2019 Doctor's Thesis

Knowledge Application to Technology-Based New Business in Incumbent Firms: From A Knowledge Nature View

Graduate School of Economics, Nagoya University

Academic Advisor: (Professor) Yamada Motonari

Name: Xiao Yan

Contents

1 Introduction 4

2 Literature Review 8

2.1 New business development in this study 8

2.2 Previous literatures on new business development in incumbent firms 9

2.2.1 Previous works on difficulties of incumbent firms' new business development 9

2.2.2 Previous works on organizational separation and on its limitation 11

2.3 This dissertation's view 14

2.4 Previous literature on specific individual knowledge 16

2.4.1 Significance of specific individual knowledge in new business development 16

2.4.2 Previous literature on utilizing existing knowledge to absorb external technology 18

2.5 Previous literatures on various knowledge in the entire organization of a new business 20

3 Research method and settings 23

3.1 This paper's objectives and research methods 23

3.1.1 This paper's objectives 23

3.1.2 Selected methods 24

3.2 Fundamental weakness of case studies 25

3.3 Research settings 26

3.3.1 Rationale for the case choices 26

3.3.2 Background of the chosen firms 28

3.3.3 Data collection 28

4 A framework of specific-knowledge application for new business development 30

4.1 Case one: Denso's agriculture support business 30

4.1.1 New product and its technologies 30

4.1.2 Comparison of existing and new technologies' combination structures 32

4.1.3 New business development 34

4.2 Case two: Panasonic's agriculture engineering business 35

4.2.1 New product and its technologies 35

4.2.2 Comparison of existing and new technologies' combination structures 36

4.2.3 New business development 38

4.3 A Framework of specific-knowledge application for new business development 39

4.3.1 New business development process 39

4.3.2 New business development approaches 41

5 A framework of knowledge acquisition for new business development . 47

5.1 Case one: Denso's agriculture support business 47

5.1.1 New business 47

5.1.2 Knowledge acquisition.....47

5.2 Case two: Denso's healthcare business 51

5.2.1 New business 51

5.2.2 Knowledge acquisition.....52

5.3 A framework of knowledge acquisition for new business development 54

5.3.1 Category one 55

5.3.2 Category two 56

5.3.3 Category three 59

6 Discussion 63

6.1 Proposition of the model 63

6.1.1 Results.....63

6.1.2 A model of knowledge application from an incumbent firm's existing field to its technology-based new business 65

6.2 Academic and practical implications 71

7 Conclusions and Limitations 74

References 77

Appendix First hand materials 86

1 Introduction

In the rapidly developing economic environment, firms, especially the incumbent manufacturing firms, which have accumulated rich technologies and manufacturing knowledge to their competitive advantage, must increasingly diversify their knowledge to respond quickly and flexibly to market changes. More precisely, for the organizations' long-term growth and survival, development within their existing field is not enough; new businesses beyond the existing field must also be created by exploiting their own competitive advantage. One way for incumbent firms to exploit their competitive advantages in areas such as technologies and manufacturing knowledge for new business development is to integrate their existing technology with technology from external sources. This is referred to as technology-based new business (TBNB in short) in this paper.

Despite numerous previous works (Abernathy and Clark, 1985; Tushman and Anderson, 1986; Anderson and Tushman, 1990; Henderson and Clark, 1990; Christensen, 2001) indicating the failure of incumbent firms in discontinuous innovation (including new business development), other researchers suggest that incumbent firms may actually be contributing to new business development to a much larger extent than generally assumed in the literature (Tushman and O'Reilly, 1996; O'Reilly and Tushman, 2007; O'Reilly and Tushman, 2016 and so on).

Some previous works suggest a solution for dealing with incumbent firm's difficulties on developing new businesses. The suggestion is that incumbent firm should develop new business separately from its existing field (Tushman and O'Reilly, 1996; O'Reilly and Tushman, 2007; O'Reilly and Tushman, 2016). This practice is called

organizational separation. In such practice, incumbent firm's new business can develop and grow autonomously, avoiding the risk of old and successful way of doing things to undermine the new one. For example, since a new business is autonomously developed in a separated organization, it can avoid completing for funds with existing businesses, which often have bigger sales and retain larger markets than the new one.

However, this solution of organizational separation has a limitation. It will make it difficult for the new business to access the existing field knowledge of the incumbent firm. Previous works (Wi, 2001; Iansiti et al, 2003; Igami, 2018; O'Reilly and Tushman, 2016) indicate the issue of inaccessibility of existing knowledge for new businesses as a limitation of organizational separation.

However, there has been little research investigating the limitation of organizational separation from the view of knowledge nature (its precise illustration is shown in Section 2.3). This dissertation will conduct research to develop a knowledge application model for overcoming the limitation of organizational separation, from the view of knowledge nature. Knowledge application in this study indicates incumbent firm applies its knowledge from its existing field to its new businesses. This issue is considered in an incumbent firm who separately develops its new businesses from its existing field. Such research conducting from the view of knowledge nature is important because incumbent firm's existing knowledge of a certain nature can be applied in its new business while others might not, or because existing knowledge that can become to possess or generate a certain nature in a new business can be applied, while others cannot. For example, the knowledge about quality control in existing field can be applied in a new business only if it is related to or homogeneous with the new business. Thus, observing the nature of knowledge being applied from incumbent firm's existing field to its new business, this paper will identify the types of existing

knowledge which can and should be applied in its new business. The precise illustration about this paper's view will delivered in Chapter 2.

Therefore, this dissertation aims to answer the main research question: what types of existing knowledge can an incumbent firm apply in its new business from its existing field, and how can it apply these types of knowledge? To answer this question, the author conducts two researches. The first research concentrates on a "specific individual knowledge" about the combination structure of existing technology. Such individual knowledge is the understanding of components (or component technologies) in a technology and their relationships. Section 2.3 provides a precise definition of this individual knowledge, the reason of investigating it and its importance for TBNB development. Thus, the first research question is as follows: how does an incumbent firm apply the "specific individual knowledge" about the combination structure of existing technology from its existing field to its new business? Because this requires investigating individual knowledge, specifically human thinking and behavior, the author employs the deep case study method. Two cases of new business development by incumbent firms in Japan (Denso and Panasonic) were chosen.

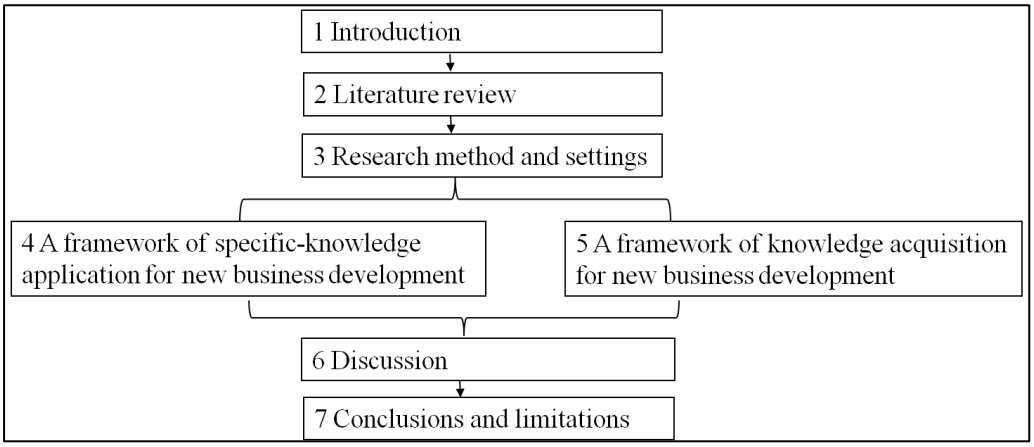
Furthermore, the second research investigates the various knowledge in the entire organization of a new business. The precise illustration about the reason for investigating such knowledge will be provided in Section 2.3. Thus, the second research question is as follows: how does an incumbent firm manage differently the acquisition of knowledge in the whole organization of a new business according to the different nature of knowledge? Since this is an explorative study to develop a new theory, the author has chosen a specific inductive approach of grounded theory pioneered by Glaser and Strauss (Charmaz, 1996). This approach necessitates that the researcher starts with individual cases, incidents or experiences and develops progressively more abstract

conceptual categories to synthesize, explain and understand data, and to identify patterned relationships (Charmaz, 1996). Data about two new businesses (Denso`s agriculture support business and healthcare business) are observed for second research.

As results of investigation, this paper provided a model for use by incumbent firm to apply its existing knowledge in its technology-based new business. Specifically, this paper identified three types of existing knowledge can and should be applied from incumbent firm's existing field to its new business. And we developed three different methods for these three types of existing knowledge above to be applied in a new business. More precise introduction about the result will be delivered in Chapter 6.

This dissertation is organized as follows, as shown in Figure 1. Chapter 2 begins with the introduction about the concept of new business in this study. And it reviews previous works related to incumbent firms' new business development, then, points out the limitation of these previous works and states this paper's perspective for overcoming this limitation. Chapter 3 delivers the research methods and settings. Chapter 4 and Chapter 5 present analysis of two researches, which are conducted for pursuing the main research question. Chapter 6 discusses this paper's findings. And, in the last chapter delivers the conclusions and limitations of this dissertation.

Figure 1 Contents of this dissertation



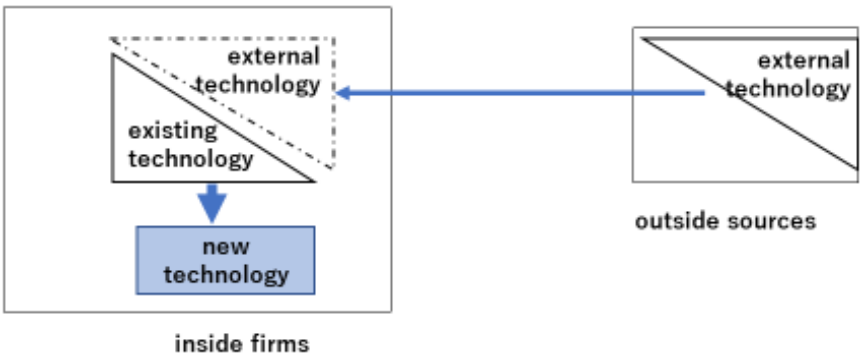
2 Literature Review

First, Section 2.1 outlines the definition of new business development in this study. Section 2.2 reviews previous works on new business development in incumbent firms. Then it reviews previous works on organizational separation and previous works on the limitation of the organizational separation. In Section 2.3, the author introduces this dissertation's view on overcoming the limitation. Sections 2.4 and 2.5 discusses the literatures concerning the aforementioned views.

2.1 New business development in this study

New business development in this study indicates an incumbent firm's development of technology-based new business beyond its existing field. As shown in Figure 2-1, technology-based new business indicates that an incumbent firm, based on its own existing technology, selects a suitable external technology (e.g., the technology of a firm with which this incumbent firm has an alliance relationship) and integrates these two technologies to generate a new technology. In other words, the incumbent firm identifies an external technology that can be integrated with its existing technology to create a new technology beyond its existing field. This paper refers to this as technology-based new business (TBNB).

Figure 2-1 Technology-based new business



2.2 Previous literatures on new business development in incumbent firms

Extant previous works suggest two main explanations for incumbent firms' failure to create new business, one explaining the failure reasons and the other explaining the solution to deal with it. Section 2.2.1 covers the former and Section 2.2.2 the latter.

2.2.1 Previous works on difficulties of incumbent firms' new business development

Previous studies on difficulties of incumbent firms' new business development will be summarized in Table 2-1, and their precise introduction will be delivered in following paragraphs.

Table 2-1 Previous works on difficulties of incumbent firms' new business development

Difficulty	Reason	Previous works
Radical innovation	Incumbent firms tend to be handicapped by their previous successes with the old technological paradigm, their existing skills and so on.	(Abernathy and Clark, 1985; Anderson and Tushman, 1990)
Incremental innovation with totally different architecture	The architectural knowledge is embedded in the structure and information processing procedures of incumbent firms.	Henderson and Clark (1990)
Main stream customer needs satisfaction	Incumbent firms that have been dealing with existing customers will be difficult to deal with the new customers.	Christensen et al. (2001, 2003)

Previous researches indicate that it is difficult for incumbent firms to innovate radically due to the technical rigidities that have traditionally given them their competitive advantages (Abernathy and Clark, 1985; Tushman and Anderson, 1986; Anderson and Tushman, 1990; Henderson and Clark, 1990; Christensen, 2003).

Their previous works are introduced one by one in following. According to Abernathy and Clark (1985) and Tushman and Anderson (1986), incremental innovation reinforces capabilities of incumbent firms, while radical innovation requires them to draw on new technology and commercial skills, and to employ new problem-solving approaches. Incumbent firms tend to be handicapped in developing new businesses by their previous successes with the old technological paradigm (Tushman and Anderson, 1986). Their existing skills, abilities and ways of operating constrain their actions and make them difficult to respond effectively (Abernathy and Clark 1985). This is the competitive challenge for incumbent firms.

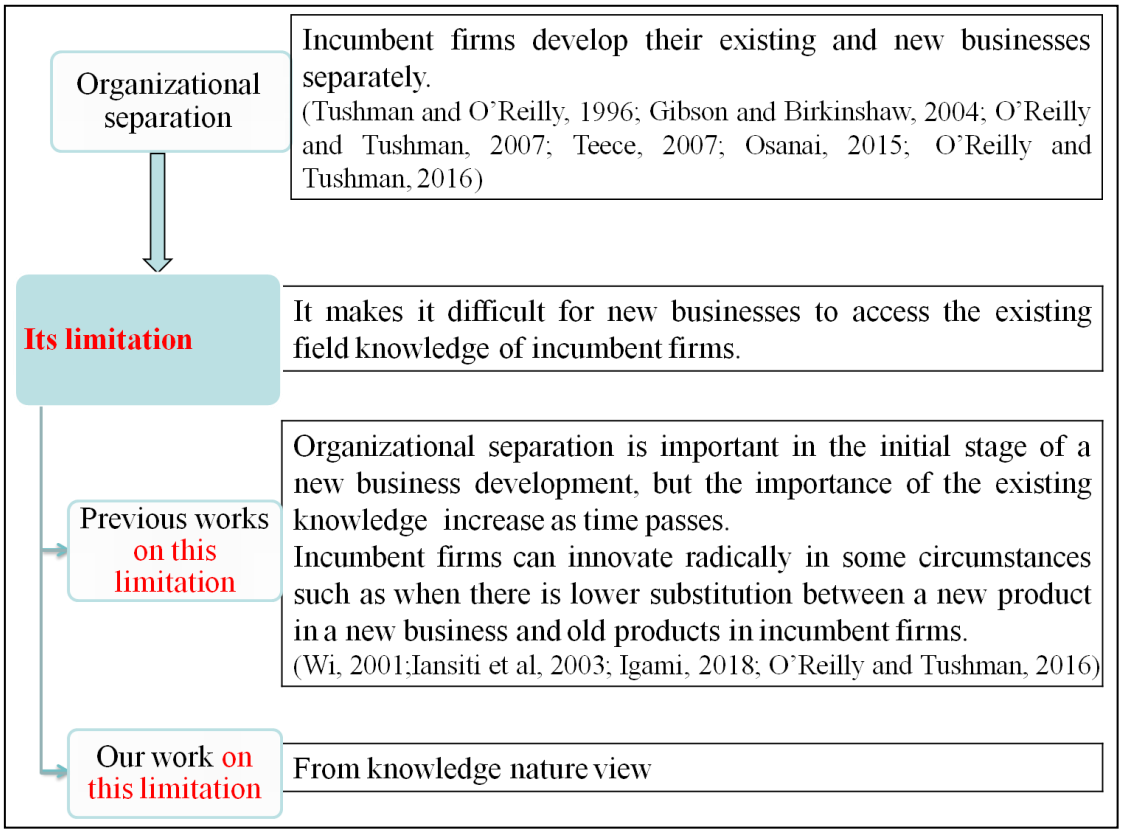
Moreover, Henderson and Clark (1990) suggest that even the type of innovation is incremental if there is such an innovation in that architecture, which is defined as the relationship among the components that comprise a technology or a product, has changed totally from the prior one inside their firms, they cannot adopt to this new architecture quickly. This is because the existing architectural knowledge inside incumbent firms becomes less useful when such innovations are adopted and because architectural knowledge tends to be embedded in the structure and information processing procedures of incumbent firms.

