Knowledge Integration in a Product Development Organization for New Businesses: A Case Study of a Precision Device Manufacturer

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***Abstract*--This study discusses knowledge integration in product development organizations for new businesses. The goal is to contribute to establishment of methodology that helps accomplish the purpose of entry into new business.**

This study analyzes establishment of new product development organizations and their entry into new businesses. There are many differences between existing businesses and new businesses; characteristics of product, characteristics of market and so on. Knowledge required for existing businesses and knowledge required new businesses is different. Thus it is very important to integrate knowledge required for existing businesses and knowledge required new businesses.

This study indicates that persistence to existing knowledge of product development organization maybe an adverse factor of knowledge integration since it prevents from searching new knowledge necessary for new businesses and absorbing searched knowledge. It is suggested for product development organization to have unlearning process of knowledge not required for new businesses.

I. INTRODUCTION

There are several reasons for companies to entry into new businesses.

According to Burgelman, industries generally follows life cycle of growth, maturity and decline [4]. Thus it is very important for companies to keep long-time growth. One solution is to create new businesses.

Some company entries into new businesses in order to cope with change of business environment like globalization. Under the circumstance that the conventional way of management contributed for growth became ineffective, structural change from conventional businesses to new businesses may be required.

There are many failed cases in which the purposes of entry to new businesses have not been accomplished. The goal of this study is to contribute to establishment of a methodology to help accomplish the purposes of entry into new business. . This is the social significance of this study.

In this study, problems of knowledge integration in the product development organization for new businesses were investigated and analyzed. Adverse factors of knowledge integration are mainly discussed.

II. LITERATURE REVIEW

A. Organizational Learning

According to Matsuyuki and Matsuyuki, an organization has its own intelligence, and is an actor who learns the same as a person. When an organization learns from another heterogeneous organization, this activity is called "organizational learning" [9].

Matsuyuki and Matsuyuki proposed three major characteristics of organizational learning: 1) interaction between heterogeneous organizations, 2) occurrence of double loop learning and 3) destruction of inertia of learning.

1) Interaction between Heterogeneous Organizations

In general, the bigger the heterogeneity between organizations is, the bigger the outcome of organizational learning is. However, if the heterogeneity between organizations is too big, organizational learning may not work.

2) Occurrence of Double Loop Learning

When one organization encounters heterogeneous information and knowledge in organizational learning, the organization learns the inner model (e.g. norms, judgment criteria and organizational culture) of the other organization. By comparing this model with its own inner model, action to change its inner model may occur. This is called "double loop learning".

The concept of "double loop learning" was originally proposed by Argyris [1]. When the error detected and corrected permits the organization to carry on its present policies or achieve its present objectives, then that error-and-correction process is single-loop learning. Double-loop learning occurs when error is detected and corrected in ways that involve the modification of an organization's underlying norms, policies and objectives.

3) Destruction of Inertia of Learning

When validity of results of learning in the past has been proved several times, "inertia of learning" may be produced.

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 the organization to do so.

The relationship between organizational learning and alliances is often discussed.

Heller and Fujimoto state three conditions to be met for cooperation to function effectively [7]. 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 [5].

B. Abandonment of Learning

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" [6].

An organization will have particular logic and interpretation of the world regarding management of organization and business. These were developed through experience in the core business and shared among top managers. Prahalad and Bettis call them "dominant logic" [10].

Under the environment of the increasing diversity caused by acquisitions or structural changes in the core business, abandonment of learning of dominant logic by top managers will be required for continuous success of organization.

C. Key Factor for Success in New Business

As for key factor for success in new business, MacMillan classifies in 5 groups; 1) culture, climate and support by whole company 2) mission, strategy and environment of new business 3) structure and design of new business 4) planning, monitoring and evaluation 5) staff organization and reward system to manage new business [8]. Tsai et al also classify in 4 groups; 1) culture, climate and support by whole company 2) structure of new business and effort of industrialization 3) planning, monitoring and evaluation 4) strategy and environment [11].

In order to discuss key factor for success in new business, it is necessary to have basic model of new business development to explain how new business development is advanced in the organization and how top management, middle management and person in charge are engaged.

Burgelman indicates a process model of corporate venturing. Burgelman sets 3 levels of management: 1) group leader and venture manager 2) department of new business 3) management team of company. Ideas and proposals of new business opportunity are transferred to department of new business as a business project to have organizational support. The business project merged into activities of whole company acquiring trust and approval of top management [3].

Block and MacMilllan claim clearly different two types of leadership and management, that is, senior management of parent organization and management team of new business, are necessary for success of new business [2]. It implies that there are two issues in new business; management in individual business project level and management in whole company level to create and promote business projects.

