

A Study on Business Growth Factor to Create Innovation Process of Companies (Case Study in Refrigerated Truck Company)

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Abstract.

Previous studies into the elements that influence the growth factors of SME show that creating new values by innovation is a key to sustainable business progress, and also that there are constant demands for creating innovation in the society. In response to such demands, there have been various models developed on creating innovation. Many have pointed out the importance of grasping the innovation not as a solution for a single problem but for the whole process of engineering development - as a system which integrates the product manufacturing, engineering and business application. Furthermore, such innovation is increasingly considered significant in the studies on the elements influencing the factors that lead to constant progress of business of, not only SME, but also companies in general. In this study, we took an example of a Japanese manufacturer which achieved the position of a niche top and has been successful in continually growing in business to investigate on and analyze the following two subjects; "the elements influencing the growth factor of an enterprise" and "the transition of the growth factors in accordance with each product lifecycle". The result hereby shows the different elements that can create a value affecting the business growth factors in the respective stages of product lifecycle, such as Introduction, Growth and Maturity.

Keywords: Product Life Cycle, Niche, Innovation, Manufacturer

1. Introduction

One of the issues about innovation is how to create innovation and convey to the world the importance of the creating innovation [1]. Previous studies into the elements that influence the growth factors of SME show that creating new values by innovation is a key to sustainable business progress, and also that there are constant demands for creating innovation in the society. In response to such demands, there have been various models developed on creating innovation [2] – [5]. Many have pointed out the importance of grasping the innovation not as a solution for a single problem but for the whole process [6] of engineering development - as a system which integrates the product manufacturing, engineering and business application [7] & [8].

Furthermore, such innovation is increasingly considered significant in the studies on the elements influencing the factors that lead to constant progress of business of, not only SME, but also companies in general.

In this study, we took a case study of a Japanese manufacturer which achieved the position of a niche [9] – [11] top and has been successful in continually growing in business to investigate on and analyze the following two subjects; "the elements influencing the growth factor of an enterprise" and "the transition of the growth factors in accordance with each product lifecycle"[12]. The result hereby shows the different elements that can create a value affecting the business growth factors in the respective stages of product lifecycle, such as Introduction, Growth and Maturity. By making an analysis on different stages of business growth as well as the transition of products, amount of sales, and the number of employees of a sample company, we tried to draw a certain

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conclusion on what elements affect the company's business growth factors and on how such factors may change in each stage of the product lifecycle.

Our aim in this study is to clarify the elements that can affect the business growth factor, so that we could create innovation by appropriately manipulating such elements. Actually, innovation occurs in the process of trying to solve problems of an individual or a company, thus as a result could create a new market and address to an expanded demand. Innovation can lead to a social system reform in this context. From this point of view, the cycle of an innovation process can be divided into the following three phases; generating a value, transmitting the value, and creating the way to materialize the value leading to the society's reform. Among these three, we focused on the first phase of "generating the value" with a view to defining the elements that influence a company's growth and showing the actual contents of such elements as a framework. On the other hand, when we look at business growth, we need to consider the product life cycle, which consists of the phases of introduction, growth, maturity and decline.

We studied the innovation's process chain in correspondence with each phase of product lifecycle, focusing on the elements that affect the business growth factors as well as the transition of such factors according to the phases of product lifecycle. The aim of this investigation and discussion is to draw a certain conclusion on what major elements there are to affect the consistent progress of a company, which could also change along with the process of innovation. A Japanese manufacturer so called Y,

which achieved the niche top, as a case study to analyze the elements of innovation process using a framework. The product life cycle and the number of sales and employees in Company Y is shown in Figure 1. The points of change in the product life cycle were determined based on Figure 2 shown next. Figure 2 shows the three-year average of sales and the percentage change in the three-year average of sales. The 13 years after establishment, when the three-year average rate of change in sales suddenly turned positive, was defined as the change point between the introduction and growth period. The change point between the growth period and the maturity period was set at 43 years after establishment, when the three-year average rate of change in sales was almost zero. Thus, in this study, the product life cycle was divided into three periods: introduction (0-13), growth (14-43), and maturity (44-).

