

Study of Industrial Marketing Approaches Providing for the Regulated Cause of Firm's Profitability

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The profitability of Japanese industrial companies has been decreasing over the past decade, and as such this situation is in urgent need of attention. This paper focuses on establishing a profitability conceptual model comprising a set of hypotheses obtained from reviewing existing literature and through interviews in order to discuss the factors that determine the profitability of industrial companies and the approaches to be taken to improve it.

I conducted a questionnaire survey comprising Japanese industrial companies to validate the model and to verify a set of hypotheses quantitatively by means of a partial least square (PLS) regression analysis. It was found that active in-house information exchange led to investments in product and application & customer development. It was confirmed that the differentiation of products increased profitability. It was also noted that a stronger relationship between customer products and manufacturer products resulted in increased interdependence on business transactions that tended to decrease profitability.

1. Background and Purpose of the Study

1.1 Purpose of the Study

The existing theory in industrial marketing has two-axis, "expandability" and "relationship". (Takashima and Minami, 2006) In the axis of "expandability" the appropriate expansion strategy of production goods is drawn on the basis of the segmentation approach; in other words, this axis explains how the profits for main products are affected by the mature market. On the other hand, in the axis of "relationship" where an interaction model exists, it is stated how both the general aspects and the adaptive aspects are related to the main products and impact the firm's profitability.

To further develop these studies, it is necessary to build and verify a profitability conceptual model by incorporating individual theories. The approach of this study is to derive hypotheses from individual theories, to classify the main products of production goods companies in patterns in accordance with the general aspect axis (ability to create differentiation) and the adaptive aspect axis (relationships of customer products), to conduct interviews with notably profitable companies selected from in the representing quadrant, and to build a conceptual model for profitability by elaborating the hypotheses and to statistically validate the model using a partial least squares (PLS) regression analysis.

In this research, we aim to verify the hypotheses quantitatively by conducting questionnaire surveys comprising industrial companies and referring to the firms' financial data, and to find theoretical and practical implications.

2. Literature Review

The study of industrial marketing started with the typology of goods in "Principles of Merchandising" in the 1920s (Copeland, 1924). Later, in the 1980s, a study was made by the IMP group in Northern Europe, focusing on "Interaction Based on a Long-term Relationship" (Håkanson and Snehota, 2000). Meanwhile, it was pointed out that "These studies were descriptive, in which studies were needed from the viewpoint of product classification." (Yoda, 2000)

In this chapter, focusing on the two axis of industrial marketing, we reexamine how the results from the recent works hold and how they influence profitability.

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2.1 Information Exchange, Impact on Product and Application & Customer Developments

Market information consists of such elements as market scale for new products, needs and wants from customers, nature of market segment, and strategies and activities of competitive companies. It is obtained through various methods including marketing research, negotiation with distribution businesses, and competitive analysis (Ottum and Moore, 1997). These elements, in particular, the information exchanged between the marketing and R&D departments for product development, are referred to as “outside information” and it is argued that the transfer of outside information reduces uncertainty under the information processing paradigm and results in successful new product development (Moenaert and Souder, 1990). As such, it can be considered that the responding to customer needs increases the possibility of new products being accepted in the market and decreases the risk of failure. At the same time, companies often get ideas about products from the apparent customer needs, but the product development on the apparent needs makes it difficult to achieve inimitability and competitive advantage for long, which results in commoditization and price competition. Therefore, it is pointed out that companies need to exploit products that may respond to the potential needs of customers (Slater, Narver and MacLachlan, 2004). Christensen (1995) indicated, on the basis of a case study of the hard disk drive industry, that responding only to the customer explicit needs is myopia and he has pointed out the problem of overshooting in which technology exceeds customer explicit needs. This has suggested that customer potential needs become important.

From the viewpoint of application & customer development, the lead user method (Von Hippel, 1986) is proposed to discover or create potential needs. Lead users are users who have the needs to be commoditized in several months or years and act as forecast laboratories for the future needs of customers.

Considering the above, collecting the marketing data including such potential needs, sharing it among the departments and utilizing it (Ottum and Moore, 1997) are supposed to activate information exchange and have a positive impact on product and application & customer developments.

2.2 Expansion Strategy

From the viewpoint of product development, the expansion strategy is linked to the specificity of the differentiation between one's products and services and those of competitors, which yields competitive advantages (Grant, 1991). If a company can offer the value to buyers at higher prices, premium pricing can be adopted.

The cost of differentiation is not always clear. Thus, the cost of differentiation is determined by cost drivers of value activities supportive of specificity and it is pointed out that there is a trade-off relationship between specificity and cost drivers (Porter, 1983; Porter, 1985). Hence, differentiating one's products while curbing costs are considered to improve profitability.

In contrast, as an expansion strategy from the viewpoint of application & customer development, it is argued, with regard to the relationship between customer defection and profitability in the service industry, that the intensive retention of existing customers is likely to promote a profit increase in a matured market rather than the cultivation of new customers (Reichheld and Sasser, 1990). As a basis to explain why customer retention leads to profitability, it is assumed that promotion costs expended for developing new customers are reduced, resulting in a higher profit margin. Furthermore, there exists a study on the resource allocation issue that states the expenses to be paid for customer development through market development and for existing customer retention (Reinartz, Thomas and Kumar, 2005). In this study, it is validated that customer development and continued relations with existing customers are connected with profitability for B2B high-technology manufacturers.

