Knowledge Integration in a Product Development Organization Accompanied by M&A: A Case Study of a Precision Device Manufacturer

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Abstract--**This case study of a precision device manufacturer discusses knowledge integration in a product development organization after M&A. The goal is to contribute to establishment of a methodology that helps to accomplish the purpose of M&A. The special feature is to analyze establishment of a new product development organization, and its entry into a new market from the standpoint of knowledge management.**

This study proposes the "ARC Model" to explain knowledge integration in product development organizations after M&A. Knowledge integration is conducted in three phases, i.e., "Assessment", "Reorganization" and "Cooperation". In the first phase, knowledge of the acquiring company and the acquired company is assessed. In the second phase, product development organizations are reorganized based on assessment in the first phase. Strategic transfer and far transfer of existing knowledge are conducted. In the third phase, knowledge is created in the process of product development in the new organization. Near transfer and serial transfer of the newly created knowledge are conducted.

This study indicates that one of the adverse factors against knowledge integration in product development organizations is difference of corporate cultures and another is persistence of knowledge not necessary for the new market.

I. INTRODUCTION

The number of M&A (mergers and acquisitions) is increasing all over the world in recent years. M&A is conducted for a variety of purposes, e.g. enlargement of business scale, enhancement of existing businesses, entry into new businesses and acquisition of intellectual property. However, there are many failed cases in which the purposes have not been accomplished.

The goal of this study is to contribute to establishment of a methodology to help accomplish the purposes of M&A, and to strengthen competitiveness of companies. This is the social significance of this study.

Current problems of knowledge integration in the product development organization after M&A were investigated and analyzed in this study. Finally, a theoretical model was proposed to explain the knowledge integration in the product development organization after M&A. This is the academic significance of this study.

II. LITERATURE REVIEW

A. Knowledge Management

All knowledge does not have the same value for a company. When knowledge management is conducted in a company, it is recommended to classify knowledge, and determine how to manage the knowledge for each classification.

As key elements of knowledge management, Milton specified level of necessity of knowledge in a company, and level of knowledge that a company has [8].

According to Dixon, there are five categories of knowledge transfer, as shown in Table 1 [3]. An appropriate category of knowledge transfer can be selected based on three factors of knowledge; characteristics of receiver of knowledge, characteristics of work to transfer knowledge, and characteristics of the knowledge to be transferred.

B. Project Chain

Nobeoka and Cusumano studied multi-project strategy in the automobile industry [10][11]. It is important for a company to transfer knowledge created in one product development project to other product development projects rapidly and effectively, so that a company can maintain its competitiveness sustainably.

Aoshima and Nobeoka proposed the concept of project chain [1][9]. A project chain enables the effective storage, transfer and reuse of project knowledge, since project knowledge will be transferred before it disappears.

TABLE 1. FIVE CATEGORIES OF KNOWLEDGE TRANSFER

Category	Definition
Serial Transfer	To transfer knowledge when a team does a task, and then the same team repeats the task in a new context
Near Transfer	To transfer knowledge from a source team to a receiving team that is doing a similar task in a similar context but in a different location
Far Transfer	To transfer tacit knowledge from a source team to a receiving team when the knowledge is about a non-routine task
Strategic Transfer	To transfer very complex knowledge from one team to another in cases where the teams may be separated by time and space
Expert Transfer	To transfer explicit knowledge about a task that may be done infrequently

There are two types of project chains; human transfer type and time overlapping type. In the human transfer type, core members of a team will be transferred from one project to another project of a different product or different generation. In the time overlapping type, project activity and knowledge transfer are conducted concurrently by having time overlap between two projects for which knowledge transfer is necessary.

C. *Organizational Learning*

According to Matsuyuki and Matsuyuki, an organization has its own intelligence, and is an actor who learns same as a person. When an organization learns from another heterogeneous organization, this activity is called "organizational learning" [7].

Schein proposes a multi-layer model of corporate culture, and explains its effect on organizational learning [13]. When one organization encounters heterogeneous information and knowledge in organizational learning, the organization learns the inner model (e.g. rule, judgment criteria and organizational culture) of the other organization. By comparing it with its own inner model, action to change its inner model may occur. This is called "double loop learning".

The relationship between organizational learning and alliances is often discussed.

Heller and Fujimoto state three conditions to be met for cooperation to function effectively [6]. The alliance partners must 1) co-exist as separate learning organizations, 2) be able to evaluate accurately a partner's relative organizational strengths and weaknesses, and 3) have the motivation and ability to facilitate a partner's inter-firm learning.