Incidentally, there were a few exceptions in the maturity stage from 44 years after establishment to present, which we still treat as being in the same process. One was in 46 years after establishment when there was a rapid increase in sales and decrease in employment due to the nationwide recession. The other was in 51 years after establishment when there were sharp increases in both sales and employment as a result of the business expansion by M&A. Also, among the three phases of innovation process such as generating the value, transmitting the value and then materializing the value leading to society reform, we discuss the first one here. As for the other two, we will report in the following issues.

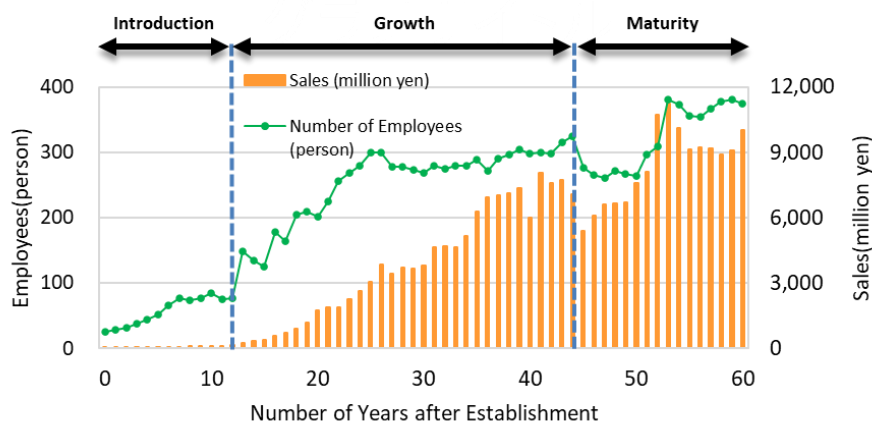


Fig 1. The product life cycle, sales, and number of employees at Company Y

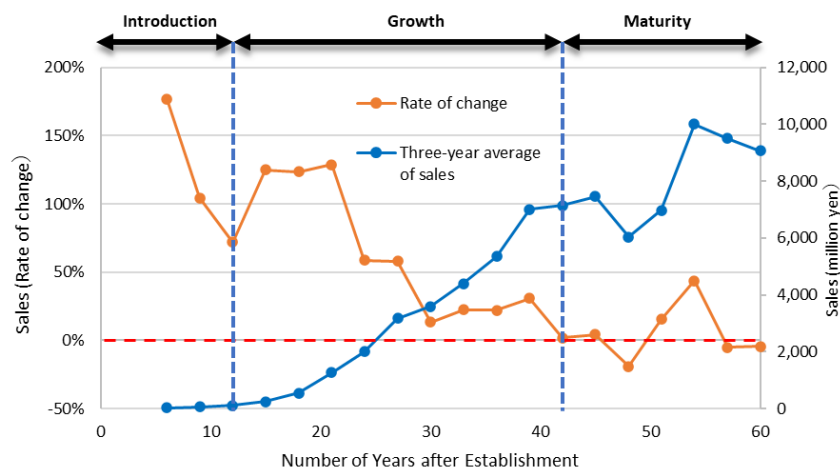


Fig 2. The product life cycle and the three-year average of sales and the percentage change in the three-year average of sales

2. Methods

We considered the possibilities of developing a product and generating a market by controlling the elements of an innovation process, regarding the business growth stages as the product's life cycle.

From this point of view, we presumed that a successful niche top company would be consistently controlling the life cycle of the chief product that is affecting the growth factor by

appropriately manipulating the relevant elements of the innovation process. We applied the innovation process chain, which is from generating the market by addressing to the problems of a client, expanding it leading to the society reform, to the chief product's life cycle. Then tried to clarify the elements of the consistent growth and the transition of relevant factors by different processes of innovation. The flowchart of the study is shown in Figure 3.

