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External Technology Integration for New Business Creation: An Absorptive Capacity View

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This paper empirically examines the impact of the absorptive capacity of the established company on the creation of its new business by acquiring technology from an external source. There are multiple challenges in new business creation by external technology integration: First, firms must be able to manage differently the technology integration in a new business field and that in existing business. Second, firms must be able to manage and deploy their absorptive capacity to effectively assimilate the external technology inside. This paper develops a theoretical underpinning on the absorptive capacity theory and wide range of technology integration literature. Field interviews were conducted to evaluate the validity of the theoretical underpinning. The result suggests that established firms must handle the simultaneous management of 1. business proposals by individuals with absorptive capacity, 2. business start-up from neither-complete-seeds push and nor-needs pull, and 3. personal connection with outside sources.

Field of Research: Management

1. Introduction

Faced with this period of Japanese economy which is called the “lost 20 years”, what kind of future prospect can be drawn by Japanese manufacturing companies? Firms, especially the established firms, must increasingly improve their management flexibility in the rapidly developing environment. Firms respond to it by entering new different business fields in order to enhance their flexibility and supplement their existing core business for future growth.

Established firms have been focusing on core competencies and functions. As a result of this narrow focus, they are finding that internal development of all technology needed for the new business and new product is difficult and impossible. They must increasingly acquire external technology for development of their management flexibility.

There are multiple challenges in established firms’ new business creation beyond their existing core business by external technology integration. First, firms must be able to manage differently the technology integration in new business fields and that in existing business. Second, firms must be able to manage their absorptive capacity to effectively assimilate the external technology inside. Previous literature has focused on the technology integration from a firm knowledge architecture view and the interorganizational interaction view (these previous literatures will be introduced in the next part of literature review); however, it has not analyzed it from an absorptive capacity view. Our goal in this paper is to provide theoretical inside and practical guidance on how to address these challenges from an absorptive capacity view. Specifically, how do established firms manage their absorptive capacity to enhance their knowledge diversity and firm’s flexibility for new business creation?

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The result suggests that established firms must manage their absorptive capacity to enhance their knowledge diversity and firms' flexibility by handling the simultaneous management of 1. business proposals by individuals with diversified and creative absorptive capacity, 2. business start-up from neither-complete-seeds push and nor-needs pull, and 3. personal connections with outside sources.

In this paper, this paper first summarizes the previous literature on innovation, technology integration and external technology integration, and elaborate the research gap in the literature and derive a theoretical underpinning which forms the basis for the subsequent fieldwork. The ensuing two sections present analysis of field interviews of the case. The remainder of the paper discusses the findings and their implications for research and practice.

2. Literature Review

In this review of the literature, the author will argue that a gap remains between technology integration literature(Iansiti1995) and external technology integration literature (Stock and Tatikonda 2004). Previous literature (Abernathy and Clartk 1985; Tushman and Anderson 1986; Anderson and Tushman 1990; Henderson and Clark 1990; Christensen 2001; Christensen et al. 2003) indicated the failure of established firms in discontinuous innovation, and some previous literatures (Howell and Higgins 1990; Iansiti 1995; Iansiti 1997; Iansiti 2000; Chesbrough and Kusunoki 2001; Tatikonda and Stock 2004; Karson and Loven 2005; Verganti and Buganza 2005; Augustin et al 2005; Tatikonda and Stock 2008; Karlsson and Taylor 2010; Kingo 2013) analyzed how they address the failure. Among the literature about how to address this failure, the research on technology integration is reviewed as a concern of this paper.

2.1 The Failure of Established Firms

Technology discontinuities can lead to intensified technological competition or even to a complete breakdown of competitive patterns (Abernathy and Clartk 1985; Anderson and Tushman 1990). As a consequence, a process of "creative destruction" may unfold, which eventually leads to the demise of established firms (Bergek*et al* 2013). Extant previous work suggests two main explanations for their failure, one explaining the failure reasons and the other explaining the solutions to deal with it.

According to Abernathy and Clark (1985) and Tushman and Anderson (1986), incremental innovation reinforces capabilities of established firms, while radical innovation forces them to ask a new set of questions to draw on new technology and commercial skills, and to employ new problem-solving approaches. Established firms tend to be handicapped by their previous successes with the old technological paradigm (Tushman and Anderson 1986): their existing skills, abilities and ways of operating constrains their actions and make it difficult to respond effectively (Abernathy and Clark 1985). This is the competitive challenge for established firms.