Furthermore, Christensen et al. (2001, 2003) demonstrate that even if no radical innovation nor architectural innovation occurs in technology, once the mainstream customers' main performance requirement is satisfied, they will embrace radical innovations that offer new attributes (e.g., reliability, convenience, or cost). Incumbent firms that have been dealing with existing customers will find it difficult to deal with the new customers.

2.2.2 Previous works on organizational separation and on its limitation

How does an incumbent firm create and develop its new businesses? One branch of previous studies indicates that an incumbent firm should develop its new businesses separately from its existing businesses. This means that the existing business is developed within the existing organization, and the new business is developed within a new organization. This practice is called organizational separation. However, the limitation of organizational separation is that developing existing and new businesses separately makes it difficult for new businesses to access the existing field knowledge of the incumbent firm. Some researchers have also examined this limitation. These previous studies are summarized in Figure 2-2, and their precise introduction will be delivered in following paragraphs.

Figure 2-2 Previous works on organizational separation and on its limitation



Previous works on organizational separation are introduced here (Tushman and O'Reilly, 1996; Gibson and Birkinshaw, 2004; O'Reilly and Tushman, 2007; Teece, 2007; Osanai, 2015). For example, Tushman and O'Reilly (1996) indicate that incumbent firm develops its new business in an autonomous organization separately from its existing business. In their work, they use three examples of successful ambidextrous organizations to explain what the organizational separation is like in reality. One of them is called Asea Brown Boveri (ABB). ABB has over 5000 profit centers with an average of 50 people in each. These centers operate like small businesses. The logic is that these units are small and autonomous so that employees can feel a sense of ownership and are responsible for their own results. Moreover, Osanai (2015) indicates that even when a new technology (called high technology in his work) emerges and its new business is successful, the old technology (called low-medium technology in his work) often retains large markets, thereby this situation requires the firm to simultaneously develop its existing business of old technology and new business, inside the firm. In his work, he uses the case of TV technologies. In television business in late 1990s, the old technology of CRT television is replaced with new one of flat panel displays (FPD). Despite the interest in FPD television is increasing, the global shipment in 2006 includes 130 million CRT televisions and only 46 million FPD televisions. In this situation, firms should develop both existing business for CRT and new business for FPD inside firms for a while. A firm's new business should be separated from its existing business, so that is can develop autonomously. Through such practices, an incumbent firm's new business can develop and grow autonomously; this avoids the risk of the old and successful way of doing things undermining the new one. For example, since a new business is autonomously developed in a separated organization, it can avoid completing for funds with existing businesses, which often have bigger sales and retain larger markets than the new one.

However, this paper indicates that organizational separation has one limitation; developing existing and new businesses separately—a practice called organizational separation—makes it difficult for new businesses to access the existing field knowledge of the incumbent firm. Some researchers have paid attention to this issue. They emphasize the importance of applying existing field knowledge to new businesses.

This paragraph discusses previous works that have paid attention to the limitation of organizational separation. Recognizing the importance of utilizing existing field knowledge in new businesses, they have conducted researches as follows. For example, Wi (2001) explains the process of applying existing knowledge to new businesses in a firm that develops its existing and new business separately. His work uses the case of desktop PC and laptop PC development. In order to develop the new product (laptop PC), the firm develops its new business in a new organization, separately from existing organizations. He indicates that, after this, this new business, which is developed separately in a new organization, acquires existing knowledge from its existing field through the relocation of development engineers from the existing organizations. Moreover, Iansiti et al (2003) indicate that, in the initial stage of a new business development, organizational separation is important, but the importance of the existing organization increases as time passes. Moreover, from an economics perspective, Igami (2018) identified two situations where the incumbent firm can innovate radically: when there is lower substitution between a new product in its new business and old products in an incumbent firm and when the incumbent firm possesses an overwhelming advantage in terms of R&D ability. Furthermore, O'Reilly and Tushman (2016) observed three common elements associated with successful ambidexterity. The first is that, if the new business is able to apply existing resources for developing its competitive advantage, this ambidexterity can be considered as successful. These

resources include the technological resources, brand name and the access to customers. The second is that new businesses can obtain support from the firm's top management. This support can help resolve conflicts between the two businesses: such as new business's application of resources from the existing fields. The third is sufficient separation from the existing field so that the new businesses can carefully design the organizational interface necessary for applying knowledge from the existing field.

However, few studies consider the nature of knowledge as a factor when determining the existing knowledge in incumbent firm to be applied in its new businesses. The next section will introduce it precisely.

2.3 This dissertation's view

This paper identifies the types of knowledge that an incumbent firm can and should apply from its existing field to its new business. The types of knowledge are developed by observing, in cases, the nature of the existing knowledge being applied in a new business. The reason (for observing it) is that its nature determines whether it can and should be applied from an incumbent firm's existing field to its new businesses. More precisely, this observation is chosen because existing knowledge of a certain nature can be applied into new businesses, while others cannot, or because existing knowledge that can be molded to possess or generate a certain nature in a new business can be applied, while others cannot. Thus, this paper analyzes cases to understand and identify what kinds of knowledge natures can be observed in the context of applying knowledge to new businesses.

Thus, the main research question is as follows:

What types of existing knowledge can an incumbent firm apply in its new business from its existing field, and how can it apply these types of knowledge?

To answer these questions, this paper conducts two researches, the reasons for which are as follows.

When considering the application of existing knowledge to develop a new business, it is important to use the existing knowledge to recognize a business idea (including what new product to develop and how to plan its commercialization). This consideration primarily concerns an individual's perspectives (in specific, their thinking) on developing a product idea and planning its commercialization. Moreover, this paper concentrates on new business development based on incumbent firm's existing technology. Thus, the first research concentrates on a "specific individual knowledge" about the combination structure of existing technology. Specific individual knowledge about the combination structure of existing technology is the understanding of components (component technologies) in a technology and their relationship. For example, it indicates which components have mutual complementary relationships and which is substitutable with external technology. It also concerns the understanding of the functions of each component and the overall technology. Such specific individual knowledge concentrates on one's understanding about a technology's components. Henderson and Clark (1990) argues that knowledge about the linkages between components of a product is called architectural knowledge.

Thus, the first research question is as follows:

How does an incumbent firm apply the "specific individual knowledge" about the combination structure of existing technology from its existing field to its new business?

The definition of “specific individual knowledge” is provided in the paragraph above, and the importance of such individual knowledge will be stated in Section 2.4.1.

In addition to such application for recognizing new business ideas, it is important to apply existing knowledge in order to implement the work of new business development, such as product design, production processes, and so on. Such applications are large and have various forms; therefore, it is difficult to specify an existing knowledge to apply. Thus, the second research concentrates on the various knowledge in the whole organization of a new business, observing which knowledge applications are from the existing field and which are from outside sources, eventually in order to identify existing knowledge applied to the new business.

Thus, the second research question is as follows:

How does an incumbent firm manage differently the acquisition of knowledge in the whole organization of a new business according to the different nature of knowledge?

The author will introduce the definitions of the various knowledge in the whole organization of a new business in Chapter 4, which introduces the interview data about various knowledge in new business acquired from different sources.

2.4 Previous literature on specific individual knowledge

2.4.1 Significance of specific individual knowledge in new business development

As mentioned before, the first research concentrates on the specific individual knowledge about the combination structure of existing technology; thus, this section reviews previous literatures to propose the theoretical assumption about the importance

of this specific individual knowledge.

The most direct and important reason for conducting research from the view of this specific individual knowledge is that this study focuses on the technology-based new business development in incumbent firms. Thus, it is important to discover whether the technology related knowledge—the specific individual knowledge introduced above—can recognize the product idea, especially, the value of external technology and create new technology by integrating external technology with existing technology.

Previous literature supports this paper's assumption about the importance of this specific individual knowledge. For example, Arthur (2011) suggests that novel technologies must arise by a combination of existing technologies. The existing technology here is not existing field technology, but technology that exists. Internal components of technology constantly change, being replaced by better components, materials improved, or the methods to combine are improving. Moreover, similar perspectives can be observed in architectural innovation literatures. According to Ulrich (1995), product architecture is a design philosophy that details how to decompose a product as a system and define the relationship between its subsystems. They indicate that when architectural innovation happens, items of necessary elemental technology also change.

These arguments suggest that, when an external technology replaces one or more components of an existing technology with a similar design philosophy, the existing technology can evolve into a new technology.

Moreover, Cohen and Levinthal (1990) argues the absorptive capacity, which is the ability of a firm to recognize the value of new external information and assimilate and

apply it, is important for its innovative capabilities. Lindsay and Norman (1977) suggests that knowledge may be normally acquired but not well utilized when an individual did not already possess the appropriate contextual knowledge necessary to render the new knowledge fully intelligible.

These arguments suggest that prior existing knowledge, such as the combination structure of existing technology integrated with external technology, is the main factor in determining the success of newly integrated technology (e.g., its commercialization).

Based on the abovementioned suggestions, the author proposes a theoretical assumption as follows. It can be argued that individuals who possess knowledge about the combination structure of an existing technology have the ability to recognize the value of an external technology that can be integrated with an existing technology. This knowledge can be used to plan the commercialization of a new product developed from the newly integrated technology.

2.4.2 Previous literature on utilizing existing knowledge to absorb external technology

The significance of the specific individual knowledge mentioned above is to find out the proper external technology to be integrated with an existing one. Thus, this section reviews previous works on the process of how to use the existing knowledge inside firms to absorb external technology.

About absorptive capacity, Cohen and Levinthal (1990) primarily conceptualized it, as illustrated in Section 2.4.1. Furthermore, Zahra and George (2002) identify four dimensions of a firm's absorptive capacity, by analyzing and synthesizing previous

literatures on absorptive capacity. They indicate four distinct but complementary dimensions: acquisition, assimilation, transformation, and exploitation, as shown in Table 2-2. Those four dimensions are illustrated as following. The acquisition refers to a firm's identifying and acquiring externally generated knowledge, based on their prior knowledge base. Assimilation refers to that the firm's routines and processes allows it to analyze and interpret the information acquired from outside sources. Transformation denotes the action of a firm's routines, which is for facilitating the combination of existing knowledge and the newly acquired and assimilated knowledge. Exploitation refers to leveraging existing competences to create new knowledge by incorporating acquired and transformed knowledge.

Table 2-2 Previous work on the process of utilizing existing knowledge to absorb external technology

Four dimensions			
Acquisition	Assimilation	Transformation	Exploitation
Acquire external knowledge, based on prior knowledge base	Interpret acquired knowledge	Facilitate the combination of existing and external knowledge	Create new knowledge

It can be observed that these four dimensions are identified following the process of utilizing external knowledge inside a firm. The first dimension relates to acquisition of external information based on prior knowledge base, while the second of assimilation indicates analyzing and interpreting the external information. The third dimension of transformation concerns the combining of the acquired and assimilated knowledge with existing knowledge. Finally, the fourth dimensions deals with the creation of new knowledge with transformed information. Moreover, it can be observed that the acquisition is based on the accumulation of the knowledge base inside firms. However, this study differs from previous research on this point, as it concentrates on a specific individual knowledge instead of the knowledge base. In another words, this paper

emphasizes the application of a specific individual knowledge from the incumbent firm's existing field to its new business. The process in this study begins with "applying specific individual knowledge."

Thus, referring to Zahra and George (2002)'s four dimensions, this paper will identify the process of applying "specific individual knowledge" to absorb external technology for new business development in Chapter 4.

2.5 Previous literatures on various knowledge in the entire organization of a new business

Since the second research observes how an incumbent firm manages differently the acquisition of knowledge in the whole organization of a new business according to the different nature of knowledge; the author will develop different knowledge acquisition methods for various knowledge (knowledge with different nature) in Chapter 4. Thus, this section reviews literatures on knowledge acquisition and knowledge nature.

About previous literatures on knowledge acquisition, "exploitation" and the "exploration" are well known. March (1991) defines exploitation as a "refinement, choice, production, efficiency, selection, implementation and execution," while exploration involves "search, variation, risk-taking, experimentation, play, flexibility, discovery, and innovation."

This definition is broad in scope and allows for various interpretations. The notions of exploration and exploitation are studied under a wide variety of research areas such as organizational learning and knowledge domain (March, 1991; Levinthal and March, 1993) and organizational design (e.g., Tushman and O`Reilly, 1996). As for practical

implications, He and Wong (2004) state that exploration involves the activities of entering new product-market domains (e.g., introducing a new generation of products and opening new markets), whereas exploitation includes improving existing product-market efficiency (e.g., improving existing product quality and reducing product cost). In the organizational design literature, Tushman and O`Reilly (1996) suggest that there is a trade-off relationship between exploration and exploitation. The activity, which involves simultaneously developing a firm's existing business and a new business in an organization, is the firm's ambidexterity. Moreover, in organizational learning literature, Levinthal and March (1993) indicate that exploration involves "a pursuit of new knowledge," whereas exploitation involves "the use and development of things already known."

Following the assumptions above and given this paper's objective, in the new business, applying internal existing knowledge is a form of exploitation, while applying external knowledge is a form of exploration. The knowledge acquisition method in this study will be developed based on this assumption.

Moreover, concerning the concepts of "exploitation" and "exploration," the author has to clarify another interpretation that is also used in this study. At the corporate level, developing the existing core business is called exploitation, while creating a new business is called exploration. These two activities of exploration and exploitation are in trade-off relationships (as mentioned in the content dealing with organizational separation illustrated in Chapter 1). This interpretation is associated with organizational literature (e.g., Tushman and O`Reilly, 1996).

We here review literature on the knowledge nature. About previous literatures on knowledge nature, explicit and tacit are well known. Tacit knowledge, as originally

characterized by Polanyi (1962), is constructed from individuals' own experience in the world and forms the basis for explicit knowledge. Polanyi (1962) defines tacit knowledge is nonverbalized or even non-verbalizable, intuitive, unarticulated. On the other hand, he indicates that explicit knowledge (called articulated knowledge) is specified either verbally or in writing, computer programming, patens, drawings or the like. Moreover, according to Nonaka and Krogh (2009), knowledge is explicit and tacit in continuum. Explicit knowledge can be uttered, formulated in sentences, and captured in drawing and writing. Tacit knowledge is rooted in action, procedures, routines, commitment, ideals, values and emotions

3 Research method and settings

Section 3.1 introduces the research methods and the rationale for selecting these methods. Section 3.2 discusses the fundamental weakness of case studies and solutions to address those weaknesses. Section 3.3 describes the selected cases for the research questions, including why choose them, the backgrounds of the chosen firms, and how the author collected the data.

3.1 This paper's objectives and research methods

This research chooses an inductive theory building method. The most important point to bear in mind when considering which approach to adopt is first, the purpose of the research, and second, the methods that are best suited to either test a hypothesis, explore a new or emerging area within the discipline, or to answer specific research questions (Inoue, 2014). The following will explain why this method is selected, by analyzing the purpose of this study.

3.1.1 This paper's objectives

The main research question in this dissertation is as following: what types of existing knowledge can an incumbent firm apply in its new business from its existing field, and how can it apply these types of knowledge? In order to pursue this question, the author conducts two researches. The former aims to investigate how an incumbent firm applies the "specific individual knowledge" about the combination structure of existing technology from its existing field to its new business; the latter aims to investigate how an incumbent firm manages differently the acquisition of knowledge in the whole

organization of a new business according to the different nature of knowledge. The research methods for these two studies slightly vary.