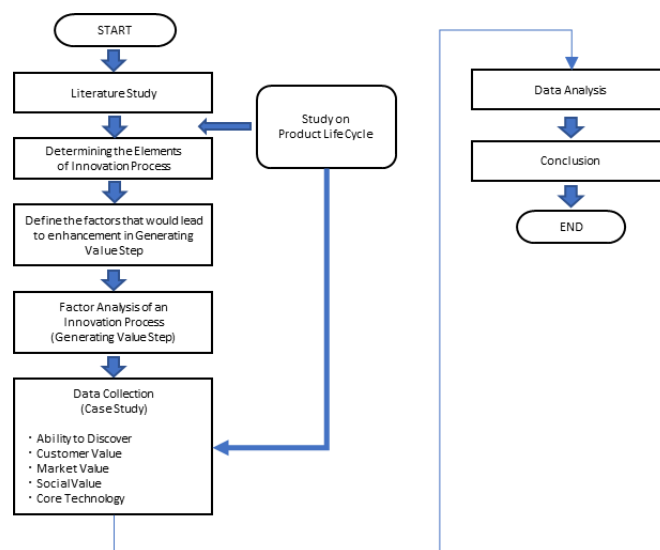


Fig 3. Research Flowchart

The Company Y we took as an example for analysis here excels in manufacturing of vehicles with built-in freezing machine, which it developed in 1922 for the first time in Japan, and achieved the position as a niche top in the country. It dominates the market share of the large-size refrigerated truck in Japan (500

among 1500 cars sold in Japan in 2013 were manufactured by Y). Its total sales amount in 2018 was 12.9 billion yen with 536 staff employed.

2.1 The Analysis of the Elements of Innovation Process

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We used the framework shown in the Chart 1 to analyze the elements required in each phase of the innovation process. Then we tried to find the actual content of such elements to define the ones that actually affect the result. In the analysis, the process of “generating the value” in the framework for each respective product lifecycle, we try to define the factors that would lead to enhancement of (1) ability to foresee and

discover, (2) customer value, (3) market value, (4) social value, and (5) core technologies. Then we clarified the significant elements by defining the ones that correspond with each factor. We conducted individual research interviews on the representative and officers of the company to gather the detailed information on how they achieved each element.

Table 1. The Framework of Factor Analysis of an Innovation Process

	Innovation Process Chain		Innovation Process Framework	The Way to Discover	Results (elements)
1	Generating the value	(1)	The ability to foresee and discover	<ul style="list-style-type: none"> • Serendipitous encounter • Notice the sign of social system • Consider of product life cycle • Think about what customers are having trouble with deeply 	<ul style="list-style-type: none"> • The customer needs (Potential or Revealed) • Premonition of development • Improvement • Concept planning
		(2)	Customer value	• Think about how to solve what customers are having trouble	<ul style="list-style-type: none"> • Create products important to customers • Achieve the concept
		(3)	Market value	• Think about how many people will be pleased by solving customer problems	• Create products important to markets
		(4)	Social value	• Think about how society changes when many people are pleased	• Create products important to society
		(5)	Core technologies	• Think about what will be the core technology and organizational form to create values (to delight customers)	• Core technology becomes clear
2	Transmitting the value				
3	Materializing the value to lead to society reform				

2. Transmitting the value,
3. Materializing the value to lead to society reform,
we will report in the following issues.

2.1.1 In the Introduction phase of a product life cycle: the process of “generating the value”

In the case of Company Y, the introduction period is from 0 to 13 after establishment. Y developed the first refrigerated truck produced in Japan during the introduction period. One of the reasons for the success of this development is related to the needs of the US military. During the war, the US military was looking for a supplier to carry fresh foods such as meat and ice cream from Kanto to Kyushu. Many trucking companies located in the Kanto area declined US military requests. Only company K in Kyushu responded to the request of the US military. Company F anticipated the development of a business that transports fresh food. Company F requested Y to develop a

refrigerated truck to transport fresh food. Company Y has developed Japan's first refrigerated truck to meet the needs of Company F. The second factor behind the success of this development is the problems of fishermen and farmers in Kyushu. At that time, fishermen and farmers in Kyushu did not have the means to ship fresh foods to fresh markets in Tokyo and Osaka. For this reason, the produced fresh food could only be shipped or sold to a limited market inside Kyushu. They were in a situation where they could only get a small profit. Company F focused on distributing fresh food produced by fishermen and farmers to large markets in Tokyo and Osaka using a refrigerated truck.