Moreover, Henderson and Clark (1990) suggests that architectural innovations destroy the usefulness of the architectural knowledge of established firms, and that since architectural knowledge tends to become embedded in the structure and information processing procedures of established firms, this destruction is difficult for firms to recognize and hard to correct (Henderson and Clark 1990).

Furthermore, according to Christensen (2003), firms generally improve technologies faster than their customers need or ultimately are willing to pay for. Christensen et al. (2001, 2003) demonstrates that there is even no radical innovation nor architectural innovation occurring in technology, once the main performance requirement of main-stream customers is satisfied, they will therefore embrace the disruptive innovation based on the new attributes it offers, e.g. reliability, convenience or cost.

The review of the innovation literature has identified that once a change occurs in technology or customer demand relating to that technology, established firms will find it difficult to devote sufficient resources to develop solutions, especially if such projects compete with initiatives addressing the needs of known and powerful customers (Bower and Christensen 1995).

2.2 To Address the Failure

Extant previous literature has shown the reasons why technology discontinuity causes the demise of established firms. For example, there are the management of organizational alignment with the technology characteristics (Chesbrough and Kusunoki 2001), leadership management (Howell and Higgins 1990), and project design management (Iansiti 1995; Iansiti 1997; Iansiti 2000； Stock and Tatikonda 2004; Stock and Tatikonda 2008; Karson and Loven 2005; Verganti and Buganza 2005; Augustin et al 2005; Karlsson and Taylor 2010; Kingo 2013). With concern of this paper, the attention will be paid to the project design literature. The technology integration literature review is structured around two central points, first (represented by Iansiti 1995, 1997) dealing with how to manage technology and information from the view of research and development process inside the firm, second (represented by Stock and Tatikonda 2004, 2008) dealing with the technology integration between two separated firms. the author will argue that there is a need to identify technology integration for a new business creation beyond its core business.

2.2.1 Technology Integration

Iansiti (1995) indicates that in an environment characterized by discontinuous technological change, development performance is related to the process of technology integration. He suggests the importance of system focusing approach and managing the structure of knowledge. In particular, effective organizations are characterized by a `system focused` approach (dedicating adequate resource, focusing on early generation of knowledge, and retaining past knowledge). Individuals in integration group possess T-shaped pattern of skill (deep in one, broad in many) to understand technical options and also know how to manage their discipline base with other knowledge bases and context specific factors.

Technology integration theory emphasizes the “architecture of knowledge base”, but the source of the knowledge (inside development or outside sourcing) is not mentioned at all. However, outside source of knowledge are often critical to the innovation process(Cohen and Levinthon 1990; March and Simon1958).

2.2.2 External Technology Integration

Extant literatures are focusing on the management of technology integration, where the technology is from an outsource. One of the most central lines of research on external technology integration between two separated firms is that of Stock and Tatikonda (2000,

2004, 2008) wherein they hypothesis and empirically verify a conceptual framework based on information processing theory. They call it external technology integration (ETI).

They define ETI as the process of managing the acquisition and incorporation of technology from separated firms. They introduce technology uncertainty as one of the factors influencing the technology integration process and the nature of the source-recipient relationship as another influencing factor. Thus, with high levels of technology uncertainty there is a need for greater inter-organizational interaction and conversely, where the recipient organization understands the new technology, a less intensive inter-organizational interaction is warranted (Stock and Tatikonda 2004). Furthermore, Stock and Tatikonda (2008) empirically examines the fitness of technology nature and the interaction with external source, also examines contextual factor, which are prior experience, user participation and project criticality.

External technology integration theory focuses on the interorganizational interaction between the source and the recipient in accordance with the nature of technology uncertainty. However, there is a need for investigation of how to recognize the value of new external technology, and whether that external technology is smoothly assimilated inside the recipient.

Thus, the following section is going to investigate what factors will influence the integration of external technology inside the recipient?

3. Theoretical Underpinning

This section argues that the absorptive capacity of established firms is the main factor which influences recognizing the value of external new information and assimilating it inside the recipient.

3.1 Factors Promote External Technology Assimilation Inside

Cohen and Levinthal (1990) argues that the ability (labeled as absorptive capability) of a firm to recognize the value of new external information, assimilate it and apply it to commercial ends is critical to its innovative capabilities. Lindsay and Norman (1977) suggests that knowledge may be normally acquired but not well utilized subsequently because the individual did not already possess the appropriate contextual knowledge necessary to make the new knowledge fully intelligible. And, faced with technological challenge (such as entry by an innovative start-up), established firms may be able to enhance absorptive capacity in domain in which they do not have much experience (Lenox and King 2004). Thus, absorptive capacity inside established firms is the main factor which determines the success of external technology integration for new business creation beyond their existing core business.

