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How Can Business Ventures Attain Sustainability? : System Dynamics Approach

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ABSTRACT

The 2007–2008 global economic recession and consequent high unemployment have led to the emergence of business ventures that play a major role in local economic development and job creation. In particular, the success rate of technology-based business ventures is higher than that of other small businesses. The number of such success stories rises with proper incubation support. The Korean government is making persistent efforts to promote job-creating business ventures. Previous research has only contributed a fragmentary understanding of the sustainability of business ventures. By contrast, this study focuses on a more comprehensive understanding, by simultaneously considering the knowledge of the founder(s), sustainability, and the influence of support for ventures using the system dynamics method. This method helps address the factors critical to the sustainability of business ventures. It also helps to understand the correlations among the key factors such as types of knowledge and the incubation timing. The present study adopts the well-known resource-based view theory (RBV) as a framework. Human resources are a major source of venture business sustainability. Especially, the knowledge held by business founder(s) may ultimately determines the competitive advantage of the venture firm. Hence, in this study, knowledge resources of ventures are considered in three dimensions, such as the understanding of ways by which to start a new business, know-how about the business type, and a deep understanding of the relevant industry. This study finds that pre-entry knowledge and incubation timing are significant factors influencing the success of business ventures. By investigating the relationship between three types of knowledge and two possible incubation times, entrepreneurs can decide when to opt for incubation, a decision that depends on their pre-existing knowledge. This study also found that sustainability does not always improve even with proper incubation because of a negative relationship between management experience and technological experience. Incubation can only help correct biases stemming from the founder's experience, but incubation before the launch of a business cannot improve the founder's technological knowledge about his business since it is hard to acquire technological expertise without practical experience.

KEYWORDS: Sustainability, Knowledge, Business venture, Government support, Effectiveness, System dynamics, Causal loop diagram (CLD)

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1. Introduction

The 2007–2008 global economic recession and consequent high unemployment have resulted in business ventures taking center stage in bringing about local economic development and job creation. With help from the Korean government, which has a policy of supporting entrepreneurs, 28,193 business ventures were started in 2012[1]. Investment in such ventures reached KRW 1.4 trillion in 2013[2]. However, since the dot-com bubble burst in 2000, the sustainability—sustainable competitive advantage[3] of business ventures has always been questionable. As business ventures increase, too many other ventures are closing down. The Korean government is making persistent efforts to restore the business venture ecosystem to ensure job creation.

In particular, the success rate of technology-based business ventures is higher than that of other types of ventures. The number of such successes rises with proper incubation support. However, the effectiveness of such government support has not yet been fully understood. Most existing research has only focused on the correlation between a venture's sustainability and its pre-existing resources, which is its founder(s) knowledge[3]. Hence, previous studies have only contributed a fragmentary understanding of business sustainability. By contrast, this study focuses on a more comprehensive understanding of a business venture by simultaneously considering the knowledge of its founder(s), sustainability, and the influence of support. To our knowledge, this is the first such study to consider these three factors simultaneously. This gap may be owing to the complexity and dynamic changeability intrinsic to a business venture. This study adopts the system dynamics method because it is more effective in addressing the factors critical for the sustainability of business ventures than other methods. It also helps to understand the correlations among the key factors. By using this approach, we expect to obtain new insights regarding the sustainability of business ventures.

2. Literature Reviews

2.1 Resource Based View

The present study adopts the well-known resource-based view theory (RBV) as a framework [4]. RBV argues that companies with valuable, rare, inimitable, and not substitutable resources have a sustainable competitive advantage. It also argues that the competitive advantage of a firm is based on the resources at its disposal[4]. Based on RBV, even if the market offers good opportunities, failure to accurately identify what resources an enterprise has internally and not have to adequate resources will not only make full use of opportunities, but will also lead to long-term difficulties. On the other hand, if firms have resources that can secure competitive advantage in any market environment, firms are more likely to lead opportunities and threats to firms' advantage. To identify the resource of firms, RBV distinguishes between tangible and

intangible resources. However, in the context of business ventures, it is not sufficient to consider tangible resources since these businesses initially rely on the human capital of their founder(s) and does not have proper pre-existing tangible resources. Furthermore, from an RVB perspective, human resources can be said to be a major source of business sustainability. The value of human resources possessed by individual firms must have a heterogeneity that can act as a competitive advantage. In addition, the knowledge of human resources will most likely have the form of tacit knowledge. Since such tacit knowledge is difficult to express in words, only observable through use and only through execution, transfer of knowledge will take a lot of time, cost and inimitable. In other words, the knowledge held by the business founder(s) ultimately determines the competitive advantage of the venture firm[5]. Therefore, this study aims to focus on their intangible resources embodied in the knowledge of their founder(s). Knowledge resources include the understanding of ways by which to start a new business, know-how about the business type, and a deep understanding of the relevant industry[3, 6, 7]. This study focuses on these three types of knowledge, as they are strongly related to business ventures.