According to Yamada, climate established in conventional business affects decision making to organize stored resources fitting to new business. It is important for structure and climate of parent organization established fitting to conventional business to support new business project effectively [12].

III. STRATEGY OF STUDY

This study is a case study. Entry into new businesses by Company A, a major Japanese precision device manufacturer, was researched. Company A developed and started to sell new products in markets that were new to Company A.

The major research question of this study is "How is knowledge integration conducted in a product development organization after entry to a new business?" In order to answer this question, this study dealt with the establishment of new product development organizations named Division C and Division Y, and its entry into new businesses.

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 of Company A

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. Division B operates business of MFP/LP in a conventional market and Division B and Division C operates business of MFP/LP in new markets.

Division X and Division Y deal with products other than MFP/LP; Division X operates business of cameras that is conventional market for Company A. Division Y operates business of projectors that is new market to Company A.

B. Case 1: Entry into Production Printing Market of MFP/LP

Among market segments of MFP/LP, three of them are related to this case; office market, host printing market and production printing market. Table 1 shows a comparison of them. 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.

Division C is one of the divisions of MFP/LP targeting the production printing market. The production printing market is a new market to Company A, and to enter to this new market is considered as a new business.

When Company A entered into the production printing market, Division C was established by vertical integration of the 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 A considered is necessary for success to provide high value-added services to customers in the production printing market. Company A focuses on Printing Division of Company D. 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.