1. Factor 1. Ability to foresee and discover.

Find signs of social change. Think thoroughly about the issues and negatives that

are important to customers. During the war, American military personnel stationed in Kyushu cannot live the same diet as the United States. Kyushu fishermen and farmers cannot transport fresh food to mass consumption areas in the Kanto and Kansai areas. Therefore, only a limited market in Kyushu can be obtained, and the scale of business cannot be expanded.

2. Factor 2. Customer value.

Think about how you can solve problems and negatives that are important to your customers. The development of a large refrigerated truck will allow large quantities of frozen and fresh foods to be transported to distant markets. American military personnel stationed in Japan during the war can have the same diet as the United States. Fresh food products produced by Kyushu fishermen and farmers can be distributed to large markets in Tokyo and Osaka.

3. Factor 3. Market value.

Resolve issues and negatives that are important to customers and think that more people will be pleased. Creation of the refrigerated truck transport market and the accompanying refrigerated truck market. As a result, Company F and Company Y can start new businesses.

4. Factor 4. Social value.

Think about what you can do to please more people. Furthermore, we will consider what we can do to change society in a better direction. The “business of transporting fresh food by refrigerated truck”, which did not exist in the world, can create a large supply chain that includes producers, consumers and truckers.

5. Factor 5. Core technologies.

What are the core technologies and core organizations to achieve business success?

Y company's technology (engineers involved in designing, manufacturing and manufacturing commercial special vehicles) necessary to develop a refrigerated truck that did not exist in Japan.

2.1.2 In the Growth phase of a product life cycle, the process of “generating the value”

In the case of Company Y, the growth period is from 14 to 43 after establishment. Company Y foresaw the following two needs during the growth period. The first is the customer's need to distribute fresh food. The second is the need for cold chain network

development due to the spread of frozen foods. The growth period was examined from the perspective of two needs, the need for increased distribution and the need for increased production.

a. Growth period: (1) Needs for expanding distribution volume.

Naturally, in order to increase the distribution of fresh food, it is necessary to increase the production of fresh food. F Transportation paid attention to the fact that beans that are produced by bean farmers in Kagoshima are quickly damaged. Beans can only be provided to consumption areas close to bean farmers because they are quickly damaged. As a result, the production volume was limited, which was a big problem for bean farmers and negative. If you can develop a truck transportation method that maintains the freshness even for long-time transportation, you can solve the problems and disadvantages of bean farmers. For this reason, Company F focused on truck transportation using a refrigerated truck. By using refrigerated truck transportation, bean farmers can provide high-quality beans to the mass consumption market in Kanto and Kansai. If that happens, the bean farmers will be able to sell a large amount of beans, which will solve their problems and negatives. Company F focused on the difficulties and negatives of bean farmers.

1. Factor 1. Ability to foresee and discover.

Find signs of social change. Think thoroughly about the issues and negatives that are important to customers. Company F learned about the troubles and disadvantages of a Kagoshima bean farmer who was a user of trucking. Since the beans produced by the bean farmers are damaged quickly, they can only be provided to the consumption areas near the bean farmers. This was the reason why the production of beans was limited. Company F discovered the troubles and negatives of bean farmers and foresaw the development of the truck transportation business using refrigerated truck transportation.

2. Factor 2. Customer value.

Think about how you can solve problems and negatives that are important to your customers. If a trucking method that maintains freshness for a long period of time can be developed, it is possible to solve important customer problems and problems. Refrigerated

truck transportation will make it possible to provide beans with high freshness to the mass consumption market in Kanto and Kansai. Bean farmers can increase the production of beans.

3. Factor 3. Market value.

Resolve issues and negatives that are important to customers and think that more people will be pleased. The bean farmers in Kagoshima decided to decide the planting area of the beans according to the refrigerated truck transportation capacity (transportable amount) of Company F using Y company refrigerated truck. Company F-logistic and Company Y have created a new business model that is completely different from the traditional local production for local consumption model. Company F and Company Y have created a new market for fresh food transportation.

4. Factor 4. Social value.

Think about what you can do to please more people. Furthermore, we will consider what we can do to change society in a better direction. For agricultural products other than beans, it has become possible to expand production and distribution using refrigerated truck transportation. Refrigerated truck transportation has helped increase the consumption and production of fresh foods, resulting in increased income for fishermen and farmers.