As such, there exists a trade-off relationship between spending on acquiring new customers and retaining existing customers, and it is found that the next-best allocation, i.e., the spending for existing customer retention, has a larger impact on long-term profitability. Accordingly, such expansion strategies as facilitating application & customer development are not necessarily meant to increase profitability.

2.3 Relationship between an Interaction Model with Product Differentiation and Customer Products

A variety of relationships are stated as the characteristics of business relations in production goods. The representing paradigm used to explain technologies and products is referred to as an interaction model (Håkansson, 1980). The interaction model picks up a problem-solving capability as characteristics of its own products and services, and recognizes transaction relations for production goods on two axes, i.e., general aspects and adaptive aspects. The general aspects are aspects relating to the extent of customer reliance on the professional problem-solving capability of a company. Specifically, general aspects are defined on the basis of the difference between the technical level of the products and services offered by a company and those of its competitors and based on the customers' demand for higher technology, products and services. That is, it is the capability of a company to create product differentiation. The adaptive aspects, on the other hand, are aspects relating to the customers' reliance on the capability of a company to supply products and services in response to the individual needs of customers. Specifically, the adaptive aspects are defined on the basis of the adaptability of a company in response to individual needs of customers, such as production upon special orders and specification is higher than that of other companies, and the companies expected response to individual needs when customers have a huge variety of needs. This interaction model explains that the marketing strategy for a selected company is divided into four types as shown in Fig. 2-1 by extracting two problem-solving capabilities from the general and adaptive aspects on the company.

A company in the first quadrant with a higher capability on general and adaptive aspects is able to adapt to individual customer needs and has a higher capability to solve problems, allowing the response to customers and product development to proceed in a well balanced manner. A company in the second quadrant with a high capability on general aspects and a low capability on adaptive aspects is capable of promoting product development to solve the problems of customers. A company in the third quadrant with low capabilities on both general and adaptive aspects finds it difficult to solve the problems of customers and to adapt to customers, and will therefore need to pursue a low price strategy. Finally, a company in the fourth quadrant with a low capability on general aspects and a high capability on adaptive aspects finds it difficult to respond to and solve the problems of customers, but can capture customer demand because of its capability to respond flexibly to customer needs.

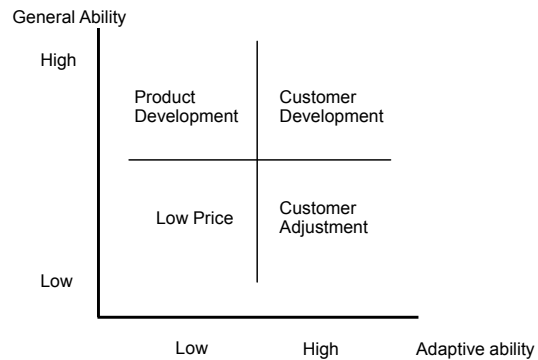


Fig.2-1 : Interdependence Model for problem-solving ability Håkansson (1980)

Viewing from general aspects, product differentiation plays a significant role in increasing profitability. If products and services have specificity, such products or services will be differentiated from competitors. If a company offers specificity to provide buyers with more value it can set premium prices. The cost of differentiation is not always clear. The cost of differentiation is determined by cost drivers of value activities supportive of specificity. It is pointed out that there are two relationships between specificity and cost drivers. (Porter, 1985)

- (1) the impact of factors yielding specificity for value addition on cost drivers:
- (2) the impact of cost drivers on the cost of creating specificity:

In fact, the provision of products and services creating specificity enables premium pricing while increasing costs.

In reverse, this also means that costs impact product development and specificity creation. As mentioned above and as is derived from an interaction model, product differentiation for customers leads to increased profits in general aspects because of premium pricing, while the increased development and manufacturing costs due to product differentiation negatively impact profits, unless well suppressed. On the other hand, by focusing on the relationship with customer products in adaptive aspects, we get that the manufacturing cost increases if customization is

excessively promoted. If the relationship with customer products is stifled excessively interdependence on business transactions between companies arises, which decreases profitability. (Takashima, 1998)

2.4 Summary

From the literature review, we get that active information exchange within the company has a positive impact on product differentiation, and on application & customer development, from the viewpoint of the production goods being exposed to large investment risks. Aggressive product differentiation while suppressing cost may increase profitability but may have a negative impact on the relation between application & customer development and profitability, because retaining the existing customer impacts profitability positively.

In the interaction model, the capability to solve the problems for customers (differentiation creating capability), being a general aspects is connected to product differentiation and enables premium pricing while suppressing profitability through increased developing costs unless these costs are managed properly. The capability to flexibly adapt to customers, being an adaptive aspect is connected to the relationship with customer products, and facilities excessive customization of products while increasing manufacturing costs. If the relationship with customer products is too strong, the dependence on business transactions arises, which decreases profitability.