3.1.2 Selected methods

First, this section discusses why choose the inductive research of a deep case study for first research. The first research is concerned with the complex phenomenon of human thinking and behavior to activate the intelligence of an individual's creative nature. Its purpose is to find a mechanism to explain firms' internal factors and the causal relationship between the human intelligence and his new business idea recognition. George and Bennett (2005) indicate that case studies can examine the casual relationships in one case. Case study researchers can observe many variables and even the unexpected aspect in one case, and can identify what conditions activate the casual mechanism.

Thus, this paper chooses a deep case study method (Inoue, 2014) to answer a specific research question to find the causal relationship between the individual knowledge and its recognition of new business idea, and the mechanism for activating this causal relationship. To achieve this purpose, the author chooses two incumbent firms' new businesses created beyond their existing fields. Section 3.3.1 will illustrate what cases are selected and why select them.

Second, this paragraph explains why choose the inductive research of grounded theory for second research. The second research aims to observe the nature of various knowledge in an entire organization, which consists of the knowledge of many individuals; hence, the data to analyze is not about an individual, but about a large number of individuals, and their knowledge exists or is applied in various ways in that

organization. Thus, this paper chooses the specific inductive approach of grounded theory. That is, starting with individual cases, incidents, or experiences and developing progressively more abstract conceptual categories to synthesize, explain, and understand the data and to identify patterned relationships within it (Charmaz, 1996). The aim is to generate a new theory based on the data. To achieve this purpose, this paper chooses one incumbent firm's two new businesses, beyond its existing core business. Section 3.3.1 will illustrate what cases are selected and why select them.

3.2 Fundamental weakness of case studies

Case studies have fundamental weaknesses that need to be mentioned before its application. Researchers (e.g., George and Bennett, 2005; Inoue, 2014) state several limitations of case studies. First one is "selection bias." Case study researchers sometimes deliberately choose cases that share a particular outcome related to their purpose. Second one is the sensitivity of investigator. The researcher is the primary instrument of data analysis. Thus, he or she sometimes cannot analyze completely objectively. The last one is that in case study methods, there is a trade-off among the goals of attaining theoretical parsimony (or objectivity), establishing explanatory richness, and keeping the number of cases within a manageable number.

This paragraph provides solutions for the limitations above. First, the solution to the weakness of case selection bias is that cases are selected closely according to the objective of study, in specific, the type of theory he or she intends to build (Eisenhardt and Graebner, 2007). In other words, the selection of cases is based on their contribution to the development of the theory. This study chooses cases, considering their contribution to the research objectives. In specific, since the first research investigates an unusual phenomenon, which indicates application of a specific individual knowledge

about the combination structure of existing technology to new business idea recognition, the author chooses two typical cases: two incumbent firms' new businesses. The precise introduction is in Section 3.3.1. Moreover, the second research aims to build a new theory, thereby the author chooses two similar cases for comparison. In specific, this paper builds a new theory by comparing and synthesizing the differences and similarities of the data on existing knowledge applying for two new businesses from a same existing field. Its precise introduction is in Section 3.3.1. Second, the solution to the weakness related to the investigator's sensitivity during the case analysis is to test the generated theory with various data (not only first-hand material, but also second-hand material from the Patent library) or with prior literature supported by various data (Fujimoto et al., 2005).

3.3 Research settings

3.3.1 Rationale for the case choices

Since the first research investigates an unusual phenomenon of applying a specific individual knowledge, the author chooses two typical cases of two incumbent firms' new businesses: Denso's agriculture support business and Panasonic's agriculture engineering business, with the new "ProFarm" and "Passive House" products, respectively.

These cases are selected for the following reasons. The first reason is for the suitableness for this paper's research objectives. In these two cases, incumbent firms, based on their existing technology in the existing field, utilize external technology by integrating them with existing one to develop new technology. And their new businesses fields are quite different from the existing core business. It seems that Denso's new

agriculture support business is unrelated at all with the existing core business of automobile components. It is the same with Panasonic: the agriculture engineering business differs from the consumer electronics, residential housing, and automobile components sectors. This difference can contribute to their knowledge diversification development, because new business development in totally different field can generate novel knowledge for incumbent firms. The second reason is that they can be considered as the successful cases. ProFarm, developed by Denso's agriculture support business, contributes to Japanese agriculture by saving labor cost in a labor shortage circumstance, since it allows farmers to remotely monitor greenhouse. And, customers admit it as a high-quality product since it is developed using Denso's quality control steps for automobile products. For example, it has already purchased and used by celery seeding houses and eustoma seeding houses. Moreover, Passive House, developed by Panasonic's agriculture engineering business, can reduce energy costs because it runs on natural energy without using air conditioners. It is accepted by customers. For example, the famous farm in Japan, called Tomita Farm[1], purchased 10 products.

The second research aims to build a new theory, thereby the author chooses two similar cases for comparison: applying of existing knowledge for two new businesses from a same existing field. In specific, the author chose Denso's two new businesses; namely, the agriculture support business with new "ProFarm" product and the healthcare business with the new "iArms" product. These cases are selected for the following reasons. Both of these two businesses are in a different field from its existing field of automobile components. The existing field knowledge applying for these two chosen new businesses are from the same source of Denso's automobile components field. Moreover, as similarly with reason for first research, this difference can contribute to

[1] Tomita Farm, Tomitanoen (富田農園) in Japanese, is an agriculture production corporation in Hokota City. It remains 300 greenhouses. (2019.10.13, Available at: https://www2.panasonic.biz/ls/solution/works/tomita.html).

their knowledge diversification development. Moreover, as for chosen cases' successfulness, ProFarm's has introduced before. iArms has received plural awards; the excellence award of "The 6th Robot Award[2]" in December 2014 and "Chunichi Industrial Technology Award[3]" in 2015.

3.3.2 Background of the chosen firms

This section introduces the backgrounds of the two firms the author chose to investigate the research questions: Denso Corporation and Panasonic Corporation. Denso Corporation is a leading supplier of automobile components, with 187.4 billion Japanese Yen (US$ 1.8 billion) in capital, 168,813 employees on a consolidated basis, and 5,108.3 billion Japanese Yen (US$ 48.1 billion) in revenue on a consolidated basis from April 1 in 2017 to March 31 in 2018. Denso develops world leading technologies and products that increase security and safety. Panasonic Corporation engages in consumer electronics at the core, and also in housing, automotive, and B2B solutions to offer better living to their customers. They had 274,143 employees in 2018 and 7,982.2 billion Japanese Yen in revenue in 2018.

3.3.3 Data collection

This paper collected two kinds of data: first-hand and second-hand materials. The first-hand materials are collected as following process. The author pursued the research

[2] The "Robot Award", Robotto Taisho(ロボット大賞) in Japanese, is sponsored by MRTI (Ministry of Economy, Trade and Industry) and JMF (Japan Machinery Federation). This award is given to robots that have a high contribution to future market creation. (2019.10.13, Available at: https://www.denso-wave.com/ja/robot/info/detail__757.html).

[3] Chunichi Industrial Technology Award, Chunichi Sangyo Gijutsu Sho(中日産業技術賞) in Japanese, is sponsored by the firm of Chunichi New Paper, for the purpose of contributing to the development of Japanese industrial technology. (2019.10.13, Available at: https://www.jstage.jst.go.jp/article/jjmi/86/4/86_377/_pdf).
Similar introduction (2019.10.13, Available at: https://www.chunichi.co.jp/info/award/sangisho/).

purposes through a series of in-depth field interviews with the project leaders (of Denso`s agriculture support business and Denso`s healthcare business). Between 2016 and 2019 the project leader of the agriculture support business was interviewed four times in a semi-structured way and the project leader of the healthcare business once. In Dec 2016 the author's first interview was conducted with project leader of agriculture support business. In Jan 2017 the author interviewed both project leaders of agriculture support and healthcare in Denso and collected very detailed data. Afterwards, the author communicated with project leader of agriculture support business by e-mails very closely: 3 mails received from Mar 2017 to Oct 2017, 6 mails received from 15th to 29th in Sep 2018 and a mail in May in 2019. Moreover, concerning Panasonic's data, the author collects it from a second hand materials[4].

The second hand materials in his paper are collected from firms' homepages[5] and the Patent library. The new product figures, its introductions and the firms' backgrounds are collected from firms' homepages. This paper will develop a technology figure in Chapter 4, based on its introductions in Patent library. The information in the Patent library is published by the National Centre for Industrial Property Information and Training.

[4] Katayama, O. (2014), "Panasonic's Profitable Fun-Agriculture," *Osamu Katayama Official Website*, http://katayama-osamu.com/wordpress/2014/10/2114.

[5] Denso's agriculture support business (2019.10.13, Available at: https://www.denso.com/jp/ja/about-us/business-fields/newbusiness/agtech/).
Denso's healthcare business (2019.10.13, Available at: https://www.denso-wave.com/ja/robot/info/detail__757.html).
Panasonic's agriculture engineering business (2019.10.13, Available at: https://www2.panasonic.biz/ls/solution/works/tomita.html).

4 A framework of specific-knowledge application for new business development

This chapter pursues the first research question. To recall, first research question is as follows: how does an incumbent firm apply the "specific individual knowledge" about the combination structure of existing technology from its existing field to its new business?

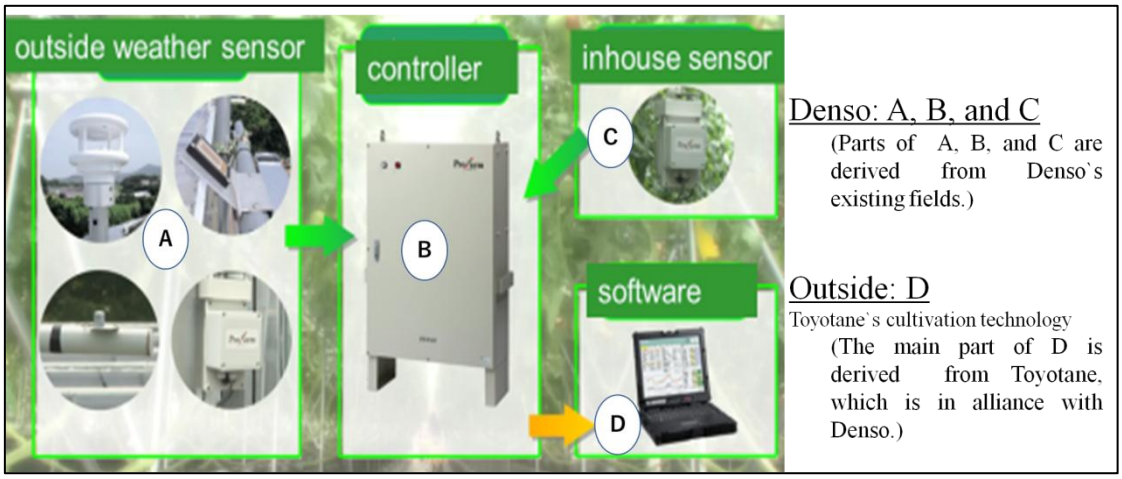
In order to pursue this research question, this paper uses two cases—Denso's agriculture support business and Panasonic's agriculture engineering business. Case one is introduced in Section 4.1 and case two in Section 4.2. The framework is proposed in Section 4.3.

4.1 Case one: Denso's agriculture support business

4.1.1 New product and its technologies

This section introduces the new product and its related technologies. ProFarm, the product developed by Denso's agriculture support business, is shown in Figure 4-1. This product is a greenhouse environment control system. It allows farmers to remotely monitor greenhouses' temperature, humidity and CO^2 levels from a smart phone. Utilizing it, Denso contributes to more efficient and stable vegetable cultivation.

Figure 4-1 ProFarm



(Source: based on Denso website homepage[6])

The technologies involved in the ProFarm product are shown in Figure 4-1. This product applies technologies from both Denso's existing field as well as from external sources. ProFarm is developed by exploiting the sensing technology (A and C on Figure 4-1) and the controller (B on Figure 4-1) from Denso's existing field of automobile components.

Moreover, the technology of cultivation is complex, and critical for promotion of farm harvest and food production. For example, a plant that grows in cold climates requires different levels of temperature and humidity than a plant that grows in hot climates. The "cultivation technology" in this paper indicates the optimum (e.g., maximum or minimum) condition for a plant to grow, such as optimum temperature, soil and air moisture, and CO_2 level. This cultivation technology (D in Figure 4-1) is derived from the Toyotane Corporation. Toyotane is the leading company among those specialized in supporting horticultural agriculture in Japan.

[6] Denso's new business of agriculture support (2019.10.13, Available at: https://www.denso.com/jp/ja/about-us/business-fields/newbusiness/agtech/).

4.1.2 Comparison of existing and new technologies' combination structures

This section introduces the combination structures for both the existing and new technologies. Then, it compares them to observe whether the "specific individual's" prior knowledge (about the combination structure of existing technology) has been reflected (or utilized) in the new technology.

As for the existing technology, according to the interview survey, the project leader at Denso's new business of agriculture support has work experience in IC (integrated circuit) design in automobile component systems. He developed semiconductor circuits for air bags. His task was to evaluate and deliver prototypes—considering circuits that satisfy the airbag specifications—and as such, he knows how the computer system functions within the control system. In other words, he has knowledge about the combination structure of the automobile environment control system.

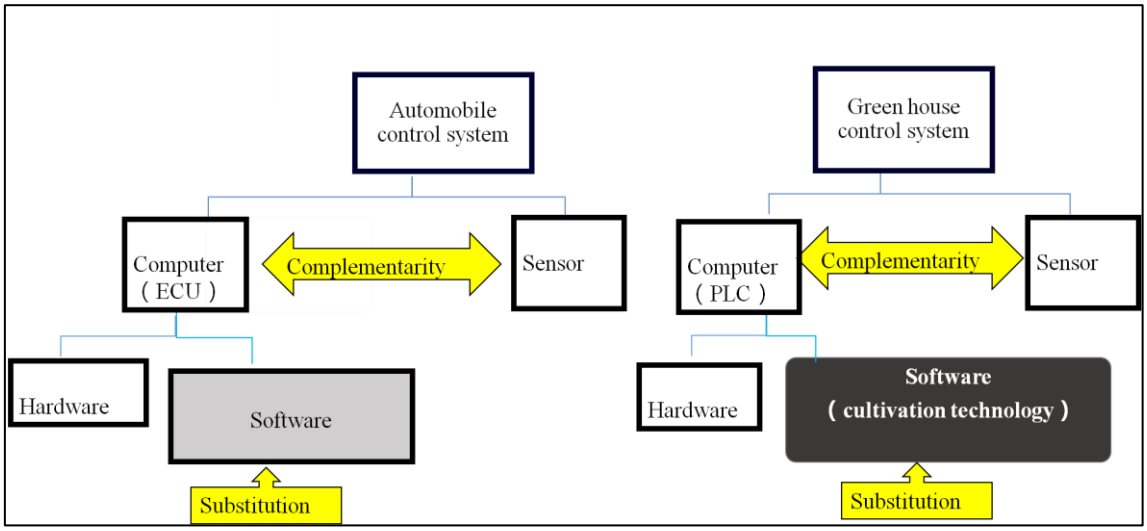
The combination structures of the two technologies, the automobile environment control system and the greenhouse environment control system, are graphically shown in Figure 4-2. The existing technology of the automobile environment control system consists of two components, a computer and sensor. The former comprises software and hardware. The technology for greenhouse environment control systems (the new) also consists of two main components: a computer and sensor. One more component, present in both technologies, is called the controller, and is generally included in the "computer component," as the controller is closely connected to the computer.

One thing in above to be clarify is that the computer component of new technology consists of software and hardware. The hardware is sourced from its existing field,

using the computer for Denso Wave's robot. The software, which was initially developed for in-car environment control, is reprogrammed according to cultivation technology, which is offered by Toyotane. This reprogramming process gives the new business a competitive advantage, since the process of converting Toyotane's tacit knowledge of cultivation technology into an explicit software program is difficult to imitate.