2.2 System Dynamics

The system dynamics method helps to understand the target system, especially when there are complex and dynamic relationships and interactions among the components over time[8-10]. System dynamics is a methodology for researching and managing complex feedback systems such as business and social systems, and has been used to address virtually any kind of feedback system. Feedback, in particular, is what distinguishes system dynamics from other methodology. Feedback usually refers to the situation of X affecting Y through the cause-effect chain and then the situation of Y affecting X. It is very difficult to predict how well the system will work by only looking at the linkage between X and Y and the linkage between Y and X independently. Only by looking at the entire system as a single feedback system can the correct conclusion be reached. System dynamics has the advantage of identifying the effects between complex causal relationships that cannot be accounted for as a set of independent causal relationships. Also, system dynamics methodology can identify complex system shapes that change over time. To capture complex relationships, system dynamics uses a causal-loop diagram (CLD). A CLD is created by causal or influential relationships among the related components through process theory. The connections between components reflect causal relationships, and not mere correlations. With circled causal links (the connection between the beginning and end components), a causal loop is created. A causal loop contains a loop identifier, which indicates the loop polarity. The polarity of the link and the loop are decided by whether the relationship is an accumulation or erosion. A complete CLD consists of interacting causal loops and is also called a feedback loop. According to

Forrester[8], dynamic hypotheses with CLD may be formulated on the basis of interviews, group discussions, historical data (or documents), and exploratory studies such as case studies. Hence, in accordance with its goal, the present study formulates dynamic hypotheses based on case studies.

3. Case Studies and Suitable CLD

3.1 Case A: Positive Relationship between Pre-incubation and Sustainablity

Gachisoft, Inc. has the recognition technology for postal addresses. The founder of A had considerable technological expertise about recognition technology from his previous job experience. However, he was a new entrepreneur. Since he had worked as a technician, he did not have any understanding about the industry. Therefore, he decided to opt for an incubation service offered by the government before starting his own venture. The incubation service provided him with mentoring from prior founders in similar industries. Mentoring helped him understand how to establish a firm and rise funds (increasing his knowledge about starting a new venture). In addition, he could also acquire better knowledge about the recognition technology market (increasing his knowledge about the industry). With the knowledge he acquired from mentoring, he could improve the quality of his business planning and make his postal address recognition technology more suitable for the current market situation (sustainability). The launch of his business was successful. Earlier, the public had not been concerned with the recognition technology market, but this changed because of his success. Currently, angel investors try to look for companies similar to his.

Similar to Gachisoft's case, founders often start a venture with an innovative business idea or technology. Many previous studies have emphasized the strong positive relationship between a firm's sustainability and the knowledge of its founder(s) [11-15]. However, depending on whether the founder's expertise lies in a business idea or in a technology, the firm may become one-sided. In most cases, management-oriented founders lack technological knowledge. In other words, it is hard to have both management experience and technological expertise. Of course, it is possible but such companies usually don't need incubation in the first place. Such cases are not excluded in this study, because it focuses on the relationship among the types of knowledge, the incubation time, and sustainability. For instance, the founder of Gachisoft had strong technological expertise but weak management experience.

As with Gachisoft's case, in technology-based firms, the knowledge about the type of business is often related to a particular technology. Such knowledge is closely related to the founder's previous technological experience. With high knowledge about the type of business, the founder has a thorough knowledge of his source technology. Hence, such firms are guaranteed to have a high quality of source technology. The quality of source technology positively influences

a firm's sustainability[16]. If there are many successful business ventures, people are willing to invest in ventures. High sustainability of business ventures is sure to follow market attraction. Market attraction comes with investment in ventures. With sufficient investment, many firms can obtain suitable incubation before they launch their businesses. With suitable incubation before the launch of business, the founder(s) can improve their knowledge about the industry and about starting new ventures. appropriate incubation period helps to increase the sustainability of such businesses. In this case, the incubation before launch of business positively influence the stainability of firm. most cases, this is found to be reliable (cases A, C, and D). Based on this case, we have drawn an accumulation CLD, as shown in Figure 1.

