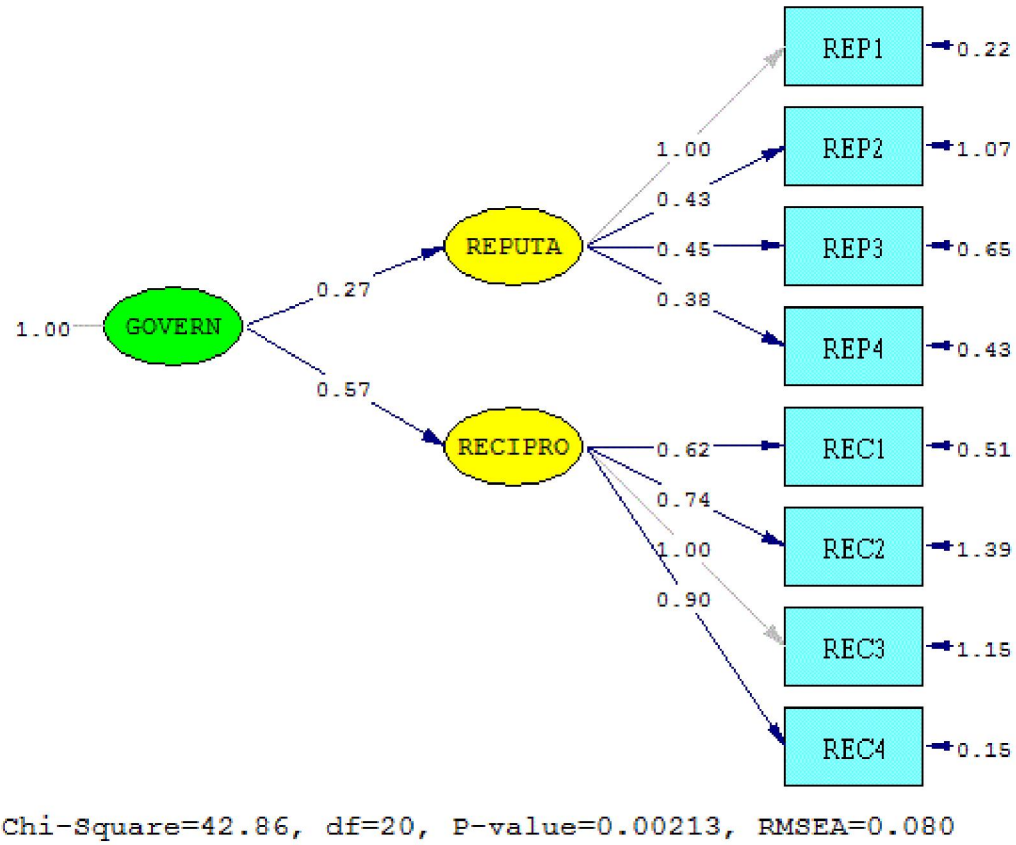
revealed an acceptable fit (χ^2=42.86, df=20, RMSEA=0.080, NFI=0.91, CFI=0.95, GFI=0.94) (Table 4). The ratio chi-square/degrees of freedom is below 3 (χ^2/df = 2.1) indicated that the model was acceptable fit. All parameter estimates were significant at the 0.5 level provided a sufficient for convergent validity. The composite reliability of RECIPRO was greater 0.80 to satisfy reliability test, and the composite of REPUTA measurement was 0.632 as an acceptable reliability (Hatcher, 1994; Hair, Anderson, Tatham, & Black, 1998). Moreover, all items loaded on one factor each led to a verification of indicators passed the discriminant validity test. Eventually, the second-order latent variables (GOVERN) comprise two first-order factors (REPUTA and RECIPRO). The REPUTA factor was interpreted by four items (REP1, REP2, REP3, and REP4) and RECIPRO indicator was constructed by four items (REC1, REC2, REC3, and REC4) (Figure 8).

Table 4: Parameter Estimates for Second-order CFA for Network Governance

Construct	**Path Label**	**Parameter Estimate**	**t-value**	**Standardized Estimate**
	REP1, REPUTA	1.00		
	REP2, REPUTA	0.43	4.81*	0.09
	REP3, REPUTA	0.45	5.90*	0.076
Reputation	REP4, REPUTA	0.38	6.09*	0.063
	REC1, RECIPRO	0.62	9.32*	0.067
	REC2, RECIPRO	0.74	7.66*	0.097
	REC3, RECIPRO	1.00		
Reciprocity	REC4, RECIPRO	0.90	10.82*	0.083
Construct Equations				
REPUTA, GOVERN		0.27	1.52	0.18
RECIPRO, GOVERN		0.57	2.71*	0.21
*p<0.05				
χ^2=42.86, df=20, n=181, p-value=0.0021, RMSEA=0.080, NFI=0.91, CFI=0.95, GFI=0.94				

Variables	Composite Reliability
Reputation	0.632
Reciprocity	0.805

Figure 8: Second-order Confirmatory Factor Analysis of Network Governance



3.2.1.3. Network content

In the last second-order network's characteristic factor, there were three first-order factors comprising trust (TRUST), quality of information (QUALITY), and diversity of information in

networks (DIVERSI). A set of four items (TRU1, TRU2, TRU3, and TRU4) constructed the TRUST scale, a set of five items (QUA1, QUA2, QUA3, QUA4, and QUA5) indicate the QUALITY factor, and the DIVERSI indicator was represented by a set of six items (DIV1, DIV2, DIV3, DIV4, DIV5, DIV6). The result revealed a poor fit for first-order confirmatory factor analysis (χ^2=244.54, df=87, RMSEA=0.10, NFI=0.94, CFI=0.96, GFI=0.85). The RMSEA and GFI violated the cutoff rule because the factor DIV6 cross-loaded on both quality and diversity factors, and item TRU4 cross-loaded on trust and quality factors as well. To satisfy the requirement of single loading of items, we thus dropped DIV6 and TRU4 from the set of items to improve the result. As expectation, the result was hugely improved and reached the requirement of acceptable fit (χ^2=107, df=62, RMSEA=0.064, NFI=0.96, CFI=0.98, GFI=0.92) (Table 5). The ratio chi-square/degrees of freedom is below 2 (χ^2/df = 1.73) indicated that the model was acceptable fit. The test of convergent validity and the discriminant validity of indicators was passed because all parameter estimates were significant at the 0.5 level, and all items loaded on one factor each.

Table 5: Parameter Estimates for First-order CFA for Network Content

Path Label	**Parameter Estimate**	**t-value**	**Standardized Estimate**
TRU1, TRUST	0.72	13.45*	0.054
TRU2, TRUST	0.78	14.97*	0.052
TRU3, TRUST	0.73	8.76*	0.084
QUA1, QUALITY	1.17	14.85*	0.079
QUA2, QUALITY	1.26	15.32*	0.082
QUA3, QUALITY	1.16	14.28*	0.082
QUA4, QUALITY	1.05	12.32*	0.086
QUA5, QUALITY	1.07	12.55*	0.085
DIV1, DIVERSI	1.37	12.22*	0.11

DIV2, DIVERSI	1.66	15.08*	0.11
DIV3, DIVERSI	1.63	13.95*	0.12
DIV4, DIVERSI	1.34	12.16*	0.11
DIV5, DIVERSI	1.37	11.99*	0.11
*p<0.05			
χ^2=107.47, df=62, n=181, p-value=0.0003, RMSEA=0.064, NFI=0.96, CFI=0.98, GFI=0.92			

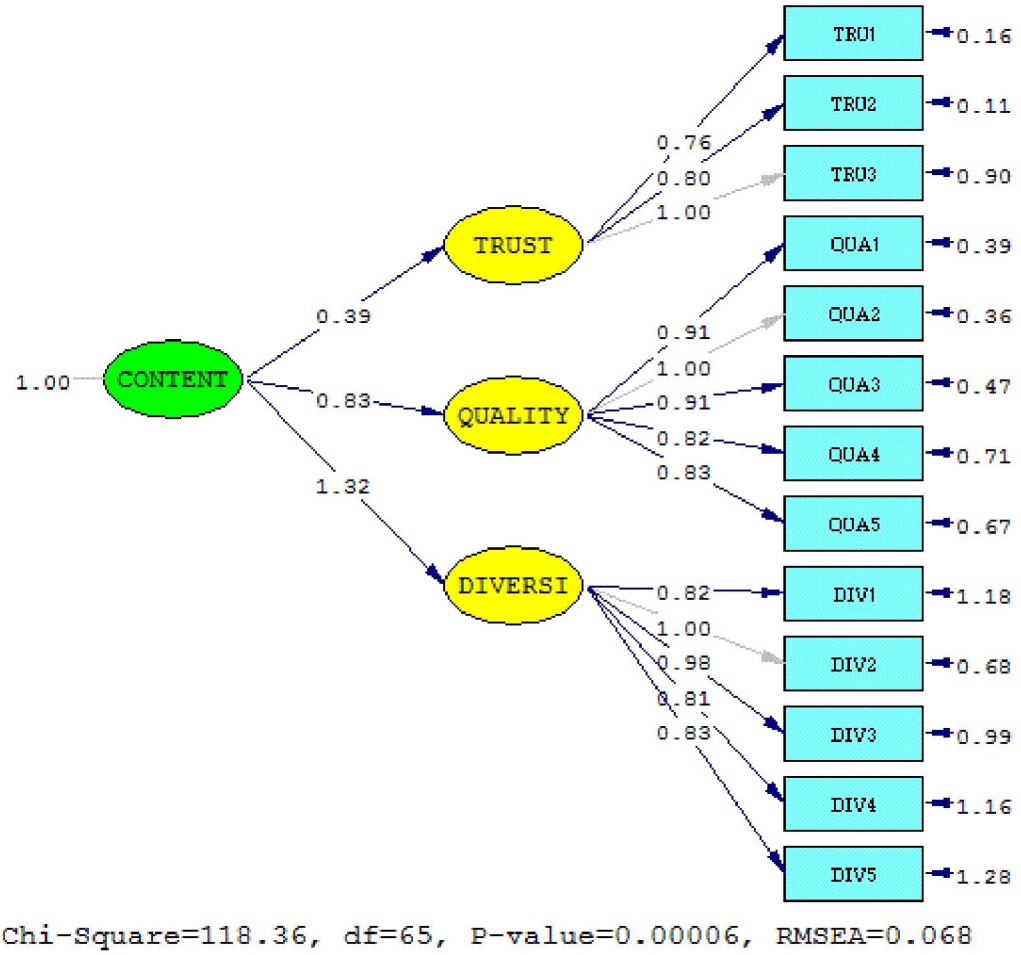
The second-order confirmatory factor analysis of CONTENT measurement after reconstructing also revealed an acceptable fit (χ^2=118.36, df=65, RMSEA=0.068, NFI=0.95, CFI=0.97, GFI=0.90) (Table 6). The ratio chi-square/degrees of freedom is below 2 (χ^2/df = 1.82) indicated that the model was acceptable fit. All parameter estimates were significant at the 0.5 level to satisfy convergent validity, and the composite reliability of TRUST, QUALITY, and DIVERSI were greater 0.80 to meet the requirement of reliability. After reconstructing, none of the items cross-loaded in the model led to a verification of discriminant validity. Thus, the trust and diversity of information scales were reconstructed by three items (TRU1, TRU2, and TRU3) and five items (DIV1, DIV2, DIV3, DIV4, and DIV5), and the quality of information scale still maintained five items (QUA1, QUA2, QUA3, QUA4, and QUA5). These three first-order factors interpreted the second-order latent variable CONTENT (Figure 9).

Table 6: Parameter Estimates for Second-order CFA for Network Content

Construct	Path Label	Parameter Estimate	t-value	Standardized Estimate
	TRU1, TRUST	0.76	16.38*	0.046
	TRU2, TRUST	0.80	17.26*	0.046
Trust	TRU3, TRUST	1.00		
	QUA1, QUALITY	0.91	18.57*	0.049
	QUA2, QUALITY	1.00		
	QUA3, QUALITY	0.91	17.66*	0.052
	QUA4, QUALITY	0.82	14.35*	0.057
Quality of information	QUA5, QUALITY	0.83	14.80*	0.056
	DIV1, DIVERSI	0.82	13.38*	0.061
	DIV2, DIVERSI	1.00		
	DIV3, DIVERSI	0.98	15.68*	0.063
	DIV4, DIVERSI	0.81	13.30*	0.061
Diversity of information	DIV5, DIVERSI	0.83	13.08*	0063
Construct Equations				
TRUST, CONTENT		0.39	3.89*	0.10
QUALITY, CONTENT		0.83	7.52*	0.11
DIVERSITY, CONTENT		1.32	9.81*	0.13
*p<0.05				
χ^2=118.36, df=65, n=181, p-value=0.00, RMSEA=0.068, NFI=0.95, CFI=0.97, GFI=0.90				

Variables	Composite Reliability
Trust	0.812
Quality	0.926
Diversity	0.909

Figure 9: Second-order Confirmatory Factor Analysis of Network Content



3.2.2. Entrepreneurial capability

3.2.2.1. Original entrepreneurial capabilities

Results from exploratory factor analysis revealed a six-item entrepreneurial technology scale (TEC1, TEC2, TEC3, TEC4, TEC5, and TEC6), a five-item organizational capability scale (ORG1, ORG2, ORG3, ORG4, and ORG5), and a four-item entrepreneurial human resource scale (HUM1, HUM2, HUM3, and HUM4). The first-order confirmatory factor analysis of original entrepreneurial capability factors revealed that item ORG1 and ORG4 cross-loaded on the ORGANI and HUMAN

factors, and item TEC6 cross-loaded on both TECHNO and HUMAN. To satisfy the single loading rule, we thus removed ORG1, ORG4, and TEC6 from the measurements even the result provided an acceptable fit (χ^2=155.75, df=87, RMSEA=0.066, NFI=0.90, CFI=0.95, GFI=0.90). After removing the ORG1, ORG4, and TEC6 items, the first order confirmatory factor analysis of original entrepreneurial capability measurements revealed a good fit (χ^2=72.78, df=51, RMSEA=0.049, NFI=0.92, CFI=0.97, GFI=0.94) (Table 7). The ratio chi-square/degrees of freedom is below 2 (χ^2/df = 1.43) indicated that the model was acceptable fit. The model was also convergent validity with all parameter estimates were significant at the 0.5 level, and indicators were discriminant validity because of the single loading of all items.

Table 7: Parameter Estimates for First-order CFA for Original Entrepreneurial Capabilities

Path Label	**Parameter Estimate**	**t-value**	**Standardized Estimate**
TEC1, TECHNO	0.84	6.44*	0.13
TEC2, TECHNO	1.26	12.28*	0.10
TEC3, TECHNO	1.23	11.46*	0.11
TEC4, TECHNO	1.16	11.51*	0.10
TEC5, TECHNO	0.96	7.46*	0.13
ORG2, ORGANI	0.74	7.69*	0.097
ORG3, ORGANI	1.00	9.27*	0.11
ORG5, ORGANI	0.63	6.40*	0.098
HUM1, HUMAN	0.72	6.57*	0.11
HUM2, HUMAN	1.35	11.70*	0.11
HUM3, HUMAN	1.43	10.97*	0.13
HUM4, HUMAN	1.51	12.14*	0.12
*p<0.05			
χ^2=72.78, df=51, n=181, p-value=0.024, RMSEA=0.049, NFI=0.92, CFI=0.97, GFI=0.94			

The second order confirmatory factor analysis of original entrepreneurial capabilities also provided an acceptable fit (χ^2=86.87, df=54, RMSEA=0.058, NFI=0.90, CFI=0.96, GFI=0.93) (Table 8). The ratio chi-square/degrees of freedom is below 2 (χ^2/df = 1.61) indicated that the model was acceptable fit. All parameter estimates were significant at the 0.5 level indicated that the model was convergent validity. The composite reliability of TECHNO, ORGANI, and HUMAN were greater 0.70 to satisfy the requirement of reliability. After removing cross-loading items, the model only remained single loading items which led to a satisfaction of discriminant validity. Consequently, to measure original entrepreneurial capabilities, we utilized a five-item entrepreneurial technology scale (TEC1, TEC2, TEC, TEC4, TEC5), a three-item organizational capability scale (ORG2, ORG3, and ORG5), and a four-item entrepreneurial human resource scale (HUM1, HUM2, HUM3, and HUM4) (Figure 10).

