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The Initial Fluid Stage of University Spin-offs
—A Case from Kyushu Institute of Technology—

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1 Introduction

University spin-offs, while important, have not yet obviously contributed to the economy in many regions (Leslie and Kargon, 1996). In this study, we focus on the initial fluid stage of university spin-offs, in which many ventures remain by the evidence of studies around the world. This initial fluid stage of university spin-offs will be explored via a detailed analysis of a spin-off of Kyushu Institute of Technology (KIT). It is argued that the dynamic entrepreneurial capability is the key mechanism of entrepreneurship to generate business value from its resources.

2 "Initial Fluid Stage"

Olofsson et al. (1987) studying university spin-offs in Sweden, Roberts (1990) about MIT's cases and Pan (2008) about Japan's cases found that technology-based spin-offs, in their early stage, are in a predicament that they have difficulty establishing a definite business domain and endeavor to generate the business value from their ambiguous technology by trial and error.

We define this stage as "*initial fluid stage*[1]" in terms of the life cycle of technology-based start-ups. It refers to a process from the formation and transfer of resources developed in universities to the generation of business value from them. It is an iterative process of opportunity perception, opportunity exploitation and opportunity creation. Referred to the previous studies, we summarize three characteristics emerging among spin-offs in this stage. First, spin-offs have not yet established their definite business domain. They tend to have kinds of innovative ideas, but are not sure if any one could really generate the economic value for them (Levitt, 1963). Second, they are likely to engage in the sub-business such as consulting or contract research in order to solve the problem of a lack of capital. Third, as a result of the first and second characteristic, their income structure can not exactly reflect the business value of their technology.

3 A Research Question and Assumptions

3.1 Research on University Spin-offs

Studies on university spin-offs can be classified into three types. First type is about the relationship between university spin-offs and their affiliated academic organizations[2] (Di Gregorio and Shane, 2003; etc.). These studies focus on the question how university policies affect the creation and development of university spin-offs. One of the persuasive studies is selectivity-support model (SSM) (Roberts and Malone, 1996; etc.). In SSM, academic organizations operating in a developed environment, where venture capital and entrepreneurs are readily available, offer low selectivity and support to their spin-offs, while those in an underdeveloped environment, where

[1] "Fluid Stage" is initially defined by Abernathy (1978) and Utterback (1994). They define it as the first stage of innovation dynamics involving the transitional stage and the specific stage in terms of product innovation, process innovation, competitive environment and organizations.

[2] Academic organizations here comprise universities and research institutes.

capital and entrepreneurs are scarce, offer high selectivity and support.

This kind of study offers a perspective of "supportive environment" which can facilitate the creation and development of spin-offs, in that the different culture and system between academy and business tend to be a conflict. It indicates that parent organizations with their support policy plays a role to offer their spin-offs initial resources involving not only the transfer technology but also other tangible and intangible resources, which can be considered as the original resources for spin-offs. Furthermore, it also implies that legitimacy is a prerequisite condition for the creation and survival of a novel organization, which also is proved to be an important resources for a start-up (Zimmerman and Zeitz, 2002; etc.). So we can postulate that the legitimacy resources might be indispensible for a new start-up to gain the external resources.

The second type is on the entrepreneurs of university spin-offs (Clarysse and Moray, 2004; etc.). Correspondent with the previous studies about small medium enterprises, it finds that the formation and evolution of entrepreneur team are the most critical factor for a university spin-off. The third type concerns the development process of university spin-offs (Shindo, 2008; etc.). These studies focus on the entrepreneurship adapted to the challenges from the technology and market uncertainty in the developing process of a spin-off. During this process, spin-offs should accumulate the business resources, which consist of "customer relations, market share, supplier relations, manufacturing and distribution processes, technology, and reputation all of which give the company a position in its industry and market (Churchill and Lewis, 1983, p.40)."

Different from the previous studies which investigate from pre-startup stage to mature stage, our study focuses on the question how entrepreneurship to accumulate and exploit the original resources, legitimacy resources and business resources to evolve from the initial fluid stage.

3.2 Entrepreneurship and Resource-Based View (RBV)

3.2.1 Entrepreneurial Orientation

From the initiative of Schumpeter (1934)'s emphasis on the role of entrepreneurs and the destructive innovation, the field of entrepreneurship has attracted a lot of researchers' interest. However, there is still in a lack of a wide consensus, because of the heterogeneity and complexity of entrepreneurship, which is defined as a process pursuing opportunities (Shane and Venkataraman, 2000), or as creation of organizations (Gartner, 1988), or new entry (Lumpkin and Dess, 1996), etc.

Miller (1983) defines an entrepreneurial firm as the one that "engages in product-market innovation, undertakes somewhat risky ventures, and is first to come up with 'proactive' innovations, beating competitors to the punch (p.771)". Based on this definition, some studies have proposed a concept of entrepreneurial orientation (EO) consisting of the dimensions of innovativeness, proactiveness and risk-taking and suggest that it improves firm performance (Covin and Slevin, 1991; etc.). Innovativeness propensity refers to a firm's tendency to engage in new ideas, novelty, experimentation and creative processes. Proactiveness propensity is described to take an initiative to seize a market opportunities. Risk-taking propensity denotes the willingness to contribute large resources commitments to the uncertain business (Lumpkin and Dess, 1996).