5. Factor 5. Core technologies.

What are the core technologies and organizations to achieve business success? Design and manufacturing technology for refrigerated trucks suitable for the transport temperature conditions of goods that customers want to refrigerated trucks.

b. Growth period: (2) Needs for cold chain network development due to the spread of frozen foods

The development and development of a cold chain network from producers to consumers is indispensable for the spread of frozen foods to consumers and the expansion of consumption. Therefore, producers can expand supply as an organization, consumers can reduce the time required for housework, the spread of household refrigerators that keep the freshness of fresh food in the home, and refrigerated transport vehicles to connect them, He focused on the need for business growth for each refrigerated transport company.

1. Factor 1. Ability to foresee and discover.

Find signs of social change. Think thoroughly about the issues and negatives that are important to customers. Company Y has discovered consumer needs for a more affluent diet and calls for the enhancement of the cold chain network from agricultural cooperatives (JA) in Kyushu and Miyazaki and local farmers in prefectures and other local governments.

2. Factor 2. Customer value.

Think about how you can solve problems and negatives that are important to your customers. Company Y considered the next business by taking advantage of the precedent that it solved the problems and negatives of bean farmers and created customer value. If the introduction of refrigerated truck transportation, which is requested by local farmers in Kyushu and Miyazaki, such as agricultural cooperatives (JA) and prefectures, it is possible to improve the cold chain network. Fresh food and agricultural products can now be transported from Kyushu to the Tokyo metropolitan area using a large refrigerated truck. It became a means of earning cash income for farmers in the Kyushu region. Farmers' cash income has increased.

3. Factor 3. Market value.

Resolve issues and negatives that are important to customers, and think that more people will be pleased. Agricultural products can be transported from Kyushu to the Tokyo metropolitan area using a large refrigerated truck, which has become a means of earning cash income for farmers in the Kyushu region and has created a business market related to the cold chain network.

4. Factor 4. Social value.

Think about what you can do to please more people. Furthermore, we will consider what we can do to change society in a better direction. It became a means of earning cash income for local farmers in Kyushu and became a foothold for transforming local agriculture in a better direction. Created social value creation that would transform the fresh food production market (which is much larger than the refrigerated truck market and the refrigerated truck transport market).

5. Factor 5. Core technologies.

The question is what the core technologies and organizations to achieve business success are. Design and manufacturing technology of refrigerated truck in line with various market needs (large size, high temperature control

quality). Improve production technology and expand production capacity to increase production of refrigerated trucks.

2.1.3 In the Maturity phase of the product's life cycle, : the process of "generating the value"

In the case of Company Y, the maturity period is 43 years after establishment to the present. When the adoption of Electric Refrigerator was completed and the construction of the domestic cold chain network was completed, the refrigerated truck market entered a mature period. In its mature period, Company Y gained a high market share in the refrigerated truck market due to its advanced technology. And keep it up. The needs and specifications of refrigerated trucks required by customers for company Y are becoming increasingly sophisticated. Company Y can individually respond to customer needs and specifications. This strengthens Y's position as the top runner in the refrigerated truck market.

In order to grow the business in the mature period, it is most important to maintain and improve the QCD (Quality, Cost, Delivery) of the product at a high level. Customers have asked Y to make technological innovations such as "does not break down", "can carry in large quantities", and "energy saving" in order to minimize the cost of transporting fresh food. Company Y needs to develop its own unique technology, and as a result of its efforts, "Establishment of sandwich panel technology using aluminum plate and resin bonding", "FRP and aluminum hybrid panel through M & A" Has been successfully commercialized. This achieves "light weight", "high impact resistance", and "high thermal insulation", and contributes greatly to the weight reduction and energy saving improvement of the refrigerated truck.

1. Factor 1. Ability to foresee and discover.

Find signs of social change. Think thoroughly about the issues and negatives that are important to customers. Globally expanding needs for environmental performance. Needs to improve energy saving performance and product durability by reducing weight and heat insulation. Needs for advanced temperature management conditions due to diversification of packages to be transported. Need for high quality and low cost transportation. In order to solve the crew shortage, "It is necessary to build a refrigerated truck that the crew wants to ride. Individual

design needs for that. Company Y has discovered the needs of these customers.