3. Establishment of a Conceptual Model Based on a Case Analysis

3.1 Case Study

The next step of this study is that main products should be classified into types on the basis of the general aspects (differentiation creating capability) and adaptive aspects (relationships with customer products) and interviews should be conducted for companies with much higher profitability among representing quadrants in the preliminary investigation so that we can reevaluate whether the conceptual connection derived from the literature in the preceding chapter is valid.

As a step prior to selecting companies with higher profitability, first, factors closely linked to corporate profitability are extracted in the types of main products through the discrimination analysis and drawn on two axes, i.e. general aspects (differentiation creating capability) and adaptive aspects (relationships with customer products), into a scatter diagram. This is to identify the companies who are influenced by the significant operational scale constituting the profitability conceptual model by classifying the main products along two axes.

Interviews are conducted for companies from all quadrants that are significantly more profitable than the industry average. Thereby, a forecast pattern relating to profits, described by two axes of lead operational scale, i.e., “product differentiation” and “relationships with customer products” is considered to be characteristically expressed in the companies located in each quadrant, subject to investigation. In short, it is considered that the strength and weakness of such an operational scale will be observed in the profits obtained from a group of main products. (Yin, 2009)

For the interview, a focused interview method (Merton, et al., 1990) is adopted, by which the same questions as the first established ones are asked to the companies in each quadrant. Such data as corporate profiles and operating profits are collected from company brochures and published financial data so that the standards for questions for companies in each quadrant are intended to be clarified and standardized for better objectivity.

Finally, we focus on the essentials of profitability, and executive officers or executive managers, who are responsible for profits in the company, are selected for the interviews.

3.2 Results on the Profitability of Main Products

On the basis of the factors relating to profitability, which are extracted by discrimination analysis in the preceding section, a product development investment/patent acquisition factor (SSK2) is selected as a factor representing the general aspects. It was found by the discrimination analysis that an information exchange factor (SHK) had 10% more impact than the product development investment/patent acquisition factor (SSK2), although the information exchange factor (SHK) had indirect influence, as shown in the profitability conceptual model. The product development investment/patent acquisition factor (SSK2) had direct influence, and is therefore selected as a

representing factor. Further as a factor representing the adaptive aspects, a relationship factor (KN1) is selected.

On the basis of the product development investment/patent acquisition factor indicative of product differentiation as the axis representing the general aspects and the relationship factor as the axis representing the adaptive aspects, the types of main products are shown in the scatter diagram Fig. 3-1¹

Many Japanese companies are in the first and fourth quadrants, which means that they can produce characteristic products. On the other hand, the companies positioned in the second and third quadrants produce less characteristic products.

From the viewpoint of main product types and profitability, the Japanese companies are found in the first and fourth quadrants where higher profitability is sought.

To analyze in more detail, the operating profit on sales for 2007 is divided by the industry average² to determine the profit ratio (1.0 for the industry average), and the growth rate for 2007 is divided by the industry average growth rate to determine the growth ratio (1.0 for the industry average). The average of profit and growth ratios in each quadrant calculated on the basis of these definitions is shown in Table. 3-1

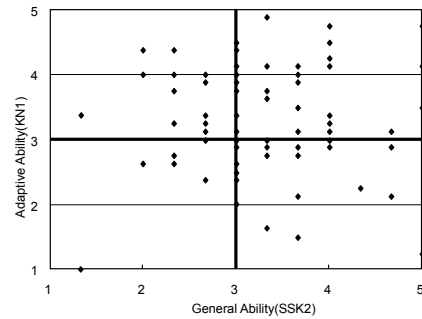


Fig.3-1 : Major Product Category

Table.3-1 : Profit & Growth Ratios

1st Quadrant		2nd Quadrant		3rd Quadrant		4th Quadrant	
Profit Ratio	Growth Ratio	Profit Ratio	Growth Ratio	Profit Ratio	Growth Ratio	Profit Ratio	Growth Ratio
1.28	1.36	0.74	1.25	0.05	-0.45	1.39	1.15
N1=20	N1=20	N2=12	N2=11	N3=6	N3=6	N4=14	N4=14

Observing the types to define profitability, the profit ratio of the products positioned in the fourth quadrant is 10% higher than that of the products in the first quadrants. Meanwhile, the growth ratio of the products positioned in the fourth quadrant is 20% lower than that of the products in the first quadrant. As such, to further increase profitability, companies urge pursue standardization of basic design to move to the fourth quadrant. In this case, the growth potential has to such that the company's position is not lowered. In the next section, we discuss the interviews conducted as part of the study.

3.3 First Quadrant: The Case of Company T³

Company T was established in November 1963. As of 2008, it had a capital of 54,961.19 million yen, 981 employees (about 10,000 in total for the group) and was listed on the first section of the Tokyo Stock Exchange.⁴ Production goods manufactured by Company T are mainly thermal processing film production equipment for manufacturing semiconductor devices⁵, plasma etching equipment, coating applicator/developing devices, and flat panel display (FPD) manufacturing equipment. Company T's main products are positioned in the first quadrant with its profit and growth ratios being 3.31 and 4.73 respectively, which are much higher than the average ratios for

¹ The scatter diagram is prepared based on the factor scores of KN1 and SSK2.