We now compare and observe the relationships between the components mentioned above. Specifically, as can be observed in Figure 4-2, Denso`s environment control system for both agriculture and automobiles have similar combination structures, in that they both contain computer and sensor technology. This finding suggests that these two components have a complementary relationship, comprising one system together. Moreover, the software and the hardware in both have also complementary relationship, comprising one system together. Further observing, we can find that, the software in existing technology is reprogrammed for agricultural purposes, using agriculture cultivation technology. Thus, it can be stated that this component of the software is substituted by a new one.

Figure 4-2 Comparison of existing and new technologies' combination structures



(Source: based on interview data)

4.1.3 New business development

This section explores how the new business is developed, especially how the "specific individual" mentioned before decides what new product to develop.

To enter new business fields, Denso actively exploits competences (technology and human resources) in its existing automobile field. The employee, who has work experience in the existing field, will actively move to new businesses. The project leader at ProFarm has work experience in IC (integrated circuit) design in automobile component systems. He developed semiconductor circuits for air bags and therefore knows about the combination structure of the in-car environment control system.

In terms of selecting new products to develop, at Denso, the new business project leader is responsible for deciding what product to develop in a given business field. Specifically, the top management of Denso has already decided they will enter the agricultural field; however, what products in the agricultural field they will develop is not decided.

Furthermore, concerning the external technology search, the project leader also has to identify an appropriate external technology to be integrated with their existing technology. He participated in an exhibition held in Tokyo, where he exchanged contact information with a correspondent from the Sakata Seed Corporation[7]. That person recommended, and ultimately introduced, Toyotane as a proper cooperation partner for Denso's agriculture business. After this introduction, the project leader engaged in an alliance relationship by visiting Toyotane.

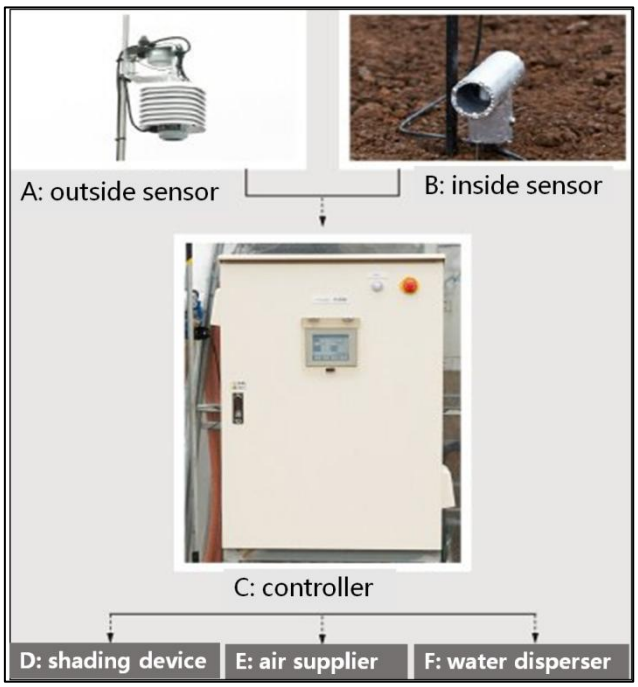
[7] Sakata Seed Corporation, Sakata No Tane in Japanese, is a famous seed company in Japan. (2019.10.13, Available at: https://www.sakataseed.co.jp/corporate/info/outline/).

4.2 Case two: Panasonic's agriculture engineering business

4.2.1 New product and its technologies

The new product in Panasonic's agriculture engineering business, Passive House, is shown in Figure 4-3. By directly using natural energy—such as sunlight, wind, and water—without relying on the electrical energy of air conditioners, it controls the environment inside the greenhouse for crops to grow. Unlike common plant houses, it does not use air conditioners or heating machines, and consequently, can reduce energy costs. As shown in Figure 4-3, the sensor devices (A and B) can monitor the greenhouse environment conditions (temperature, humidity, and solar radiation) in real time. The controller box (C) can control the devices (D, E and F) such as the ventilation fan, windows, and lighting.

Figure 4-3 Passive House



(Source: based on Panasonic website homepage[8])

[8] Panasonic's Passive House (2019.10.13, Available at: https://www2.panasonic.biz/ls/solution/works/tomita.html).

The technologies of Passive House are also shown in Figure 4-3. Panasonic adopts technologies both from its existing field and external sources. The technology of sensors (A and B) and the controller (C) are from Panasonic's existing field[9]. They have been developed for electronics and residential products. Additionally, the optimal condition for crops to grow (e.g., maximum or minimum temperature and so on), which is called cultivation technology in this paper, is created by purchasing the requisite materials from the market[10] and then further refining them by Panasonic[11], since Panasonic does not have adequate knowledge regarding crop cultivation. This cultivation technology is programmed into computers and cell phones. It is not visible in this product figure; however, it is visible in Figure 4-4 in the next section.

4.2.2 Comparison of existing and new technologies' combination structures

As for the existing technology, the technology of environment control systems in Panasonic's existing field is applied to its new business venture (Katayama, 2014). Moreover, the individual in charge of planning the commercialization of Passive House has work experience in Panasonic's existing field in developing algorithms for the control system program of massage chairs (Katayama, 2014). This suggests that he knows about the combination structure of the environment control system for residential

[9] Panasonic applies its technologies of sensing and controlling to its development in the agriculture field. (2019.10.13, Available at: https://www2.panasonic.biz/ls/solution/theme/agri/index.html).

[10] Passive House is developed by combining the natural "power" with the optimum arrangement design of agriculture materials, which are purchased from the market. (2019.10.13, Available at: https://news.panasonic.com/jp/topics/2014/38455.html).

[11] Panasonic does experiments to find out the "maximum and minimum" conditions (such as of temperatures) for crops to grow. (2019.10.13, Available at: http://katayama-osamu.com/wordpress/2014/10/2114/).

housing.

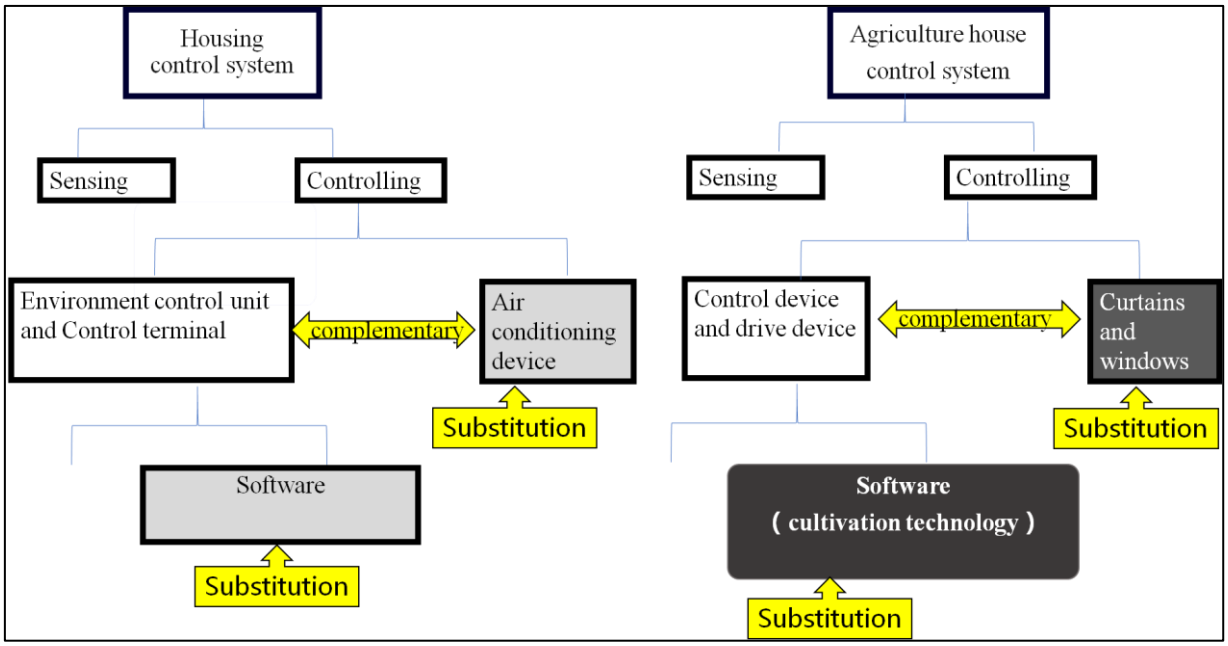
The two technologies' combination structures are graphically shown in Figure 4-4. The existing technology, in the left section of Figure 4-4, consists of two components: controlling and sensing. Furthermore, the controlling consists of two other components: the "environment control unit and control terminal" and "air conditioning device." Moreover, similarly with this existing technology, the new technology of the agriculture environment control system, in the right section of Figure 4-4, also consists of two components: controlling and sensing. The controlling is comprised of two components: "control device and drive devices" and "curtains and windows." The computer, which is for the control terminal or control device above, consists of software and hardware. The software for this new product is programmed based on the cultivation technology, which is purchased from the market and then further refined at Panasonic.

Here is the comparison and observation of the relationships between these components. As observed in Figure 4-4, Panasonic's environment control systems for both indoor housing and agriculture have a similar structure. They have two parts: controlling and sensing. In both technologies, there is a complementary relationship between controlling and sensing, together creating a single system.

Additionally, the controlling component in both technologies contains mutually complementary components. Specifically, the controlling component in the existing technology has mutually complementary components: the "environment control unit and control terminal" and "air conditioning device." Furthermore, the controlling component in the new technology has mutually complementary components: the "control device and drive device" and "curtains and windows." However, the air conditioning in the existing technology is substituted by "curtains and windows" for

developing the new technology, and the software in the existing technology is substituted by the new one, that is programmed based on the cultivation technology (optimum condition for crops), which is purchased from the market and then further refined at Panasonic.

Figure 4-4 Comparison of existing and new technologies' combination structures



(Source: based on Patent Library data)

4.2.3 New business development

The author finds a similar situation in Panasonic's agriculture engineering business as in the case of Denso. Specifically, the person in charge of planning and developing of commercialization projects for "Passive House," prior to this, in Panasonic's existing field, has worked in developing algorithms for the control system program of massage chair. This program contains microcomputer development, as mentioned in Section 4.2.1. This suggests that he knows about the combination structure of the existing field's environment control system technology (including in-house environment control

system), and its functions of each component and the whole system.

4.3 A Framework of specific-knowledge application for new business development

This section summarizes and synthesizes the data from the two cases above and proposes a framework, called “a framework of specific-knowledge application for new business development,” as shown in Figure 4-5. This framework consists of two elements: the new business development process and the new business development approaches.

Figure 4-5 A framework of specific-knowledge application for new business development

New business development process			
Applying specific individual knowldge (about the combination structure of existing technology)	Searching (for external technology)	Reprogramming (searched external technology)	Integrating (reprogrammed external technology and existing technology)
1 2 3	1 3	1 2 3	1 2 3

Involve functions for

New business development approaches
The individuals who possess the specific knowledge above do the following:
1 Decide which new product to develop in the decided field
2 Plan the commercialization of new product
3 Find an external source with whom the inter-firm relationship is established

4.3.1 New business development process

The new business development process refers to (the process of) applying the specific individual knowledge to absorb (utilize) external technology, in order to create new technology. This process is identified by following Zahra and George’s (2002) four

dimensions of absorptive capacity—acquisition, assimilation, transformation and exploitation (as mentioned in Section 2.4.2).

This paper calls the first phase of the process “applying specific individual knowledge,” (as shown in the upper part of Figure 4-5). This is because it has been observed in these cases that incumbent firm emphasizes and encourages the application of such individual knowledge from its existing field to its new business development. In both cases, the individuals, who take charge of new business development—such as the project leader—decide what new product to be developed or plan its commercialization, have working experience in the existing field. Such experiences provide them with knowledge about the combination structure of existing technology, as emphasized in Section 4.1 and 4.2. Moreover, it can be stated that the utilization of this individual’s knowledge in new businesses can also be observed in the similarity between new and existing technologies’ combination structures. Their similarities are shown in Figure 4-2 and Figure 4-4, and very precisely illustrated in Sections 4.1.2 and 4.2.2.

The remaining phases of the process involve “searching for external technology,” “reprogramming,” and “integrating,” as shown in the upper part of Figure 4-5. The following examines how these three phases are derived by analyzing the cases. For example, in the case of Denso, the new business project leader searches for a proper external technology for cultivating from outside sources (Toyotane). In the case of Panasonic, the cultivation technology is from the market. Thus, this paper calls the second phase “searching for external technology.” After searching for and determining the appropriate cultivation technology, Denso reprogrammed it instead of directly using it. More precisely, the cultivation technology at Toyotane is its tacit knowledge, which has not yet been digitalized. Denso digitalizes this knowledge through its own programming technology. Moreover, in the case of Panasonic, according to Katayama

(2014), the cultivation technology is created by materials purchased from the market and then further refined by Panasonic, instead of directly using it. Thus, this paper calls the third phase the "reprogramming." After reprogramming the external technology, Denso integrates it with its existing technology of in-car environment control system. In Panasonic, the external technology is also integrated with its existing technology for developing new technology. Thus, the fourth phase is called "integrating."

4.3.2 New business development approaches

This section summarizes the new business development approaches in the cases, as shown in the lower part of Figure 4-5. Then, it discusses their significance for new business development.

First, Approach 1 is summarized as "the individuals who possess the specific individual knowledge about the combination structure of existing technology decide what new product to develop in the decided field." In the case of Denso, it is clear that for new business development, the top management decides that agriculture will be their new field. Afterwards, the business project leader searches for and decides to develop an agriculture environment control system in the requested field.

The following four paragraphs discuss the significance of Approach 1 by observing how it involves functions for the four phases of the new business development process, as shown by the arrow in Figure 4-5. Particularly, the author discusses, firstly about the specific individual knowledge (which is the main element in the approach), and then about what feature can be observed in Approach 1 and the significance of such a feature.

Before introducing the observed feature in Approach 1, this paragraph discusses the

project leader's "individual knowledge" about the combination structure of existing technology. The project leader above knows the combination structure of the existing technology, such as how many components it has, which components have a mutual complementary relationship, and which components can be substituted. Therefore, he or she is more likely to recognize the value of an appropriate external technology that can substitute some component(s) of the existing technology.

A feature that has been observed in Approach 1, concerning two technologies intended for integration, is that any existing technology (that the specific individual possesses the knowledge about its combination structure) can be integrated with any external technology (that can be integrated with the existing technology to develop a product that satisfies market need in the agriculture field). The following introduces the process of finding this feature. In the case of Denso, the top management decided to venture into the new field of agriculture without deciding what product would be developed. This means they chose agriculture as the new target field without defining the exact customer needs to be targeted (such as specific products). The new business project leader has the right to decide what new product to develop in the agriculture field (the new target field). Thus, regarding what external technology is required, it can be argued that the new business project leader can search and choose any external technology that can be integrated with the existing technology to develop a product that satisfies customer needs in the agriculture field.

Moreover, a similar situation can be observed in Panasonic's case. It is found that Passive House was developed by integrating an existing technology (that the specific individual possesses knowledge of its combination structure) and an external technology (that can satisfy market need in agriculture plant houses and can also lower investment cost). According to the open data of a report interviewing the project leader

of Passive House (Katayama, 2014), Passive House was conceived in order to satisfy the need to develop a new product in the agriculture plant house industry, as before that, Panasonic had already started developing the closed-facility of plant house. They have had difficulties and worked hard, on lowering investment by not using material that increase cost. To meet this need, they developed an agriculture environment control system through the use of purchased material, which lowered the initial investment cost. An individual, who is in charge of planning new product's commercialization, refined the purchased material by experimenting and searching for the optimum conditions (e.g., maximum and minimum temperature) required for spinach to grow, and then found the equipment that can be used to establish this optimum condition. The reason he is able to do the work mentioned above is because he is familiar with the combination structure of residential environment control systems. This combination structure is the same as that of the new technology (greenhouse environment control system).