Hamel suggests partners may have competitive, as well as collaborative aims regarding each other, and that "process" may be more important than "structure" in determining learning outcomes [4].

When validity of results of learning in the past has been proved several times, "inertia of learning" may be produced. Praharad and Bettis call this "dominant logic" [12]. The inertia of learning inhibits recognition of the value of new knowledge, and decreases adaptability of an organization to a new environment. It is difficult for an organization to overcome inertia of learning by itself. But organizational learning enables to overcome this inertia.

If an organization persists in using old knowledge that is no longer necessary, this prevents acquisition of new necessary knowledge. It is important for an organization to abandon old invalid knowledge and replace it with new valid knowledge. Hedberg defines this activity as "abandonment of learning" [5].

III. STRATEGY OF STUDY

This study is a case study. An M&A conducted by Company A, a major Japanese precision device manufacturer, was researched.

The research question of this study is "How is knowledge integration conducted in a product development organization after M&A?" In order to answer this question, this study dealt with the establishment of a new product development organization named Division C, and its entry into a new market. Factors adverse to knowledge integration were pursued as well.

Data was collected by referring to company documents and conducting interviews with related individuals. Collected data was analyzed qualitatively. Current problems of knowledge integration in the product development organization were investigated and analyzed.

IV. CASE STUDY OF COMPANY A

A. *Organization and Market of MFP/LP*

Organization of Company A is shown in Figure 1. Company A adopts division system. The main products of Company A are MFP/LP (Multi Functional Printer and Laser Printer). There are several segments in the market for MFP/LP. Company A has several divisions of MFP/LP and each division has a target market segment of its own.

Among market segments of MFP/LP, three of them are related to this case; office market, host printing market and production printing market. Table 2 shows a comparison of them.

Division C is one of the divisions of MFP/LP targeting the production printing market. MFP/LP is required to provide features to realize a variety of customer requests. When MFP/LP replaces conventional printing machines used by customers, it is necessary for MFP/LP to realize features identical to those of conventional printing machines.

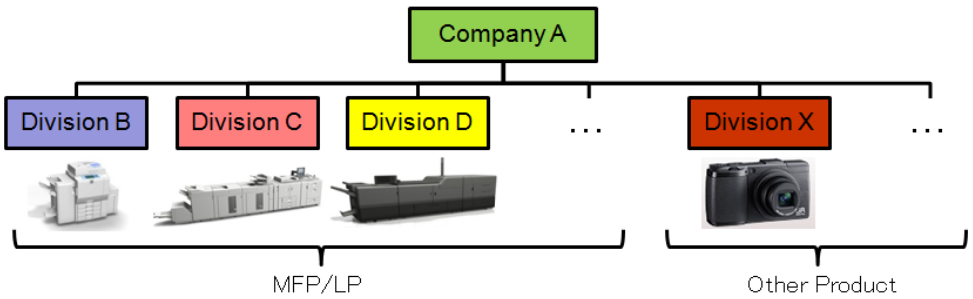

Figure 1. Organization of Company A

TABLE 2. THREE MARKET SEGMENTS OF MFP/LP

	Office Market	Host Printing Market	Production Printing Market
Usage	Handouts, Meeting Minutes	Invoices, Financial Statements	Flyers, Direct Mails, Catalogs
End User	Office Workers	Operators of Backbone Systems	Operators of Printing Systems
Decade of Establishment	1960s	1990s	2000s
Organization	Division B (Predecessor of Division C)	Division D (Former Printing Division of Company D)	Division C

B. Entry into Production Printing Market

When Company A entered into the production printing market, Division C was established by vertical integration of organization in April 2007 as shown in Figure 2. Most members of Division C were transferred from Division B, which targeted the office market.

Company D is an American company and is one of the major technology companies in the world.

Company D provided high value-added printing solutions in the host printing market for many years. Company A judged this capability was the key for success in the production printing market. Thus Company A acquired Printing Division from Company D and reorganized it as Division D in June 2007.

C. Creation of Product Development Roadmap

When Division C was established in April 2007, there was one product platform No.1 developed for the office market, as shown in Table 3 and Figure 3.

When Company A acquired Printing Division from Company D in June 2007, product platform No.2 for host printing market was acquired at once.