However, the empirical results of the relationship between OE and firm performance are mixed. Some results turned out to be a positive relationship between them (e.g., Jantunen et al., 2005) while others failed to (e.g., Lee et al., 2001). Although Lumpkin and Dess (1996) argue that the relationship between EO and performance is context specific, it is still doubted if EO may always contribute to improve performance (Lee et al., 2001; etc.). Then, studies on EO have developed from the contingency approach (Lumpkin and Dess, 1996) to the RVB approach, which tends to

explain the mechanism between EO and performance (Igarashi, 2008; etc.).

3.2.2 Dynamic Capability

The RVB approach examines the link between a firm's internal characteristics and performance (Penrose, 1959; Barney, 1991; etc.). Penrose (1959) initially proposes that a firm is basically a pool of resources and emphasizes the role of entrepreneurs in the growth of a firm in the view of resources. This approach stresses the heterogeneity and immobility of firm's valuable and scarce resources as the sources of competitive advantage (Barney, 1991). These resources are intrinsically inimitable, since they may be causally ambiguous, socially complex to be understood, and the ability to obtain a particular resource may be dependent on unique, historical circumstances.

However, under the condition of resource constraints and market uncertainty, RVB can hardly explain how new start-ups to get competitive advantage to survive and grow. There should be another kind of mechanism (Wiklund and Shepherd, 2005). Teece etc. (1997), based on the RVB approach, propose the concept of dynamic capability—"the firm's ability to integrate, build and reconfigure internal and external competences to address rapidly changing environment (p.516)." In addition to the input of resources, they emphasize the issues like skill acquisition, learning and accumulation of resources. The distinctive capabilities of firms are embedded in firms' managerial and organizational process, shaped by their specific position and the paths available to them. And the competitive advantage of firms lies with this process, position and path.

Compared with Teece etc. (1997) which concern the established business firms, Alvarez and Barney (2001) propose the concept of entrepreneurial capability by a resource-based view of entrepreneurship for the entrepreneurial ventures, since they find that most current strategic research tends to leave entrepreneurship on the sidelines. They argue that venture's entrepreneurial capability can fuel innovation and push a venture from survival to growth stage. The entrepreneurial capability may result in the firm heterogeneity, so resource heterogeneity and immobility are the cornerstones of entrepreneurial success. However, their study has not analyzed the mechanism of capability as the capability approach does.

3.2.3 Dynamic Entrepreneurial Capability

In this study, based on the RBV-inspired dynamic capability and EO, we propose a concept of *dynamic entrepreneurial capability*, which is considered as the mechanism of entrepreneurship for university spin-offs to evolve from the initial fluid stage. Dynamic entrepreneurial capability consists of the proactive and innovative dimension to exploit and create new opportunities. It also includes the abilities to accumulate, integrate and reconfigure the internal and external resources to create the business value from organizational specific resources, and the abilities to orchestrate changes and organize efficiently so as to be able to take advantage of new opportunities.

Original resources, legitimacy resources and business resources are proposed to be important for a spin-off to evolve from the initial fluid process, in which, its dynamic entrepreneurial capability would be formed and developed. In order to investigate this process, we decide to use case study method. Next, we analyze the dynamic entrepreneurial capability formed in the initial fluid process by studying a university spin-off in Kitakyushu Research and Science Park (KRSP).

4 Case Study

Kithit Company (Kithit), a university spin-off of KIT, was founded in 2005 by Mr. Shimotsuma, Professor Ishihara and Professor Sato to transfer the artificial intelligence voice system (AIVS) with

a capital of 20 million yen. The reasons why we have chosen this spin-off as our case are that it is less than 5 years old, located in a university science park (KRSP) and its entrepreneur team has endeavored to create the business value of the transfer technology[3]. In the following, we divide its initial stage into three phases to analyze how it has developed its business (Table 1).

The first phase is a preparing and start-up phase. Before starting up, the entrepreneur team of Mr. Shimotsuma, Professor Ishihara and Professor Sato always discussed how to develop Japan's semiconductor industry and contribute to enhance the quality of people's life, since Mr. Shimotsuma and Professor Ishihara had once worked in a semiconductor company as a technician and the two professors undertook a project of human interface and had developed AIVS at that time. With the help of FAIS[4] and the support center in KIT, they created their company–Kithit. Mr. Shimotsuma[5] took the place of representative director and two professors became directors. In spite of a clear vision, the potential of their technology was still ambiguous, so they had to study what products they should develop on earth. Simultaneously, Mr. Shimotsuma, without any management experience, actively took the related lectures and study meetings held in KSRP and had a face-to-face meeting with the incubator manager to discuss the problems in their development.