This paragraph discusses the significance of new business development with such features mentioned above. It can be seen that such new business development encourages the individuals (who possess knowledge about the combination structure of existing technology) to think and act flexibly; consequently, they can recognize the value of the external technology. It also helps the individuals recognize the possibility for creative integration of such external technology with existing technology. "Proper external technology" refers to a technology that is from a new field beyond the incumbent firm's existing field. Moreover, it can be integrated with the existing technology to develop a technology in a new area beyond the existing field. This "creative integration" refers to the creation of a new technology through the combination of technologies from two different fields.

To sum up the significance of Approach 1, it can encourage "the specific

individuals" to find the proper external technology and to recognize the possibility of creative integration through the combination of the newly found external technology and the existing technology.

Second, Approach 2 is summarized as "the individuals who possess the specific knowledge about the combination structure of existing technology plan the commercialization of the new product," as shown in the lower part of Figure 4-5. For example, in the case of Panasonic, the individual who possesses knowledge about combination structure of existing technology takes charge of the new product's commercialization planning as a commercializing project manager.

This paragraph discusses the significance of Approach 2, by observing how it involves functions over the four phases of the new business development process. It can be argued that specific individual knowledge in this approach can help the individual in planning the newly developed product's commercialization, by helping them interpret the operating functions, and evaluate the commercial value of the external technology in the newly integrated technology. The precise illustration of the above argument is as follows. In the case of Panasonic, the individual understands the functions of each component within the existing technology as well as that of the technology as a whole; as such, he can interpret what function the external technology can play in the newly integrated technology. The individual can also evaluate the commercial value of the newly found cultivation technology after its integration with the existing technology. For example, the external cultivation technology is created by materials purchased from the market. He or she can conclude that using such newly purchased materials to reprogram the software can lower the initial investment costs. Similarly, in the case of Denso, the external technology (cultivation technology), which is not digitalized in Toyotane, is reprogrammed by Denso's programming technology. The new business

project leader can then evaluate its value—the process of reprogramming is difficult to imitate and this results in Denso's competitive advantage.

To sum up the significance of Approach 2, it can encourage "the specific individuals" to interpret and evaluate the functions and commercial value of the newly found external technology after its integration with the existing technology.

Third, Approach 3 is summarized as "the individuals who possess the specific knowledge about the combination structure of the existing technology find an external source with whom the inter-firm relationship is established," as shown in the lower part of Figure 4-5. In the case of Denso, the new business project leader, who possesses knowledge about the combination structure of the automobile environment control system, searched for partners with whom the existing technology could be collaboratively utilized. The project leader participated in an exhibition and met people from Sakata, whose recommendations helped him explore a potential partnership with Toyotane.

This paragraph analyzes the significance of Approach 3, by observing how the approach involves functions for the first and second phases of the new business development process. The individuals who possess knowledge about the combination structure of existing technology, have the opportunity to meet diverse people (e.g., people possessing a wide range of knowledge about markets and industry) from various fields. Such inter-personnel relationships can help the individuals search for a proper external technology. Eventually, the incumbent firm can build a collaborative relationship with the external source, which provides the proper external technology.

To sum up the significance of Approach 3, it can help "the specific individuals"

meet diversified people to find a proper external technology from a new field beyond the incumbent firm's existing field.

This paragraph summarizes the analysis of Chapter 4. It developed a framework, as shown in Figure 4-5, by summarizing the data about the process of new business development and how new business ideas are developed by "specific individuals" who possess knowledge about the combination structure of existing technology. In this framework, the "specific individuals" can think and act flexibly to search for a proper external technology from diversified external sources, and can also interpret and evaluate the operating functions and the commercial value of the newly found external technology after its integration with the existing technology. This newly integrated technology is developed from two technologies from two different fields.

Here is a basic summary of the above analysis. External technology refers to technology from a new field beyond the incumbent firm's existing field. It is integrated with the existing technology to develop a new technology beyond the firm's existing field. Thus, it is argued that the specific individual's recognizing the value of such external technology can be viewed as the **creative nature** generated from his prior knowledge.

Therefore, it can be argued that the incumbent firm should, by using the proposed framework, apply the "specific individual knowledge" (about the combination structure of existing technology) to generate creative nature for its new business development.

5 A framework of knowledge acquisition for new business development

This chapter pursues the second research question. To recall, the second research question is that: how does an incumbent firm manage differently the acquisition of knowledge in the whole organization of a new business according to the different nature of knowledge? In order to pursue it, this chapter uses two cases—Denso's agriculture support business and Denso's health care business. The case one is introduced in Section 5.1 and the case two in Section 5.2. The framework is proposed in Section 5.3.

5.1 Case one: Denso's agriculture support business

5.1.1 New business

Denso's new business of agriculture support is used as the case one. Denso actively utilizes its existing technology of sensor and controller to develop new business in agriculture field. Its new product is called "ProFarm." It is a greenhouse environment control system, which maintains the greenhouse environment at optimum levels for the growth of crops throughout the year in response to changing conditions in and around the greenhouse. Moreover, Denso applies external technology. Denso adopts the technology of cultivating from Toyotane. This product is introduced briefly, since its precise introduction is in Section 4.1.

5.1.2 Knowledge acquisition

Denso utilizes various knowledge both from their existing field and outside sources. This section firstly introduces the method how to collect and summarize the data about the knowledge acquisition. After that, the precise interview data of knowledge

acquisition is followed.

Firstly, this paragraph will introduce how the data is collected. As mentioned in Section 2.3, the second research concentrates on the various knowledge in the whole organization of a new business, observing which knowledge applications are from existing field and which are from outside sources, eventually in order to identify which existing knowledge is applied from existing field to new business. Thus, the data about knowledge acquisition includes those both from outside sources and existing fields. As the need to apply external knowledge varies according to firms' demand, knowledge sets from outside sources are not specified beforehand; instead, they are developed afterward by analyzing survey data. The author found two sets of knowledge acquired from outside sources; these are numbered as 1 and 2 in the tables of 5-1 and 5-2, which will summarize knowledge acquisition data. Moreover, regarding knowledge exploitation from within the existing field inside the firm, the author uses the dependent variables found in Sugiyama and Osanai's (2007) work as a reference in establishing five sets of knowledge, numbered 3 through 7 in the tables (5-1 and 5-2). The final set, numbered as 8, displays other important source of knowledge exploitation from existing field, other than those noted in the prior five sets.

This paragraph introduces how the data about the above eight sets of knowledge are arranged in Table 5-1. This table will indicate their source, whether in an existing field or an external one, and their "labor mobility," in the right-hand columns. The reason for considering their sources is that different sources provide knowledge with different nature (or characteristics). As for the reason of indicating "labor mobility," it was recognized during the interviews that knowledge is transferred with labor mobility or immobility, even from the same sources of the existing field, thereby conveying the meaning of labor mobility. If the knowledge currently utilized in the new business was

obtained from outside sources, “outside” is indicated in the source column, and “no” otherwise. If the knowledge currently utilized in the new business was developed within the existing field, “inside” is noted in the source cell, and “no” otherwise. Moreover, it is indicated “yes” in the column for labor mobility if there is labor mobility, and “no” otherwise.

Table 5-1 ProFarm knowledge sets

Knowledge Sets	Source	Labor mobility	Knowledge Acquisition Description
1 Basic product concept	Outside	No	Professor Goto at Chiba University gives advice on basic product concept.
2 Way of doing business in an industry	Outside	No	Professor Goto at Chiba University offers advice about how to do business in the industry
3 Product design	Inside	Yes	Project Leader (A) ,who comes from the existing field, was a designer of IC (integrated circuit) for automobile.
4 Production process	No	No	Workers with no experience
5 Quality control	Inside	No	The automobile departments help the new business (The same computer as in Denso Wave’s Robot)
6 Supplier relationship	Inside	No	Suppliers with long-term relationships offer lower delivery prices. (The same supplier as for computer of Denso Wave’s Robot)
7 Marketing expertise	Inside	No	The automobile business’ subordinate department takes charge of marketing (The same marketing method used to sale components to Toyota)
8 Others	Inside	Yes	Product design logic (same as knowledge set 3)

Secondly, the following seven paragraphs provide precisely the interview data about the eight sets of knowledge in Table 5-1. Professor Goto, from Chiba University’s Graduate School of Horticulture, proposed the basic ProFarm *product concept.*

Knowledge about the “*way of doing business*” involves the manner of launching and developing a new product in a new industry, including who to access for getting the permission to commercialize it. The project leader emphasized that Professor Goto had taught his team the method of gaining permission to commercialize the new product in the agriculture industry. This knowledge transfer did not involve any labor movement.

Knowledge about "*product design"* indicates the skills and expertise which are generated from one's experience of design related work. The interview reveals that the knowledge about the combination structure of existing technology, which is obtained during new business project leader's prior working experience in existing field, is utilized in new business. His such knowledge helps him make decisions on new product.

The knowledge about "*production processes" and "quality control"* relates to skills and expertise generated from one's experience of production and quality control work, such as manufacturing defects, and product improvements, and so on. New employees participate in the production process of ProFarm. Quality control work is conducted with the help of engineers and technicians from the automobile field, but they do not shift to the new business field. The reason why they can conduct these works in new business is followed. ProFarm employs a computer which is also used to control the Denso Wave's Robots. This computer for factories is sold worldwide, and both Denso and its subsidiary of Denso Wave can conduct maintenance and repairs and ensure quality control.

Furthermore, as the Denso Wave's computer is used in the new ProFarm product, "*the supplier"* that delivers components for Denso Wave can offer lower delivery prices to ProFarm.

Regarding "*marketing expertise"*—specifically, advertising, sales method and so on—ProFarm's marketing occurs through a subordinate department within the automobile field. ProFarm product is sold to Toyotane, and not directly to farmers. The primary marketing work here involves providing information for Toyotane to promote

easier sales. This method of selling-to-firm (not selling to customers) is the same as with that of the automobile components delivered to Toyota.

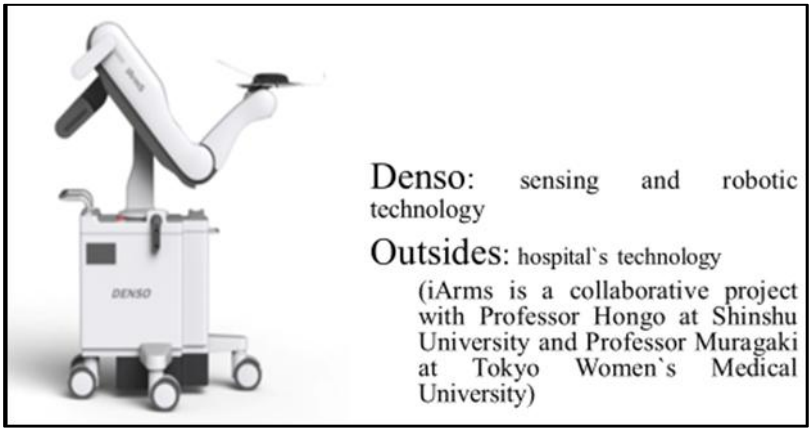
The final knowledge set from the existing field concerns other knowledge than what has been previously mentioned. According to the statement from the ProFarm project leader, this final knowledge set is almost the same knowledge as the third one. The precise description about the final knowledge set is in the following. Design logic of the existing field's product was helpful in the new business' creation. Specifically, automobile environment control system monitors and controls the environment in car by computers, thereby providing optimum conditions. The product's design logic parallels that of ProFarm. This project leader has worked as a designer in the automobile industry before moving into the new field; this means the new business' design logic is obtained from the existing field, with labor mobility.

5.2 Case two: Denso's healthcare business

5.2.1 New business

Denso's new business of healthcare is used as the case two. The iArms, the new product (Figure 5-2) in healthcare business, is a surgical robot to smoothly support a surgeon's arms and wrists. It will reduce fatigue and shakiness during surgery. Denso exploited the sensing and robotic technologies developed in the (existing) automobile components field, and combined them with a hospital's expertise in medical science and engineering; the latter is called "external technology" in this paper. iArms is a joint project with two university professors: Professor Kazuhiro Hongo at the Medical Department of Neurosurgery of Shinshu University and Professor Yoshihiro Muragaki at the Advanced Biomedical Sciences Institute of Tokyo Women's Medical University.

Figure 5-2 iArms and its technology



(Source: based on Denso website homepage[12])

5.2.2 Knowledge acquisition

Interview data of knowledge acquisition for iArms is introduced and summarized in the same manner as in Case One. One more thing to clarify is that, as for labor mobility column, if both labor mobility and immobility occurred, the column is left blank. It is summarized in Table 5-2, with its price introduction followed.

Table 5-2 iArms knowledge sets

Knowledge Sets	Source	Labor mobility	Knowledge Acquisition Description
1 Basic product concept	Outside	No	Professor Hongo (at Shinshu University) and Professor Muragaki (at Tokyo Women's Medical University) offer advices about the basic product concept
2 Way of doing business in an industry	Outside	No	Professor Hongo (at Shinshu University) and Professor Muragaki (at Tokyo Women's Medical University) offer advice about how business in an industry is conducted
3 Product design	Inside	Yes	Project Leader (B) was a designer of evaporative control valve for automobile
4 Production process	Inside		Human resources in the existing field (production process of Denso Wave's robot)
5 Quality control	Inside		Human resources in the existing field (quality control for Denso Wave's robot)
6 Supplier relationship	Inside		Supply relationships in the existing field (Denso Wave's arm-type robot)
7 Marketing expertise	No	No	No relationship with the existing field
8 Others	Inside	Yes	Firm spirit (for example, think more deeply when encountering challenges)

[12] Denso's healthcare business (2019.10.13, Available at: https://www.denso-wave.com/ja/robot/info/detail__757.html).

The following five paragraphs provide precisely the interview data about eight sets of knowledge in Table 5-2. Professor Hongo and Professor Muragaki proposed the basic iArms "*product concept.*" The new business' project leader emphasized that these two professors conveyed knowledge about *how the healthcare industry conducts its business*.

Regarding t*he "product design" knowledge*, the healthcare project leader has experience as a designer in automobile components field, with specific experience in designing evaporative control valves. Concerning design verification, Denso conducts regular meetings for confirming the design of products, and the same verification process is adopted for almost all products, irrespective of design variance. The interview data indicates that the insights provided by the project leader, based on his prior experience during product design verification meetings, are useful when designing iArms.

Moreover, regarding knowledge about *"production process" and "quality control,"* it can be implemented by workers with relevant work experience in the existing field. For example, the workers responsible for quality control in producing Denso Wave`s arm-type robot can implement the same processes in the new business, which uses the same robot. Denso's employees, who possess relevant work experience in the existing field, can move to new businesses through the firm's internal-open recruitment system. This system gives employees the free rights to apply for and move to new positions without their superiors' permission. It facilitates the transference and application of existing knowledge on production processes and quality control to new businesses. According to the interview data, labor mobility sometimes occurs, but sometimes does not, and thus, the labor mobility column is left blank.

Further, *the suppliers* that provide arm-type robot components for the existing field also provide items for the iArms. Although the existing fields of automobiles differs from the new healthcare business, the same arm-type robot is used in both the fields. This allows the supplier relationship developed in the existing field to be extended to the new business.

Moreover, regarding *the marketing* of iArms, Denso's existing business lacks human resources with the experience of conducting business with hospitals or doctors; thus, the marketing of iArms has no connection with the existing field. The interviewee clarified that, *aside from these knowledge sets (indicated as others),* Denso's firm spirit of "thinking more deeply when encountering challenges" helps in making progress in all the process of developing this new business. Project leader states that they encountered many challenges. This firm spirit supports them to overcome the challenges.

5.3 A framework of knowledge acquisition for new business development

Before proposing the framework, this section summarizes and synthesizes the data above in two cases. Table 5-3 summarizes the findings from two cases.