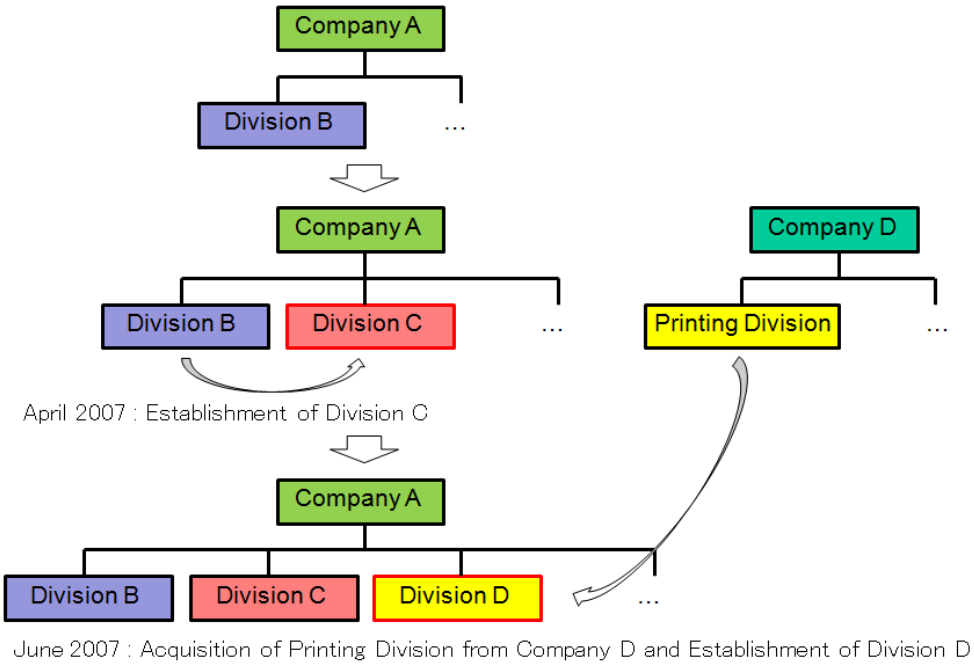

Figure 2. Reorganization of Company A

TABLE 3. PRODUCT PLATFORM FOR PRODUCTION PRINTING MARKET

No.	Original Target	Developed Organization
1	Office Market	Division B
2	Host Printing Market	Division D
3	Production Printing Market	Division C and Division D

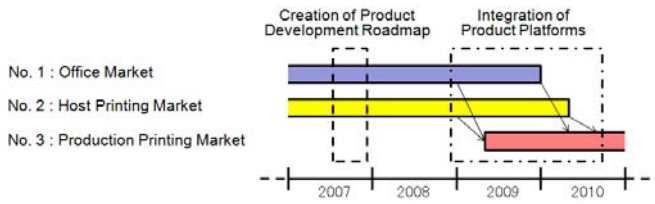

Figure 3. Integration of Product Platforms for Production Printing Market

A product development roadmap was created for the purpose of efficient product development after M&A. Development resources were assigned to the selected area intensively based on this roadmap.

In the product development roadmap, integration of product platforms was planned. As a product platform for production printing market in the future, it was determined to unify product platforms No.1 and No.2, and integrate them into product platform No.3.

In the process of a creating product development roadmap, target features and performance specifications were determined at first. Then elemental technologies and software modules necessary to realize them were identified. Status of their ownership was investigated in the product development organization of Division C. Finally, development plan for elemental technologies and software modules that were necessary but not owned was determined.

In addition to the development plan, reorganization of the product development organization was planned. Optimization of assignment of development resources was the goal. It was decided to abandon knowledge that used to be necessary for either the office market or the host printing market, but which was unnecessary for the production printing market.

Joint product development of Division C and Division D was planned in the product development roadmap. Joint product development for host printing market started from January 2008, and joint product development for production printing market started from April 2009.

D. Integration of Product Development Process

Division D was to conduct most joint product development for the host printing market. Therefore the product development process of Division D, which was that of Company D, was adopted for this product development project.

However, both Division C and Division D were to conduct some joint product development for the production printing market. Occurrence of problems caused by differences of product development process between Division C and Division D was a concern.

In order to prevent problems, a working group was established to integrate product development processes of Division C and Division D in February 2008.

E. Joint Product Development for Production Printing Market

Project E was the first joint product development project for the production printing market conducted by Division C and Division D.

One of main development strategies of Project E was "to use existing development property of Division D". Investigation of the status of ownership of elemental technologies and software modules necessary for the production printing market showed that Division D had more necessary properties than Division C.