As following, the theoretical underpinning by which this study is supported derives predominantly from the literature of absorptive capacity.

3.2 The Absorptive Capacity and Its Characteristics

Cohen and Leventhal (1990), who mentioned the notion of absorptive capacity first, defines it as following. They think of basic research as broadening the firm`s knowledge base to

create critical overlap with new knowledge and providing it with the deeper understanding that is useful for exploiting new technical developments that build on rapidly advancing science and technology.

One reason why absorptive capacity can promote external technology integration in new business creation is that it can develop the diversity of firm knowledge. According to Cohen and Levinthal (1990), some portion of that prior knowledge should be very closely related to the new knowledge to assimilate, and some fraction of that knowledge must be fairly diverse, although still related, to permit effective, creative utilization of the new knowledge. the author can argue that as a result of this diversification the discontinuity between internal technology and external technology can be overcome.

Another reason is that facing an uncertain environment absorptive capacity would form expectations for new knowledge. According to Cohen and Levinthal (1990), the possession of related expertise will permit the firm to better understand and therefore evaluate the import of intermediate technological advances that provide signals about the eventual merit of a new technological development knowledge. Consequently, absorptive capacity permits the firm to predict more accurately the nature and commercial potential of external technology inside the firm. Moreover, according to Lenox and King (2004), previous related working experience can increase the effectiveness of information provision.

Thus, the author can argue that individuals with working experience in core business can decrease or even diminish the discontinuity of internal technology with the external technology, which is incorporated for new business creation. And, they can predict more accurately the commercial potential of external technology for their new business creation. Thus, the author can propose that individuals with working experience in a core business will enhance the success possibility of new business creation.

Moreover, this paper argues that how to deliver the absorptive capacity which is initially developed and located in a core business is important for new business creation.

Researchers have investigated how managers may develop absorptive capacity by building internal knowledge stocks (Cohen and Levinthal 1990; Henderson and Cockburn 1998; Lenox and King 2004). However, few previous research has considered how the absorptive capacity is delivered. Deliberation of absorptive capacity is as important as its development, since the location where information can best be developed and maintained is often different from where it can best be used (Von Hippel 1994).

Therefore, the research question is articulated as follows: RQ1: How do established firms manage their absorptive capacity to enhance their knowledge diversity and firms' flexibility for new business creation?

4. Methodology

This paper investigates our proposed research questions through a series of in-depth field interviews with the project leader who starts up the new business by integrating internal technology with the technology from the external source. This paper selects a case study methodology because this study is the initial empirical evaluation of the causal relationship between absorptive capacity and technology integration in new business creation. Case studies are often an appropriate strategy for studying a phenomenon that is complex, as

case studies provide the opportunity to analyze relationships between constructs in a more detailed manner than would in larger scale approach such as a survey (Benbasat*et al* 1987).

The Agriculture Support Business of DENSO Corporation in Japan is one of the cases in a wider study carried out on the theme of technology integration in new business creation by the author.

As one of the leading suppliers in the global automobile components market, DENSO knows how to stay ahead in the automobile components industry; however, DENSO tries to spread risk by developing new business opportunities, trying to enter many fields such as health care, security, micro grid, electronic assist, community network solution business, cold chain, bio and agriculture support.

The reason of choosing the DENSO`s agriculture support business case is that this new business field is quite inconsistent with its existing core business of automobile components. It seems that the new business of agriculture support is unrelated at all to the existing core business of automobile component business. The study will focus on the causal relationship of the success of seemly-unrelated new business creation and the absorptive capacity developed in existing core business.

The data is collected from first hand materials of field interviews conducted from 2016 to 2017 with the project leader, and second-hand materials of The NIKKEI (Japanese economic and business newspaper), academic journals and the company homepages.

4.1 DENSO New Business Fields

DENSO`s research and development efforts continue to drive them into new areas of business, solving problems and benefiting society beyond the automotive industry, such as micro grid, electronic power assist, security, healthcare, biotechnology, agriculture support, cold chain and community network solution businesses.