Table 5-3 Findings from the cases

Knowledge sets	ProFarm		iArms	
	Source	**Labor mobility**	**Source**	**Labor mobility**
1 Basic product concept	Outside	No	Outside	No
2 Way of doing business in an industry	Outside	No	Outside	No
3 Product design	Inside	Yes	Inside	Yes
4 Production process	Nothing	No	Inside	
5 Quality control	Inside	No	Inside	
6 Suppliers relationships	Inside	No	Inside	
7 Marketing expertise	Inside	No	Nothing	No
8 others (firm spirits)	Inside	Yes	Inside	Yes

Table 5-3 presents three categories derived through an observation of knowledge-acquisition data in the two cases. In both cases, the knowledge sets of 1 and 2 are acquired from outside sources without labor mobility, and the knowledge sets of 3 and 8 originate from existing field with labor mobility. They are shaded in gray. However, differences exist in the knowledge acquisition for knowledge sets of 4, 5, 6 and 7.

Based on these three categories, the author will discuss and identify the patterned relationship between the nature of each category of knowledge and its method of acquisition, suggesting that knowledge of a different nature has a different acquisition method. Section 5.3.1 is category one, which discusses the nature of knowledge—which is determined by observing its function in a new business—and how it was acquired (exploitation or exploration) in knowledge sets 1 and 2. It is indicated "knowledge is acquired or applied," if the person's knowledge (e.g., his or her advice, experience, and so on) is used, or the person conducts the job. Section 5.3.2 of category two refers to the knowledge sets 4, 5, 6, and 7; and Section 5.3.3 of category three covers knowledge sets 3 and 8. The framework, as shown in Table 5-4, is developed through the discussion in the following three sections (5.3.1, 5.3.2, and 5.3.3).

5.3.1 Category one

In both cases, knowledge sets of 1 and 2 were derived from outside sources. While Denso knows how to do business in the automobile components field, based on knowledge about who their customers are and what products they prefer. However, Denso has no such knowledge in the agriculture and healthcare industries. These two knowledge sets from these new fields are novel, heterogeneous in nature for Denso, and

impossible to find in existing field inside the firm (Table5- 4).

Table 5-4 A framework of knowledge acquisition for new business development

Knowledge Sets		Category one	Category two	Category three
		1 basic product concept 2 way of doing businesses	4 production process 5 quality control 6 supplier relationship 7 marketing expertise	3 Product design 8 Firm spirit
The Nature of Knowledge		Novel and Heterogeneous	Homogeneous and Related	Tacit
Acquisition Method	**This paper**	"Exploration"	"Dual-Use Exploitation"	"Integrative Exploitation"
	Previous works	Exploration	Exploitation	

In both cases, university professors proposed the basic product concepts, with details in Table 5-1 and 5-2. Further, project leaders in both cases stated that university professors taught them how to conduct business in these two new fields. This suggests that Denso pursued new knowledge from outside sources; no human resource mobility occurred.

The acquisition methods in the framework will be developed following the concept in previous works (March, 1991; Levinthal and March, 1993). Exploration consists of pursuing new fields of knowledge, while exploitation consists of making the most from existing competencies inside firms. Thus, this paper suggests that novel, heterogeneous knowledge should be explored from outside sources. Its acquisition method is called the "exploration" (Table 5-4), consistent with previous works (March, 1991; Levinthal and March, 1993).

5.3.2 Category two

The acquisition of knowledge sets of 4, 5, 6, and 7 is not similar between in the two cases and varies even in the same business. However, and more importantly, there is a

common point observed in knowledge sets of 4 through 7 with their nature and acquisition methods. The author found out that these 4 sets of knowledge can be exploited from the existing field without labor mobility, but only in cases when it is useful for new businesses—in another words when it is related or homogeneous in nature with new business. The following introduces the process of author's finding.

The two cases are analyzed separately. First, the agricultural support business (ProFarm) recruited new employees for its production processes; thus, there is no application of knowledge from the existing field. However, regarding quality control, they requisitioned workers from Denso's existing business field as and when they encountered quality problems requiring assistance. These workers from the existing field can conduct the work of quality control of ProFarm, since ProFarm uses the computer which is also used in the existing field. This suggests that when the nature of knowledge regarding quality control for ProFarm is similar to, or homogeneous with, the knowledge of the existing field, it can be applied from existing field to new businesses. There is knowledge application from the existing field but no labor mobility since they help only when it is necessary.

Moreover, agriculture support business uses the supplier relationship developed in the existing field; specifically, this new business purchased materials—the computer, which is also used in the existing automobile components field—at a lower price from Denso's automobile components supplier. This suggests that when the nature of the knowledge regarding supplier relationship for new business is related to, or homogeneous with, that of the knowledge of the existing field, it can be applied from existing field to the new business. There is knowledge application from an existing field but no labor mobility.

Regarding marketing expertise, ProFarm applies knowledge from the existing field; its

sales method is the same as that used in the existing field. ProFarm products are delivered to Toyotane, but not direct users of farmers; similarly, products in the automobile components field are delivered to Toyota, and not directly to the car users. Thus, the author assumes that if the nature of knowledge regarding marketing for new business is related to, or homogeneous with, that of the knowledge in the existing field, it can be applied from existing field to new businesses. There is no labor mobility, since ProFarm's marketing is conducted by the subordinate department in the existing field.

Secondly, the healthcare business (iArms)' production process and quality control workers were from existing fields. The arm-type robot of Denso Wave—Denso`s subsidiary—is used in iArms. Both Denso and Denso Wave workers could implement its production and quality control processes. Similarly, supplier relationships for the arm-type robot developed in the existing field can be shared with the firm's healthcare business. However, marketing of iArms has no connection with existing field. These data about knowledge acquisition for iArms suggest results similar to those for ProFarm discussed above. The knowledge regarding new businesses' production process, quality control, and supplier relationship that is related to, or homogeneous with, the existing field, can be applied from existing field without labor mobility.

Many product suppliers recognize quality as an important factor that can set their products apart from those of their competitors. Moreover, a good supplier relationship with trust and honest communication can mutually benefit both sides. Moreover, Kaur and Dhaliwal (2015) indicate that the heart of a business' success lies in its marketing. Thus, it is desirable for incumbent firm's new businesses to apply these four sets of knowledge, which are developed and accumulated in existing field during their long-term development.

To sum up, this indicates that knowledge sets from 4 through 7 can be exploited from existing field only if and when they are related, homogeneous with the of new businesses. There is no labor mobility involved in most cases; however, there is the possibility of exceptions, which is left to future researchers to analyze.

This paper calls their acquisition method as the "dual-use exploitation" (Table 5-4), as knowledge sets can be used both in the existing field and in the new business without labor mobility.

5.3.3 Category three

5.3.3.1 The knowledge nature

Here is the discussion of the nature of knowledge sets of 3 product design and 8 firm spirit. The author found similar results regarding the nature of these two sets of knowledge. Knowledge sets of 3 and 8 are explicit in nature; however, the author finds that what functions in new business is not the explicit knowledge itself but tacit knowledge, which has developed from this explicit knowledge.

Firstly, this and the following paragraphs discusses about knowledge set 3. In both cases, project leaders have experience as product designers in the automobile components field. Knowledge concerning product design in case one indicates technology's combination structure, as referencing its components' complementarities and substitutability. The project leader in case one called it the "product design logic." He states that the understanding about the product design logic of existing technology helps him recognizing the possibility of developing new technology, whose design logic is the same as existing technology's. "Product design logic" is explicit knowledge. However, it can be argued that this explicit knowledge of "product design logic" becomes his

know-how to guide his thinking and acting during the process of developing new technology. This know-how is tacit knowledge. Thus, the knowledge set 3 ("product design logic"), which is explicit knowledge, functions in new businesses when it becomes tacit knowledge (know-how).

This knowledge in case two indicates the knowledge obtained from the quality confirmation meeting in Denso, including the verification process for products design. The process for products design verification is explicit knowledge. However, according to the interview, this knowledge helps him to make decisions in iArms design work. This suggests that his awareness, obtained from previous experience in quality confirmation meeting, guides him making decisions for new product design work. Thus, it can also be argued that this awareness above becomes his know-how to guide his thinking and acting in new business development. Such know-how is also tacit knowledge. Thus, the knowledge set 3 (about verification process of product design) which is explicit knowledge, functions in new businesses when it becomes tacit knowledge (know-how).

Secondly, this paragraph discusses about the nature of knowledge set 8 of firm spirit. The author finds similar feature as for knowledge set 3 of product design. It is found out that, knowledge of the firm spirit manifests in new business when it becomes cultural knowledge, which is tacit knowledge. In the case of iArms, the project leader stated that the firm spirit (e.g., to think more deeply when encountering challenges) in its existing field supports his team to overcome challenges during the process of developing the new business. The firm spirit of Denso has its origin in a written format (e.g., in a written document). This is explicit knowledge. However, Denso's firm spirit becomes cultural knowledge when it is embodied and embedded in the new business workers and their actions (Nonaka and Konno, 1998). This is tacit knowledge. Thus, the knowledge

set 8 (firm spirit) which has its origin in a written format, functions in new businesses when it becomes tacit knowledge (cultural knowledge).

5.3.3.2 The acquisition

Here is the discussion of author's finding about how these two sets of knowledge are acquired from existing field. It is acquired to play an integrative role in new business; specifically, the "integration" is achieved by the tacit knowledge promoting the application of the "external novel knowledge" and the "homogeneous and related knowledge" within a new business. The following two paragraphs deliver the process of this discuss in detail.

First, ProFarm's project leader "recognized" the connection between existing and external technologies. It means, by recognizing the value of cultivation technology (the external technology), he promotes the applying of external knowledge (such as new product concept of green house environment control system).

Second, iArms' project leader noted that Denso's firm spirit—to think more deeply when encountering challenges—supports them overcome challenges during the new business development process. This new business is developed by both the external novel knowledge (such as new product concept of iArms) and the knowledge which is called related and homogeneous knowledge (such as supplier relationships developed for Denso Wave's robot). This suggests that such tacit knowledge of firm spirit above not only can promote the application of novel knowledge but also can promote the application of the knowledge called related and homogeneous knowledge, in order to develop a new business. This paper calls this process as "integrating" external

knowledge with the knowledge from existing-field.

Moreover, in both cases knowledge sets 3 and 8 are exploited with labor mobility. The project leader's know-how is transferred to the new business with them. And, cultural knowledge, which is embodied and embedded in workers' actions, can move to the new business with them. Tacit knowledge is difficult to transfer to another person through written or verbal means, as it is often not codified and may not be easily expressed (Chugh, 2015).

Thus, it is suggested that such tacit knowledge, which can play the role of "integration," should be exploited in new business using human resources as a medium.

> **This paper notes this acquisition method as "integrative exploitation" (Table 5-4),** as it is transferred from the existing field to play the role of integrating heterogeneous and homogeneous knowledge for TBNB.

6 Discussion

Chapter 2 argued that there is a limitation in organizational separation, is indicated as the solution for incumbent firms to address their difficulties in creating new businesses. This limitation is that the separate development of existing and new businesses—the practice called organizational separation—makes it difficult for incumbent firms' new businesses to access its existing knowledge. In order to respond this issue, the author sets out the main research question as follows: what types of existing knowledge can an incumbent firm apply in its new business from its existing field, and how can it apply these types of knowledge?

This chapter discusses a model that provides a guide for incumbent firm to apply its existing field knowledge to its new business. The model is proposed in Section 6.1 as the results from Chapters 4 and 5. Section 6.2 further explores the academic and practical implications of this paper.

6.1 Proposition of the model

6.1.1 Results

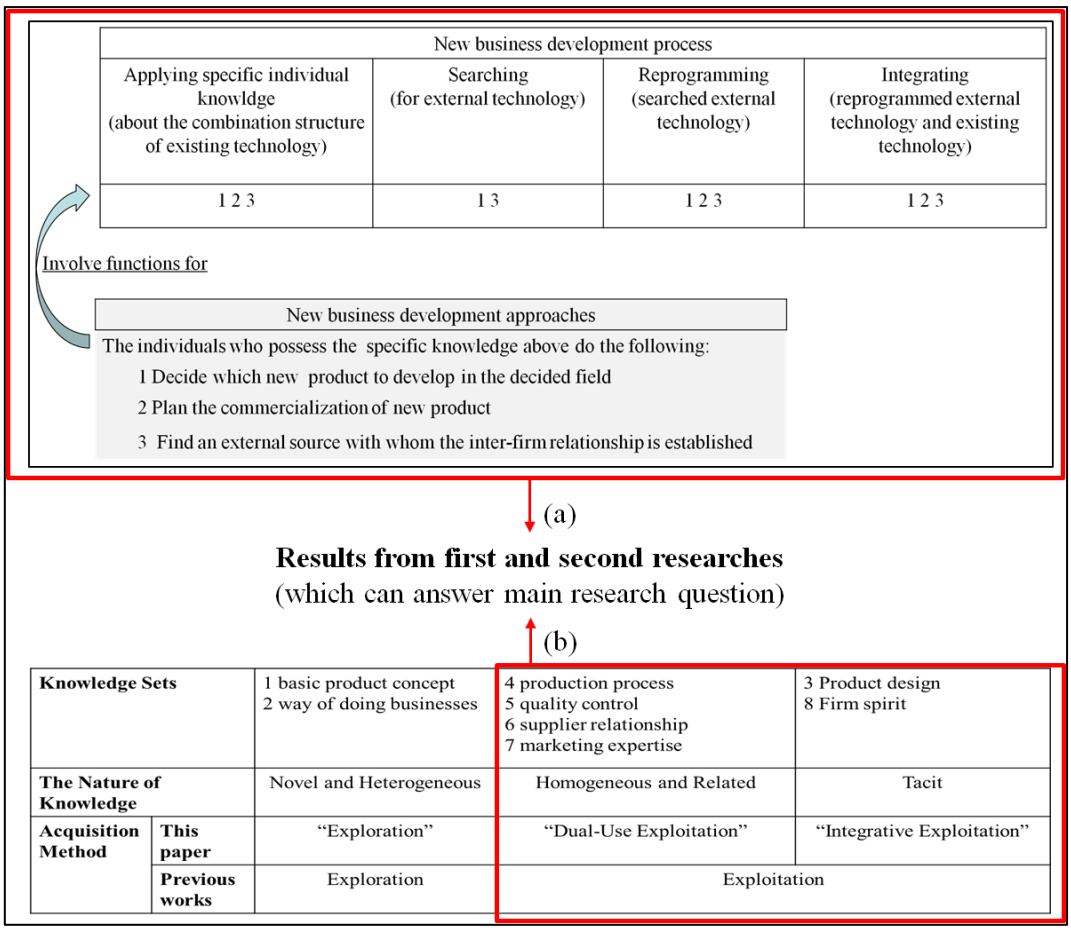
This paper has conducted two researches in order to determine what types of existing knowledge an incumbent firm can apply in its new business from its existing field. The following will identify the results, which can answer the main research question.

Panel (a) in Figure 6-1 outlines the results from the first research in Chapter 4. This result is derived by analyzing two incumbent firms' new businesses. Chapter 4 clarified how the specific individual knowledge (about the combination structure of existing technology) can generate creative nature in new businesses. This refers to existing

knowledge, thereby answering the main research question, as shown in the red boxes. Chapter 4 proposed a framework for how such a specific individual knowledge generates creative nature.

Panel (b) in Figure 6-1 indicates the result from the second research in Chapter 5. This result is derived by analyzing an incumbent firm's two new businesses. Chapter 5 identified knowledge in three different nature and their three different acquisition methods. One of them is novel and heterogeneous in nature, referring to knowledge from outside sources. It does not relate to the main research question, as shown in Figure 6-1. The other two, which are shown in the red boxes, answer the main research question, since these two refer to knowledge from existing fields.