² The trading circles average (1.0) is computed on the basis of the data from the quarterly journals in Japan (2006, 2007: Spring data).

³ Mr. T, Executive Operating Officer for the Management Strategy Office was interviewed.

⁴ Visit <http://www.tel.co.jp> for the detailed company information.

⁵ The manufacturing process of semiconductor devices (from upstream to downstream) is as follows: (1) oxidized film formation/nitride film formation, (2) pattern formation, (3) element isolation formation, (4) gate formation, (5) contact formation, (6) multilayer interconnection formation, and (7) wafer inspection.

profit and growth in the first quadrant, 1.28 and 1.38 respectively. In the interview, the main products were recognized by the company to be in the first quadrant, and there were no discrepancies between our and the company's views on this.

In case of the products of Company T, the manufacturing process for semiconductor devices accounts for about 11% of the company's revenue. Listed typically as core products are a group of products related to pattern formation in the manufacturing process for semiconductor devices, such as a product for coating and developing photo-resist applications, referred to as coater/developer (share 80%) and plasma etching equipment (share 50%) used for etching IC patterns transferred on the photo-resist. The vital technologies for these products are thin-film formation technology and micromachining technology, enabling thin-film formation and micromachining on the current level, 65nm - 45nm⁶.

Boosting the production yield becomes a major factor of advancing differentiation in comparison with the products of other companies. As a business form, follow-up to customers in need of state-of-the-art technologies (about 10 companies all over the world, 2 companies in Japan) is centralized and specialized, but the business is firmly established. Therefore, interdependence on other companies in terms of integration into or business affiliation with customer companies was not found.

As for application & customer development, few new customers were acquired. As to the future application & customer development, the existing customers in India, China, etc., where low-end semiconductor devices of the 130nm level are currently being used for home appliances, will be provided with manufacturing equipment. Further future needs for post-sales services are anticipated.

As a determinant for higher growth, the impact of the silicon cycle was pointed out. This is similar to the inventory cycle of semiconductors in which ups and downs of growth are seen once every four years. The financial data of Company T for FY2007 shows high growth, and the profitability, too, is high relative to the growth, if the sales volume is maintained to some extent.

3.4 Second Quadrant: The Case of Company P⁷

Company P was established in September 1939. As of 2008, it had a capital of 2,960.97 million yen, 1,563 employees (consolidated) and was listed on the first section of the Tokyo Stock Exchange.⁸ The main products of Company P are opening and closing mechanism parts and fastener parts for automobiles; these products are positioned in the second quadrant. Company P's profit and growth ratios are 1.35 and 0.49 respectively, while the average ratios for profit and growth in the second quadrant are 0.74 and 1.25 respectively. The company's profitability exceeds the average in the quadrant.

Among Company P's main products, the opening and closing mechanism parts for automobile console boxes (air damper) and automobile fastener parts⁹ are designed by using integrated shapes and common component parts to lower costs while responding to customer products (automobiles). Company P's products involve few human operators during the manufacturing process. Thus, manufacturing equipment is automated for mass production, lowering the manufacturing cost. Compared with the products of overseas labor intensive companies, price competitiveness is maintained because of restrained labor costs. In view of the nature of products, no profits are expected from maintenance services.

From the viewpoint of developing new products, the information exchange within the company is activate throughout the organization with the Marketing, R&D, and Production/Technology departments collaborating closely to exchange information. Patent applications are also eagerly filed. Furthermore, the Company activity seeks customers' potential needs right from the stage of product development by sending guest engineers to key customers.

Meanwhile, as a negative effect of the stronger relationship with customer products, the company is

⁶ Nm stands for 10⁻⁹ meter.

⁷ Mr. Y, Manager, Promotion Department, Enterprise Resource Planning was interviewed.

⁸ Visit <http://www.piolax.co.jp> for the detailed of company information.

⁹ Here the parts being referred to are resin and metal fasteners used for fixing interior/exterior automobile parts to the body panel.

sometimes burdened with remedial measures for defects in their customers' products. According to the experience for the drive components for Company N automobiles, regardless of the oligopoly in the market for Company P's products, the cost increase caused by a reduced dimensional tolerance for quality control by the demand of Company N was not permitted to be passed on to the customer by the purchasing department. In other words, given their understanding of the customer's situation the reduction in the margins was accepted, confirming interdependence in business transactions.

As for application & customer development, in a somewhat controversial practice, the applications of other companies' products are analyzed by tearing down¹⁰ automobiles, as automobile parts are their main products. As for customer development, they respond to each of domestic automobile manufacturer plan to consolidate their position in Japan and aim to work for overseas automobile manufacturers in the future.

3.5 Third Quadrant: The Case of Company O¹¹

Company O was established in April 1939. As of 2008, it had a capital of 2,295.16 million yen, 216 employees and was listed on the first section of the Tokyo Stock Exchange.¹² The main products of Company O are film condensers used in the business of measures against electromagnetic noises; its products are positioned in the third quadrant. Company O's profit and growth ratios are 2.12 and 2.87 respectively, which are much larger than the average profit and growth ratios in the third quadrant 0.05 and -0.45 respectively.