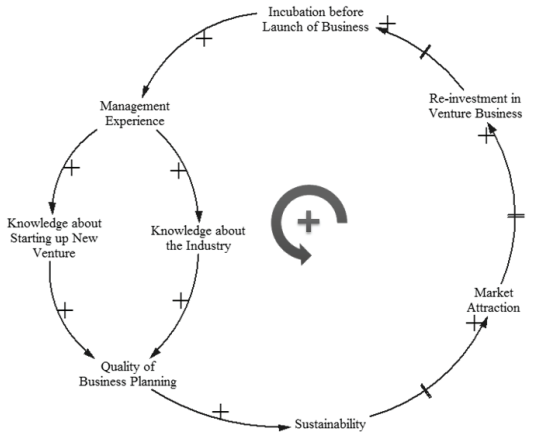

Figure 1. Accumulation CLD for incubation before the launch of business & the knowledge about the starting up new venture and/or the industry.

3.2 Case B: Negative Relationship between Pre-incubation and Sustainablity

There can be cases opposite to case A, where the founder(s)'s knowledge was mainly technology oriented. The case of Kmob, Inc. provides a clear example of a founder who had a pre-existing high level of management experience, but improved on his technological expertise during his incubation period. He had started a business venture on information security. He was funded by Fujitsu. Finally, he sold his company to Hauri, a major antivirus software company, at a satisfactory price. This successful experience gave him sufficient knowledge on managing a company. After this successful venture, he decided to start a new mobile software solution company.

However, mobile software is different from information security software. He decided to join the Convergence Technology Research Commercialization Center (CTCC), a government-funded incubation center for ventures specializing in technology, before launching his new business. He focused on developing a paperless e-conference mobile solution. However, even though he could use the finest equipment for prototype development and support from CTCC, he could not develop a differentiated feature on his paperless e-conference mobile solution. Although he had sufficient experience on how to manage a company, he did not have any knowledge about mobile software. Without knowledge about the type of business, the quality of source technology cannot be exceptional. Achieving exceptional advances in technology is a necessary condition to sustain a business venture. His company is barely operational at

present. In this case, the incubation before launch of business negatively influence the stainability of firm. Based on this case, an erosion CLD is shown in Figure 2.

Figure 2. Erosion CLD for incubation before the launch of business & the knowledge about the type of business.

For founders, while incubation before the launch of a business can improve only two types of knowledge—knowledge about starting a new venture and knowledge about the industry—suitable incubation after the launch of a business can improve all three types of the knowledge. This is because they can use first-hand experience to adjust their technology and business plans to the market situation. It is difficult to make technological adjustments prior to a beta-test. That is the main reason the costs of maintenance and technological adjustments in technology accounts for most of the expenses incurred during the SDLC (software development lifecycle)[17]. Hence, incubation after the launch of a business focuses on adapting the business venture to the market situation. When firms increasingly adjust their technology in accordance with the market situation, the founders can realize the comparative (dis)advantages of their technology (technological experience). They also learn to handle problems (gaining management experience). By gaining strong technological and management experience, founders can improve their knowledge about starting a new venture, about the industry, and about the type of business. As mentioned before, business ventures are, at inception, usually based on the biased knowledge of their founders, which generates a bias in the firm's comparative advantage. However, through proper incubation after the launch of the business, founder(s) can improve all three types of knowledge essential to sustainability. In addition, they can resolve the biases in their firms. With balanced improvement, overall sustainability is increased. Higher rates of success in business ventures may attract more investors.

3.3 Case C: Positive Relationship between Post-incubation and Sustainablity

Case C represents a case in which incubation after the launch of a business helped the founder improve his knowledge about the industry and about starting a new venture. The founder of RFsemi Technologies, Inc. is an acknowledged expert on DRAM semiconductors. Based on his experience, he launched a venture company to develop a semiconductor. However, developing a semiconductor requires a long period of time, massive funds (and/or equipment), and substantial

research personnel to enable commercial deployment. Therefore, he decided to secure incubation from the government-funded Technology Business Incubator (TBI). TBI provided him with all the equipment he needed and helped him with fund management, legal advice including advice on the patent process, and marketing (knowledge about starting a new venture). In addition, a major problem with such long-term development is that it is easy to mistime it. Because of this risk, TBI recommended keeping pace with the changes in the market and provided information about the semiconductor market flow (knowledge about the industry).

With various kinds of support from TBI, he focused on developing a low-powered semiconductor for a mobile device (improving the quality of his business planning). Finally, he was able to develop a low-powered bipolar radio frequency (RF) device optimized for mobile devices. This device was the smallest highly sensitive Electret Capacitor Microphone (ECM) Chip in the world (enhancing sustainability). Presently, his company's global market share in ECM is over 43% (proof of its sustainability). In addition, his company is the first microchip company to be listed on the KOSDAQ(clearly demonstrating market attraction). In this case, the incubation after launch of business positively influence the stainability of firm. Based on this case, an accumulation CLD is presented in Figure 3.