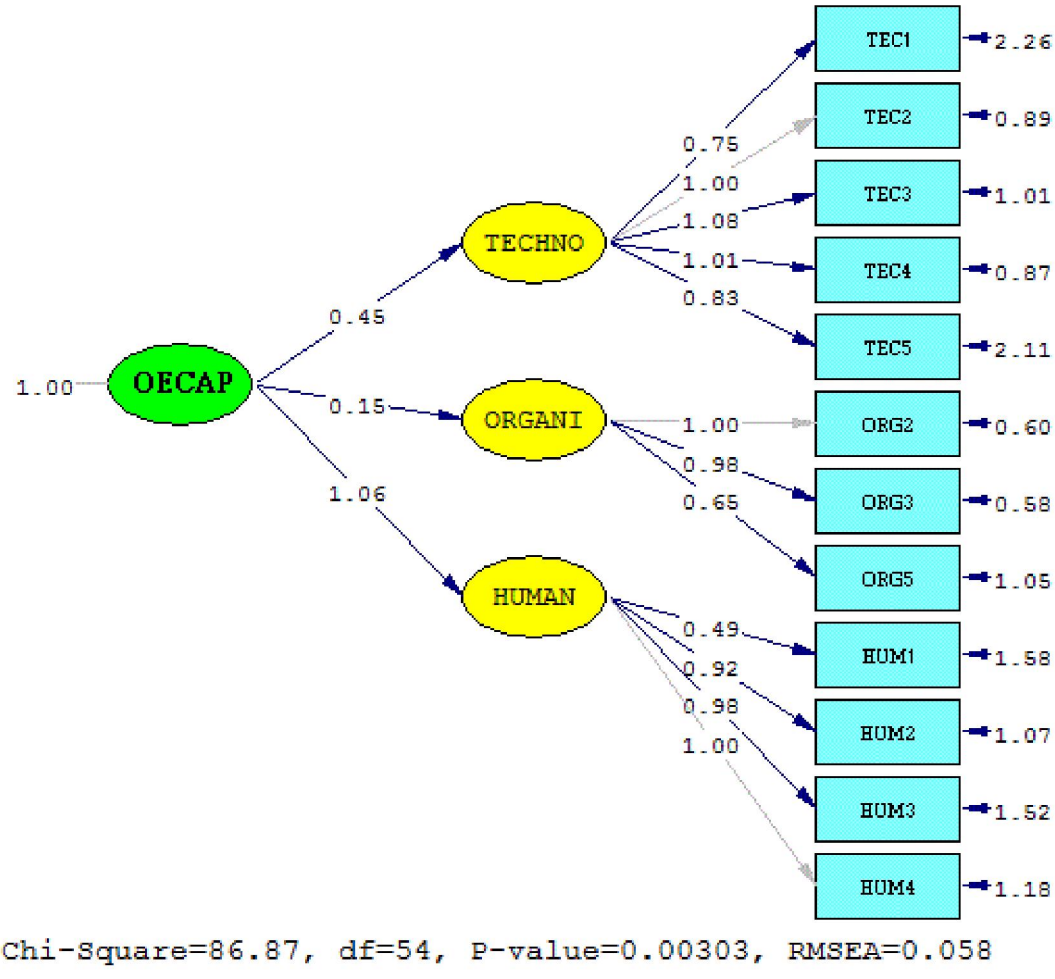
Table 8: Parameter Estimates for Second-order CFA for Original Entrepreneurial Capabilities

Construct	**Path Label**	**Parameter Estimate**	**t-value**	**Standardized Estimate**
Entrepreneurial technology	TEC1, TECHNO	0.75	6.23*	0.12
	TEC2, TECHNO	1.00		
	TEC3, TECHNO	1.08	10.84*	0.099
	TEC4, TECHNO	1.01	10.93*	0.093
	TEC5, TECHNO	0.83	7.05*	0.12
Organizational capability	ORG2, ORGANI	1.00		
	ORG3, ORGANI	0.98	9.72*	0.10
	ORG5, ORGANI	0.65	7.06*	0.093
Human resource	HUM1, HUMAN	0.49	6.30*	0.079
	HUM2, HUMAN	0.92	10.03*	0.091
	HUM3, HUMAN	0.98	9.73*	0.10
	HUM4, HUMAN	1.00		
Construct Equations				
TECHNO, OECAP		0.45	3.42*	0.13
ORGANI, OECAP		0.15	1.24	0.12

HUMAN, OECAP	1.06	6.31*	0.17
*p<0.05			
χ^2=86.87, df=54, n=181, p-value=0.003, RMSEA=0.058, NFI=0.90, CFI=0.96, GFI=0.93			

Variables	**Composite Reliability**
Entrepreneurial technology	0.804
Organizational capability	0.701
Human resource	0.808

Figure 10: Second-order Confirmatory Factor Analysis of Original Entrepreneurial Capabilities



3.2.2.2. Necessary supplemental capabilities

As prior definition, necessary supplemental capabilities comprise a five-item entrepreneurial strategy scale (STR1, STR2, STR3, STR4, and STR5), a four-item commercial capability scale (COM1, COM2, COM3, and COM4). The first order confirmatory factor analysis of entrepreneurial strategy factor (STRATE) and commercial capability factor (COMMER) revealed a good fit (χ^2=30.24, df=26, RMSEA=0.030, NFI=0.94, CFI=0.99, GFI=0.96) (Table 9). The ratio chi-square/degrees of freedom is below 2 (χ^2/df = 1.16) indicated that the model was an acceptable fit. The model was also convergent validity because all parameter estimates were significant at the 0.5 level, and indicators were discriminant validity because of the single loading of all items.

Table 9: Parameter Estimates for First-order CFA for Necessary Supplemental Capabilities

Path Label	**Parameter Estimate**	**t-value**	**Standardized Estimate**
STR1, STRATE	0.81	9.06*	0.089
STR2, STRATE	1.01	8.38*	0.12
STR3, STRATE	1.03	10.80*	0.095
STR4, STRATE	0.92	6.95*	0.13
STR5, STRATE	0.39	3.02*	0.13
COM1, COMMER	0.38	4.43*	0.086
COM2, COMMER	1.27	9.07*	0.14
COM3, COMMER	1.41	11.68*	0.12
COM4, COMMER	0.86	7.24*	0.12
*p<0.05			
χ^2=30.24, df=26, n=181, p-value=0.26, RMSEA=0.030, NFI=0.94, CFI=0.99, GFI=0.96			

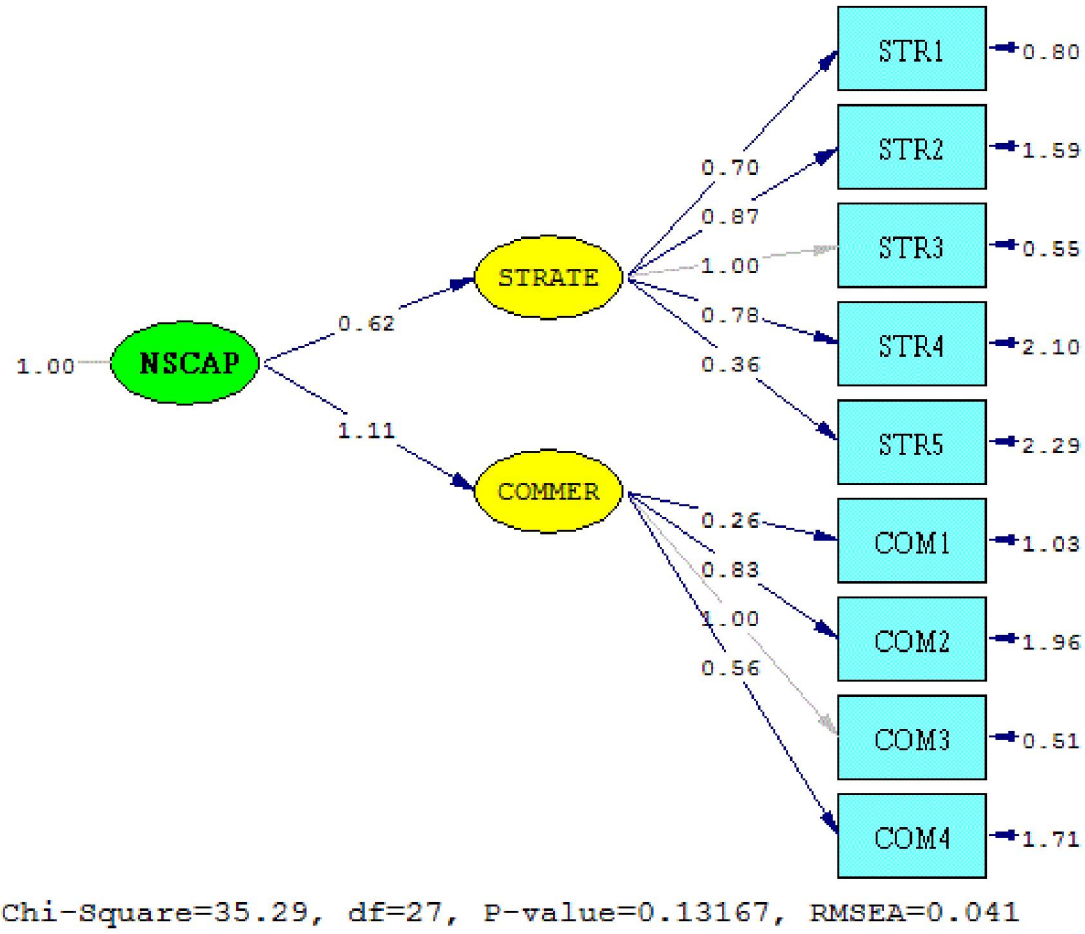
The second order confirmatory factor analysis of necessary supplemental capability measurement provided a proof of good fit (χ^2=35.29, df=27, RMSEA=0.041, NFI=0.93, CFI=0.98, GFI=0.96) (Table 10). The ratio chi-square/degrees of freedom is below 2 (χ^2/df = 1.31) indicated that the model was an acceptable fit. Because all parameter estimates were significant at the 0.5 level, the model passed the convergent validity test. The composite reliability of all factors was greater 0.70 meant the reliability of measurements was passed. Measurements were constructed by single loading items led to a satisfaction of discriminant validity of indicators. Thus, the necessary supplemental capability measurement remained two first-order factors comprising a five-item entrepreneurial strategy (STR1, STR2, STR3, and STR4), a four-item commercial capability scale (COM1, COM2, COM3, and COM4) (Figure 11).

Table 10: Parameter Estimates for Second-order CFA for Necessary Supplemental Capabilities

Construct	**Path Label**	**Parameter Estimate**	**t-value**	**Standardized Estimate**
Entrepreneurial strategy	STR1, STRATE	0.70	8.91*	0.079
	STR2, STRATE	0.87	8.27*	0.11
	STR3, STRATE	1.00		
	STR4, STRATE	0.78	6.92*	0.11
	STR5, STRATE	0.36	3.30*	0.11
Commercial capability	COM1, COMMER	0.26	4.30*	0.060
	COM2, COMMER	0.83	7.40*	0.11
	COM3, COMMER	1.00		
	COM4, COMMER	0.56	6.36*	0.088
Construct Equations				
STRATE, NSCAP		0.62	4.60*	0.13
COMMER, NSCAP		1.11	6.80*	0.16
*p<0.05				
χ^2=35.29, df=27, n=181, p-value=0.13, RMSEA=0.041, NFI=0.93, CFI=0.98, GFI=0.96				

Variables	Composite Reliability
Entrepreneurial strategy	0.702
Commercial capability	0.708

Figure 11: Second-order Confirmatory Factor Analysis of Necessary Supplemental Capabilities



3.2.3. Success of spin-off's foundation

In the previous definition, the success of spin-off's foundation is measured by ability of the new venture to access the financial resource including returning investors and new investors. In other words, the success of a spin-off's foundation measurement was constructed by a three-item returning

investment scale (RIN1, RIN2, and RIN3) and a five-item new investment scale (NIN1, NIN2, NIN3, NIN4, and NIN5). The first order confirmatory factor analysis of returning investment (REINV) and new investment (NEINV) factors revealed a good fit (χ^2=29.47, df=19, RMSEA=0.055, NFI=0.94, CFI=0.98, GFI=0.96). However, the item NIN2 was cross-loaded on both REINV and NEINV factors. To ensure the rule of single loading of all items, we removed the item NIN2. The result of first order confirmatory factor analysis of REINV and NEINV factors revealed a good fit (χ^2=14.36, df=13, RMSEA=0.024, NFI=0.99, CFI=1.00, GFI=0.98) (Table 11). The ratio chi-square/degrees of freedom is below 2 (χ^2/df = 1.10) indicated that the model was good fit. The model was also convergent validity with all parameter estimates were significant at the 0.5 level, and indicators were discriminant validity because of the single loading of all items.