4.2 The ProFarm of Agriculture Support Field

Utilizing greenhouse environment control systems and energy conservation technologies, DENSO contributes to more efficient and stable vegetable cultivation and improved agricultural competitiveness. DENSO’s ProFarm Monitor Kit is one product developed by the agriculture support division. It allows farmers in Japan to remotely monitor greenhouses, temperature, humidity and CO_2 levels from a smartphone to improve crop production, efficiency and stability. It creates a vertical greenhouse environment that will increase the ability to harvest food due to land constraints or during labor shortages in countries around the world.
This product is developed by exploiting the technology of air conditioning systems of automobile and the control system technology for manufacturing factories. Technology of cultivation is learnt from Chiba University in Japan. The Toyotane Corporation, in an alliance relationship with DENSO, transfers the knowledge about doing business in the agriculture industry. Table 1 provides a summary of technologies of ProFarm, Table 2 the technology and knowledge from outside sources.

Table 1: Technologies

Internal technology	External technology	New technology
Technology of air condtioning systems and control systems of automobiles	Cultivating technology	Green house IC technology

(IC: information and communication technology)

Table 2: Profarm Technology and Knowledge from Outside Sources

Knowledge and technology acquisition from an outside source	Basic product concept：Chiba University in Japan
	Cultivation technology：Toyotane Corporation
	Way of doing business in an industry： (for example, the access to whom for the permission of commercializing the products in the agriculture industry)

To enter new business fields, DENSO actively exploits competences (including technology, human resource and so on) developed in existing field of automotive industry. The individuals (including the project leader in agriculture support business), selected by executors from an existing core business, are in charge of choosing and deciding what products to be developed in a given business field. And an infirm open recruitment system provides the chance for individuals, with working experience in automobile components fields, to enter the new business. Table 3 provides a summary of technology and information resources for agriculture supporting business. The mark of ○ represents that the human resources, who carrying that knowledge, join new businesses from existing core businesses of automobile components, otherwise the mark of × is denoted.

Table 3: Profarm Technology and Knowledge from the Existing Field

○	Product design	Project leader' working experience of IC designing in automobile business field
×	Quality control	Subordinate department of the automobile business field
×	Production process	Individuals who have no prior experience
○	Supplier relationship	The supplier relationship developed in the automobile business
×	Marketing expertise	Subordinate department of the automobile business
○	Logic of designing products	Design the ProFarm by the logic of designing automobile engine components control system For example, the information of temperature and humidity of electronic components is monitored and controlled by computers providing optimum conditions. This logic is utilized in designing of Profarm.

(IC: Information and Communication system)

5. Result and Discussion

In our case study, DENSO`s research and development efforts, developed in the automobile components field, continue to drive them into new area of agriculture business, beyond the automotive industry. The green house IC system technology is developed by integrating the technology of air conditioning system and control system for automobiles with the cultivating technology of Chiba University and Toyotane Corporation. This section will discuss the meaning of business proposals by individuals who possess absorptive capacity, and how the absorptive capacity is delivered and exploited in order to enhance firms' knowledge diversity and flexibility.

This paper is going to argue that the technology integration for new business creation requires established firms to handle the simultaneous management of 1. business proposal by individuals possessing absorptive capacity, 2. business start-up from neither-complete-seeds push and nor-needs-pull, and 3. that individuals' personal connection with outside source.

5.1 Business Proposal by Individuals Possessing Absorptive Capacity

Here the author discusses the meaning of this business proposal method for firm knowledge diversity and creativity. The project leader of the agriculture support business had working

experience of IC design for automobile engines. According to his words, the logic of designing IC systems in automobiles is similar to that of designing ICT in green house. For example, the information of temperature and humidity of electronic components is monitored and controlled by computers providing most optimum conditions. This logic of designing controlling system of automobile components is utilized in designing Prafarm, the green house control system.

This illustrates that the project leader's ability developed from his working experience is a critical reason why DENSO, an automobile components company, can create a new business for the agriculture field. As mentioned in section three of the theoretical underpinning, absorptive capacity can develop firm' knowledge diversity, by some portion of the capacity closely related to new knowledge and some fraction diverse. In the case of DENSO agriculture support business, the project leader's prior knowledge (e.g. the air condition system in automobile components) is recognized to related to the new technology of the green-house IC system. The other fraction of prior knowledge permits effective utilization of that new knowledge. For example, the control system for a manufacturing factory, which is used for automobile IC system, will permit the effective use of new knowledge (cultivating knowledge) to develop the green-house IC system.