Company O's electromagnetic noise measures business¹³ is very restrictive in terms of its applications and particularly focuses on commercial power supply. The commercial power supply sector is regulated for safety by law, and the company's main products have been approved. The laws and regulations seeking to tighten approval build migration barriers that form a special kind of business structure and restrict easy emergence of other competitors. For adaptive aspects of products (relationships with customer products) the complete standard design is adopted. The standard design is also adopted for the general aspect, too, but the differentiation in terms of know-how during the manufacturing process becomes characteristic.

Potential customer's needs are not solely related to storage capacity. Potential needs can also be unexpected, such as increasing the film condenser's heatproof temperature such that there is no failure even if the condenser is stored in a warehouse in the equatorial regions, or restricting the amount of expansion when charged.

Company O seeks to stimulate potential needs well from customer information and to differentiate from other companies' products by taking immediate actions through active information exchange in the company. From the viewpoint of craftsmanship, potential customer needs are embodied by utilizing the manufacturing process know-how.

Inverters for controlling revolutions for the purpose of energy savings had a penetration rate of 20%: the installation of these inverters necessitates the elimination of high-frequency waves and electromagnetic noise. Accordingly, the market is in a phase of expansion. While customer companies have spin-offs and expanded to overseas production bases, the company is engaging in application & customer developments in response to the reorganization and spinning off of these traditional customer companies. Meanwhile, regardless of the fact that the smooth emergence of competitors was not anticipated while the market was tending to expand, the company places much value on services before and after the sale in order to ensure profitability.

¹⁰ This method is actually used for cost control; Company P uses this method to investigate the products of its competitors.

¹¹ Mr. M, Senior Managing Director for Administration was interviewed.

¹² Visit <http://www.okayaelec.co.jp> for detailed company information.

¹³ The company creates products to deal with electromagnetic noise caused by the inflow and outflow of electric power and provides products and services to protect equipment from malfunctions and failures.

3.6 Fourth Quadrant: The Case of Company S ¹⁴

Company S was established in February 1968. As of 2008, it had a capital of 8,651 million yen, 1,871 employees, and was listed on the first section of the Tokyo Stock Exchange.¹⁵ The main products of Company S are equipment for clinical examination and reagents for tests; its products are positioned in the fourth quadrant. The company's profit and growth ratios are 2.47 and 2.67 respectively, exceeding the average ratios for profit and growth in the fourth quadrant, 1.39 and 1.15 respectively.

Company S specialty is laboratory testing which is one of the two major examinations in medical science. Among their products, the blood cell counter has the biggest market share in the world. As for their business model, they create both products and reagents, while other competitors create only products or reagents. The products are manufactured in Japan and exported to many countries, but the reagents are produced for the local market. The overseas market accounts for 70% of the sales, and the domestic market 30%. Products and reagents account for 35% and 65% of the sales respectively; thus it is the reagents and not the products that drive profitability. There are four market segments; Europe, the Americas, China and AP.¹⁶

As for product development, the company has built a system wherein domestic MR information is collected, stored in an in-house database and used for development. The company's employees are sent to university laboratories or hospitals for joint studies to grasp potential needs. The main products are differentiated, but the relationships with customer products are not that strong. Accordingly, there are no discrepancies in their recognition of positioning in the fourth quadrant. However, the software portion, a component of the products, is customized for the customers. That is, the products are exported to nations around the world where laboratory test items may vary, and the products are therefore devised with software (and not hardware) modifications to enable a response appropriate to the specific conditions.

As for application & customer development, the company is making efforts to begin sales of its testing equipment for lifestyle-related diseases and diabetes not only to hospitals and specialized inspection institutes but also to individuals; in this regard, an application for housing construction companies is being developed.

¹⁴ Mr. N, Manager of Management Planning Department was interviewed.

¹⁵ Visit <http://www.sysmex.co.jp> for the detailed of company information.

¹⁶ Here AP stands for Asia- Pacific.

4. Establishment of a Profitability Conceptual Model and Hypotheses

4.1 Hypotheses Derived from Information Exchange and Expansion Strategy

For production goods with a higher development risk, positive utilization of in-house information exchange enables faster product development and utilization of information from lead customers makes it possible to anticipate the future course of a market. Therefore, it is considered that information exchange leads to application development. That is, a hypothesis is established, i.e., if information exchange is active in the company, the individuals generating ideas for developing products (number of filed patents), and as a result, investment for product development will increase. On the other hand, if information exchange is activate in the company, the future course of market will be anticipated, leading to application & customer development; at the same time, while retaining existing customers, the promotion cost will not be required, allowing the profitability to increase. Therefore, a hypothesis that aggressive application & customer development is not necessarily linked with improved profitability is derived.

H1: If information exchange is active in the company, application & customer developments will increase.

H2: Even if application & customer developments are active, profitability will not increase.

4.2 Hypotheses Derived From the General Aspects

From the viewpoint of the general aspects, if the products are differentiated from the products of competitors and are offered with more value, it is possible to charge premium prices. That is, a hypothesis is established, i.e., if product development receives more investment differentiated products are developed and premium prices are charged, resulting in increased profitability.

On the other hand, another hypothesis is also established at the same time, i.e., if investment in product development increases, the costs for development and manufacturing will increase, resulting in a decrease in profitability.