Table 11: Parameter Estimates for First-order CFA for Success of Foundation

Path Label	**Parameter Estimate**	**t-value**	**Standardized Estimate**
RIN1, REINV	1.07	10.24*	0.10
RIN2, REINV	1.28	11.33*	0.11
RIN3, REINV	0.91	6.48*	0.14
NIN1, NEINV	1.07	9.30*	0.11
NIN3, NEINV	0.66	7.81*	0.084
NIN4, NEINV	0.65	6.06*	0.11
NIN5, NEINV	0.83	6.58*	0.13
*p<0.05			
χ^2=14.36, df=13, n=181, p-value=0.35, RMSEA=0.024, NFI=0.97, CFI=1.00, GFI=0.98			

The result of the second order confirmatory factor analysis of success of spin-off's foundation measurement (FOUND) revealed an acceptable fit (χ^2=22.19, df=14, RMSEA=0.075, NFI=0.94,

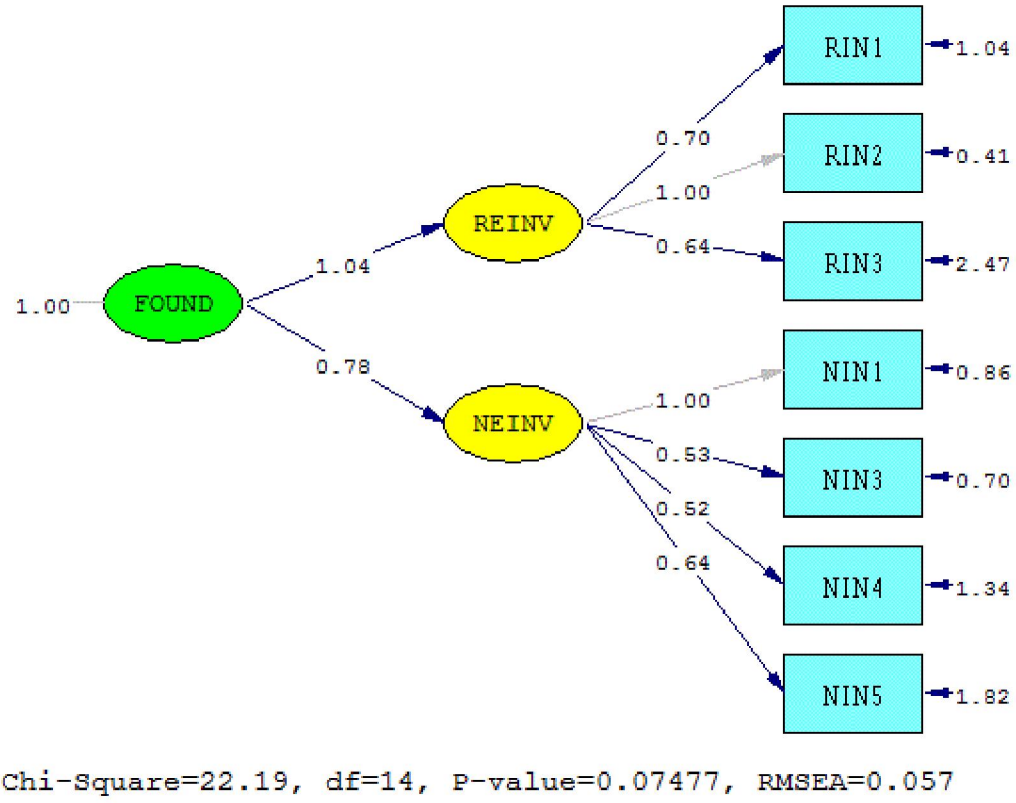
CFI=0.97, GFI=0.96) (Table 12). The ratio chi-square/degrees of freedom is below 2 (χ^2/df = 1.59) indicated that the model was an acceptable fit. All parameter estimates were significant at the 0.5 level meant the model was satisfied convergent validity. The composite reliability of REINV factor was greater than 0.70 to pass the reliability test, but the composite reliability of NEINV was 0.609. However, the NEINV is a new concept in the success of spin-off's foundation measurement, and its composite reliability was acceptable (Hatcher, 1994; Hair, Anderson, Tatham, & Black, 1998). All items loaded on one factor each that proved a discriminant validity of indicators. Consequently, the second-order FOUND factor contents two first-order factors comprising three-item return investment scale (RIN1, RIN2, and RIN3) and a five-item new investment scale (NIN1, NIN2, NIN3, NIN4, and NIN5) (Figure 12).

Table 12: Parameter Estimates for Second-order CFA for Success of Foundation

Construct	**Path Label**	**Parameter Estimate**	**t-value**	**Standardized Estimate**
	RIN1, REINV	0.70	7.57*	0.092
	RIN2, REINV	1.00		
Return investments	RIN3, REINV	0.64	6.02*	0.11
	NIN1, NEINV	1.00		
	NIN3, NEINV	0.53	7.16*	0.074
	NIN4, NEINV	0.52	5.85*	0.089
New investments	NIN5, NEINV	0.64	6.09*	0.11
Construct Equations				
REINV, FOUND		1.04	6.54*	0.16
NEINV, FOUND		0.78	5.02*	0.16
*p<0.05				
χ^2=22.19, df=14, n=181, p-value=0.075, RMSEA=0.057, NFI=0.94, CFI=0.97, GFI=0.96				

Variables	Composite Reliability
Return investments	0.714
New investments	0.609

Figure 12: Second-order Confirmatory Factor Analysis of Success of Foundation



3.2.4. Spin-off's performance

According to the result of the exploratory factor analysis, the measurement of the spin-off's performance comprised a four-item financial performance scale (FPE1, FPE2, FPE3, and FPE4) and a six-item operational performance scale (COP1, COP2, COP3, COP4, COP5, and COP6). The result of first-order confirmatory factor analysis of the financial performance (FPER) and operational

performance (OPER) factors revealed a poor fit (χ^2=108.04, df=34, RMSEA=0.11, NFI=0.89, CFI=0.92, GFI=0.89). In the confirmatory factor analysis, item COP6 caused large standardized residuals. This item was highly correlated with three items COP2, COP4, and COP5. Moreover, item COP5 cross-loaded on both FPER and OPER factors. We thus removed OPE5 and OPE6 to reach an acceptable fit (χ^2=33.91, df=19, RMSEA=0.066, NFI=0.95, CFI=0.97, GFI=0.96) (Table 13). The ratio chi-square/degrees of freedom is below 2 (χ^2/df = 1.78) indicated that the model was acceptable fit. The test of convergent validity and the discriminant validity of indicators was passed because all parameter estimates were significant at the 0.5 level, and all items loaded on one factor each.

Table 13: Parameter Estimates for First-order CFA for Spin-off's Performance

Path Label	**Parameter Estimate**	**t-value**	**Standardized Estimate**
FPE1, FPER	1.03	13.62*	0.076
FPE2, FPER	1.14	15.70*	0.073
FPE3, FPER	0.80	8.15*	0.098
FPE4, FPER	0.91	10.28*	0.088
COP1, OPER	0.91	9.62*	0.095
COP2, OPER	0.88	8.12*	0.11
COP3, OPER	0.78	8.41*	0.092
COP4, OPER	0.64	7.40*	0.087
*p<0.05			
χ^2=33.91, df=19, n=181, p-value=0.019, RMSEA=0.066, NFI=0.95, CFI=0.97, GFI=0.96			

The result from second-order factor analysis of the spin-off's performance measurement also revealed an acceptable fit (χ^2=37.23, df=20, RMSEA=0.069; NFI=0.94; CFI=0.97; GFI=0.95) (Table 14). The ratio chi-square/degrees of freedom is below 2 (χ^2/df = 1.86) indicated that the

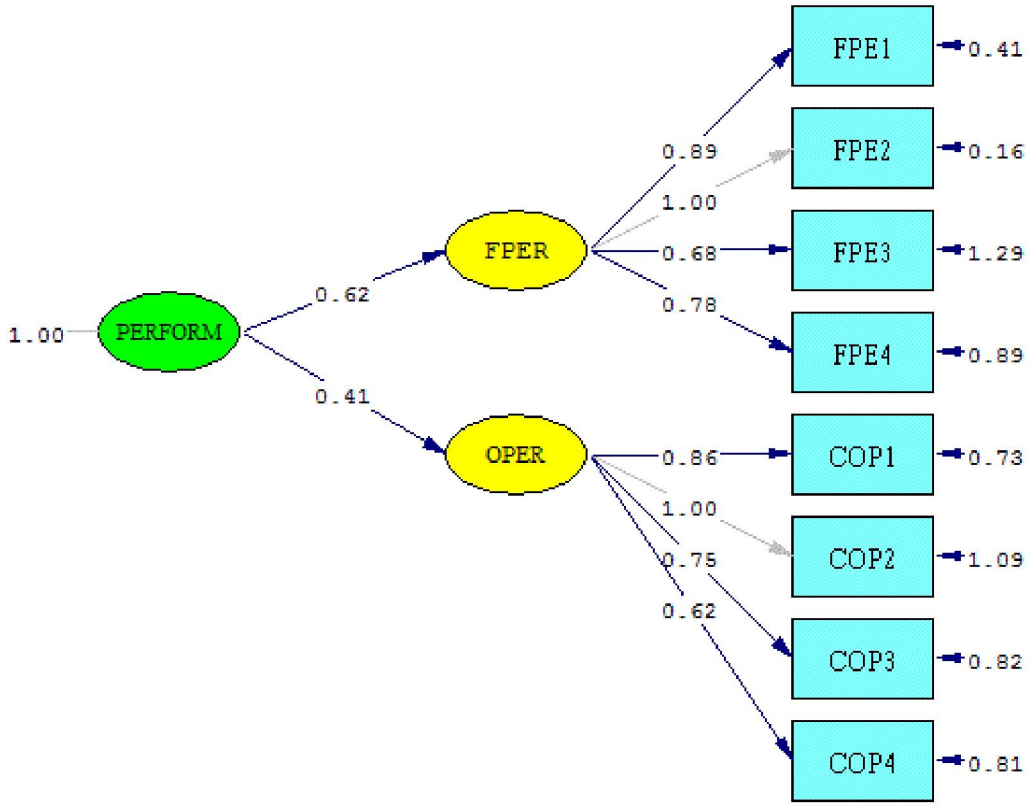
model was an acceptable fit. All parameter estimates were significant at the 0.5 level to prove a sufficiency of convergent validity. The composite reliability of FPER and OPER factors were greater 0.70 to satisfy the reliability test. The indicators satisfied the discriminant test because all items loaded on one factors each. Consequently, the spin-off's performance measurement was reconstructed by a four-item (FPE1, FPE2, FPE3, and FPE4) financial performance factor and a four-item (COP1, COP2, COP3, and COP4) operational performance factor (Figure 13).

Table 14: Parameter Estimates for Second-order CFA for Spin-off's Performance

Construct	**Path Label**	**Parameter Estimate**	**t-value**	**Standardized Estimate**
Financial performance	FPE1, FPER	0.89	14.94*	0.060
	FPE2, FPER	1.00		
	FPE3, FPER	0.68	8.54*	0.08
	FPE4, FPER	0.78	11.08*	0.07
Operational performance	COP1, OPER	0.86	9.10*	0.094
	COP2, OPER	1.00		
	COP3, OPER	0.75	8.35*	0.090
	COP4, OPER	0.62	7.44*	0.083
Construct Equations				
FPER, PERFORM		0.62	4.47*	0.14
OPER, PERFORM		0.41	2.32*	0.18
*p<0.05				
χ^2=37.23, df=20, n=181, p-value=0.01099, RMSEA=0.069, NFI=0.94, CFI=0.97, GFI=0.95				

Variables	Composite Reliability
Financial performance	0.842
Operational performance	0.744

Figure 13: Second-order Confirmatory Factor Analysis of Spin-off's Performance



Chi-Square=37.23, df=20, P-value=0.01099, RMSEA=0.069

3.3. Hypothesis test

This study tested a complexly structural model in nature because of the large number of hypotheses was identified between the first- and second-order factors, and between second-order factors and endogenous constructs. In this step, to confirm or contradict the prior researches we discussed all hypotheses and tested if these hypotheses were supported.

To test the research's hypotheses, we initially created composite scores for the factors which construct social network characteristics (SNET) and entrepreneurial capability (ECAP) variables. The items identified from the second-order confirmatory factor analysis of STRUCT, GOVERN, CONTENT, INCAP, and ERCAP variables were utilized to estimate average scores for factors in the proceeding measurement model. These factors became observed variables constructing the SNET and ECAP endogenous latent variables. Because we indicated these latent variables in two different measurements and constructed them from distinct concepts in the previous step, we conducted separate confirmatory factor analysis for social networks and entrepreneurial capabilities.

3.3.2. Entrepreneurial capabilities

The original entrepreneurial capability (OECAP) and necessary supplementary capability (NSCAP) variables interpret the entrepreneurial capability (ECAP) endogenous latent variable. In the model of entrepreneurial capabilities, OECAP and NSCAP contributed as manifest indicator variables of latent constructs. The confirmatory factor analysis of entrepreneurial capabilities revealed a good fit (χ^2=0.79, df=4, RMSEA=0.00; NFI=0.91; CFI=1.00; GFI=1.00) (Table 15). Because all parameter estimates were significant at the 0.5 level, the model passed the test of convergent validity. All variables loaded on one factor each that proved a certification of discriminant validity of indicators.

Table 15: Parameter Estimates for First-order CFA for Entrepreneurial Capabilities

Path Label	Parameter Estimate	t-value	Standardized Estimate
TECHNO, OECAP	0.58	5.24*	0.11
ORGANI, OECAP	0.37	4.66*	0.08
HUMAN, OECAP	0.36	3.34*	0.11
STRATE, NSCAP	0.72	8.44*	0.085
COMMER, NSCAP	0.60	6.63*	0.091
OECAP, NSCAP	1.31	7.31*	0.18
*p<0.05			
χ^2 = 0.79, df=4, n= 181, p-value=0.94, RMSEA=0.00, NFI=0.99, CFI=1.00, GFI=1.00			

Hypotheses 1a-c: Entrepreneurial technology (TECHNO), organizational capability (ORGANI), and entrepreneurial human resource (HUMAN) factors were hypothesized to be statically significant indicators of the original entrepreneurial capability factor (OECAP). The hypotheses from 4a through 4c were supported because all parameter estimates were positively and statistically significant at the $p<0.05$ level. In other words, the theories of original entrepreneurial capabilities of Cooper and Bruno (1977), Garnsey (2002), and Aspelund, Berg-Utby, and Skjevdal (2005) were supported in this study.

Hypotheses 2a-b: The hypotheses 5a and 5b stated that entrepreneurial strategy (STRATE) and commercial capability factors (COMMER) are positive and statistically significant indicators of the necessary supplementary capability factor (NSCAP). The result from confirmatory factor analysis revealed that all parameter estimates were positive and statistically significant at the $p<0.05$ level. Thus, both hypotheses 5a and 5b were supported. This result supports the theory of Wright *et al.* (2007) and Shane (2004) regarding to the necessary supplementary capabilities.

3.3.1. Social network characteristics

The endogenous latent variable, social network characteristics (SNET), was interpreted by network structure (STRUCT), network governance (GOVERN), and network content (CONTENT) variables. In this model, the STRUCT, GOVERN, and CONTENT variables played roles of manifest indicators of the latent construct. The result of first-order confirmatory factor analysis revealed a poor fit (χ^2=56.46, df=17, RMSEA=0.11; NFI=0.93; CFI=0.95; GFI=0.93). The cause of this poor fit was the cross-loading of DIVERSI variable on both STRUCT and CONTENT factors. To satisfy the single loading rule, we removed the DIVERSI variable from the CONTENT measurement. The result of confirmatory factor analysis highly improved and achieved good fit (χ^2=13.44, df=11, RMSEA=0.035; NFI=0.98; CFI=1.00; GFI=0.98) (Table 16). The ratio chi-square/degrees of freedom is below 2 (χ^2/df = 1.22) indicated that the model was good fit. The model also passed the test of convergent validity with all parameter estimates were significant at the 0.5 level, and the discriminant validity of indicators with all variables loaded on one factor each.

Table 16: Parameter Estimates for First-order CFA for Social Network

Path Label	**Parameter Estimate**	**t-value**	**Standardized Estimate**
DENSI, STRUCT	0.81	6.24*	0.13
CENTRA, STRUCT	0.86	11.67*	0.074
TIES, STRUCT	0.77	6.63*	0.12
REPUTA, GOVERN	0.22	4.40*	0.051
RECIPRO, GOVERN	0.85	9.34*	0.091
TRUST, CONTENT	0.46	7.41*	0.061
QUALITY, CONTENT	0.80	9.06*	0.088
STRUCT, GOVERN	0.89	10.09*	0.09
STRUCT, CONTENT	1.19	14.15*	0.08

GOVERN, CONTENT	1.28	10.26*	0.12
STRUCT, GOVERN	0.89	10.09*	0.09
STRUCT, CONTENT	1.19	14.15*	0.08
GOVERN, CONTENT	1.28	10.26*	0.12
*p<0.05			
χ^2 = 13.44, df=11, n= 181, p-value=0.27, RMSEA=0.035, NFI=0.98, CFI=1.00, GFI=0.98			

Hypotheses 3a-c: In previous part, we hypothesized that network density (DENSI), centrality of members in networks (CENTRA), and ties in networks (TIES) are statistically significant and positive indicators of network structure (STRUCT). The prior result of confirmatory factor analysis revealed that each parameter estimate was positive and statistically significant at the $p<0.05$ level. Thus, we conclude that the hypotheses from 1a through 1c were supported. This result supported the theory of network structure of Brass and Burkhardt (1993), Burt (1992), Scott (1991), and Wasserman and Faust (1994).