In addition, MFP/LPs of Printing Division of Company D used to be highly evaluated in the host printing market. The host printing market is similar to the production printing market than the office market.

Project E was followed by other joint product development projects. Project F was overlapping with Project E, and Project G started after closure of Project E.

In the former case, project chain of time overlapping type was formed between Project E and Project F; in the latter case, project chain of human transfer type was formed between Project E and Project G, as shown in Figure 4.

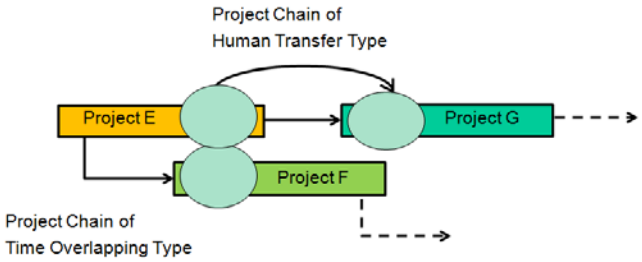

Figure 4. Project Chains with Project E

V. DISCUSSIONS

A. Knowledge Acquisition in a New Market

Knowledge of Division C and Division D about the market is shown in Figure 5.

In order for Division C to develop products for the production printing market, knowledge of the production printing market was necessary. Since Division C already had knowledge about the office market, Division C had to acquire inherit knowledge about the production printing market that was not included in knowledge on office market. Therefore Division C established a joint product development organization with Division D that had knowledge about the host printing market.

Strategic transfer was conducted during reorganization of product development organizations of Division C and Division D. Existing knowledge to manage reorganization stored in Company A was transferred here.

In the joint product development organization, organizational learning between Division C and Division D was conducted. Division C acquired knowledge in common with the production printing market and the host printing market from Division D.

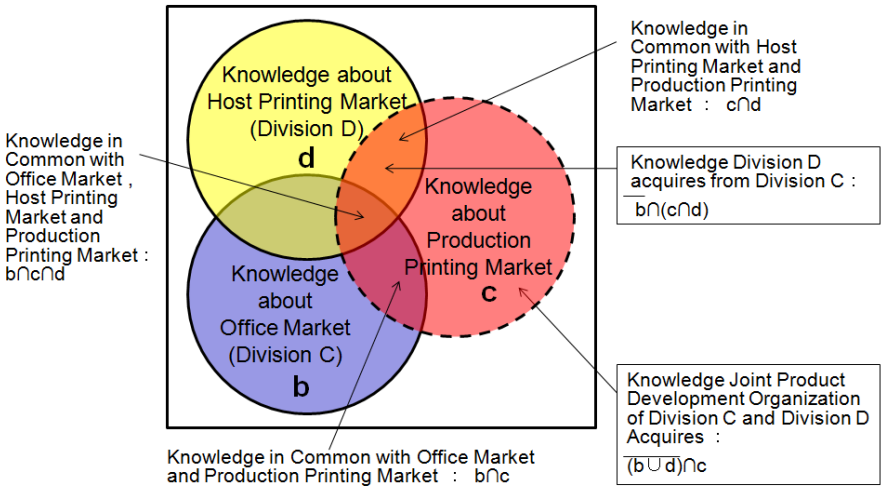

Figure 5. Knowledge of Division C and Division D about the Market

Far transfer of existing knowledge was conducted here. Acquisition of knowledge about a new market is one of the short-term results of M&A, as shown in this case.

Even after establishment of a joint product development organization, there was still a lack of knowledge about the production printing market. Such knowledge was acquired by creation in the process of joint product development by Division C and Division D.

In the joint product development organization, several product development projects were managed simultaneously or sequentially. Near transfer and serial transfer of created knowledge was conducted continuously among the product development projects.

Knowledge integration was conducted by creation and transfer of new knowledge. Efficiency of acquisition of knowledge by joint development is one of the mid-term and long-term results of M&A, as shown in this case.

B. Adverse Factors against Knowledge Integration

In the activity of the working group to integrate the product development processes of Division C and Division D, several differences of product development processes were pointed out. Since Division C was established from Division B that was part of Company A, Division C referred to the product development process of Company A. Division D continued the product development process of Company D. Major differences were as follows:

1) Point and criteria to decide to start a project

2) Criteria to apply fix of problem to machines in field

Analysis implied that there was a difference of corporate culture between Division C and Division D, as shown in Table 4, which was behind the difference of product development processes between Division C and Division D.