H3: If information exchange is active in the company, investment for product development will increase.

H4: If investment for product development increases, profitability will increase.

H5: If investment for product development increases, development and manufacturing costs will increase.

H6: If development and manufacturing costs increase, profitability will decrease.

4.3 Hypotheses Derived from the Adaptive Aspects

From the viewpoint of the adaptive aspects, if the relationships with customer companies and products strengthen, the relationships with customer products are strengthened from the stage of development. In relation to customer products, interface will of special specification (customized). If the relationship for this customer product is too strong, power relationship is easily generated because of special specification, and the supplying company (supplier side) will be in a weak position. As a result, such a hypothesis is established that customer companies will increase QCD (i.e. Quality, Cost, and Delivery) requests further.

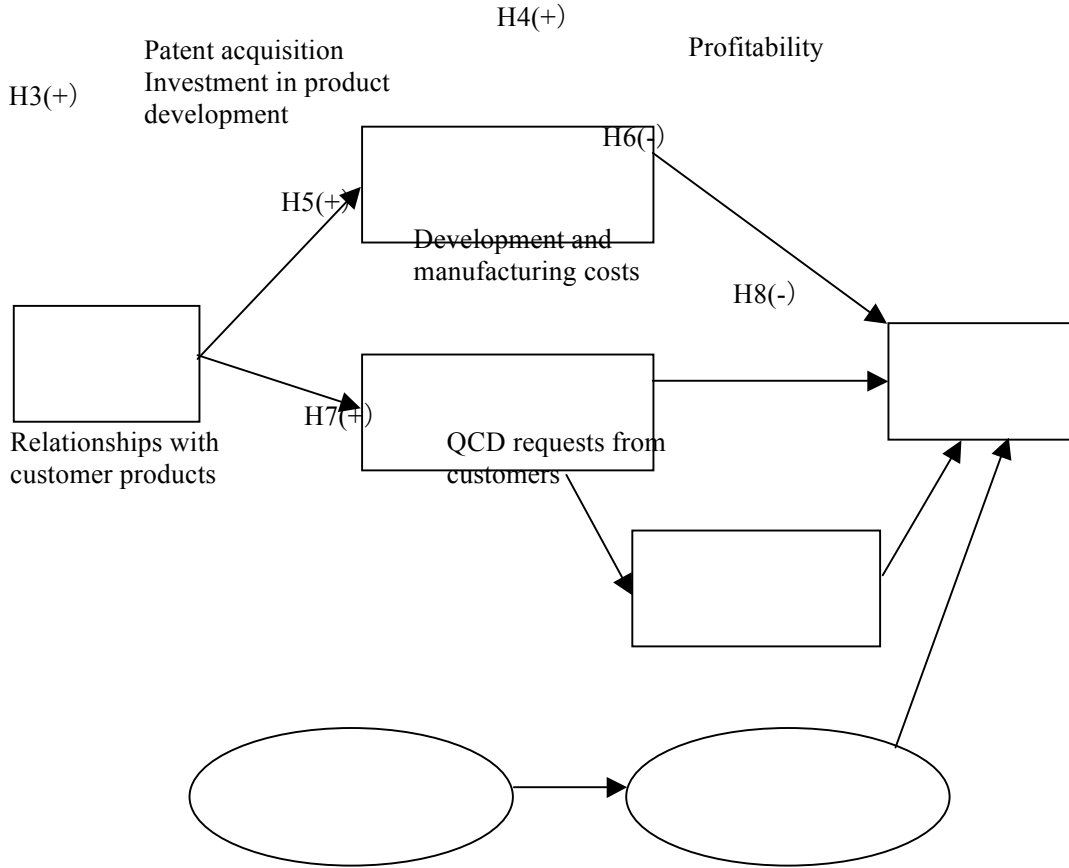
And such a hypothesis is established that if QCD requests are excessive, it is difficult to increase sales prices because of the interdependence on customer companies, resulting in a decrease in profitability.

H7: If the relationships with customer products strengthen, QCD requests from customers will increase.

H8: If QCD requests are excessive, profitability will decrease.

The above hypotheses are summarized in the conceptual model for profitability in perspective, as shown in the next page in Fig. 4-1.

Information exchange



5. Empirical Analysis of Profitability Conceptual Model

5.1 Coverage of the Survey

Among industrial companies in Japan, the survey covers the B2B area and companies that publish financial statements. The survey focuses on planning in content, such as product planning, application & customer development; therefore the president's office and management planning department should be the subject of the survey. Furthermore, department heads and officers above the department manager, those who would be qualified to decide on commercialization of planned products, were asked for a response.

- 1) Coverage of the survey: companies listed on the first section of the Tokyo Stock Exchange
- 2) Type of business: steel, non-ferrous metal, metal products, machinery, electric equipment*, transportation equipment*, precision instrument*¹⁷
- 3) Departments to be surveyed: president's office, management planning department
- 4) Ranks of survey respondents: equivalent to department heads and managers

5.2 Survey Method

The survey was carried out in February 2008 for 1,003 companies and was administrated by a mailed questionnaire, and 76 valid responses were received.¹⁸

Considering that it is difficult to collect a sufficient number of samples, because domestic

¹⁷ As to the type of business, the industrial companies are designated in detail by small classification

¹⁸ Out of the questionnaire responses non- industrial companies and missing values are eliminated to decide valid responses.

competitors in production goods, who are listed on the Tokyo Stock Exchange and are somewhat large in size are very few in number, B2B companies (in a broader sense) were selected for the questionnaire survey.