Hypotheses 4a-b: The prior result of confirmatory factor analysis of network governance revealed that all parameter estimates were positive and statistically significant at the $p<0.05$ level. It provided a strong evidence to support the hypotheses 2a and 2b which stated that the reputation of members (REPUTA) and reciprocity among members (RECIPRO) in networks are statistically significant and positive indicators of network governance (GOVERN). The results supported the network governance theories of Brass (1984), Thorelli (1986), Krackhardt (1990), Larson (1992), and Jones, Hesterly, and Borgatti (1997) which highlight the importance of reputation and reciprocity in the network form of governance.

Hypotheses 5a-c: The prior result from confirmatory factor analysis of social network suggested that the DIVERSI factor must be removed from the indicators of social network measurement (SNET). Because this study concerned on the entire structural model, we only maintain elements that contribute to the model. Thus, we removed the DIVERSI despite the result from confirmatory factor analysis of network content proved that the DIVERSI positively and significantly indicates network content (CONTENT). It means that the hypothesis 3c was not supported. On the other hand, the hypotheses 3a and 3b that trust among members in networks (TRUST) and quality of information flow in networks (QUALITY) are positive and statistically significant indicators of network content (CONTENT) were supported because all parameter estimates were positive and statistically significant at the $p<0.05$ level. In other words, the network content comprises quality of information flew within networks (Cohen & Levinthal, 1990) and trust among participants (Larson, 1992; Lorenzoni & Lipparini, 1999; Amit & Zott, 2001).

3.3.3. Measurement model

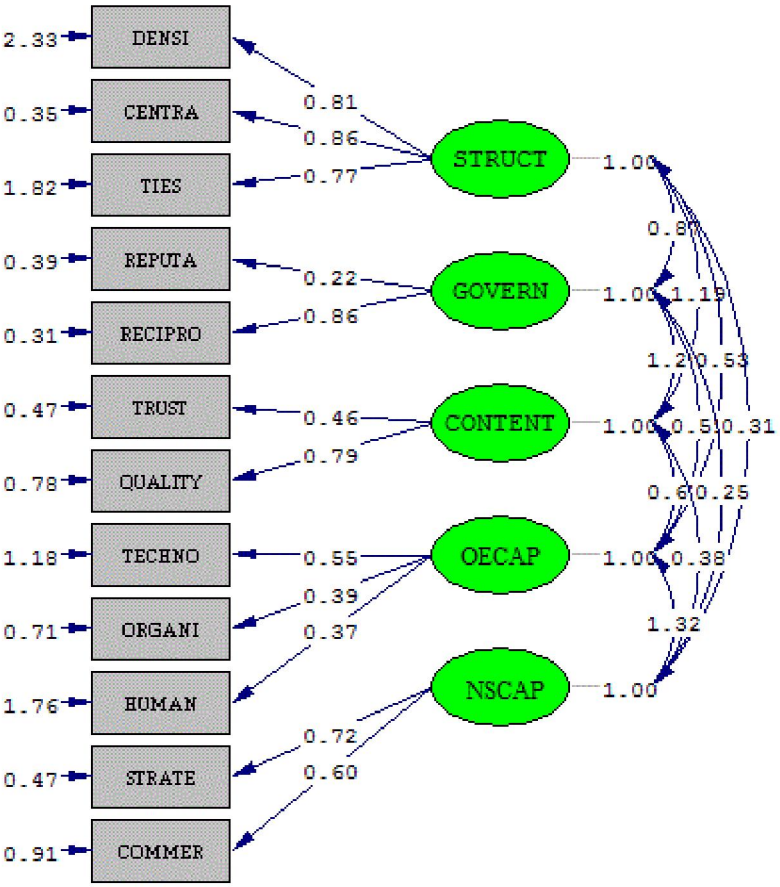
Following the results from two prior confirmatory factor analyses, the social network characteristics (SNET) retained seven indicators, and entrepreneurial capabilities (ECAP) remained five indicators. In the social network characteristic measurements, the network density (DENSI), network centrality (CENTRA), and network ties (TIES) interpret network structure (STRUCT). Network reputation (REPUTA) and network reciprocity (RECIPRO) construct network governance (GOVERN). Trust among members (TRUST) and quality of information flew in networks (QUALITY) indicate network content (CONTENT). Meanwhile, original entrepreneurial capabilities (OECAP) were indicated by entrepreneurial technologies (TECHNO), organizational capabilities (ORGANI), and entrepreneurial human resources (HUMAN). Entrepreneurial strategies (STRATE) and commercial

capabilities (COMMER) interpret necessary supplementary capabilities (NSCAP) in entrepreneurial capability measurements (ECAP).

Table 17: Parameter Estimates for Measurement Model

Path Label	**Parameter Estimate**	**t-value**	**Standardized Estimate**
DENSI, STRUCT	0.81	6.20*	0.13
CENTRA, STRUCT	0.86	11.73*	0.073
TIES, STRUCT	0.77	6.62*	0.12
REPUTA, GOVERN	0.22	4.32*	0.051
RECIPRO, GOVERN	0.86	9.49*	0.091
TRUST, CONTENT	0.46	7.45*	0.061
QUALITY, CONTENT	0.79	9.02*	0.088
TECHNO, OECAP	0.55	5.13*	0.11
ORGANI, OECAP	0.39	4.89*	0.080
HUMAN, OECAP	0.37	3.51*	0.11
STRATE, NSCAP	0.72	8.51*	0.085
COMMER, NSCAP	0.60	6.63*	0.091
STRUCT, GOVERN	0.87	10.07*	0.09
STRUCT, CONTENT	1.19	14.13*	0.08
GOVERN, CONTENT	1.26	10.31*	0.12
OECAP, NSCAP	1.32	7.29*	0.18
STRUCT, OECAP	0.53	3.71*	0.14
STRUCT, NSCAP	0.31	2.83*	0.11
GOVERN, OECAP	0.59	3.99*	0.15
GOVERN, NSCAP	0.25	2.20*	0.11
CONTENT, OECAP	0.67	4.13*	0.16
CONTENT, NSCAP	0.38	3.13*	0.12
*$p<0.05$			
χ^2 = 62.27, df=44, n= 181, p-value=0.033, RMSEA=0.049, NFI=0.93, CFI=0.97, GFI=0.95			

Figure 14: Measurement Model



Chi-Square=62.71, df=44, P-value=0.03327, RMSEA=0.049

The confirmatory factor analysis of social network characteristics (SNET) and entrepreneurial capabilities (ECAP) revealed a good fit (χ^2=62.27, df=44, RMSEA=0.049; NFI=0.93; CFI=0.97; GFI=0.95) (Table 17). All of indices satisfied the requirement of a good model fit. All parameter estimates were statistically significant at the 0.5 level, and all variables loaded on one factor each. Thus, the model passed the test of convergent validity and achieved a certification of discriminant validity of indicators.

3.3.4. Structural model

This was the final phase of analyses, which estimated the structural model. In this step, we tested the model's hypotheses at which the key theoretical constructs. This step constructed the final structural

model which provided the basis to test if the crucial variables interpret the latent variables, whether those latent variables predict the success of spin-off's foundation and spin-off's performance, and if the success of spin-off's foundation influences the spin-off's performance. The final measurement model produced the co-variances of factors to conduct the structural model. Firstly, we utilized the DENSI, CENTRA, TIES, REPUTA, RECIPRO, TRUST, QUALITY, DIVERSI, TECHNO, ORGANI, HUMA, STRATE, and COMMER factors to produce composite scores indicated two endogenous constructs comprising social network characteristics (SNET) and entrepreneurial capabilities (ECAP). From the results of confirmatory factor analyses of success of spin-off's foundation and spin-off's performance, the composite scores were also utilized to conduct the endogenous constructs, including REINV and NEINV interpreted FOUND, and FPER and COMPET indicated PERFORM. To conclude the results of hypothesis tests, the structural model must satisfy access to fit and converge. The initial result revealed that the structural model was insufficient fit to the data (χ^2=47.20, df=25, RMSEA=0.070; NFI=0.89; CFI=0.93; GFI=0.94). Then, we released the DIVERSI factor and re-specified the model.

The model was re-conducted with two endogenous constructs SNET and ECAP, which were indicated by composite scores produced from DENSI, CENTRA, TIES, REPUTA, RECIPRO, TRUST, QUALITY, TECHNO, ORGANI, HUMA, STRATE, and COMMER factors. The results from the first-order confirmatory factor analysis revealed that the structural model was an acceptable fit (χ^2=16.6, df=21, RMSEA=0.0001; NFI=0.97; CFI=1.0; GFI=0.98) (table 18). The Lisrel output of the second-order confirmatory factor analysis represented a structural model with an acceptable fit (χ^2=41.57, df=25, RMSEA=0.061; NFI=0.91; CFI=0.95; GFI=0.95) (Table 19). Additionally, the ratio chi-square/degrees of freedom is below 2 (χ^2/df = 1.66) indicated that the model was an

acceptable fit. All parameter estimates were significant at the 0.5 level meant the model was satisfied convergent validity.

Table 18: Parameter Estimates for First-order CFA for Structural Model

Path Label	**Parameter Estimate**	**t-value**	**Standardized Estimate**
STRUCT, SNET	0.73	9.60*	0.076
GOVERN, SNET	0.52	11.10*	0.046
CONTENT, SNET	0.83	15.74*	0.053
OECAP, ECAP	0.54	8.63*	0.062
NSCAP, ECAP	0.71	9.76*	0.073
REINV, FOUND	0.77	4.14*	0.19
NEINV, FOUND	0.74	4.35*	0.17
FPER, PERFORM	0.49	4.98*	0.097
OPER, PERFORM	0.57	5.91*	0.097
SNET, ECAP	0.31	3.85*	0.08
SNET, FOUND	0.22	2.35*	0.09
ECAP, FOUND	0.24	2.22*	0.11
SNET, PERFORM	0.13	1.16	0.11
ECAP, PERFORM	0.80	6.97*	0.11
FOUNDA, PERFORM	0.21	1.56	0.13
*$p<0.05$			
χ^2=16.60, df=21, n= 181, p-value=0.74, RMSEA=0.0001, NFI=0.97, CFI=1.00, GFI=0.98			

Hypotheses 1: The hypothesis 1 stated that the network structure (STRUCT) statistically significantly and positively indicates the social network characteristics (SNET). The result from

confirmatory factor analysis revealed that the parameter estimate was positive and statistically significant at the $p<0.05$ level (Table 19). Thus, we conclude that the hypothesis 1 was supported.

Hypotheses 2: The network governance (GOVERN) statistically significantly and positively interprets the social network characteristics (SNET) as hypothesized (H2). As the result from confirmatory factor analysis represented, the parameter estimate was positive and statistically significant at the $p<0.05$ level (Table 19) led to a conclusion that hypothesis 2 was supported.

Hypotheses 3: The network content (CONTENT) also indicated statistically significantly and positively the social network characteristics (SNET). The parameter estimate was positively and statistically significant at the $p<0.05$ level. Thus, the hypothesis 3 was supported (Table 19).

Table 19: Parameter Estimates for Second-order CFA for Structural Model

Path Label	**Parameter Estimate**	**t-value**	**Standardized Estimate**
STRUCT, SNET	0.81	10.83*	0.074
GOVERN, SNET	0.57	12.66*	0.045
CONTENT, SNET	1.00		
OECAP, ECAP	0.44	6.90*	0.063
NSCAP, ECAP	1.00		
REINV, FOUND	1.00		
NEINV, FOUND	0.57	6.13*	0.093
FPER, PERFORM	0.24	3.54*	0.067
OPER, PERFORM	1.00		
SNET, FOUND	0.22	2.42*	0.091
ECAP, FOUND	0.11	1.25	0.089
SNET, PERFORM	-0.09	-1.36	0.067
ECAP, PERFORM	0.36	4.84*	0.074
FOUNDA, PERFORM	0.10	1.33	0.078
*p<0.05			
χ^2=41.57, df=25, n= 181, p-value=0.020, RMSEA=0.061, NFI=0.91, CFI=0.95, GFI=0.95			

These results supported the studies of Amit and Zott (2001) and Hoang and Antoncic (2003). These researchers studied entrepreneurship beyond the network approach which differs from the network analysis of other authors. In the network approach, the network characteristics derived from three groups comprising of network structure, network governance, and network content.

Hypotheses 4: The hypothesis 4 stated that the original entrepreneurial capabilities (OECAP) indicate statistically significantly and positively the entrepreneurial capabilities (ECAP). This hypothesis was supported because the result from confirmatory factor analysis revealed that the parameter estimate was positive and statistically significant at the $p<0.5$ level (Table19).

Hypotheses 5: The hypothesis 5 was also supported because the parameter estimate was positive and statistically significant at the $p<0.05$ level (Table19). In other words, the necessary supplementary capabilities (NSCAP) indicate statistically significantly and positively the entrepreneurial capabilities (ECAP).

Results of hypotheses 4 and 5 allow us to conclude that the entrepreneurial capabilities comprise entrepreneurial technology, organizational capability, human capital, entrepreneurial strategy, and commercial capability. This result supports the conclusion of other scholars in investigating the factors which influence the process of spin-off's foundations (Vohora, Wright, & Lockett, 2002; Shane & Stuart, 2002; Shane, 2004).

Hypotheses 6a-b: The hypotheses 6a and 6b stated that returning investments (REINV) and new investments (NEINV) are positive and statistically significant indicators of success of spin-off's foundation (FOUND). The result from confirmatory factor analysis revealed that all parameter estimates were positive and statistically significant at the $p<0.05$ level (Table 19). Thus, both hypotheses 6a and 6b were supported.

Hypotheses 7: The entrepreneurial capabilities (ECAP) statistically significantly predict success of spin-off's foundation (FOUND) as hypothesized (H7). As the result from confirmatory factor analysis represented, the parameter estimate was not statistically significant at the $p<0.05$ level (Table 18) lead to a conclusion that hypothesis 7 was not supported.

Hypotheses 8: The hypothesis 8 stated that the social network characteristics (SNET) statistically significantly predict the success of spin-off's foundation (FOUND). The parameter estimate was positive and statistically significant at the $p<0.05$ level (Table 18). It means that the hypothesis 8 was supported.

Hypotheses 9a-b: The result of confirmatory factor analysis of network governance revealed that parameter estimates of FPER and OPER were positive and statistically significant at the $p<0.05$ level (Table 19). It provided a strong evidence to support the hypotheses 9a and 9b which stated that the financial performance (FPER) and operational performance (OPER) are statistically significant and positive indicators of spin-off's performance (PERFORM). This result supports the notion of Westerberg and Wincent (2008) and Dimitratos, Lioukas, and Carter (2004) stated that the performances of spin-offs comprise both financial and operational performances.