The second phase is a test phase. In this phase with the support of FAIS, Kithit mainly took part in robot projects with the local robot organizations, for example, "A Robot PR Project" of RIDC-01 which could sweep and was exhibited in different public areas, and a robot named Maetel[6] exhibited at Kitakyushu Airport. Kithit was responsible to develop and install its AIVS into these robots and make them flexibly communicate with people. Via these exhibitions in the public, Kithit attracted a lot of people's attention and also got other chances to join collaborative robot projects. The entrepreneur team, with the hope to further develop in robot industry, went to exhibit their technology around Japan and showed their systems to machine manufacture companies with a subsidy offered by FAIS for marketing; however, the results were disappointed.

The third phase is a challenging phase. In this phase, they attempted to create their original product because of the failures in the robot market. Reconsidering their initial intention, the entrepreneurial team considered toys for people who stayed in front of computer all the day. They found that even although there were many toys with speaking functions, the words they were able to say were so limited that users might soon lose fun of them. They considered if a toy could change its words according to different people and situations, this toy must be very attractive. With subsidies and the technology accumulated from the collaborative projects, they thus attempted to make prototypes and developed a system of word-chain game. For about a year, they finally completed their first product–Tane Chan and later Mantaro, which included a cute doll, a speaker, a microphone and related software. The words these toys were able to say could be easily increased by upgrading, so it could solve the problem of the monotonous conversation of the present toys.

During this period, Kithit was widely reported by both the local and the national range press. It also actively promoted its products by participating in various exhibitions and opened a web shop in its homepage to start a mail order service. Meanwhile, Kithit went on cooperating with the local robot organizations to join collaborative projects, such as a robot named Hoshi-San also displayed

[3] First of all, we inquired the entrepreneurs in the list of university spin-offs located in the KRSP, if they would like to accept our interview and study. Then we gained acceptance from four spin-offs and interviewed all of them. By studying their developing process, we regard Kithit as the most suitable one for our study.

[4] FAIS is the abbreviation of Kitakyushu Foundation for the Advancement of Industry, Science and Technology, which is responsible for the general management of KSRP and cooperation between universities and industry, etc.

[5] As of July 2009, Mr. Shimotsuma retired.

[6] It is a robot of a famous character in Galaxy Express 999.

in the Kitakyushu Airport. On the other hand, Kithit endeavored to develop its original technology. In July 2009, it developed and brought its second original product HIT-ST1, a super tweeter to market. However, marketing is still an obstacle to evolving form its initial fluid stage[7].

Table 1 A Summary of the Initial Fluid Stage

Phase	The preparing and start-up phase	The test phase	The challenging phase
Capital	Research subsidies	Business-related subsidies	Business-related subsidies, revenues
Technology	Transfer technology	Transfer technology	A combination of transfer technology and original technology
Products	Planned products kind to human beings	Collaborative projects of RIDC-01 and Maetel Robot, etc.	Tane-chan and Mantaro, HIT-ST1, Collaborative projects of Hoshi-San robot, etc.
Business	Semiconductor industry, AIVS	Robot industry	Toys, products of high quality of sounds

5 Discussion

Kithit has strived to establish its business domain by developing products from robot business, toys to super tweeters. It is an iterative process of opportunity perception, exploitation and creation. During this process, it has accumulated, integrated and reconfigured original resources, legitimacy resources and business resources and developed its capabilities (Table 1, 2).

Kithit has gained from the support organizations the original resources including cheap facilities, subsidies, participation in the "learning ba" with kinds of lectures, seminars and exhibitions, and consulting services from the incubator manager. By 2009, it has been reported by media 27 times and exhibited its products in exhibitions for about 26 times, through which it received national publicity and enhanced its reputation. By exploiting and reconfiguring these original resources and legitimacy resources, it has accumulated business resources, including the chances to cooperate with the local robot organizations, to raise capital, to connect its business partners, to approach its customers. Its dynamic entrepreneurial capability has also been developed in this trial-and-error process to recognize, exploit and create business opportunities.

Table 2 A Summary of Resources and Capability Accumulated in the Initial Fluid Stage

Classification	Methods	Resources	Capability
Original resources	Spun off from KIT located in KSRP	Subsidies, consulting services, a "learning ba", etc.	Learning and accumulating capability to do business and run a firm
Legitimacy resources	27 times reported by media and 26 times participating in exhibitions by 2009	Reputation and trust, a closed relationship with the local society, etc.	The abilities to approach the customers, and to reconfigure legitimacy resources to gain the business resources
Business resources	Cooperation with partners	Supplier relations, customer relations, technology accumulation, etc.	The abilities to recognize, exploit and create business opportunities, and to reconfigure the existing resources

6 Conclusion

This paper explored the dynamic entrepreneurial capability of a university spin-off to evolve from the initial fluid process by using case study method. There are two contributions from our study. First, it has made the process of the initial fluid stage clear to some extent, in which a spin-off accumulates, integrates and reconfigures its original resources, legitimacy resources and business resources to recognize, exploit and create business opportunities. Second, we have taken the initiative step to verify and establish the dynamic entrepreneurial capability approach in the chaotic flied of entrepreneurship, although deeper research hereafter is needed.

[7] The information above was from an interview of Mr. Shimotsuma and the incubator manager, articles about Kithit in newspaper and its homepage.

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