Figure 6-1 Results from the first and second researches

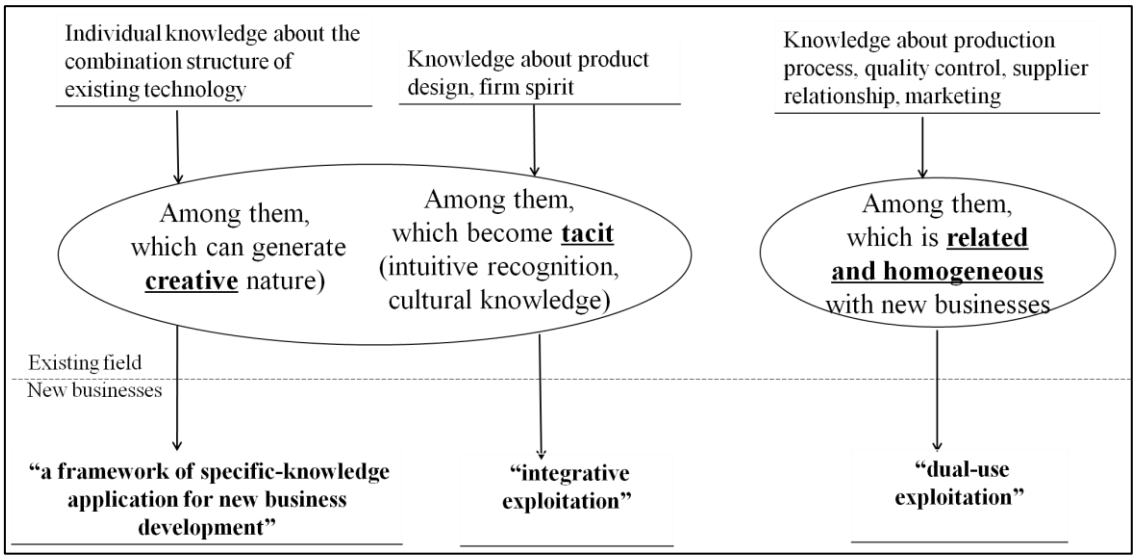


6.1.2 A model of knowledge application from an incumbent firm's existing field to its technology-based new business

This section proposes a model (in Figure 6-2) to provide incumbent firm with guidelines on what types of existing knowledge an incumbent firm can apply in its new business from its existing field, and how it can apply these types of knowledge.

First, this section discusses which types of existing knowledge an incumbent firm can apply in its new businesses, and then discusses their value and function for new businesses. It is found that among the individual knowledge about the combination structure of existing technology, those which can generate creative nature can be applied in new businesses, as shown in the left section of Figure 6-2.

Figure 6-2 A model of knowledge application from an incumbent firm's existing field to its technology-based new business



Chapter 4 clarified that individual knowledge (about the combination structure of existing technology) is promoted to recognize the value of proper external technology, which can be integrated with existing technology to develop a new one. Proper external technology refers to a technology from a new field beyond the incumbent firm's existing field. And, it will be integrated with existing one to develop a technology in a new field beyond its existing field. The author argued that such recognition is the creative nature generated from the individual knowledge. Thus, among the individual knowledge about the combination structure of existing technology, those which can generate creative nature should be applied in new businesses, as shown on the left in Figure 6-2.

What kind of functions does the creative nature (derived from the above individual knowledge) play for new businesses? In both cases of Denso's ProFarm and Panasonic's Passive House, the new business project leader's individual knowledge about the combination structure of existing technology was applied in the new business ventures, where such specific knowledge promotes the generation of new technology. This new technology is a novel technology for the incumbent firm. Thus, it can provide novelty for incumbent firm's new businesses.

Moreover, it can be observed in Figure 6-2 that the "creative nature" mentioned above is included in the circle of tacit knowledge. The individual knowledge about the combination structure of the existing technology helps the project leaders to intuitively recognize the value of proper external technology. This intuitive recognition has no format. Thus, the author includes the "creative nature" in the circle of tacit knowledge.

Two more types of existing knowledge can be applied in new business, as shown in the two circles in Figure 6-2. These two are identified in Chapter 5. Among the

knowledge about (e.g., production process, quality control, supplier relationship, and marketing), only those which are related and homogeneous with the new business can be applied in this new business.

What kind of functions does the related and homogeneous knowledge play for new businesses? Such knowledge, when applied to new businesses, can help save costs. For example, in the case of ProFarm, the workers who can implement quality control for Denso Wave's manufacturing robot, help new businesses when there are problems. There is no labor mobility required and no need for new employee recruitment and training. Thus, it can save the time required for new employee recruitment. It requires time and cost to develop new employees' cooperation, and to build trust relationships with other employees within the firm. Both cases can explain this value, such as supplier relationships and marketing expertise in ProFarm, and production processes, quality control, and supplier relationship in iArms.

Among the knowledge (e.g., about product design and firm spirit), those which can become tacit knowledge (e.g., know-how and cultural knowledge) can be applied to the new business, as shown in the left circle of Figure 6-2.

What kind of functions does such tacit knowledge play for new businesses? It plays the function of integration. This "integration" is achieved by such tacit knowledge promoting the application of the "external novel knowledge" and the "homogeneous and related knowledge," within a new business. The process of this integration is illustrated here. ProFarm's project leader recognized the value of external technology of cultivating; thus, it can be argued that he promoted the utilization of "external novel knowledge" about new product concept of greenhouse environment control systems. This intuitive recognition is tacit knowledge. Moreover, iArms' project leader noted that

Denso's firm spirit—which becomes tacit knowledge during its utilization in new business—supports the new business overcome challenges. This new business is developed by both the external novel knowledge (such as new product concept of iArms) and "the related and homogeneous knowledge" (such as supplier relationships developed in Denso Wave's robot). This suggests that such tacit knowledge above not only can promote the application of novel or heterogeneous knowledge but also can promote the application of the knowledge called related and homogeneous knowledge, within a new business.

Based on the discussion regarding types of existing knowledge, the first suggestion is delivered.

> **Suggestion 1:**
>
> **The following three types of existing knowledge in an incumbent firm can be applied from its existing fields to its new businesses. Specifically, the three types of knowledge are as follows: concerning the individual knowledge about the combination structure of existing technology, among them those which can generate creative nature; concerning the knowledge about product design and firm spirit, among them those which can become tacit knowledge; and concerning the knowledge about production process, quality control, supplier relationship, and marketing, among them those which are related and homogenous with its new business.**

Based on the discussion above regarding the function and value (for new business) of these three types of knowledge in Suggestion 1, the following three suggestions are delivered. Since they concern the knowledge in Suggestion 1, they are numbered as 1.1, 1.2 and 1.3.

Suggestion 1.1:

The incumbent firm should emphasize the application of the creative nature derived from the specific individual knowledge, as it can provide novelty for incumbent firm's new businesses.

Suggestion 1.2:

The incumbent firm should emphasize the application of tacit knowledge which is generated from its existing knowledge, as it can promote knowledge integration in new businesses.

Suggestion 1.3:

The incumbent firm should emphasize the application of related and homogeneous knowledge as this would help it save costs for its new businesses.

Second, the author discusses the acquisition methods for these three types of existing knowledge. Chapter 4 proposed a framework for the individual knowledge about the combination structure of existing technology in order for it generating creative nature, as shown in Figure 6-2. This framework is called "A framework of specific-knowledge application for new business development."

Moreover, concerning existing knowledge about product design and firm spirit, for among them those which can become tacit knowledge, this paper developed a method called "integrative exploitation" as shown in the lower part of Figure 6-2. This method requires human resource movement within the incumbent firm from its existing field to new business. Then, concerning existing knowledge about the production process,

quality control, supplier relationship, and marketing, for among them those which are related and homogeneous with the new businesses, this paper developed a method called “dual-use exploitation,” as shown in Figure 6-2. This method does not require human resource movement inside the incumbent firm from its existing field to the new business.

Based on the discussion about the different knowledge acquisition methods, the second suggestion is delivered.

> **Suggestion 2:**
>
> **The incumbent firm should apply its existing knowledge into its new businesses using various methods in accordance with the various natures of these existing knowledge.**

Third, the author discusses precisely the advantages of the “framework of specific-knowledge application for new business development,” which is one of the acquisition methods. The first advantage is that the knowledge embedded in (the mind of) the individual who possesses knowledge about the combination structure of existing technology, and particularly, the creative ideas in this person’s mind, will inflow into the incumbent firm’s new business. Creative ideas indicate his recognition of new business ideas (such as, what new product to develop and how to plan its commercialization). Such recognition is embedded in the individual and will flow into new businesses with them. The incumbent firms have accumulated rich knowledge in its existing field. Thus, the author argues that this method can demonstrate the incumbent firms’ superiority in its new business development.

The second advantage is that the framework can maximize the creativity of individual

knowledge. The individuals have the discretion to “flexibly” choose proper external technology based on their own existing knowledge, thereby allowing them to think and act creatively. Furthermore, this flexible discretion instills a sense of responsibility in the individuals and incentivizes them to develop new businesses. This can be considered the third advantage of the framework.

Suggestion 3:

The incumbent firm should offer the following discretions for the individuals who possess the knowledge about the combination structure of existing technology: the right to decide the new product idea (such as what new product to develop and how to plan its commercialization) and to search for external technology (which is to be integrated with existing technology).

6.2 Academic and practical implications

First, the author discusses the implications derived from the conclusions to the main research question, as shown in Table 6-1. Previous literature on new business development in incumbent firms suggests that they should develop their new business separately from their existing field. This practice is called organizational separation. However, organizational separation has a limitation that it makes difficult for incumbent firms’ new businesses to access its existing field knowledge. Previous researches (Wi, 2001; Iansiti et al, 2003; Igami, 2018; O’Reilly and Tushman, 2016) have also paid attention to the importance of applying the incumbent firm’s existing field knowledge for its new business development, from various views (such as, regarding the process of applying such knowledge, an economics perspective and so on).

However, few previous works investigate this issue from the view of knowledge nature.

As a theoretical contribution to literature on new business development within an incumbent firm, this study developed a new model from a knowledge nature view: "a model of knowledge application from an incumbent firm's existing field to its technology-based new business." This model provides guidelines for the incumbent firm to identify what types of existing knowledge (according to its nature) should be applied to its new businesses and for how to apply these types of knowledge. Specifically, concerning individual knowledge about the combination structure of existing technology, among them those which can generate creative nature can be applied in the new business. This study also provides a framework to generate creative nature from this individual knowledge. Additionally, concerning existing knowledge about product design and firm spirit, among them those which can become tacit knowledge can be applied in new businesses using "integrative exploitation." Concerning existing knowledge about the production process, quality control, supplier relationship, and marketing expertise, among them those which are related and homogenous with incumbent firm's new business can be applied using "dual-use exploitation."

Table 6-1 Implication for new business development

Literature on new business development in incumbent firms	
Previous literature	Organizational separation → Its limitation: Difficult for new businesses to access their existing field knowledge
This study	•From the view of knowledge nature •Provide a knowledge application model for overcoming limitation of organization separation

Secondly, this paragraph discusses the implication from the first research, as shown in Table 6-2. This study supplements and enriches the literature on utilizing knowledge

inside firm to absorb external technology. Existing literature, on how to apply knowledge within firm to absorb external technology, mainly concentrates on the knowledge base accumulated within a firm. From a novel perspective relating to a specific individual knowledge within the firm, this study provides a framework to absorb external technology to generate new technology. This specific knowledge is that about the combination structure of existing technology.

Table 6-2 Implication on utilizing knowledge inside firm to absorb external technology

Literature on utilizing knowledge inside firm to absorb external technology	
Previous literature	From the view of knowledge-base accumulated inside firm
This study	•From the view of a specific individual knowledge inside firm •Provide a new framework

Thirdly, this paragraph discusses the implication from the second research, as shown in Table 6-3. This study supplements and enriches the knowledge acquisition theory, which previously focused on exploitation and exploration (March, 1991; Levinthal and March, 1993). This dissertation proposed other two new methods. Specifically, this paper suggests a knowledge acquisition framework that can facilitate the effective use of existing field knowledge by suggesting different methods—“dual-use exploitation” and “integrative exploitation”—according to the nature of knowledge.

Table 6-3 Implication for knowledge acquisition

Literature on the knowledge acquisition	
Previous literature	“exploration” and “exploitation”
This study	•Propose two new methods: “integrative exploitation” and “dual-use exploitation”

Fourthly, as another practical guideline to facilitate the effective use of knowledge in the existing field, this study proposes the “dual-use exploitation” concept. It can help save costs for incumbent firm’ new businesses. It is more beneficial for incumbent firm’s new business to focus on acquiring homogeneous and related knowledge from its existing field, as any integration of new human resources from external sources requires high levels of cooperation, time, and effort to develop trust with other employees within the firm.

7 Conclusions and Limitations

In the rapidly developing economic environment, firms, especially incumbent firms, must increasingly improve their diversity. The diversity of knowledge, for this paper’s purposes, refers to the variety of knowledge accumulated within firms. This diversity can enable firms to respond to environmental changes effectively, since the ability to adapt to it depends on the firm’s prior experience and accumulated knowledge base (Cohen and Levinthal, 1990; Pennings and Harianto, 1992a).

Firms enters new business fields in order to enhance their knowledge diversity and supplement their existing core businesses for future growth. The previous studies, on how incumbent firms develop new businesses, emphasize organizational separation. However, this paper argues that developing existing and new businesses separately, known as organizational separation, will make it difficult for incumbent firm’s new businesses to access knowledge in its existing fields.

Incumbent firms should overcome this limitation by utilizing the model proposed in this study. The model is called “a model of knowledge application from an incumbent firm’s existing field to its technology-based new business,” as shown in Figure 6-2 of Section

6.1.2. This is because that, the accumulated rich knowledge in existing fields is their competitive advantage, and firms should rigorously apply this superior knowledge to their new businesses as much as possible.

The precise illustration of the model (in Figure 6-2), which answers the main research question, is as follows.

This paper suggests that the following three types of existing knowledge in the incumbent firm can be applied from its existing field to its new business. Firstly, concerning individual knowledge about the combination structure of existing technology, among them those which can derive creative nature should be applied from incumbent firm's existing field to its new business. This knowledge should be applied using the "framework of specific-knowledge application for new business development." Secondly, concerning knowledge about product design and firm spirit, among them those which can become tacit knowledge should be applied, by the method of "integrative exploitation." Thirdly, concerning knowledge about production process, quality control, supplier relationship, and marketing, among them those which are related and homogenous with new business should be applied by using "dual-use exploitation."

By using this model, knowledge in incumbent firm's existing fields can encourage it to absorb novel technology and knowledge from outside sources. This newly entered novel technology and knowledge helps develop a new business. The development of new business is a way of creating another novel knowledge for the incumbent firm. This newly created novel knowledge, in turn, becomes the incumbent firm's existing knowledge and expands its knowledge base to further absorb more novel, external knowledge. Such an absorbing cycle can continuously enhance firms' knowledge diversity.

However, this study has some limitations. First, it is necessary to test the results obtained here by further exploring other several cases. Second, this research primarily focuses on a system product development. More expansive research is required to test the findings on other kinds of products. Third, this study proposes a framework for individual knowledge concerning existing technology to generate creative nature in Chapter 4. However, the framework's effectiveness also depends on the individual's comprehension ability and cognitive flexibility. Fourth, Although Chapter 5 illustrates that knowledge of product design and firm spirit can become tacit knowledge in the process of new business development, the condition that can turn such knowledge into tacit knowledge, has not been considered. Thus, further research is required to investigate the conditions that promote the transformation of such knowledge into tacit knowledge. These remaining issues need to be further investigated in the future study.

References

Abernathy, W.J. and Clark, K.B. (1985), "Innovation: Mapping the Winds of Creative Destruction," *Research Policy*, Vol.14, Iss.1, pp.3-22.

Ahuja, G. and Lampert, C.M. (2001), "Entrepreneurship in the Large Corporation: A Longitudinal Study of How Established Firms Create Breakthrough Inventions," *Strategic Management Journal*, Vol.22, No.6-7, pp.521-643.

Anderson, P. and Tushman, M.L. (1990), "Technological Discontinuities and Dominant Designs: A Cyclical Model of Technological Change," *Administrative Science Quarterly*, Vol.33, No.4, pp.604-633.

Anderson, C.J., Glassman, M., Macafee, R.B. and Pinelli,T. (2001), "An Investigation of Factors Affecting How Engineers and Scientists Seek Information," *Journal of Engineering and Technology Manage*ment, Vol.18, No.2, pp.131-155.