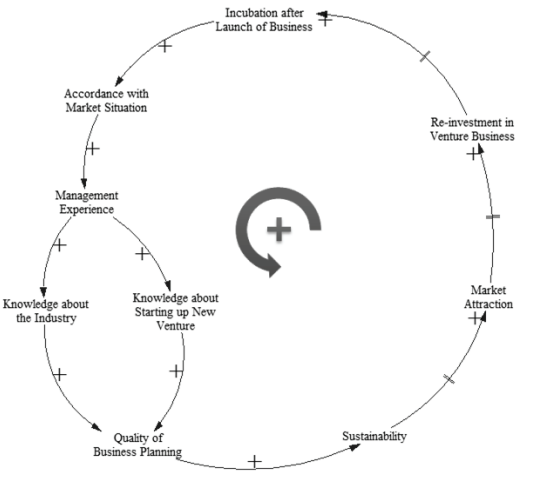

Figure 3. Accumulation CLD for incubation after the launch of business & knowledge about the industry and starting up new venture.

3.4 Case D: Positive Relationship between Post-incubation and Sustainablity

Case D represents a case where incubation after the launch of a business helped the founder improve his knowledge about the type of his business. Daone Technology, Inc. was established to develop a smart wireless charging system by using Near Field Communication (NFC) technology. The founder had several years of management experience from previous jobs and academic knowledge on business based on his MBA degree. However, he did not have enough technological experience to develop a smart wireless charging system. Hence, he applied for inclusion in the government's business-incubating project.

Through such incubation, his company obtained support for prototyping, pilot production, and entering a new market. During the incubation period, entrepreneurship consultants helped him

identify current market trends (so that he could adapt to the market situation). In addition, he was mentored by technological experts on NFC (increasing his knowledge about the type of business). Eventually, Daone Technology succeeded in developing a more user-friendly smart wireless charging system (producing a high quality of source technology).

Because of this exceptional technology, Daone Technology secured additional funds of KRW 100 million from the government and KRW 3 billion from angel investors (ensuring sustainability). In addition, their smart wireless charging system won an award in an international ideas competition (reflecting market attraction). After Daone Technology's great success, its founder was appointed a director of Global Entrepreneurship Network Corporation and helped foster other entrepreneurs (re-investing in business ventures). In this case, the incubation after launch of business positively influence the stainability of firm. Based on this case, an accumulation CLD is presented in Figure 4.

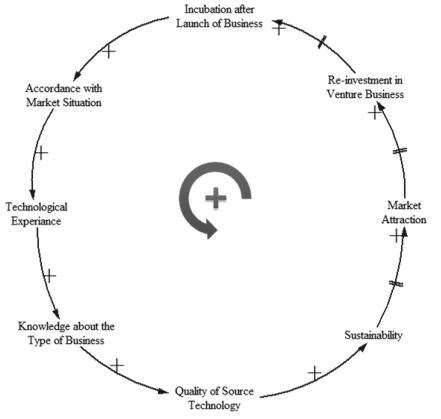

Figure 4. Accumulation CLD for incubation after the launch of business & knowledge about the type of business.

All the aforementioned CLDs are presented together in Figure 5.

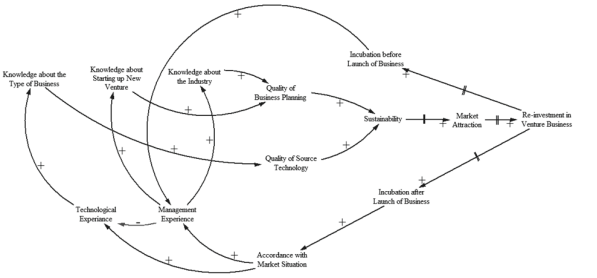

Figure 5. The Casual Loop Diagram for Sustainability in venture business.

4. Conclusions

This study makes several important contributions to the existing literature on business ventures and sustainability. Academic scholars have maintained that an appropriate incubation period helps to increase the sustainability of such businesses. In most cases, this is found to be reliable (cases A, C, and D). However, even with proper incubation, sustainability does not always improve (case B). This is because of a negative relationship between management experience and technological experience. As mentioned earlier, there are cases where founders have both management experience and technological experience, and incubation is not needed in such cases. Incubation can help correct biases stemming from the founder's experience, but incubation before the launch of a business cannot improve the founder's technological knowledge about his business. This is because it is hard to acquire technological expertise without practical

experience. Hence, to improve technological experience, the founder needs to opt for incubation only after a prototype product is developed (i.e., only after the business has been launched).