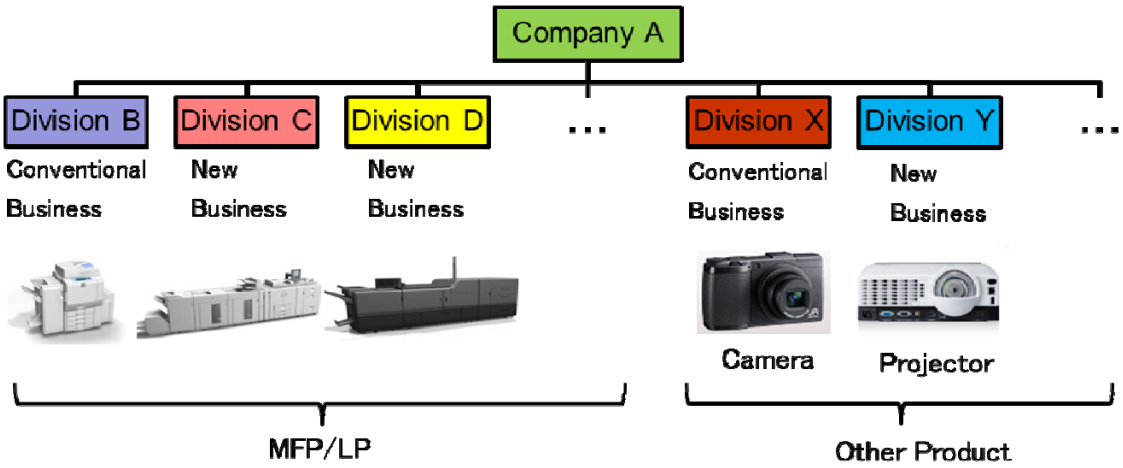

Figure 1. Organization of Company A

TABLE 1. 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

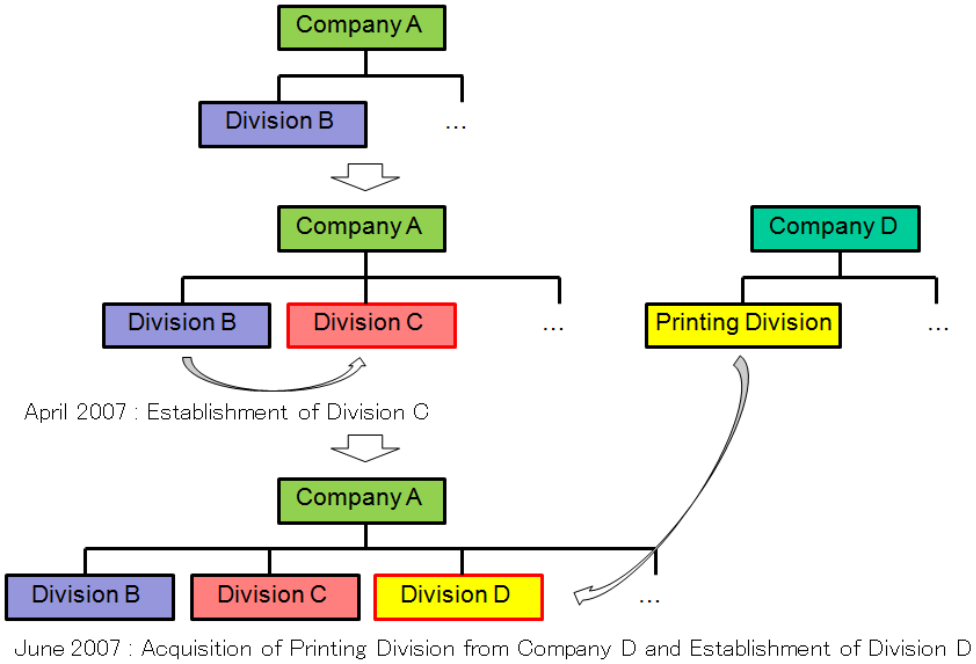

Figure 2. Reorganization for Production Printing Market

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

When Division C was established in April 2007, there was one product platform developed for the office market. When Company A acquired the Printing Division from Company D in June 2007, product platform for the host printing market was acquired at once. In the product development roadmap, integration of product platforms was planned to entry into the production printing market which was new market to Company A. As a product platform for the production printing market in the future, it was determined to integrate two product platforms into one product platform.

In the process of creating a 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, a development plan for elemental technologies and software modules that were necessary but not owned was determined.

Reorganization of the product development organization was planned as well. 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 the host printing market started from January 2008, and joint product development for the production printing market started from April 2009.

Division D was to conduct most 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.

Product development for the production printing market was conducted by the joint product development project by Division C and Division D. One of main development strategies of this project 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 more similar to the production printing market than to the office market.

C. Case 2: Entry into Business of Projector

As stated in "A. Organization of Company A", Division Y of Company A operates business of projectors which was a new business for Company A. Division Y was established to enter into business of projectors.

The stage gate method is a project management technique in which an initiative or project is divided into stages, separated by gates. At each gate, the continuation of the process is decided. The decision is based on the information available at the time, including the business case, risk analysis, and availability of necessary resources.

Company A adopts the stage gate method for new business development. Company A separates a process of new business development into 5 stages, that is, Stage 0: Growth Strategy Plan, Stage 1: Business Opportunity Search, Stage 2: Business Creation, Stage 3: Business Development and Stage 4 Business Start as shown in Figure 3.

At first, Stage 0 was conducted by Planning Department. In July 2008, a Cross Functional Team was established to conduct Stage 1. In April 2009, a Project Team was established. Stage 2 and Stage 3 were conducted by the Project Team. In October 2010, Stage 4 started and the first product was launched in the market. Division Y was established at that time.

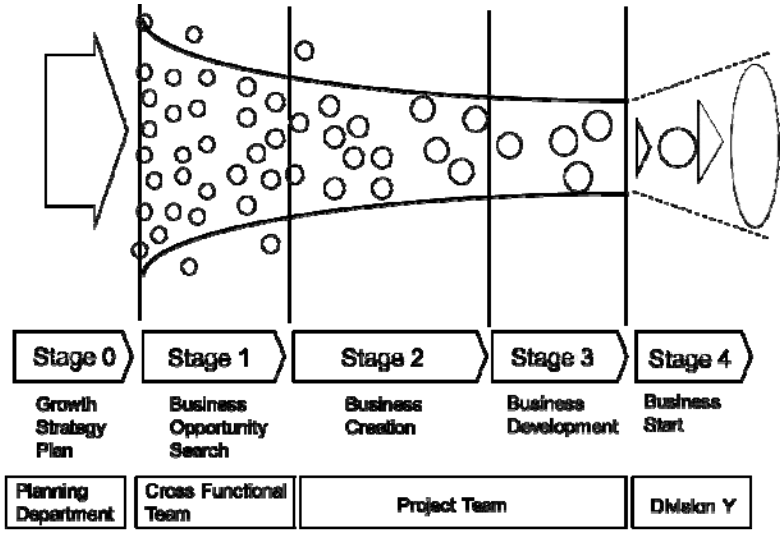

Figure 3. Stage Gate Process in Company A

There are several market segments of projectors as shown in Table 2. Company A determined that its target market segments were "High End", "Standard" and "Ultra Short Focus". Among three of them, "Ultra Short Focus" was the most important market segment for Company A since Company A had competitive advantage in this area of optical devices. Market sizes of "High End" and "Standard" are big. Thus Company A planned to have products in them to continue business of projector by enlarging sales volume of projectors.

Company A had abundant experiences in development of optical devices and products of MFP/LP and camera. However, Company A had never developed projector products. It was expected that it would take long time to have products for all the three segments.