Arenius, P. and Minniti, M. (2005), "Perceptual variables and nascent entrepreneurship," *Small Business Economics*, Vol.24, Iss.3, pp.233-247.

Athanassiou, N. and Nigh, D. (2000), ''Internationalization, Tacit Knowledge and the Top Management Teams of MNCs,'' *Journal of International Business Studies*, Vol.31, No.3, pp.471-87.

Augustine, S., Payne, B., Sencindiver, F. and Woodcock, S. (2005), "Agile Project Management: Steering from the Edges," *Communications of the ACM*, Vol.48, No.12, pp.85-89.

Arthur, W.B. (2011), *The Nature of Technology: What It Is and How It Evolves*, Free Press, Kindle.

Benner, M.J. and Tushman, M.L (2003), “Exploitation, Exploration, and Process Management: The Productivity Dilemma Revisited,” *Academy of Management Review*, Vol.28, No.2, pp.238-256.

Berends H., Vanhaverbeke W. and Kirschbaum R. (2007), “Knowledge Management Challenges in New Business Development: Case Study Observations,” *Journal of Engineering and Technology Management*, Vol.24, Iss.4, pp.314-328.

Bergek, A., Berggren, C., Magnusson, T. and Hobday, M. (2013), “Technological discontinuities and the challenge for incumbent firms: Destruction, disruption or creative accumulation?” *Research Policy*, Vol. 42, Iss.6-7, pp. 1210-1224.

Bhatt, G.D. (2002), “Management Strategies for Individual Knowledge and Organizational Knowledge,” *Journal of Knowledge Management*, Vol.6, No.1, pp.31-39.

Brem, A. and Voigt, K.I. (2009), “Integration of market pull and technology push in the corporate front end and innovation management—Insights from the German software industry,” *Technovation*, Vol.29, Iss.5, pp.351-367.

Burgelman, R.A. (1983), “A process Model of Internal Corporate Venturing in the Diversified Major Firm,” *Administrative Science Quarterly*, Vol.28, No.2, pp.223-244.

Charmaz, K. (1996), “The Search for Meanings-Grounded Theory,” In Smith, J.A. Harre, R. and Langenhove, L.V. (Eds.), *Rethinking Methods in Psychology*, pp.27-49, London: Sage Publication.

Chi, M.T.H. and Slotta, J.D. (1993), “The Ontological Coherence of Intuitive Physics,” *Cognitive and Instruction*, Vol.10, Iss.2-3, pp.249-260.

Christensen, C.M. (2001), “Making Friends with Disruptive Technology: - An Interview with Clayton M. Christensen,” *Strategy & Leadership*, Vol.29, No.2, pp.10-15.

Christensen, C.M. (2003), *The Innovator’s Dilemma: The Revolutionary Book That will Change the Way You Do Business*, Harper Business: New York.

Chugh R. (2015), “Do Australian Universities Encourage Tacit Knowledge Transfer? Proceedings of the 7th International Joint Conference on Knowledge Discovery,” *Knowledge Engineering and Knowledge Management*, ISBN 978-989-758-158-8, pp.128-135, DOI: 10.5220/0005585901280135.

Cohen, W.M. and Levinthal, D.A. (1990), “Absorptive Capacity: A New Perspective on Learning and Innovation,” *Administrative Science Quarterly*, Vol.35, No.1, pp.128-152.

Davenport, T.H. and Prusak, L. (1998), *Working Knowledge*, Harvard Business School Press, Boston.

Dodgson, M. (1993), “Organizational Learning: A Review of Some Literatures,” *Organization Studies*, Vol.14, No.3, pp.375-394.

Eisenhardt, K.M. and Graebner. M.E. (2007), “Theory building from cases: opportunities and challenges,” *The Academy of Management Journal*, Vol.50, No.1, pp.25-32.

Fujimoto Takahiro, Takahasi Nobuo, Sintaku Jyunjiro, Abe Makoro and Kasuya Makoto (2005), *Research Mind Research Methodology of Business and Management field-based research methods (リサーチ・マインド　経営学研究法　field-based research methods)*, YUHIKAKU（有斐閣）.

Grover, V. and Davenport, T.H. (2001), ‘‘General Perspectives on Knowledge Management: Fostering a Research Agenda,’’ *Journal of Management Information Systems,* Vol.18, No.1, pp.5-21.

Gibson, C.B. and Birkinshaw, J. (2004), “The Antecedents, Consequences, and Mediating Role of Organizational Ambidexterity,” *The Academy of Journal*, Vol.47, No.2, pp.209-226.

Grant, M. R. (1996), “Toward a knowledge-based theory of the firm,” *Strategic Management Journal,* Vol.17, Iss.S2, pp.109-122.

George, A.L. and Bennett, A. (2005), “*Case Studies and Theory Development in the Social Sciences,* MIT Press, Cambridge.

Hansen, M.T. and Haas, M.R. (2001), “Competing for Attention in Knowledge Markets,” *Administrative Science Quarterly,* Vol.46, No.1, pp.1-28.

Henderson, R.M. and Clark, K.B. (1990), “Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms,” *Administrative Science Quarterly*, Vol.35, No.1, pp.9-30.

Hedberg, B. (1981), “How Organizations Learn and Unlearn,” in P.C. Nystom and W.H. Starbuck, (Eds), *Handbook of Organizational Design,* Oxford University Press, Oxford.

Hedlund, G. (1994), “A Model of Knowledge Management and the N‐Form Corporation,” *Strategic Management Journal*, Vol.15, Iss.S2, pp.73-90.

Holste J.S. and Fields, D. (2010), "Trust and Tacit Knowledge Sharing and Use," *Journal of Knowledge Management,* Vol.14, No.1, pp.128-140.

Howell, J.M. and Higgins, C.A. (1990), “Champions of Technological Innovation,” *Administrative Science Quarterly,* Vol.35, No.2, pp.317-341.

Hedlund, D.J., Pisano, G. and Shuen, A. (1997), “Dynamic Capacities and Strategic Management,” *Strategic Management Journal*, Vol.18, No.7, pp.509-533.

He, Z.L. and Wong,P.K. (2004), “Exploration vs. Exploitation: An Empirical Test of the Ambidexterity Hypothesis,” *Organization Science*, Vol.15, No.4, pp.375-497.

Hitt, M.A., Nixon, R.D., Hoskisson, R.E. and Kochhar, R. (1999), “Corporate Entrepreneurship and Cross-Functional Fertilization: Activation, Process and Disintegration of a New Product Design Team,” *Entrepreneurship Theory and Practice*, Vol.23, No.3, pp.145-168.

Iansiti, M. (1995), “Technology Integration: Managing Technology Evolution in a Complex Environment,” *Research Policy*, Vol.24, Iss.4, pp.512-542.

Iansiti, M. (2000), “How the Incumbent can Win: Managing Technological Transitions in the Semiconductor Industry,” *Management Science*, Vol.46, No.2, pp.169-185.

Iansiti, M., McFarIan, F.W. and Westernman, G. (2003), “Leveraging the Incumbent’s Advantage,” *MIT Sloan Management Review*, Vol. 44, Iss.4, pp.58-64.

Igami, Misturu (2018), *Estimating Innovator`s Dilemma (「イノベーターのジレンマ」の経済学的解明)*, NIKKEIBP-SHA(日経 BP 社).

Inoue, Tatuhiko 井上達彦(2014), *Business and Management of Black Swan General Theory Based on World’s Best Case Studies (ブラックスワンの経営学　通説をくつがえした世界最優秀ケーススタディ)*, NIKKEIBP-SHA(日経 BP 社).

Karlsson, C. and Loven, E. (2005), “Managing New Technology Integration: Integrating

Software in Manufactured Products," *International Journal of Innovation Management*, Vol.9, No.3, pp.343-70.

Karlsson, C., Taylor, M. and Taylor, A. (2010), "Integrating New Technology in Established Organizations: A Mapping of Integration Mechanisms," *International Journal of Operations & Production Management*, Vol.30, No.7, pp.672-699.

Katayama, O. (2014), "Panasonic's Profitable Fun-Agriculture," *Osamu Katayama Official Website*, http://katayama-osamu.com/wordpress/2014/10/2114, (Download on 2019.10.13).

Kaur, J. and Dhaliwal. N.K. (2015), "An Exploratory Study of Marketing Practices of Co-operative Supply and Marketing Federations of Punjab and Haryana," *Journal of Marketing Vistas*, Vol.5, Iss.1, pp.53-65.

Kim, L. (1998), "Crisis Construction and Organizational Learning: Capability Building in Catching-up at Hyundai Motor," *Organization Science*, Vol.9, No.4, pp.437-534.

Kostopoulos, K., Papalexandris, A., Papachroni, M. and Inoannou, G. (2011), "Absorptive Capacity, Innovation, and Financial Performance," *Journal of Business Research*, Vol.64, No.12, pp.1335-1343.

Lavie, D., Stettner, U. and Tushman, M.L. (2010), "Exploration and Exploitation Within and Across Organizations," *The Academy of Management Annals*, Vol. 4, No. 1, pp.109–155.

Lawson, C. and Lorenz, E. (1998), "Collective Learning, Tacit Knowledge and Regional Innovative Capacity," *Regional Studies*, Vol.33, Iss.4, pp.305-317.

Levinthal, D.A. and March, J.G. (1993), "The Myopia of Learning," *Strategic*

Management Journal, Vol. 14, Iss.S2, pp.95-112.

Lindsay, P. H. and Norman, D.A. (1977), *Human Information Processing*, Academic Press, New York.

Lyles, Y. (1997), "Top Management, Strategy and Organizational Knowledge Structures," *Journal of Management Studies*, Vol.29, No.2, pp.154-174.

March, J.G. (1991), "Exploration and Exploitation in Organizational Learning," *Organization Science*, Vol.2, No.1, pp.71-87.

Nonaka, I. and Konno, N. (1998), "The Concept of `BA: Building Foundation for Knowledge Creation," *California Management Review*, Vol.40, No.3, pp.40-54.

Nonaka, I. and Krogh, G. (2009), "Tacit Knowledge and Knowledge Conversion: Controversy and Advancement in Organizational Knowledge Creation Theory," *Organizational Science*, Vol.20, No.3, pp.635-652.

Nonaka, I., Toyama, R. and Nagata, A. (2000), "A Firm as a Knowledge-Creating Entity: A New Perspective on the theory of the Firm," *Industrial and Corporate Change*, Vol.9, Iss.1, pp.1-20.

O'Reilly, C.A. and Tushman, M.L. (2007), "Ambidexterity as a Dynamic Capability: Resolving the Innovator's Dilemma," *Research in Organizational Behavior*, Vol.28, pp.185-206.

O'Reilly, C.A. and Tushman, M.L. (2016), *Lead and Disrupt: How to Solve the Innovator's Dilemma*, Stanford Business Books, Stanford.

Osanai Atsushi (2006), "The Dilemma between Organizational-Separation and Existing-Resource Exploitation: New and Old Technologies Integration in Sony`s

Color Television Business” (組織分離と既存資源圧用のジレンマ―ソニーのカラーテレビ事業における新旧技術の統合―), *Organizational Science(組織科学)*, Vol.40 (1), pp.84-96.

Osanai Astushi (2015), “Ambidextrous management of high-technology and low-medium technology: a case study in FPD TV and CRT TV business of Sony corporation,” *WASEDA BUSINESS & ECONOMIV STUDIES*, Vol.51, pp.17-42.

Pavitt. K. (1984), “Sectoral patterns of technical change: towards a taxonomy and a theory,” *Research Policy,* Vol.13, Iss.6, pp.343-373.

Pennings, J.M. and Harianto, F. (1992), “The Diffusion of Technological Innovation in the Commercial Banking Industry,” *Strategic Management Journal*, Vol. 13, Iss.1, pp.29-46.

Polanyi, M. (1962), *Personal Knowledge*, Chicago: The University of Chicago Press.

Quinn, J.B., Anderson, P. and Finkelstein, S. (1996), “Managing professional intellect: making the most of the best,” *Harvard Business Review*, Vol.74, No.2, pp.71-80.

Ratten, V., Ferreria, J. and Fernades, C, (2016), “Entrepreneurial and network knowledge in emerging economies: A study of the Global Entrepreneurship Monitor,” *Review of International Business and Strategy*, Vol.26, No.3, pp.392-409.

Sugiyama Yasuo and Osanai Atsushi (2007), “Factors Promoting Technology Integration: Effective Exploitation of Existing Knowledge and Significance of Business Proposal from Research Department”(技術統合の促進要因:既存知識の効果的活用と研究側からの提案の意義), *Akamon Management Review(赤門マネジメント・レビュー)*, Vol.6, No.5, pp.179-194.

Teece, D.J. (2007), “Explicating Dynamic Capabilities: The Nature and Microfoundations of (sustainable) Enterprise Performance,” *Strategic Management Journal*, Vol.28, Iss.13, pp.1319-1350.

Teece, D.J., Pisano, G. and Shuen, A. (1997), “Dynamic Capacities and Strategic Management,” *Strategic Management Journal*, Vol.18, No.7, pp.509-533.

Tushman, M.L. and Anderson, P. (1986), “Technological Discontinuities and Organizational Environments,” *Administrative Science Quarterly*, Vol.33, No.3, pp.439-465.

Tushman, M.L. and O’Reilly, C.A. (1996), “Ambidextrous Organizations: Managing Evolutionary and Revolutionary Change,” *California Management Review*, Vol.38, No.4, pp.7-30.

Ulrich, K. (1995), “The Role of Product Architecture in the Manufacturing Firm,” *Research Policy*, Vol. 24, No.3, pp.419-440.

Verganti, R. and Buganza, T. (2005), “Design Inertia: Designing for Life‐Cycle Flexibility in Internet‐Based Service,” *The Journal of Product Innovation Management*, Vol.22, Iss.3, pp.223-237.

Veugeler, R. (1997), “Internet R&D Expenditures and External technology Sourcing,” *Research Policy*, Vol.26, Iss.3, pp.303-315.

Wi, J.H. (2002), “Organizational Strategy of Established Firms for Adapting to a Change in Product Architecture; The Dynamic Management of Subunits Inside an Organization,” *Annals of Business Administrative Science*, Vol.1, No.1, pp.9-16.

Zahra, S.A., Yayuz,R.I. and Ucbasaran, D. (2006), “How Much Do You Trust Me? The

Dark Side of Relational Trust in New Business Creation in Established Companies," *Entrepreneurship Theory and Policy*, Vol.30, No.4, pp.541-559.

Zahra, S.A and George, G. (2002), "Absorptive Capacity: A review, Reconceptualization, and Extension," *The Academy of Management Review*, Vol.27, No.2, pp.185-203.

Appendix First hand materials

NAME	COMPANY	POSITION	DATE/MONTH/YEAR	VOLUME
Anonymous A	Denso	Project leader	27/12/2016	1 hours
Anonymous A	Denso	Project leader	27/12/2016	Received E-mail with 2020 words
Anonymous A	Denso	Project leader	24/01/2017	3 hours
Anonymous B	Denso	Project leader	24/01/2017	1.5 hours
Anonymous A	Denso	Project leader	17/03/2017	Received e-mail with 470 words
Anonymous A	Denso	Project leader	26/06/2017	Received e-mail with 400 words
Anonymous A	Denso	Project leader	06/10/2017	Received e-mail with 200 words
Anonymous A	Denso	Project leader	15/09/2018	Received e-mail with 200 words
Anonymous A	Denso	Project leader	18/09/2018	Received e-mail with 1100 words
Anonymous A	Denso	Project leader	25/09/2018	Received e-mail with 300 words
Anonymous A	Denso	Project leader	29/09/2018	Received E-mail with 600 words
Anonymous A	Denso	Project leader	01/10/2018	Received E-mail with 230 words
Anonymous A	Denso	Project leader	06/12/2018	Received E-mail with 360 words
Anonymous A	Denso	Project leader	06/05/2019	Received E-mail with 830 words