2. Factor 2. Customer value.

Think about how you can solve problems and negatives that are important to your customers. It is necessary to develop a refrigerated truck that realizes high-quality refrigerated transportation at a low price. For that purpose, it is necessary to achieve "no failure", "can be transported in large quantities", and "reduction of transportation cost by energy saving". In addition, in order to develop a refrigerated truck with excellent design that the crew prefers to ride, and a refrigerated truck that achieves ease of handling that the crew wants to ride, a uniform design is required. It is important to establish production technology.

3. Factor 3. Market value.

Resolve issues and negatives that are important to customers, and think that more people will be pleased. Create a refrigerated truck transportation market for low-priced fresh food. Create a refrigerated truck transportation market that maintains high freshness and transports long distances.

4. Factor 4. Social value.

Think about what you can do to please more people. Furthermore, we will consider what we can do to change society in a better direction. Realizes low-cost transportation with refrigerated trucks. Realizes energy-saving transportation. Realizes highly safe transportation. By providing vehicles that crews like and want to ride, they are responding to crew shortages.

5. Factor 5. Core technologies

What are the core technologies and organizations to achieve business success? Sandwich panel technology (low cost, energy saving, high durability, light weight) Temperature management technology. Customized design and high-efficiency production technology (to enable individual production) to meet the customer's individual needs (varies depending on the transport luggage and crew)

3. Discussion

a. Introduction period

Company Y has succeeded in developing Japan's first refrigerated truck during the introduction period. The reason for the success was that Company F, a customer of Company Y,

commissioned Company Y to develop a refrigerated truck to meet the needs of the US military. Company Y has the chance to succeed by the ability to foresee and discover. In addition, Company Y has succeeded in creating a high-potential product called Refrigerated truck for the first time in Japan by applying its core technologies to the opportunities that it has acquired. In addition, Company Y is a Kyushu farmer / fisherman who maintains only a limited market nearby because they do not have the means to keep fresh food fresh and ship it to the Tokyo and Osaka markets. Using the ability to foresee and discover, I quickly noticed the trouble that I couldn't ship or sell and get a small profit. Using awareness, we developed and supplied a refrigerated truck suitable for customer needs. As a result, Company Y has succeeded in creating a refrigerated truck market. Company F, a customer of Company Y, has also succeeded in creating a fresh food transport market. From this, it can be seen that in the introduction period, he needs to foresee and discover. Company Y established its innovation concept by applying its core technology to the seeds of customers obtained using its ability to foresee and discover. This proves to be a very important factor as a growth factor for companies.

b. Growth period

Company F has succeeded in expanding the market for refrigerated truck transportation by discovering the fresh food transportation needs of bean farmers in Kagoshima. By supplying Refrigerated truck to Company F, Y provides "Customer value" for bean farmers and creates "Market value" for the fresh food transportation market. It can be seen that "Ability to discover" is important to achieve market expansion by creating new markets.

In a society where Electric Refrigerator has spread to households, there has been a strong demand from consumers for the enhancement of the cold chain network. Company Y succeeded in creating Customer value by solving the problems of bean farmers. This customer value

creation movement has become a larger scale movement to create "Market value" and "Social value" involving agricultural cooperatives (JA) and local governments. Customers can transport agricultural products from Kyushu to the Tokyo metropolitan area using a large refrigerated truck, which has become a means of earning cash income for farmers in the Kyushu region. This led to a movement to change society. In order to achieve market expansion by creating a new market, this example also shows that "Ability to discoverer was important. In order to verify the situation of "customer needs to improve the cold chain network" (Social value), Figure 4 was created. Figure 4 represents The Correlation Among the Company Y's Sales Amount, Penetration Rate of Electric Refrigerator [12], and the Amount of Frozen Food Production (Gross Total)[13]. As can be seen from Figure 4, "Penetration Rate of Electric Refrigerator", "The Company's Sales Amount", and "The Amount of Frozen Food Production (Gross Total)" are rising rapidly in order. As a result, Y's refrigerated truck contributed to the enhancement of the cold chain network, and as a result, the rapid spread of the cold chain network occurred, and as a result, Y's sales increased rapidly. Because Y had an Ability of foresee, I was able to notice the "signs of social change" that the Penetration Rate of Electric Refrigerator rose rapidly. Because Y had Ability of discover, we were able to discover the growth and development of frozen foods and the enhancement of the cold chain network (they had the influence to greatly change the dietary habits of the home). . During the introduction period, Y succeeded in gaining a market by using Ability of foresee and growing the market greatly. It can be seen that Y's ability to adapt the innovation concept to the market contributes to Y's rapid growth. From this, it can be seen that, in the Growth period, adapting the ability of discover and the innovation concept to the market as factors of corporate growth are very important factors.