The questionnaire is consists of the following:

- 1) Corporate attribution: name of company, the department and title of the respondent management information, main product information, etc.
- 2) Characteristics of the basic product design: 20 questions
- 3) Relationships with main products for customer companies and with customer products: 17 questions
- 4) Market competitive environment of main products and requests from customer companies: 12 questions
- 5) Product and customer developments: 9 questions
- 6) Cost structure of main products: 7 questions

5.3 Procedure for Hypothesis Verification

As the measurement scale for this survey, the Likert 5-point scale was employed in the lines of "Power and Conflict in Distribution" (Ishii, 1983).

The 76 valid responses were subjected to a PLS regression analysis (Chin, 2010). The observation variables were first screened by factor analysis before a model was built by using the observation variables relating to the latent variables; "information exchange," "application & customer development," "product differentiation," "cost," "relationship for customer products," and "QCD requests from customers." These latent variables were constituted in accordance with the conceptual model and for each of latent variables a path analysis was conducted. For each latent variable, the R^2 and p-values in the hypotheses were calculated, and fitness to the model and level of significance for the group of hypotheses were measured. The operating profit on sales should incorporate relative evaluation to the industry average, but profit rates of each company have a mix of plus, minus, and zero values, and therefore the interval scale was considered to be better suited by definition than the ratio scale.¹⁹ By applying the 5-point scale to position the industry average at point 3 on the scale, the transformation is carried out so that the operating profit on sales for each of the target companies is expressed by equal scale distance.

6. Results of Hypothesis Verification

6.1 Verification Results of the Profitability Conceptual Model

The profitability conceptual model is shown in the next page in Fig. 6-1. A latent variable is shown in the model in the circle, and each hypothesis is shown as an arrow. The observation variable that corresponds to each question hangs in a latent variable. The latent variables (that a connected by passing) are the independent variables and the profitability conceptual model that explains the relation with profitability acts as a dependent variable. The numbers inside of the circle are the R^2 values and become an index of the goodness-of-fit of the model. To improve the goodness-of-fit of this model, H3' is added.

The path standardization coefficient, t-value, and the statistical index of the significance level in each passing are given in Table.6-1.

¹⁹ For the definition of scale level refer to Bruce Frey (2006), *Statistics Hacks*, O'Reilly (Naoki Nishizawa (Translation) "Basic Statistics and Technique to Measure the World," O'Reilly Japan), pp. 23-26. The ratio scale is equivalent to the absolute temperature system with the original point being 0 and no negative values. Meanwhile, the interval scale is like a Celsius thermometer with negative value.