In addition, this study clarified the complex relationship between incubation time and the type of knowledge that the founder of a business venture has, using the system dynamics method. By dividing the incubation time into pre- and post-launch, entrepreneurs can decide the proper time for incubation. Furthermore, although most previous studies have acknowledged that the main resource of a venture firm is the knowledge of its founder(s), this study subdivides this knowledge into three types—knowledge about the type of business, about the industry, and about starting a new venture. By investigating the relationship between these three types of knowledge and two possible incubation times (either pre- or post-launch), entrepreneurs can decide when to get incubation, depending on their pre-existing knowledge.

The limitations of this study are as follows. First, this study excluded cases where the founder(s) of a firm have both management experience and technological experience. Even if it is out of the scope of this study, such cases may have interesting implications. For example, Apple and Microsoft are cases in which the founders had both types of experience. Second, this study only considered government incubation. Since there are many cases of incubation by private parties, future studies need to consider such cases. Finally, this research is only based on case studies. Case studies are a suitable method of investigating ambiguous relationships. However, future studies need to test the relationships in this study empirically. Such research would require, for instance, simulation tests by using secondary data, surveys, and so on.

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어떻게 비즈니스 벤처가 지속가능성을 얻게 되는가?: 시스템다이나믹스 접근법을 활용하여

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요 약

2007-2008년 세계 경제 침체와 그로 인한 높은 실업은 반대로 지역 경제 발전과 일자리 창출에 중요한 역할을 하는 벤처 설립에 기회를 주었다. 특히, 기술기반 비즈니스 벤처 기업의 성공률은 다른 중소기업보다 높게 나타나고 있다. 이러한 성공 사례는 적절한 인큐베이션으로 인해 증가할 수 있다. 한국 정부는 벤처 육성을 통한 일자리 창출을 촉진하기 위해 끊임없이 노력하고 있다. 과거 비즈니스 벤처에 대한 연구는 지속가능성에 대한 단편적인 이해를 기반으로 수행되었다. 반면, 본 연구는 시스템다이나믹스 분석 방법을 사용하여 창업자, 지속 가능성 및 벤처 기업에 대한 지원 등의 영향을 동시에 고려함으로서 벤처 비즈니스에 관해 보다 포괄적인 이해를 바탕으로 비즈니스 벤처 기업의 지속가능성을 높이는 주요 요소를 찾아내려고 한다. 또한 지식의 유형 및 안큐베이션 시기와 같이 벤처 기업의 지속가능성과 관련된 핵심 요소들 간의 복잡한 상관관계를 이해하는 적절한 방법론으로서 시스템다이나믹스 방법론을 선택하여 분석하였다. 본 연구에서는 매우 잘 알려진 자원기반관점 이론

(RBV)을 이론적 프레임 워크로 채택 하였다. 인적 자원은 벤처 기업의 지속 가능성의 주요 원천이다. 특히 비즈니스 설립자가 보유한 지식은 궁극적으로 벤처 기업의 경쟁 우위를 결정하게 된다. 따라서 본 연구에서는 신규 사업을 시작하는 방법과 같은 경영에 대한 지식, 사업 유형에 대한 노하우 및 관련 업계에 대한 깊은 지식과 같이 벤처와 관련된 지식 자원을 3가지 측면으로 구분하여 분석하였다. 연구 결과, 사전에 보유한 지식과 인큐베이션 시기가 벤처 기업의 성공에 영향을 미치는 중요한 요인임을 발견하였다. 또한, 본 연구는 세 가지 유형의 지식과 두 가지 인큐베이션 시기 사이의 관계를 조사함으로써, 기업가들아 언제 인큐베이션을 선택하는 것이 유의한지를 결정할 수 있는 가이드라인을 제시하였다. 이에 더해, 경영 경험과 기술 경험 간의 부정적인 상관관계로 인해, 적절한 인큐베이션이 이루어지더라도 항상 기업의 지속가능성을 향상시키지는 않는다는 사실을 발견하였다. 결국, 기술적 지식은 실무 경험 없이 인큐베이션만으로 얻어지기 어렵기 때문에 실제 비즈니스 운영전의 인큐베이션은 기술적 지식을 높이기 어려우며, 단지 창업자의 경영과 기술간 경험적 차이에서 비롯된 편향만을 바로 잡을 수 있다는 것을 발견하였다.

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