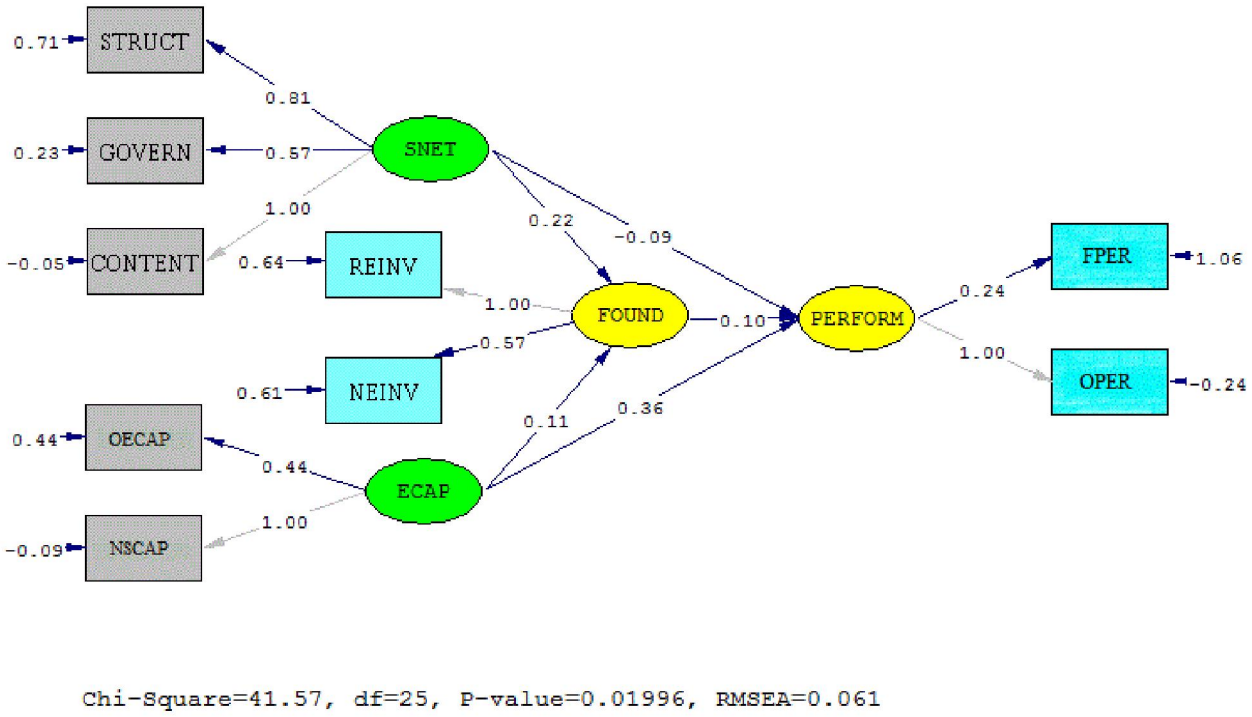
*Hypotheses 10: T*he entrepreneurial capabilities (ECAP) statistically significantly and positively influence the spin-off's performance (PERFORM) because the parameter estimate revealed from confirmatory factor analysis was positive and statistically significant at the $p<0.05$ level (Table 18). It means the hypothesis 10 was supported.

*Hypotheses 11: S*ocial network characteristics (SNET) statistically significantly predict the spin-off's performances (PERFORM). This hypothesis was not supported because the result from

confirmatory factor analysis revealed that the parameter estimate was not statistically significant at the $p<0.05$ level (Table 18).

Hypotheses 12: The final hypothesis of the study (H12) stated that the success of spin-off's foundation (FOUND) will statistically significantly influence the spin-off's performance (PERFORM) in later stage. This hypothesis was rejected because the parameter estimate was not statistically significant at the $p<0.05$ level (Table 18).

Figure 15: Structural Model



3.4. Summary

Beyond the network approach, the social network characteristics of entrepreneurial teams in the period of a spin-off's foundation comprise network structure, network governance, and network content. The study indicated that network structure was compounded from network ties, density, and centrality, and network governance including reciprocity and reputation. However, the study insufficiently proved that the diversity of information within the networks indicates the network content. Consequently, the network content comprises trust and quality of information among participants of the networks. The results also support the hypotheses that entrepreneurial capabilities include original entrepreneurial capabilities constructed by entrepreneurial technology, organizational capability, and human capital, and necessary supplementary capabilities comprising entrepreneurial strategy and commercial capability. The study supported the new concept in which the success of a spin-off's foundation is the ability of new ventures in accessing to financial resources after establishing. The results also reinforce the validity of a firm's performance instruments, which comprise both financial and operational performance factors.

Overall, results of the analysis suggest that the hypothesized structural model represent a good fit. It supports the relationships between social networks and the success of a spin-off's foundation, and linkage between entrepreneurial capabilities and a spin-off's performance. However, the results revealed that the social networks of entrepreneurial teams in the period of a spin-off's foundation are dissociated with the performances of spin-offs in the development stage. The study also failed to find the relationship between entrepreneurial capabilities and success of a spin-off's foundation, and between the success of the foundation and the firm's performances in the development period.

3.5. Resumen

Más allá del enfoque de red, las características de las redes sociales de equipos empresariales en el período de la fundación de spin-off incluyen a la estructura de red, gestión de red y la red de contenido. El estudio indica que la estructura de la red se compone de vínculos de red, densidad y centralidad y que la gobernanza de la red incluye a la reciprocidad y reputación. Sin embargo, el estudio no ha demostrado suficientemente que la diversidad de información dentro de las redes explica el contenido de la red. En consecuencia, el contenido de la red comprende la confianza y la calidad de la información entre los participantes de las redes. Los resultados también apoyan la hipótesis de que las capacidades empresariales incluyen a las capacidades empresariales originales construidas a partir de la tecnología empresarial, la capacidad de organización, y el capital humano y capacidades necesarias complementarias que comprenden la estrategia empresarial y la capacidad comercial. El estudio apoya el nuevo concepto en el que el éxito de la fundación de spin-off es la capacidad de las nuevas empresas para tener acceso a los recursos financieros después de establecerse. Los resultados también refuerzan la validez de los instrumentos de rendimiento de la empresa, que comprenden tanto los factores de rendimiento financiero y operativo. En general, los resultados del análisis sugieren la hipótesis de que el modelo estructural, representa un buen ajuste. Es compatible con las relaciones entre las redes sociales y el éxito de la fundación de spin-off, y la vinculación entre las capacidades empresariales y el rendimiento de las spin-off. Sin embargo, los resultados revelaron que las redes sociales de equipos empresariales en el período de la fundación de spin-off se disocian con las actuaciones de spin-offs en la etapa de desarrollo. El estudio tampoco logró encontrar la relación entre la capacidad empresarial y el éxito de la fundación de un spin-off, y entre el éxito de la fundación y el rendimioento de la empresa en el período de desarrollo.

CHAPTER 5

DISCUSSION AND CONCLUSION

This study analyzed the relationships between social networks and the entrepreneurship. The social networks of founders influence both the processes of foundations and performances of spin-offs. Employing social network concepts of Amit and Zott (2001) and Hoang and Antoncic (2003), this study classified the network characteristics into three catalogues comprising of network structure, network governance, and network content. Moreover, this study also employed the resource-based theory as the conjunctive elements in the processes of spin-off's foundation. The study analyzed the impacts of the conjunction factors on the successes of spin-off's foundation and spin-off's performances. To accomplish these goals, this study considered the entrepreneurial teams of the new ventures that were created by the faculties of universities as the research subjects.

Network structure focuses on network ties (Burt, 1997b; Granovetter, 1973), network density (Black, 1966; Marsden, 1990), and network centrality (Bavelas, 1948; Freeman, 1978). The ties of entrepreneurs in the networks benefit their purposes of entrepreneurship. Hansen (1999) indicated that weak ties among participants in the networks speed up the projects when transferring knowledge is not complex. The strength of ties with intricate knowledge transferring is difficult to substitute lead to highly dependencies of spin-offs on continued basic research supports (Johansson, Jacob, & Hellstrom, 2005). Regarding to network theory, this study contributes to the quality identification of network ties (Larson, 1992; Uzzi, 1996). The contributions of network ties to the entrepreneurship are uncontroversial, but their impacts vary in different contexts. Technology-based entrepreneurs benefit from relational embeddedness while non-technology-based ones benefit from structural embeddedness (Liao

& Welsch, 2003). Additionally, the network density also contributes an important role in the entrepreneurship. The density of both network and exchanging knowledge associates with involvement in innovation (Obstfeld, 2005). The entrepreneurial involvements in the spin-off's processes are as important as in any processes of changes. The benefits that derived from social networks depend on the position of each participant in the networks. A centrality in a network of indirect ties is likely to facilitate the accessing to useful knowledge from direct partners, and thus network position could be accounted as intangible strategic resources (Salman & Saives, 2005). In general, managers achieve more benefits from their large and diverse networks (Burt, 1997b). Because of visible benefits from the networks, networking became a challenge for entrepreneurs in their entrepreneurship processes. Steier and Greenwood (2000) suggested that entrepreneurs must "achieve diversity in relationships whilst overcoming the problem of relationship overload, and manage the dependencies by turning fragile into robust ties."

The network governance is a response to the exchange processes in which reciprocity among participants and reputation of partners are principal components (Deeds, DeCarolis, & Coombs, 1997; Stuart, Hoang, & Hybels, 1999; Putnam, 2000; Muthusamy & White, 2005). Hite (2005) suggested an implication of networks for new ventures regarding to resource acquisitions and effective governances. The exchanging resources and information within the networks were supposed to be influenced by the network governance. This leads to the entrepreneurs receive more benefits from other participants. The roles of network governance are to secure the exchanges of contents within the networks. Information within the networks is the most important resource for all purposes of participants. Network resources importantly explain strategic behaviors of participations in their networks (Gulati, 1999). Besides the information, trust also contributes to the value of exchanging resources. Trust-based relationships enhance and accomplish the exchanges of information and tacit knowledge

among entrepreneurs lead to promote the ability in resource acquisitions at low costs (Elfring & Hulsink, 2003).

Pittaway *et al.* (2004) found that "the principal benefits of networking as identified in the literature include: Risk sharing; obtaining access to new markets and technologies; speeding products to market; pooling complementary skills; safeguarding property rights when complete or contingent contracts are not possible; and acting as a key vehicle for obtaining access to external knowledge". Moreover, "The project teams obtained more existing knowledge from other units and completed their projects faster to the extent that they had short interunit networks paths to units that possessed related knowledge" (Hansen M. T., 2002). Networks provide "access to heterogeneous knowledge is of equal importance for overall managerial performance and of greater importance for innovation performance" (Rodan & Galunic, 2004). In general, Network capital gains access to knowledge and lead to enhance expected economic returns (Huggins, 2010). Thus, Inkpen and Tsang (2005) suggest that "for effective and efficient knowledge transfer to occur, firms may have to manage and build social capital proactively". Furthermore, Kelley, Peters, and O'Connor (2009) suggested that to enhance information exchange and knowledge building, entrepreneurs should consider forms of information technology databases and forums.

Networks also provide accesses to other necessary resources for the creation and development of new ventures. The community provides an environment in which members contribute investment fund, attract other firms, and assist other new ventures (van Auken, 2002). External relationships allow entrepreneurs to "build credibility, gain advice, financing, and customer access, build a positive image and obtain resources at below-market prices, and obtain channel access, information, and innovation" (Zhao & Aram, 1995). International networks gain access to and mobilized resources for firm's internationalization through long-term relationships (Sasi & Arenius, 2008).

In terms of building networks for resource exchanges, the roles of participants necessitate to be focused especially on the contributive abilities. Koch, Kautonen, and Grunhagen (2006) believe that key actors generate benefits for other members in the networks, and maintain a balance among heterogeneous interests of participants. Mosey and Wright (2007) believed that "entrepreneurs with prior business ownership experiences have broader social networks and are more effectives in developing network ties." The relationships of the entrepreneurs also must be focused in both individual and team levels. In study about individualism, collectivism, and entrepreneurship, Tiessen (1997) suggested that "entrepreneurship requires two activities: generating the variety through innovation or new ventures, and leveraging resources internally or by establishing external ties," and "resources leverage depends on efficient relationships that thrive under collectivism." Firm's abilities to form fresh networks for new purposes are more important than current individual structure for entrepreneurship (Kelley, Peters, & O'Connor, 2009). Because this study focuses on the university spin-offs, the benefits of academic networks also are obviously considered. For example, studying entrepreneurial activities of five universities in the midlands in England, Mosey *et al.* (2007) indicated that the university fellows strengthen the existing relationships in academic networks. Johansson *et al.* (2005) also found that the network ties of universities had a high degree of trust and informality.

This study analyzes the entrepreneurial capabilities that required for a success of spin-off's foundation and development. These capabilities were based on resources-view theory, and mostly emphasized the intangible resources. The university spin-offs collaborate with both parental organization and other firms to achieve external competencies in the technological area. In foundation stage, the parental organizations support spin-offs by providing infrastructure and expertise in a specific field (Gubeli & Doloreux, 2005). Moreover, Carayannis *et al.* (1998) stated that parental organizations supported their spin-offs by

providing funds, counsels in business and management, locations, and other needed resources. In another approach, Blyler and Coff (2003) suggested that social capital is an essential condition for dynamic capabilities to manipulate resources such as acquiring resources, integrating and recombining resources, and releasing resources. Many studies on network exchanges exploit social exchange theory (Emerson, 1976; Leik, 1992). The external network ties provide access to and exchange necessary external resources (Thorelli H. B., 1986; Zimmer & Aldrich, 1987; Jarillo, 1989; Starr & MacMillan, 1990; Nahapiet & Ghoshal, 1998).

Networking activities of entrepreneurs can gain access to valuable resources and competitive advantages (Zhao & Aram, 1995). Harryson (2008) suggested that "the values of complementary assets are embedded and unlocked by three distinct types of networks: creativity networks, transformation networks and process networks." In international entrepreneurship, the dynamic networking capabilities minimize risks of global market entry decisions (Mort & Weerawardena, 2006). Moray and Clarysse (2005) suggested that to secure the financial, technological, and human resources for science-based entrepreneurial firms, entrepreneurs must exert over social networks in the financial and business community. The entrepreneurs, who dedicate skillfully and frequently to others in their networking actions beyond intrinsic contents or function uses, have more advantages in resource acquisition than those who do not (Zott & Nguyen, 2007). In an academic environment, the networks also contribute important roles in the resource acquisitions of the new ventures. Fellows in universities who "accumulated human and social capital" "created new weak ties with external actors who provided early stage funding, market and legal information and potential customers" (Mosey, Westhead, & Lockett, 2007). However, in an empirical study of German start-ups, in contrast to most existing theories, Witt, Schroeter,

and Merz (2008) concluded that "network links have close to no impact on getting cheap or exclusive resources."

Kraus, Kauranen, and Reschke (2011) identified resources, capabilities, strategies, entrepreneurs, environment, and organizational structure as domains for a new conceptual model of strategic entrepreneurship. In the entrepreneurial processes, the financial capital remains the most important assets. A prerequisite for access to the best and sufficient capital resources is possession of a right mixture of human and social capital, which strongly depends on the industry environment (Madsen, Neergaard, & Ulhoi, 2008). This study focuses on other capitals rather than financial capital because Heirman and Clarysse (2004) stated that "financial and human resources can reinforce or substitute each other." In technology-based project evaluations, Murray and Lott (1995) found that "investors imposed higher investment return 'hurdle rates' at each stage of investment other than seed capital," Thus, to measure the success of a spin-off's foundation, this study evaluate the abilities of a new firm to access to financial resources.