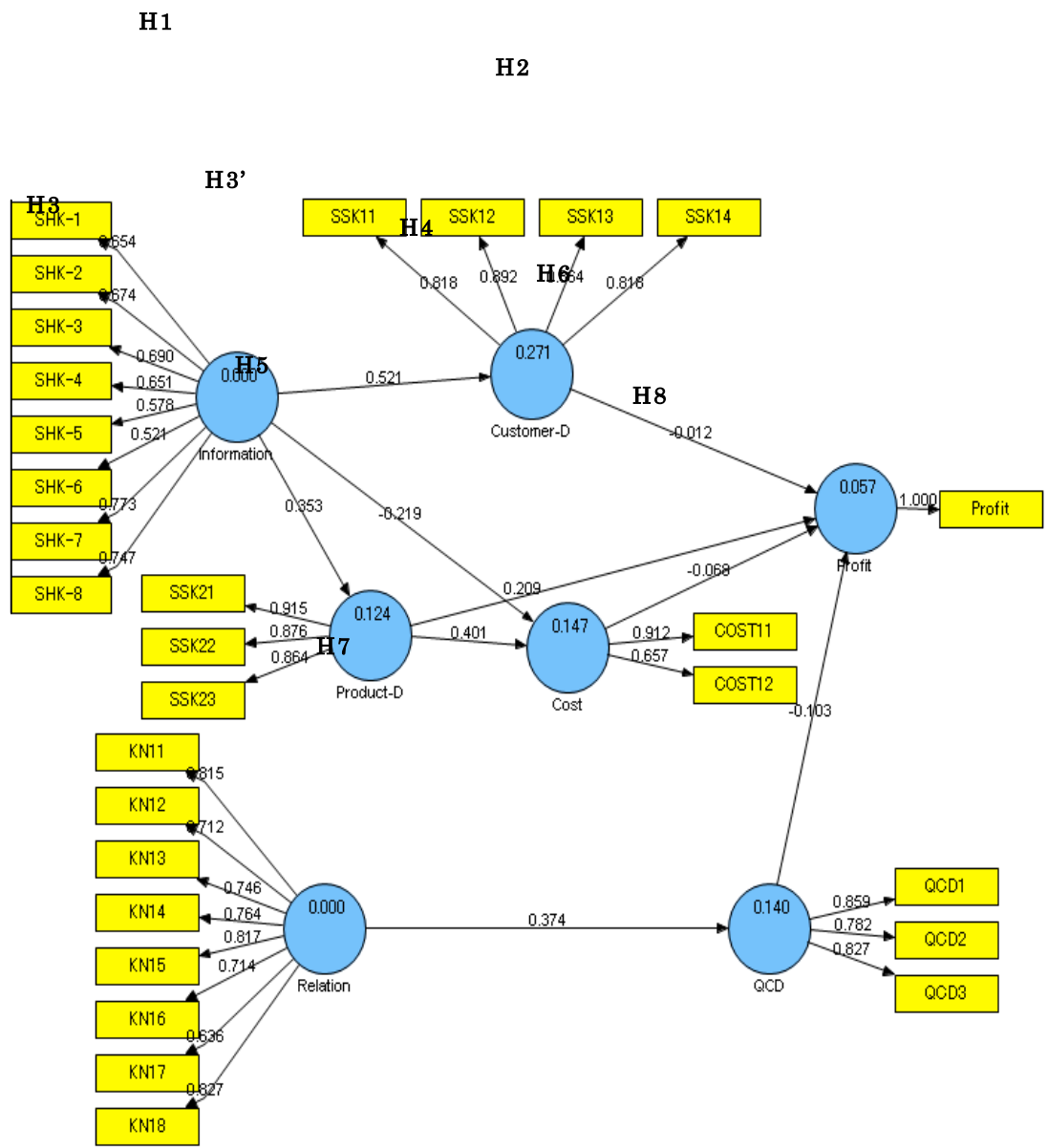


Table. 6-1: Results of hypothesis verification result

Hypothesis	Path	Standardized Coefficients	T-value
H1	Information -> Customer-D	0.521	7.058**
H2	Customer-D -> Profit	-0.012	0.240
H3	Information -> Product-D	0.353	3.290**
H3'	Information -> Cost	-0.219	1.555
H4	Product-D -> Profit	0.209	2.223*
H5	Product-D -> Cost	0.401	2.426*
H6	Cost -> Profit	-0.068	0.820
H7	Relation -> QCD	0.374	6.344**
H8	QCD -> Profit	-0.103	1.167

Significance levels: *p<5%,**p<1%

6.2 Conclusion

We find that the activation of in-house information exchange leads to investment in product development, and in application & customer development. A causal relation is confirmed between aggressive investment in product development and patent acquisition (i.e., creation of differentiated products), and profitability. In the meantime, aggressive investment in product development and patent acquisition (i.e., creation of differentiated products) increases the development and manufacturing costs. From these results, it can be said that differentiated products in expansion strategy have positive impact on firm profitability supported by statistics and the case study company T&S.

The other, it is noted that the increase in these costs tends to have negative impact on the profitability. The implementation of application & customer development also tends to have negative impact on the profitability. If the relationships with customer products are stronger, a company is strongly influenced by transactions, resulting in stronger QCD requests from customers tends to have negative impact on firm profitability. These tendencies are not supported by statistics, however the dependence of transaction in the case of company P was observed on the representative of lower profit group (2nd Quadrant). Therefore, I consider that the excessive QCD requests from customer tends to decrease firm profitability.

7. Implications

7.1 Theoretical Implications

The theoretical implications of this study are broadly classified into three points. First, deriving a hypothesis based on information exchange, product differentiation was incorporated into an interaction model to explain the integrated determinants for profitability that were verified through a quantitative approach. Second, it was proved that activate in-house information exchange led to investment in product development, and in application & customer development, while aggressive creation of product differentiation increased profitability. Finally, it was noted that if the relationships with customer products were stronger, dependence on transactions with customer increased, and subsequently excessive QCD requests from customers tends to decrease firm profitability.

7.2 Practical Implications

The practical implications of this study are broadly classified into three points. First, it was clarified that a causal relation exists between active in-house information exchange to promote investment in product development and patent acquisition, and increasing firm profitability. When investing in product development, an increase in the development and manufacturing costs tends to have a negative impact on firm profitability, and therefore, it becomes important to restrain the costs from increasing. Second, companies should increase their effort into their main products from the general aspects and restrain their adaptive aspects in order to improve profitability. Accordingly, as an indicator of successful product conceptual design, it is necessary to promote a product differentiation, while it is also important to suppress the relationships with customer products by standardizing interface to customer products as much as possible.

Finally, from the results of the interviews, there is a possibility that services relating to product sales will increase firm profitability further.

8. Limitation and Future Investigation

The document review and interviews were carried out to establishing the hypothesis group to explain the industrial firm's profitability. The hypotheses were verified by a statistical method. As a limit of the quantitative approach, the statistical evaluation was basis of the financial section data and not financial time series data. This does not evaluate financial lagged response. The hypotheses are not considered other organizational factors. Therefore, the conclusions of this paper are limited and need to further investigation. Moreover, the effect of statutory regulation like in the case with company O located in the third quadrant is not considered. That such a specific environment is a limitation of this investigation. Finally, in the interviews, it emerged that product services have improved profitability in the long term. This would be investigated in more detail as a research topic for the doctor's course.

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