Company A has corporate culture derived from hardware development. Since hardware development requires a relatively longer development period, it is necessary to decide whether to start a project or not at a relatively early stage with relatively lower accuracy of information.

On the contrary, Company D has corporate culture derived from software development. Since software development requires a relatively shorter development period, it is acceptable to decide whether to start a project or not at a relatively later stage, with relatively higher accuracy of information.

In establishment of the product development process, Company A assumed the office market that is commodity-oriented. Regarding the office market, there are a large number of customers and machines used in the field. It is difficult to visit all the customers and apply fixes of problems to machines used in the field. Therefore it is common to apply fix only when the symptoms of problems are critical.

On the contrary, in establishment of product development process, Company D assumed the host printing market, which is customization-oriented. Regarding the host printing market, there are fewer customers and machines used in the field than in the office market. Therefore it is common to visit all the customers and apply fixes of problems to machines used in the field.

TABLE 4. CORPORATE CULTURES OF DIVISION C AND DIVISION D

	Division C	Division D
Predecessor Organization	Division C of Company A	Printing Division of Company D
Target Market of Predecessor Organization	Office Market	Host Printing Market
Key Word to Express Corporate Culture	-Hardware Development -Commodity-Oriented	-Software Development -Customization-Oriented

One of the adverse factors against knowledge integration between Division C and Division D was difference of corporate culture. However, the joint product development organization of Division C and Division D would mature its corporate cultures as product development was conducted. The difference of corporate cultures would be reduced.

The production printing market is customization-oriented. In this sense, the production printing market is similar to the host printing market than the office market.

It is the key for success how to handle difference of product development processes between Division C and Division D. If Division C adheres to its product development process, a product development process that is suitable to the production printing market will not be established. In order to prevent this, it was necessary for Division C to identify fairly the product development processes not suitable to the production printing market from the product development processes of Division C. It is also necessary to abandon such processes.

Thus another adverse factor against knowledge integration in product development organization is persistence of knowledge unnecessary for the new market.

VI. CONCLUSION

A. Theoretical Model

As a conclusion, this study proposes the ”ARC Model” to explain knowledge integration in product development organizations after M&A, as shown in Figure 6.

This theoretical model explains knowledge integration in joint product development for a new market by joint product development organizations of both acquiring company and acquired company after M&A. Knowledge integration is conducted in three phases, i.e. ”Assessment”, “Reorganization” and ”Cooperation”. ”ARC” represents these phases.

In the first phase, ”Assessment”, knowledge owned by a product development organization is assessed by both acquiring company and acquired company.

Necessary knowledge and unnecessary knowledge for a new market are identified at first. Then status of ownership of knowledge necessary for new market is assessed by the product development organization of the acquiring company and the acquired company.

In the second phase, “Reorganization”, product development organization is reorganized based on the result of assessment in the first phase.

The joint product development organization is established from product development organizations of the acquiring company and the acquired company. Strategic transfer of existing knowledge about reorganization of product development organizations is conducted. In a joint product development organization, far transfer of existing knowledge necessary for new target market is conducted by organizational learning. Knowledge integration is conducted by strategic transfer and far transfer of existing knowledge here.

One of the adverse factors against knowledge integration in a product development organization is persistence of knowledge not necessary for the new market. In order to prevent this, abandonment of such knowledge is conducted during reorganization of product development organization.

In the third phase, ”Cooperation”, new knowledge is created in the process of joint product development.

Knowledge necessary for new target market but not owned by joint product development organization is created here. Near transfer and serial transfer of the newly-created knowledge are conducted via project chain of products for new market.