5.1. Spin-off's foundation

The success of a spin-off's foundation was measured through the ease in access to financial resources of the new ventures after being established. This instrument adapted from the creation concepts of Shane (2004). The results from this study support other scholars regarding to the factors impacted the successes of creations. Especially, the impacts of networks on successes of foundation or on the abilities of new ventures in financing right after established. One of the most important financial resources is from venture capitalists. Although facing information asymmetries and lack of understanding how to make decisions, the venture capitalists are very consistent in their process of making decisions (Zacharakis & Meyer, 1998). Supporting the concept of success of foundation, Wright *et al.* (2006) found

that the venture capitalists prefer their investments on new ventures after seed stage. However, the new ventures could fundraise from other resources such as business angels, banks, and parental organizations. Heiman and Claryses (2004) indicated that entrepreneurs with rich experiences prefer financial dependence without venture capitalists.

The study's results revealed that the social network characteristics influence the successes of spin-off's foundations. Starting a new venture, entrepreneurs suffer the risks in which generated from access to the initial financial resources, and characteristics of personal social networks (Rogers, 2006). Reynolds (1991) believes that because the foundation of a new venture depends on the external resources. Three dimensions of social networks, including network structure, network governance, and network content, positively influence on the spin-off's capabilities in access to financial resources. This result reinforces the prior scholars in entrepreneurial networks, which studied on separate characteristics of social networks. For instances, Reynolds (1991) concluded that the firm's initial growth depends on the networks of dense links between key participants. Strong ties provide important sources of information while weak ties offer access to financial resources (Jenssen & Koenig, 2002). The initial growth of a new venture needs support of other firms in the networks, which are based on trust and balanced reciprocities (Laumann, 1982; Larson & Starr, 1993). In general, DeCarolis *et al.* (2009) concluded that "social networks and relational capital enhance levels of illusion of control, which is directly related to the progress of new venture creation." In the other approach of entrepreneurial networks, Nahapiet and Ghoshal (1998) also stated that "social capital facilitates the creations of new intellectual capital." Zhang *et al.* (2008) believed that the entrepreneurs, especially those who have a high occupational status and relevant industrial work experiences, prefer using existing networks to approach and access to initial investors than using market methods.

Haugh (2007) highlighted the importance of resource acquisitions and networks in the processes of formal venture's creations. The influences of networks on spin-off's foundation were revealed, but we failed to find the significant contributions of entrepreneurial capabilities. This study dissented from the theories of Shane (2004) and Vohora, Wright, and Lockett (2002) towards the influences of entrepreneurial capabilities on the access to financial resources. The financial providers evaluate the organizational and marketing activities of spin-offs for their investments (Eckhardt, Shane, & Delmar, 2006). This controversy probably derived from the level of information asymmetry and the various concerns of Spanish financial suppliers.

Because of the benefits that social networks supply to the processes of a spin-off's foundation, networking activities must be important concerns of entrepreneurs. As Johannisson (1986) indicated, to prepare for a venture launching, entrepreneurs spend more time to build networks of participants with wide competencies. By linking to sponsoring institutions, a university reduces the failure possibility of their new ventures (Rothaermal & Thursby, 2006). The degrees of support from parental organizations importantly influence the success of research-based spin-offs through providing of laboratory facilities and research equipment, and through key contributions of directors of research (Steffensen, Rogers, & Speakman, 1999). However, Lerner (2005) pointed out the impractical extent of directly internal funding in the spin-off process. Zhang (2009) indicated that "university spin-offs have a higher survival rate but are not significantly different from other start-ups in terms of the amount of venture capital raised, the probability of completing an initial public offering (IPO), the probability of making a profit, or the size of employment."

The foundations of spin-offs are also impacted by other elements besides social networks and entrepreneurial resources. "The key mechanisms proposed for branding to assist small business create new ventures including opportunity recognition, innovation, business model

development, capital acquisition, supplier acquisition, customer acquisition, and success harvesting" (Merrilees, 2007). According to Haugh (2007), a social venture creation comprises opportunity identification, ideal articulation, ideal ownership, stakeholder mobilization, opportunity exploitation, and stakeholder reflection. Founders of new spin-offs base on the market competition, market growths, and employment growths to access to external financial resources (Eckhardt, Shane, & Delmar, 2006). The success of a spin-off's foundation depends on multidimensional factors, but this study focuses on influences of social networks and entrepreneurial capabilities.

5.2. Spin-off's performance

Theory of a spin-off's performances measured by both financial and operational performances (Murphy, Trailer, & Hill, 1996; Dimitratos, Lioukas, & Carter, 2004) was supported in this study. The results can be employed to measure the performances of other kinds of business institutions. The results also revealed the significant relationships between entrepreneurial capabilities and a spin-off's performances. However, the influences of social networks on a spin-off's performances were not supported. Unlike prior networking approach studies, this study emphasized three dimensions of networks of the entrepreneurial teams. Focused on social networks of the firms after being established, numerous studies indicated the influences of network characteristics on firm performances. The strong ties contribute to survival of new spin-offs rather than to entrepreneurial success (Bruderl & Preisendorfer, 1998). Both strong and weak ties positively influence firm performance (Rowley, Behrens, & Krackhardt, 2000). Structural social networks of entrepreneurs strongly relate to the managerial sales performance of new ventures (Moran, 2005). Partanen *et al.* (2008) found that, in the networks, relationships play important roles in firm's growth. Moreover, evolution of networking capability associates with the capability of competitive strategy (Mort & Weerawardena, 2006). "The networks of emerging firms evolve in response acquisition

challenges of the firm as it moves through the life cycle stages of emergence and early growth" (Hite & Hesterly, 2001). Myint *et al.* (2005) identified "a mini-cluster of Cambridge entrepreneurs as the key influence on the success of the growth process," and "their links between the companies as the structural and relational social capital of the cluster."

Unlike prior studies, this study indicated that the social networks of entrepreneurial teams during the creation processes are disassociated with firm performances. The entrepreneurial networks provide solutions for issues related to accessing, gathering, and utilizing resources during the foundation's period (Granovetter, 1985; Reynolds, 1991; Herron & Sapienza, 1992; Larson & Starr, 1993; Brajkovich, 1994). Thus entrepreneurial networks indirectly influence the growths of spin-offs (Zhao & Aram, 1995; Hansen, 1995; Ostgaard & Birley, 1996). Regarding to the resource acquisition, Vivarelly (2004) stated that "entrepreneurial projects based on a rich information set, a first-best choice and on self-commitment are more likely to develop into actual startups and better post-entry performance." "Social networks affect entrepreneurship through the resources they give access to" (Jenssen & Koenig, 2002). Filatotchev *et al.* (2009) found that "export orientation and performance depend not only on the development of capabilities through R&D and technology transfer, but also on entrepreneurial characteristics, such as the founder's international background and global networks."

Unexpectedly, the results partially supported other scholars, which found that the entrepreneurial networks negatively impact the spin-off's performances. The parameter estimate was negative but statistically insignificant at the $p<0.05$ level (Table 20). For instant, the familiarity among founders positively influences the speed of spin-off's foundations but negatively impacts the growths of new ventures because of the lacks of creativity and new ideals for the new entrants (Grandi & Grimaldi, 2005).

The results indicated that the successes of spin-off's foundations were disassociated with the spin-off's performances. This study disagreed with Hamilton (2001) in terms of contribution of early financing on the later performances of new ventures. McKelvie and Davidsson (2009) found that access to employee human capital and access to financial capital negatively impact the dynamic capabilities of spin-offs in the development stage. However, the results partially supported the discovery of Busenitz *et al.* (2005), as the signals sent to venture capitalists in early funding stages are irrelative to long-term outcomes of the new ventures.

The results revealed the significant relationships between entrepreneurial capabilities and spin-off's performances. This study supported plenty of prior theories in resource-based entrepreneurship. Initial resources of technology-based new spin-offs significantly predict their future survivals (Aspelund, Berg-Utby, & Skjevdal, 2005). Entrepreneurial qualities, resource-based capabilities, and competitive strategies motivate firm's performances. Especially, the multiple resource-based capabilities support the multiple strategies of product's market entries (Kakati, 2003). The dynamic capabilities of partners in networks importantly influence the successes of new ventures (Lee, 2007). Zahra and Bogner (1999) suggested that "the new ventures should pursue a formal strategy to achieve successful performance." Chen (2009) indicated that technology commercialization motivates the correlation between organizational resources and new venture performances. The capital supports and incubators enhance the influences of technology commercialization on new venture performances. Knowledge resources influence the performance of new ventures (West III & Noel, 2009). Knowledge creation process is "a mediator in the relationship between new venture strategy and performance" (Tsai & Li, 2007). Moreover, marketing competences positively influence the firm's performances (Snow & Hrebiniak, 1980; Conant, Mokwa, & Varadarajan, 1990; Bharadwaj, Varadarajan, & Fahy, 1993). Stage of entering to industries is the most important determinant for new venture performance (Robinson, 1998).

However, this study did not support the founding of other scholars in terms of influences of entrepreneurial capabilities on the spin-off's performances. For instance, managerial experiences do not influence significantly the performances (Sandberg & Hofer, 1987). There is insufficient evidence to prove that the initial resources influence the firm performances (Shane & Stuart, 2002). The issue of this result was the difficulty in collecting information in early phase of new ventures. Other entrepreneurship researchers believed that the initial resources quickly dissipate because they could not find empirical evidence in their studies (Bruderl & Schussler, 1990; Fichman & Levinthal, 1991).

Alternative model

The results revealed an insignificant relationship between social networks of founding teams and the spin-off's performances. As prior mentions, the inventors prefer working in the academic environment instead of attending to the new firms. These inventors can keep their relationships with the spin-offs via working within the advisory boards. However, during the creation's processes, the abilities of the founders were transferred and become the firm's capabilities. This illustrated in the alternative model that we examined the indirect influences of social network factor on the spin-off's performance measure through the entrepreneurial capability indicator. The results from this model revealed a good fit (χ^2=14.91, df=12, RMSEA=0.037; NFI=0.96; CFI=0.99; GFI=0.98). The ratio chi-square/degrees of freedom is below 2 (χ^2/df = 1.24) indicated that the model was acceptable fit. All parameter estimates were statistically significant at the 0.5 level, and all variables loaded on one factor each. Thus, the model passed the test of convergent validity and achieved a certification of discriminant validity of indicators. Thus, the social networks of the members of founding teams significantly and positively influence the entrepreneurial capabilities of the teams, and lead to affect the spin-off's performances in the growth or development stages. This result partially concur with the prior propose of Collins and Clack (2003) and Hoang and Antoncic

(2003) that social networks of founding teams affect the firm's growths. The network factor indirectly influences the performance measure via the direct effect on the entrepreneurial capability indicator (Appendix G).

5.3. Theoretical contributions

By embedding the network theory and resource-based views to entrepreneurship, the study extended the relevant theories. Instead of using network analysis method, this study utilized the network approach to evaluate the contributions of acquaintances on the entrepreneurship. Numerous prior scholars have neglected this methodology for a full three-dimension analysis of network characteristics. The social network measurement comprises of structure, governance, and content factors. This study enriched the network approach in the entrepreneurship that has been less focused on contemporary investigations. This study illustrated that the social network theory is also important in the spin-off creation researches.

The resource-based view has been investigated in many studies, but most focused on the capabilities of the new ventures. This study partially fulfilled the gap in the resource-based entrepreneurship, which almost neglected the capabilities of the entrepreneurial teams before the spin-offs occurred. This study indicated that the abilities of entrepreneurs comprising of technology capital, human resource, organizational capability, strategy, and commercial capability also contribute importantly to the new venture performances. Both social networks and capabilities of entrepreneurs in the processes of spin-off's creations must be considered in the entrepreneurship studies because of their direct and indirect influences.

This study conduces to the entrepreneurship theory by introducing another approach in foundation's successes and spin-off's performance measurements. It describes the contributions of both social networks and entrepreneurial capabilities in the foundation's processes and business performances. The foundation success measurements were adapted

from prior authors based on the spin-off's abilities in access to the financial resources after established. These instruments moderate the difficulties in measuring the creation's successes, which based on the stock values of spin-offs on the financial market. The new firms rarely issue their stocks to the public for many years after launching. This study also indicated the benefits in measuring the performances of spin-offs based on both financial and operational performances. This study partially enriches the entrepreneurship theory by covering the gap in researching the relationship between the pre-established factors and post-established outcomes.

5.4. Limitations

As similar to other studies, this study should interpret cautiously toward several factors. Firstly, the limited number of spin-offs from Spanish universities restricted this study's sample size compared to the requirement of SEM. The sample was a judged sample rather than random one. This severed the unique requirements on subject's characteristics of the research that focuses on the new firms derived from the universities in Spain. Secondly, the study adapted the measurement of successes of spin-off's foundations from prior studies. This instrument requires further investigations before we can confidently employ in our studies based on their validity in measuring the concept. Thirdly, the research based on the internet survey that the responses must comprehend the questions themselves lead to an uninsured understanding. The questions must be described by the interviewers in some circumstances even though they are understandable to the interviewees. There might be some technical issues on the internet which lead to several responses asked why they could not submit the survey.

The results from measurement model and CFAs indicated that the study necessitates further improvement. Most of the scales indicated high composite reliabilities except the scales that

measured new investments (in the success of the spin-off's process measurement) and network reputation. Especially, based upon the capabilities of spin-offs in access to the financial resources, the measurement of successes of a spin-off creation needs further refinements.

5.5. Further research

Based upon the internet-based survey, the further studies can extend the location to European university spin-offs that can generate more reliable results and refinements in the academic entrepreneurship. These results can compare with the American studies based on the distinctions in network characteristics, entrepreneurial capabilities, and financial providers. The entrepreneurial networks with the attendances of financial providers in America are different from the networks in Europe. The influences of entrepreneurial networks on the spin-off performances might be distinctive between the European context and the American circumstance.

The further research can focus on the influences of social networks on the spin-off performances toward the approach based on three dimensions of networks. This study only evaluated the network characteristics of entrepreneurs in the creation's period. These characteristics can be changed over time because of the new individual attendances or changing in relationships. The spin-offs can recruit more employees with relationship and capability additions. Each dimension of networks can variously influence the outcomes of the firms. Most of the prior studies have focused on the network analysis rather than network approach. This suggestion differs from prior studies according to the structure, governance, and content dimension approach.

5.6. Conclusion

This study indicates that the factors before establishing the spin-offs are more likely to influence on their foundations and performances. The social networks of founding teams improve the processes of spin-off's creations with their characteristics such as ties, density, centrality, reciprocity, reputation, trust, and quality of exchanging information. These characteristics were divided into structure, governance, and content dimensions of the networks that indirectly influence the performances of spin-offs in the growth stage via their contributions in enhancing the entrepreneurial capabilities of the founding teams. The spin-off's performances meliorate in both financial and operational aspects by direct effects from the capabilities of the teams in the creation period lead to their survival, growth, and development. The results from this study clarify the suggestion that entrepreneurs must build their relationships in the networks of not only the academic community but of the society because of the benefits from exchanging resources. The networks facilitate the academic entrepreneurship by improving founder's abilities in creating and developing the spin-offs lead to ameliorate the university's activities. Thus, studying the university entrepreneurship has become an interesting concern of scholars in the modern management science.