Under such a situation, Company Z, one of the major electronics manufacturers in Japan, announced its withdrawal of business of projector by the end of 2009. Company A determined to acquire Projector Division from Company Z as shown in Figure 4. The strategy was to sell products developed by Company Z in "High End" and "Standard" and develop products in "Ultra Short Focus" itself in the early period. Company A also expected to accelerate development of projectors by technology transfer from Company Z to Company A.

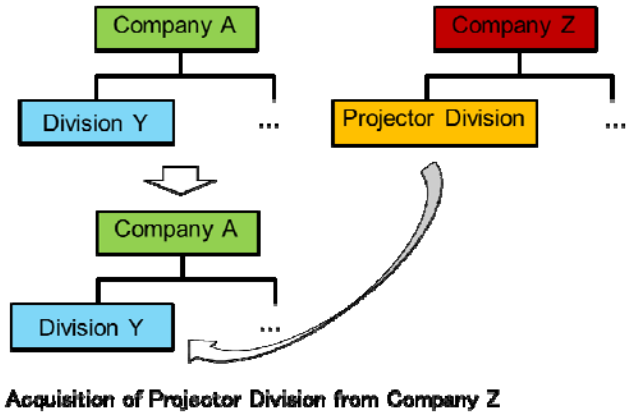

Figure 4. Acquisition of Projector Division

V. DISCUSSIONS

A. Knowledge Acquisition in New Business

<Case 1>

Knowledge of Division C and Division D about the printing market which is new market to Company A 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 or inherit knowledge about the production printing market that was not included in its knowledge about the office market. Therefore Division C established a joint product development organization with Division D, which already had knowledge about the host printing market.

Knowledge transfer was conducted during reorganization of the product development organizations of Division C and Division D. Existing knowledge to manage the 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 common to the production printing market and the host printing market from Division D. Transfer of existing knowledge was conducted here. Acquisition of knowledge about a new market is one of the short-term results of M&A.

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. Transfer of created knowledge was conducted continuously among the product development projects. Knowledge integration was conducted by creation and transfer of new knowledge.

TABLE 2. MARKET SEGMENTS OF PROJECTOR

Market Segment	Usage	Target Market Segment of Company A
Production	-Theater	
High End	-Big conference room -Big classroom	X
Standard	-Small and middle conference room -Small and middle classroom	X
Mobile	-Mobile in company	
Pocket	-Mobile	
Ultra Short Focus	-Small and middle conference room -Small and middle classroom	X