Moreover, as mentioned in section three, absorptive capacity can form expectation of new knowledge in uncertain environment and permit the firm to predict more accurately the nature and commercial potential of external technology inside the firm. In the case of DENSO agriculture support business, when the project leader comes to the cultivating knowledge, his prior working experience of designing IC system in automobile components allows him to predict the possibility of a green-house IC system business by using DENSO's resources developed in automobile business.

This illustrates that the absorptive capacity developed in core existing business can develop a firm' creativity and diversity, which is necessary for new business creation. Established firms are considered to have developed and accumulated this competence and ability in their long developing history. Therefore, this paper can argue that business proposals by individuals possessing absorptive capacity can promote established firms' knowledge diversity and firms' flexibility for new business creation.

5.2 Business Start-Up from Neither-Complete-Seeds Push and Nor-Needs-Pull

Here the author discusses the meaning of this business start-up method to project leaders' creative thinking.

For new business creation, the individuals selected by executors from the existing core business are in charge of choosing and deciding what products to develop in a given business field. This illustrates that the specific target product market is not chosen yet at that time. Likewise, since the product is not chosen, the technology is not selected yet. Even though the existing technology of automobile IC designing is utilized, it is not complete seeds-push.

Thus, this paper can argue that at the beginning stage the new business start-up is from neither-complete-seeds push and nor-needs-pull. This business start-up method can provide space and chance for project leaders to think creatively to utilize their diversified knowledge.

5.3 Personal Connection with Outside Sources

The next management issue is where to start if new business start-up is neither from complete-seeds push nor needs-pull.

According to previous work, outside sources of knowledge are often critical to the innovation process(Cohen and Levinthon 1990; March and Simon1958). Limited resources and time force many firms to focus on core competencies and functions. As a result of this narrow focus, firms find that internal development of all technology needed for new products and processes is difficult or impossible (Stock and Tatikonda 2004). Established firms especially lack flexibilities. Thus, for new business start-up, obviously, connection with outside sources is critical. According to the interview, it is impossible for a firm to make connections with outside fields beyond its own business field. For example, personal connections are the chance and trigger for the alliance with Chiba university and Toyotane Corporation. This illustrates that personal connections with outside sources increase firms' flexibility to create new business beyond their existing fields.

In sum, this study indicates that technology integration for new business creation requires established firms to enhance their knowledge diversity and firms' flexibility by handling the simultaneous management of ①business proposals by individuals possessing absorptive capacity for firm knowledge diversity and creativity, ② business start-up from neither-complete-seeds-push and nor-needs-pull for offering that individuals to think creatively, and ③individuals` personal connection with outside sources for flexible management.

6. Conclusion

Extant previous work has focused on the established firms' discontinuous environment management (e.g. a new technology, the customer needs change and new business creation). this paper has set out to study how established firms manage their knowledge diversity and firms' flexibility for new business creation from an absorptive capacity view.

Based on an exploratory case study representing a new business creation in a quite different field beyond its existing core business, this paper observed that the technology integration for new business creation requires established firms to enhance their knowledge diversity and firms' flexibility by handling the simultaneous management of 1. business proposals by individuals possessing absorptive capacity for firm knowledge diversity and creativity, 2. business start-up from neither-complete-seeds-push and nor-needs-pull for offering individuals to think creatively, and 3. individuals` personal connection with outside source for flexible management. In conclusion, these findings above show that established firms may be able to manage innovation activities in discontinuous environments (e.g. new business creation beyond its existing core business), by managing absorptive capacity. This can be considered the management implication of this study.

As a contribution to the theory, the paper has filled the gap between the technology integration theory (represented by Iansiti 1995, 1997) and the external technology integration (named by Stock and Tatikonda 2004, 2008). The technology integration theory emphasizes the "architecture of knowledge base" of research and development, and external technology integration focuses on interorganizational relationship, while this paper fills their gap and enriches the technology integration literature by using absorptive capacity theory.

Most if not all research studies have limitations and this study is no exception. First, a deep single case study was selected because this paper demonstrates a causal relationship. However, the alternative research method of quantitative data is necessary for the evaluation of its results. Second, the existence and movement of absorptive capacity from existing core business to new business is illustrated; however, the amount of absorptive capacity is not considered. Third, the human resource management of in-firm open recruitment offers employees a chance to take actions, but no guarantee. And a further opportunity for future research is inherent in the third limitation.

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