CHAPTER 6

CONCLUSIÓN

6.1. Las contribuciones teóricas

Mediante la integración de la teoría de redes y de recursos, el estudio amplía de las teorías actuales. En lugar de utilizar el método de análisis de redes, este estudio utiliza el enfoque de redes para evaluar las contribuciones de los elementos de la red en el espíritu empresarial. Numerosos estudiosos anteriores han dejado de lado esta metodología para un total de tres dimensiones de análisis de las características de la red. La medición de la red social se compone de factores de estructura, la gobernabilidad, y de contenido. En este estudio se enriquece el enfoque de red en el espíritu empresarial que se ha centrado menos en las investigaciones actuales. Este estudio ilustra que la teoría de redes sociales también es importante en las investigaciones de creación de spin-off.

El punto de vista basado en los recursos se ha investigado en muchos estudios, pero la mayoría se centró en las capacidades de las nuevas empresas. Este estudio cumplió parcialmente la brecha en el espíritu de empresa basada en los recursos, que casi descuida las capacidades de los equipos empresariales antes de que el fenómeno spin-offs se desarrollara. Este estudio indicó que las habilidades de los empresarios que componen el capital de la tecnología, recursos humanos, capacidad de organización, estrategia, y la capacidad comercial también contribuyen de manera importante a las actuaciones de empresas de nueva creación. Ambas redes sociales y las capacidades de los empresarios en los procesos de creación de spin-off han de ser consideradas en futuros estudios, a causa de sus efectos directos e indirectos.

Este estudio conduce a la teoría de la iniciativa empresarial mediante la introducción de otro enfoque en el éxito de fundación y las mediciones de spin-off de rendimiento. En él se describen las contribuciones de ambas redes sociales y las capacidades empresariales en los procesos de la fundación y actuaciones empresariales. Las mediciones de éxito de la fundación fueron adaptados de autores anteriores basados en las habilidades de la spin-off en el acceso a los recursos financieros después del establecimiento de la empresa. Estos instrumentos moderan las dificultades para medir los éxitos de la creación, que se basa en los valores de las acciones de las spin-offs en el mercado financiero. Las nuevas empresas rara vez emiten sus acciones al público incluso años después del lanzamiento. Este estudio también indica los beneficios en la medición de las actuaciones de las spin-offs basados tanto en los resultados financieros y operativos. Igualmente, se parte de la teoría enriquece el espíritu empresarial por cubrir la brecha en la investigación de la relación entre los factores pre y post establecimiento de la empresa.

6.2. Limitaciones

De manera similar a otros estudios, es necesario interpretar con cautela varios factores. En primer lugar, el limitado número de spin-offs de las universidades españolas limita el tamaño de la muestra de este estudio en comparación con el requisito de la SEM. La muestra fue una muestra al azar. Esto hizo más severos los requisitos únicos de las características del sujeto de la investigación que se centra en las nuevas empresas derivadas de las universidades de España. En segundo lugar, el estudio de adaptó la medición de los éxitos en las fundación de spin-off de estudios anteriores. Este instrumento requiere más investigaciones más en profundidad. En tercer lugar, la investigación basada en la encuesta de Internet posee limitaciones inherentes. Las preguntas deben ser descritas por los entrevistadores en algunas circunstancias, a pesar de que sean comprensibles para los entrevistados.

Los resultados de modelo de medición y análisis confirmatorio indican que el estudio es susceptible de mejoras futuras. La mayoría de las escalas indican alta fiabilidad compuesta, excepto las escalas que miden las nuevas inversiones (en el éxito de los procesos de medición de la spin-off) y la reputación de la red. Sobre todo, en base a las capacidades de las spin-offs en el acceso a los recursos financieros, la medición de los éxitos de la creación de una spin-off necesitará nuevas mejoras.

6.3. La investigación adicional

Sobre la base de la encuesta basada en Internet, los nuevos estudios se pueden extender a la ubicación en la Europa de spin-offs universitarias que pueden generar resultados más fiables y mejoras en el espíritu empresarial académico. Estos resultados se pueden comparar con los estudios norteamericanos sobre la base de las diferencias en las características de la red, las capacidades empresariales y proveedores financieros. Las redes empresariales con las asistencias de los proveedores de servicios financieros en los Estados Unidos son diferentes de las redes en Europa. Las influencias de las redes empresariales en las actuaciones spin-off podría ser distintivas respecto al contexto europeo americano.

La investigación se centrará en las influencias de las redes sociales en las actuaciones spin-off hacia el enfoque basado en tres dimensiones de las redes. Este estudio sólo evalúa las características de la red de empresarios en el período de la creación. Estas características pueden cambiar con el tiempo debido a las circunstancias individuales nuevas o cambiantes en las relaciones. Las spin-off puede contratar a más empleados con nuevas capacidades. Cada dimensión de las redes puede influir de manera diferente en los resultados de las empresas. La mayoría de los estudios previos se han centrado en el análisis de redes en lugar

de enfoque de la red. Esta propuesta se diferencia de estudios previos de acuerdo a la estructura, la gobernabilidad, y el enfoque de la dimensión de contenido.

6.4. Conclusión

Este estudio indica que los factores antes del establecimiento de spin-offs son más propensos a influir en sus fundamentos y actuaciones. Las redes sociales de los equipos fundadores de mejoran los procesos de creación de spin-offs con sus características, tales como las relaciones, la densidad, la centralidad, la reciprocidad, la reputación, la confianza y la calidad de intercambio de información. Estas características se dividieron en la estructura, la gobernabilidad, y las dimensiones del contenido de las redes que influyen indirectamente en las actuaciones de spin-offs en la etapa de crecimiento a través de sus contribuciones en la mejora de las capacidades empresariales de los equipos fundadores. Las actuaciones del spin-off de mejoran en ambos aspectos operativos y financieros por los efectos directos de las capacidades de los equipos en el período de la creación hacia su supervivencia, crecimiento y desarrollo. Los resultados de este estudio aclaran la idea de que los empresarios deben construir sus relaciones en las redes, no sólo de la comunidad académica, sino de la sociedad debido a los beneficios de intercambio de recursos. Las redes facilitan la creación de empresas por la mejora de la capacidad académica fundador en la creación y el desarrollo de la iniciativa spin-off para mejorar las actividades de la universidad. De este modo, el estudio de la iniciativa empresarial de la Universidad se ha convertido en una preocupación de interés de los investigadores en la ciencia de la administración moderna.

APPENDICES

Appendix A: Enquiring List of Spin-offs from Spanish Universities

Estimado/a compañero/a:

El motivo de la presente es solicitar tu colaboración en la realización de un proyecto de investigación sobre el proceso de creación y desarrollo de *spin-off* en la universidad española en el marco de la convocatoria 2010 de Proyectos de investigación del MICINN. De este modo, hemos desarrollado un cuestionario con el fin de obtener información sobre dicho proceso y los factores que inciden en el éxito de las *spin off* universitarias en España.

Por ello, te rogaría si fuera posible nos facilitaras un listado de las spin off de tu universidad con los datos básicos de contacto para hacerles llegar el cuestionario. Por supuesto, una vez finalizado el proyecto te haremos llegar, si así lo deseas, los principales resultados del estudio.

No dudes en hacerme llegar cualquier duda o aclaración adicional que necesites y quedo a tu disposición al respecto.

Recibe un cordial saludo

Appendix B: Cover Letter

Estimado/a compañero/a:

Con motivo de la realización del estudio sobre Creación y Desarrollo de Spin Off en España, le adjuntamos la dirección electrónica en la que puede rellenar el cuestionario relativo a su empresa Spin Off. Su colaboración es crucial para conocer el estado actual de las Spin Off y de esta manera optimizar en el futuro los procesos y recursos que las universidades o organizaciónes ponen a disposición de los emprendedores. Rellenar la encuesta no le llevará más de 10 minutos. Estaremos encantados de enviarle los primeros resultados si así lo desea, sólo tiene que hacérnoslo saber.

https://spreadsheets.google.com/viewform?formkey=dFdiMlQtQzJXOHNYYUZITkFkZmxadWc6MQ

Igualmente no dude en contactar con nosotros para cualquier duda o sugerencia.

Reciba un cordial saludo

Appendix C: Reminding Letter

Estimado :

El número de la respuesta no es suficiente para el estudio porque el número de spin-off de la Universidad de España no es muy grande.

Con motivo de la realización del estudio sobre Creación y Desarrollo de Spin Off en España, le adjuntamos la dirección electrónica en la que puede rellenar el cuestionario relativo a su empresa Spin Off. Su colaboración es crucial para conocer el estado actual de las Spin Off y de esta manera optimizar en el futuro los procesos y recursos que las universidades o organizaciónes ponen a disposición de los emprendedores. Rellenar la encuesta no le llevará más de 10 minutos. Estaremos encantados de enviarle los primeros resultados si así lo desea, sólo tiene que hacérnoslo saber.

https://spreadsheets.google.com/viewform?formkey=dFdiMlQtQzJXOHNYYUZITkFkZmxadWc6MQ

Igualmente no dude en contactar con nosotros para cualquier duda o sugerencia.

Reciba un cordial saludo

Appendix D: English Version of Survey Instruments

How many individuals who you received advices or information **related to process of establishing this firm**?											
1	2	3	4	5	6	7	8	9	10	11	12+

How correct are these statements about relationships between you and above people, and among them before establishing this firm?		Not true						Very true
DEN1	These people knew each other by name	1	2	3	4	5	6	7
DEN2	These people talked to each other about business	1	2	3	4	5	6	7
DEN3	These people saw each other regularly in business situations	1	2	3	4	5	6	7
CEN1	I talked directly with these people about business issues	1	2	3	4	5	6	7
CEN2	If any of them had information that would help me in my business, they could tell me directly	1	2	3	4	5	6	7
CEN3	If I needed advice about running my business, I could call any of these people on the telephone	1	2	3	4	5	6	7
CEN4	I am one of the first to heard about new things this group of people	1	2	3	4	5	6	7
TIE1	You would share personal matters with them	1	2	3	4	5	6	7
TIE2	You might discuss family matters with them	1	2	3	4	5	6	7
TIE3	You might ask them for advices about private matter	1	2	3	4	5	6	7
REP1	I saw myself as someone who generates a lot of enthusiasm	1	2	3	4	5	6	7
REP2	I saw myself as someone who has a forgiving nature	1	2	3	4	5	6	7
REP3	I saw myself as someone who perseveres until the task is finished	1	2	3	4	5	6	7
REP4	I saw myself as someone who likes to play with ideas	1	2	3	4	5	6	7
REC1	These people were generally pair in dealings with me	1	2	3	4	5	6	7
REC2	These people were willing to do me a favor if asked	1	2	3	4	5	6	7
REC3	We did favor for each other from time to time	1	2	3	4	5	6	7
REC4	These people patronized my business because I supported the community	1	2	3	4	5	6	7
TRU1	I was considered to be dependable by these people	1	2	3	4	5	6	7

TRU2	These people would say that I am sincere	1	2	3	4	5	6	7
TRU3	These people would trust me with personal information about themselves	1	2	3	4	5	6	7
TRU4	They would say that I am a trustworthy person	1	2	3	4	5	6	7
QUA1	When using information from people above, how accurate would you say it usually is?	1	2	3	4	5	6	7
QUA2	In general, how relevant to your issue was the information from people above?	1	2	3	4	5	6	7
QUA3	How specific was the information that you get from people above?	1	2	3	4	5	6	7
QUA4	How often was the case of information obtained from people above?	1	2	3	4	5	6	7
QUA5	How timely would you estimate information to be from people above?	1	2	3	4	5	6	7
Rate the level of information flew between you and these people		Not at all						Too much
DIV1	Market data	1	2	3	4	5	6	7
DIV2	Product designs	1	2	3	4	5	6	7
DIV3	Process designs	1	2	3	4	5	6	7
DIV4	Marketing know-how	1	2	3	4	5	6	7
DIV5	Packaging design/technology	1	2	3	4	5	6	7
DIV6	Management system and practices	1	2	3	4	5	6	7
These questions are asking about capability of the entrepreneurial team who created this firm								
How correct are the statements about technology was utilized to establish this firm?		Not true						Very true
TEC1	It was hard to make (or find) a substitute for this patented technology	1	2	3	4	5	6	7
TEC2	This technology might replace numerous existing products, services, or processes one it was commercialized	1	2	3	4	5	6	7
TEC3	This technology might replace currently variable technologies in the industry	1	2	3	4	5	6	7
TEC4	This technology had the potential to generate large economic returns	1	2	3	4	5	6	7
TEC5	This technology worked as a platform for a wide variety of commercial applications	1	2	3	4	5	6	7
TEC6	The products developed from this technology would have considerable demand in the market	1	2	3	4	5	6	7

How correct are the statements about organizational capability of entrepreneurial team?		Not true						Very true
ORG1	The management structure itself encouraged employees to believe that to improve working methods is part of the role set for all members of the organization	1	2	3	4	5	6	7
ORG2	Workers had discretion to the extent that they are able to make decisions about performing their own work in the way that they believe most effective	1	2	3	4	5	6	7
ORG3	Rewards and reinforcement enhanced the motivation of individuals to engage in improving management effectiveness	1	2	3	4	5	6	7
ORG4	Individuals had time to incubate their new and innovative ideas	1	2	3	4	5	6	7
ORG5	Major emphasis was put an training employees in working techniques and attitudes	1	2	3	4	5	6	7
How can you describe experience of entrepreneurial team before establishing this firm?		Very low						Very high
HUM1	Working experiences	1	2	3	4	5	6	7
HUM2	Business management knowledge	1	2	3	4	5	6	7
HUM3	Industrial experiences	1	2	3	4	5	6	7
HUM4	Entrepreneurial experiences	1	2	3	4	5	6	7
How correct are these statements about strategic capability of entrepreneurial team?		Not true						Very true
STR1	The management of entrepreneurial team favoured a strong emphasis on R&D, technological leadership, and innovation	1	2	3	4	5	6	7
STR2	Entrepreneurial team was very first to introduce new products and services, administrative technologies, etc...	1	2	3	4	5	6	7
STR3	The management of the entrepreneurial team exhibited a strong tendency to be ahead of other competitors in introducing novel ideals and products	1	2	3	4	5	6	7
STR4	The management of entrepreneurial team exhibited a strong tendency for high-risk projects with chances of very high returns	1	2	3	4	5	6	7
STR5	In dealing with it competitors, entrepreneurial team typically sought to avoid competitive clashes	1	2	3	4	5	6	7
How correct are these statements about commercial ability of entrepreneurial team?		Very low						Very high
COM1	We communicated with customers on a personalized base to build long-term relationships	1	2	3	4	5	6	7
COM2	We had an overall business plan to redesign our inventory management process	1	2	3	4	5	6	7
COM3	We had an overall business plan to redesign our marketing and sales process	1	2	3	4	5	6	7