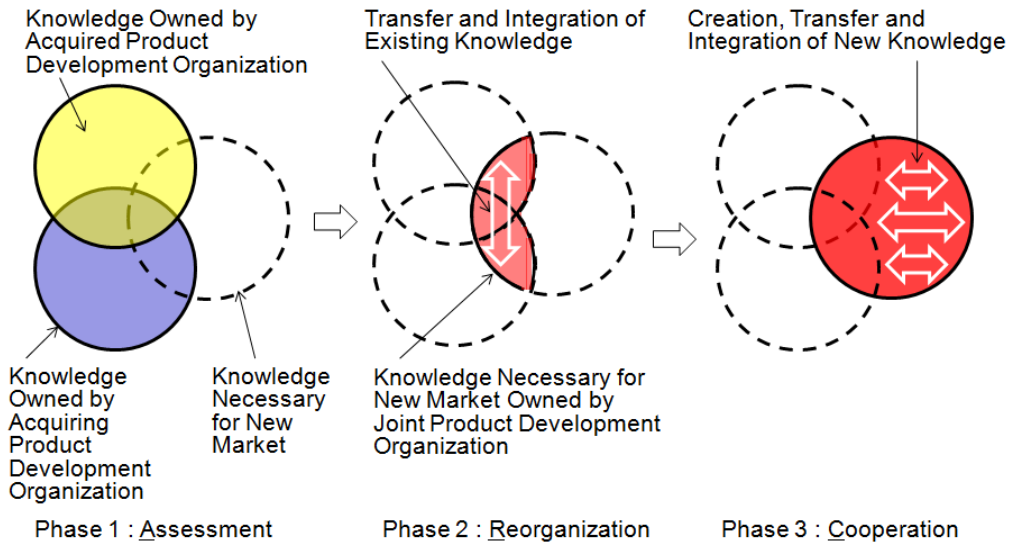

Figure 6. ”ARC Model” of Knowledge Integration in Joint Product Development

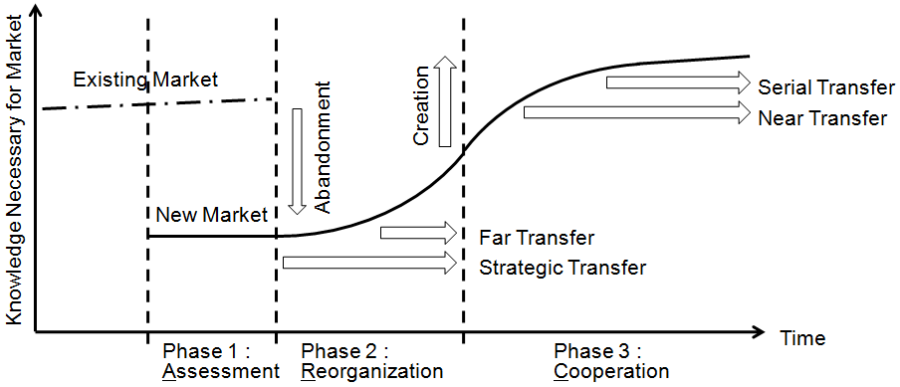

Figure 7. Sequential Change of Knowledge in "ARC Model"

One of the adverse factors against knowledge integration in a product development organization is difference of corporate culture between the acquiring company and the acquired company. This problem will be resolved in mid-term and long-term, since new corporate culture will be matured in the joint product development organization in the process of joint product development.

Sequential change of knowledge necessary for market in the "ARC Model" is shown in Figure 7. Larger value means higher quality and larger quantity of knowledge in Y axis. This figure refers to the concept of "Technology Life Cycle" proposed by Chesbrough [2].

In the first phase, "Assessment", knowledge necessary for the existing market owned by the existing product development organization is larger than knowledge necessary for new market owned by the new product development organization. This means the former contains knowledge unnecessary for the new market. It is appropriate to abandon such unnecessary knowledge at transition to the second phase, "Reorganization".

In the second phase, "Reorganization", knowledge necessary for a new market owned by the new product development organization will increase in accordance with strategic transfer and far transfer of existing knowledge.

In the third phase, "Cooperation", knowledge necessary for a new market owned by the new product development organization will increase more in accordance with knowledge creation and near transfer and serial transfer of new knowledge. Gain rate will gradually decrease as difficulty of knowledge creation increases.

B. Theoretical Connotation

Theoretical connotation of this study is to provide a new viewpoint for future study in the area of M&A and knowledge management. This study proposes a theoretical model by reconstructing related studies.

The special feature of this study is analysis of establishment of a new product development organization and its entry into a new market after M&A from the standpoint of knowledge management.

The originality of this study is the clarification of the importance of knowledge abandonment during knowledge integration in the context of joint product development after M&A.

C. Future Research Directions

The case of this study is currently underway. Continuous investigation and analysis is necessary to enhance and improve the theoretical model using new facts and findings.

This study is based on a single case. It is necessary to verify the validity of the proposed theoretical model for other products and other organizations.

ACKNOWLEDGMENTS

This study was supported by Company A. The authors are grateful for the contribution of Company A to our study. We would also like to thank professors of School of Knowledge Science of Japan Advanced Institute of Science and Technology for their helpful feedback on this study.

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