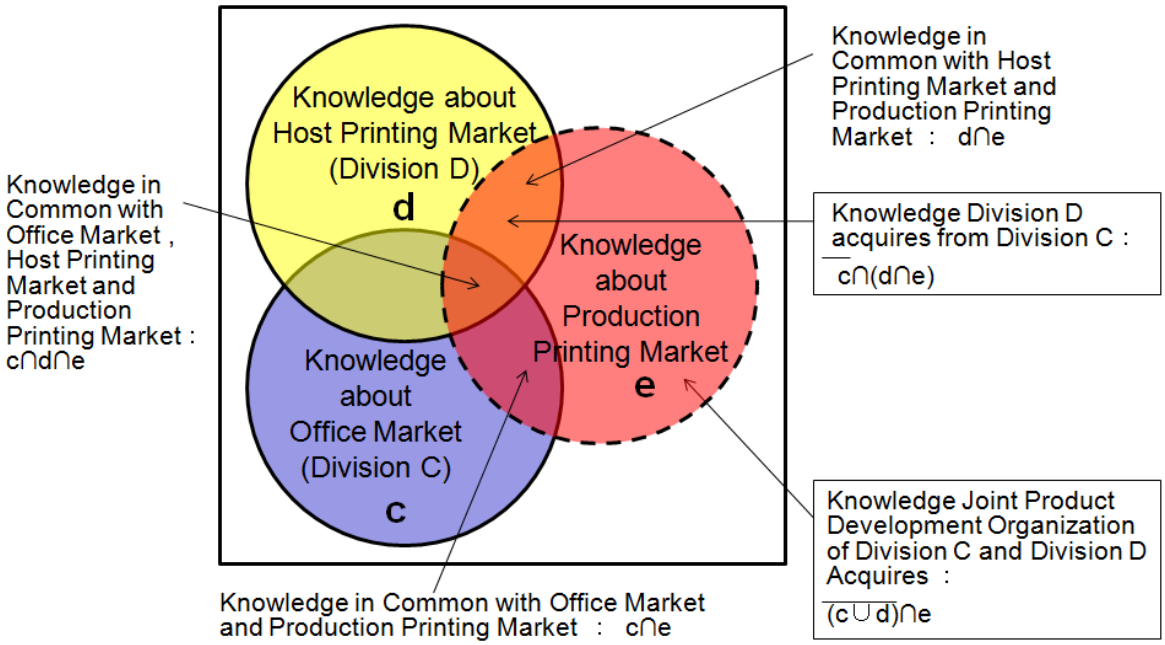

Figure 5. Knowledge of Division C and Division D about the Printing Market

<Case 2>

As stated before, Company A had abundant experiences in development of optical devices and products of MFP/LP and camera. However, Company A had never developed projector product. Since optical devices are just a part of projector product, Company A did not have enough knowledge required for development of projectors. Company A had knowledge in development of MFP/LP and camera. There are a lot of differences in characteristics of products (size, weight, power standard, etc.) among projector, MFP/LP and camera. Thus knowledge in development of MFP/LP and camera is not enough.

Company A determined to acquire Projector Division from Company Z to acquire knowledge required for development of projector products. Company A established a joint product development organization for projector with product development organization of Company A (optical device and MFP/LP product) and Company Z (projector product).

In the joint product development organization, knowledge transfer of existing knowledge, knowledge creation of new knowledge and knowledge integration were conducted in the same way of Case 1.

B. Knowledge Abandonment for New Business

<Case 1>

Company A developed products for the office market and Company D did for the host printing market. The product development processes of Company A and Company D were established as they developed products for each target market. Different product development processes of predecessor organizations may cause problems in a joint product development organization.

In the first joint product development project for the production printing market, completion of the functional specifications was delayed. Analysis implied that one of the reasons of delay is the difference of recognition about level of details of the functional specifications between Division C and Division D.

The recognition of Division D was that detailed description of the functional specifications was not necessary since specifications of modules of lower layer and modification of the functional specifications by customization were described in detail.

On the contrary, the recognition of Division C was that all the functions should be described in the functional specifications systematized and autonomously. Thus, the functional specifications written by Division D were just the list of function from the view of Division C.

Division D wrote functional specifications with level of details requested by Division C after all. However, the discussion on the level of details of the functional specifications took several months.

There was a conflict between the corporate cultures of Division C and Division D in the background of this problem. The corporate culture of Division C was statutory, but that of Division D was customary.

In order for Division C to succeed in the production printing market, it is necessary for Division C to establish product development processes suitable for the production printing market. The production printing market is more similar to the host printing market than to the office market.

Consider integration of product development processes of Division C and Division D. It is the key for success to handle differences of product development processes between them.

If there is difference, it is appropriate to adopt the product development processes of Division D. Because it will increase the possibility to establish the product development processes suitable for the production printing market.

If Division C adheres to its product development process, the product development processes suitable for 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 for the production printing market, from among the product development processes of Division C. It was also necessary to abandon such processes.

<Case 2>

Main product of Company A is MFP/LP. The product development processes of Company A were established as they developed MFP/LP. Since there are a lot of differences in characteristics of products between projector and MFP/LP, product development processes suitable for projector maybe different from those of MFP/LP.

In order for Company A to succeed in the business of projector, it is necessary to establish product development processes suitable for the projector product in the joint product development organization.

As stated before, Company A established a joint product development organization for projector with product development organization of MFP/LP product in Company A and product development organization of projector product acquired from Company Z.

It is the key for success to handle differences of product development processes between MFP/LP and projector. If there is difference, it is appropriate to adopt the product development processes of projector in order to establish product development processes suitable for the projector. It is also necessary to abandon the product development processes not suitable for the projector.

VI. CONCLUSION

A. Adverse Factors against Knowledge Integration

One of the adverse factors against knowledge integration in a new business is "persistence of existing knowledge unnecessary for a new business", since it prevents from searching new knowledge necessary for a new business and absorbing searched knowledge.

In order to dissolve this adverse factor, it is effective to establish an intentional process to abandon unnecessary existing knowledge for a new business. In the product development organization for a new business established by organizations for conventional businesses, it is important to assess the state of ownership of necessary knowledge and abandon unnecessary existing knowledge.

B. Theoretical Implications

Theoretical implications of this study are to provide a new viewpoint for future study in the area of new business development and knowledge management.

The special feature of this study is analysis of establishment of new product development organizations and their entry into new businesses, from the standpoint of knowledge management.

The originality of this study is the clarification of the importance of knowledge abandonment during knowledge integration in new business development.

C. Future Research Directions

Cases of this study are 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 two cases in a company. It is necessary to verify the validity of the proposals for other products and other organizations.

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