COM4	Improving company processes became a key of our business plan	1	2	3	4	5	6	7
These questions are asking about the firm right after establishing								
After establishing this firm, how easy could your firm access these financial sources?		Not easy						Very easy
RIN1	Private investors/ angels	1	2	3	4	5	6	7
RIN2	Venture capital	1	2	3	4	5	6	7
RIN3	Government grants	1	2	3	4	5	6	7
NIN1	Strategic partners	1	2	3	4	5	6	7
NIN2	Loans from banks and agencies	1	2	3	4	5	6	7
NIN3	Initial public offering	1	2	3	4	5	6	7
NIN4	Employees	1	2	3	4	5	6	7
NIN5	Customers	1	2	3	4	5	6	7
These questions are asking about the current performance of the firm								
How do you describe this firm compared to major competitors?		Much lower						Much higher
FPE1	Sales growth	1	2	3	4	5	6	7
FPE2	Revenue growth	1	2	3	4	5	6	7
FPE3	Growth of number of employees	1	2	3	4	5	6	7
FPE4	Net profit margin	1	2	3	4	5	6	7
COP1	Product/ service innovation	1	2	3	4	5	6	7
COP2	Process of innovation	1	2	3	4	5	6	7
COP3	Adaptation of new technology	1	2	3	4	5	6	7
COP4	Product/service quality	1	2	3	4	5	6	7
COP5	Product/service variety	1	2	3	4	5	6	7
COP6	Customer satisfaction	1	2	3	4	5	6	7

Appendix E: Spanish Version of Survey Instruments

¿Aproximadamente cuántas personas participaron en el proceso de establecimiento de la empresa aportando información o recomendaciones?											
1	2	3	4	5	6	7	8	9	10	11	12+

Por favor, valore su nivel de acuerdo de 1 (Completamente en desacuerdo) a 7 (Completamente de acuerdo) con las siguientes afirmaciones relativas a sus relaciones con las personas de la pregunta anterior								
DEN1	Las personas que le ayudaron se conocían entre ellas	1	2	3	4	5	6	7
DEN2	Estas personas contactaban a menudo entre sí sobre temas relacionados con la empresa	1	2	3	4	5	6	7
DEN3	Estas personas se veían con regularidad sobre temas relacionados con la empresa	1	2	3	4	5	6	7
CEN1	Traté directamente con estas personas acerca de los temas relativos a la empresa	1	2	3	4	5	6	7
CEN2	Si alguno de ellos tenía información que pudiera ser útil para mi empresa, me lo hacía saber directamente	1	2	3	4	5	6	7
CEN3	Cuando necesitaba asesoramiento sobre la empresa, podía llamar a cualquiera de estas personas directamente por teléfono	1	2	3	4	5	6	7
CEN4	Yo soy uno de los primeros a quien se comunican novedades relevantes para mi empresa de este grupo de personas	1	2	3	4	5	6	7
TIE1	Comparto información personal con ellos	1	2	3	4	5	6	7
TIE2	Comparto información familiar con ellos	1	2	3	4	5	6	7
TIE3	Llego a solicitarles consejos sobre asuntos privados	1	2	3	4	5	6	7
REP1	Me considero una persona que genera mucho entusiasmo	1	2	3	4	5	6	7
REP2	Me considero una persona que tiene capacidad de perdonar	1	2	3	4	5	6	7
REP3	Me considero una persona que persevera hasta finalizar las tareas	1	2	3	4	5	6	7
REP4	Me considero una persona que le gusta pensar en nuevas ideas	1	2	3	4	5	6	7
REC1	Estas personas fueron justas en el trato conmigo	1	2	3	4	5	6	7
REC2	Estas personas apoyaron a mi empresa porque consideraban la idea como beneficiosa para el entorno	1	2	3	4	5	6	7
REC3	Estas personas y yo nos ayudamos de vez en cuando	1	2	3	4	5	6	7
REC4	Estas personas estaban dispuestas a ayudarme si lo necesitaba	1	2	3	4	5	6	7

TRU1	Estas personas me consideran fiable	1	2	3	4	5	6	7
TRU2	Estas personas me consideran sincero	1	2	3	4	5	6	7
TRU3	Estas personas confían en mí información personal sobre ellos mismos	1	2	3	4	5	6	7
TRU4	Estas personas me consideran como una persona de confianza	1	2	3	4	5	6	7
QUA1	La información que me aportaron fue muy exacta	1	2	3	4	5	6	7
QUA2	La información que me aportaron fue muy relevante	1	2	3	4	5	6	7
QUA3	La información que me aportaron fue muy específica	1	2	3	4	5	6	7
QUA4	La información que me aportaron llegó cuando la necesitaba	1	2	3	4	5	6	7
QUA5	La información que me aportaron llegó muy a menudo	1	2	3	4	5	6	7
Valore a continuación el nivel de flujo de información que comparte con esas personas de 1 a 7 relativo a las siguientes cuestiones:								
DIV1	Datos sobre los mercados	1	2	3	4	5	6	7
DIV2	Diseños de productos	1	2	3	4	5	6	7
DIV3	Diseño de procesos	1	2	3	4	5	6	7
DIV4	Know how de Marketing	1	2	3	4	5	6	7
DIV5	Diseño y tecnología logística	1	2	3	4	5	6	7
DIV6	Sistema y prácticas de gestión	1	2	3	4	5	6	7
Por favor, valore su nivel de acuerdo de 1 (Completamente en desacuerdo) a 7 (Completamente de acuerdo) con las siguientes afirmaciones relativas a capacidad del equipo emprendedor antes de establecer esta empresa								
TEC1	Fue difícil y complicado desarrollar la tecnología base de nuestra empresa	1	2	3	4	5	6	7
TEC2	Nuestra tecnología podría sustituir a muchos productos, servicios o procesos existentes	1	2	3	4	5	6	7
TEC3	Nuestra tecnología podría sustituir a algunas tecnologías actuales de nuestro sector	1	2	3	4	5	6	7
TEC4	Esta tecnología tiene potencial para generar grandes beneficios económicos	1	2	3	4	5	6	7
TEC5	Esta tecnología trabaja como una plataforma para una amplia variedad de aplicaciones comerciales	1	2	3	4	5	6	7

TEC6	Los productos desarrollados a partir de esta tecnología tendrían una considerable demanda en el mercado	1	2	3	4	5	6	7
ORG1	La estructura de gestión motiva a los empleados para mejorar los métodos de trabajo.	1	2	3	4	5	6	7
ORG2	Los trabajadores pueden tomar decisiones acerca de cómo realizar su propio trabajo en la forma en que ellos creen más eficaz	1	2	3	4	5	6	7
ORG3	Las recompensas y refuerzo motivan a los trabajadores a participar en la mejora de eficacia de la gestión	1	2	3	4	5	6	7
ORG4	Los individuos dedican tiempo a desarrollar ideas nuevas e innovadoras	1	2	3	4	5	6	7
ORG5	La empresa pone especial hincapié en la formación de sus empleados	1	2	3	4	5	6	7
STR1	El equipo de gestión empresarial favorece la investigación y desarrollo, liderazgo tecnológico e innovación	1	2	3	4	5	6	7
STR2	El equipo empresarial fue el primero en introducir nuevos productos y servicios, tecnologías de administración, etc	1	2	3	4	5	6	7
STR3	El equipo de gestión se orienta hacia la rápida introducción de nuevas ideas y productos	1	2	3	4	5	6	7
STR4	El equipo de gestión realiza proyectos de alto riesgo con altas posibilidades de rentabilidad	1	2	3	4	5	6	7
STR5	El equipo de gestión trata de evitar la competencia directa con otras empresas	1	2	3	4	5	6	7
COM1	Nos comunicamos personalmente con los clientes con el fin de construir relaciones a largo plazo	1	2	3	4	5	6	7
COM2	Tenemos un plan para optimizar nuestro proceso de gestión de inventarios	1	2	3	4	5	6	7
COM3	Tenemos un plan para optimizar nuestra estrategia de marketing y ventas	1	2	3	4	5	6	7
COM4	La mejora de procesos de la empresa es clave en nuestro plan de negocio	1	2	3	4	5	6	7
Valore de 1 (Muy baja) a 7 (Muy alta) la experiencia del equipo emprendedor antes de establecer esta empresa								
HUM1	Experiencia de trabajo	1	2	3	4	5	6	7
HUM2	Conocimiento sobre técnicas de gestión	1	2	3	4	5	6	7
HUM3	Experiencia industrial	1	2	3	4	5	6	7
HUM4	Experiencia empresarial	1	2	3	4	5	6	7

Después de crear la empresa valore la facilidad/dificultad de acceder a las siguientes fuentes de financiación, de 1 (Muy difícil) a 7 (Muy fácil)								
RIN1	Inversores privados / Business Angels	1	2	3	4	5	6	7
RIN2	Capital riesgo	1	2	3	4	5	6	7
RIN3	Ayudas públicas gobiernos central y CC.AA.	1	2	3	4	5	6	7
NIN1	Otros socios estratégicos	1	2	3	4	5	6	7
NIN2	Préstamos bancarios o similares	1	2	3	4	5	6	7
NIN3	Oferta pública de adquisición (OPA)	1	2	3	4	5	6	7
NIN4	Empleados	1	2	3	4	5	6	7
NIN5	Clientes	1	2	3	4	5	6	7
Cómo describiría a su empresa frente a sus principales competidores respecto a los siguientes indicadores, de 1 (Mucho peor) a 7 (Mucho mejor)								
FPE1	Crecimiento en ventas	1	2	3	4	5	6	7
FPE2	Crecimiento de los ingresos	1	2	3	4	5	6	7
FPE3	El crecimiento del número de empleados	1	2	3	4	5	6	7
FPE4	Margen de beneficio neto	1	2	3	4	5	6	7
COP1	Innovaciones en Productos / Servicios	1	2	3	4	5	6	7
COP2	Innovación en procesos	1	2	3	4	5	6	7
COP3	Adaptación de nuevas tecnologías	1	2	3	4	5	6	7
COP4	Calidad del producto / servicio	1	2	3	4	5	6	7
COP5	Variedad de Productos / Servicios	1	2	3	4	5	6	7
COP6	Satisfacción del cliente	1	2	3	4	5	6	7

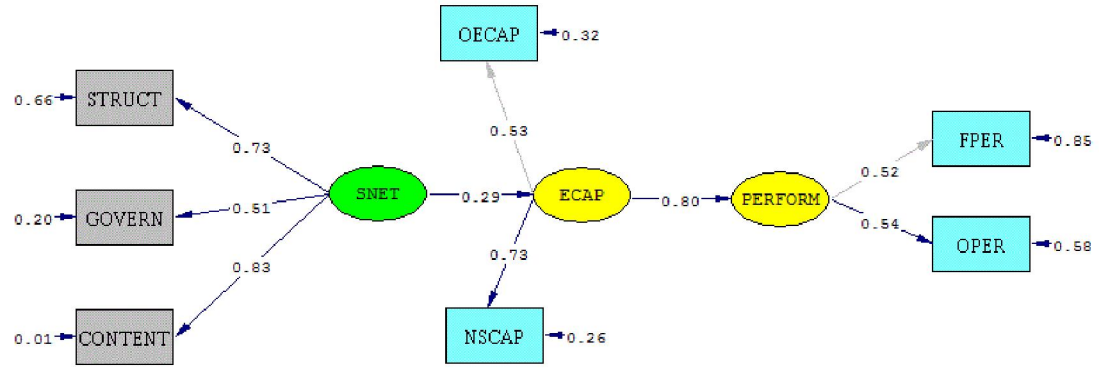
Appendix F: Factor Loading and Cronbach's Alpha

Factors / Items	Density	Centrality	Ties	Reputation	Reciprocity	Trust
DEN1	.688					
DEN2	.951					
DEN3	.925					
	α = 0.888					
CEN1		.565				
CEN2		.721				
CEN3		.734				
CEN4		.566				
		α = 0.736				
TIE1			.645			
TIE2			.943			
TIE3			.814			
			α = 0.840			
REP1				.716		
REP2				.500		
REP3				.571		
REP4				.567		
				α = 0.632		
REC1					.702	
REC2					.577	
REC3					.709	
REC4					.943	
					α = 0.805	
TRU1						.857
TRU2						.894
TRU3						.699
TRU4						.805
						α = 0.879

Factors / Items	Quality of information	Diversity of information	Entrepreneurial technology	Organizational capability	Entrepreneurial human resource	Commercial capability
QUA1	.877					
QUA2	.902					
QUA3	.864					
QUA4	.782					
QUA5	.794					
	α = 0.926					
DIV1		.769				
DIV2		.856				
DIV3		.845				
DIV4		.813				
DIV5		.808				
DIV6		.792				
		α = 0.922				
TEC1			.502			
TEC2			.808			
TEC3			.741			
TEC4			.780			
TEC5			.600			
TEC6			.725			
			α = 0.839			
ORG1				.726		
ORG2				.669		
ORG3				.792		
ORG4				.566		
ORG5				.557		
				α = 0.794		
HUM1					.506	
HUM2					.797	
HUM3					.749	
HUM4					.820	
					α = 0.808	
COM1						.507
COM2						.663
COM3						.892
COM4						.538
						α = 0.708

Factors / Items	Entrepreneurial strategy	Returning investment	New investment	Financial performance	Operational performance
STR1	.681				
STR2	.611				
STR3	.796				
STR4	.532				
STR5	.506				
	α = 0.702				
RIN1		.665			
RIN2		.937			
RIN3		.501			
		α = 0.714			
NIN1			.655		
NIN2			.506		
NIN3			.709		
NIN4			.504		
NIN5			.509		
			α = 0.655		
FPE1				.849	
FPE2				.945	
FPE3				.570	
FPE4				.692	
				α = 0.842	
COP1					.613
COP2					.581
COP3					.567
COP4					.736
COP5					.528
COP6					.591
					α = 0.767

Appendix G: Indirect Influence of Social Networks on Spin-off's Performances (Alternative Model)



Chi-Square=14.91, df=12, P-value=0.24631, RMSEA=0.037

Appendix H: Results of Hypothesis Tests

Hypohesis	Variable/Factor relationships	Results
H1a	Entrepreneurial technology indicates original entrepreneurial capability	Supported
H1b	Organizational capability indicates original entrepreneurial capability	Supported
H1c	Entrepreneurial human resource indicates original entrepreneurial capability	Supported
H1	Original entrepreneurial capabilities indicate entrepreneurial capabilities	Supported
H2a	Entrepreneurial strategy indicates necessary supplemental capability	Supported
H2b	Commercial capability indicates necessary supplemental capability	Supported
H2	Necessary supplemental capabilities indicate entrepreneurial capabilities	Supported
H3a	Network ties indicate network structure	Supported
H3b	Network density indicates network structure	Supported
H3c	Centrality of members in networks indicates network structure	Supported
H3	Network structure indicates social network characteristics	Supported
H4a	Reciprocity among members in networks indicates network governance	Supported
H4b	Reputation of members in networks indicates network governance	Supported
H4	Network governance indicates social network characteristics	Supported
H5a	Quality of flowing information in networks indicates network content	Supported
H5b	Diversity of flowing information in networks indicates network content	Not supported
H5c	Trust among members in networks indicates network content	Supported
H5	Network content indicates social network characteristics	Supported
H6a	Returning investments indicate success of spin-off's foundation	Supported
H6b	New investments indicate success of spin-off's foundation	Supported
H7	Entrepreneurial capabilities predict success of spin-off's foundation	Not supported
H8	Social network characteristics predict success of spin-off's foundation	Supported
H9a	Financial performance indicates spin-off's performances	Supported
H9b	Operational performance indicates spin-off's performances	Supported
H10	Entrepreneurial capabilities predict spin-off's performances	Supported
H11	Social network characteristics predict spin-off's performances	Not supported
H12	Success of spin-off's foundation predicts spin-off's performances	Not supported

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