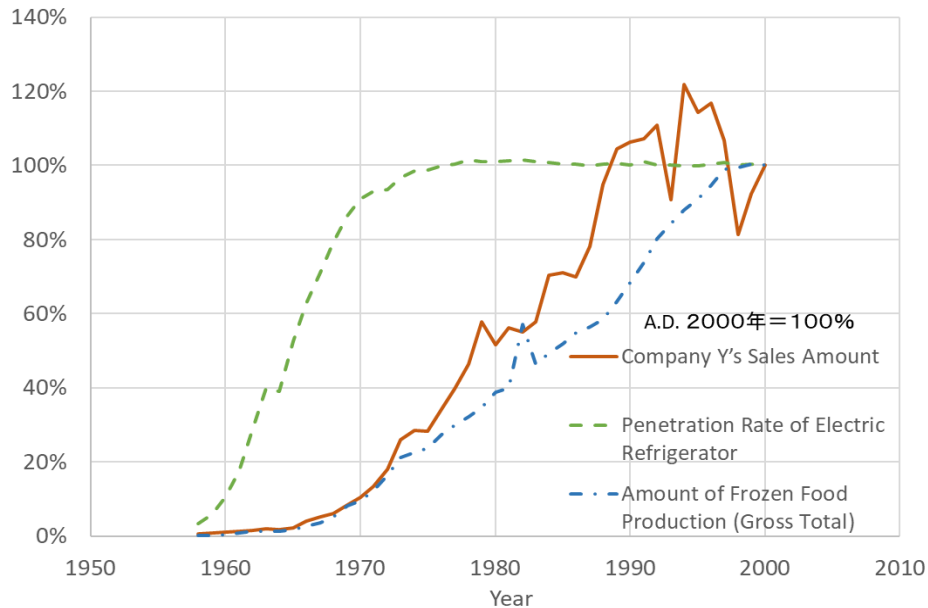


Fig 4. The Correlation Among the Company Y's Sales Amount, Penetration Rate of Electric Refrigerator, and the Amount of Frozen Food Production (Gross Total)

c. Mature period

The growing market for small electric refrigerators has grown rapidly. Once the Electric Refrigerator market has grown sufficiently, the next step will be from the stage of "requires a refrigerated truck" to the stage of "need to meet various demands for refrigerated trucks per customer". Customer value changes to various things. It is important to respond to various customer values, including services as well as Q (quality), C (cost), and D (delivery time). Dealing with "Customer value" that wants to carry cheaper is important. It is important to respond to the "Social value" of the low-priced fresh food transportation market and high freshness and long-distance transportation needs. In the Maturity phase of the product's life cycle, the factors such as being responsive to maintain and improve "customer value", "market value" and "social value" are important. At the same time, as the market diversifies in this phase, it requires a constant effort of upgrading the innovation concept and refining the core technology to respond to the change. There are many growth factors, and it is not easy to respond appropriately.

4. Conclusions

In this study, we took an example of a Japanese manufacturer which has achieved the niche top position through striving to

consistently progress in order to analyze and defined the elements that affect the company's growth factor during its innovation process, as well as the transition of such factors in different phases of product life cycle.

The result hereby successfully indicates the elements that would potentially influence the growth of a business when it is in the stage of generating a value. We could also show that there are different elements required in each transitional phase of product life cycle such as Introduction, Growth and Maturity.

- a. In the Introduction phase of a product life cycle, the most crucial element which will affect the business progress is the ability to foresee and discover. It is the ability to detect the seeds that would grow most efficiently with the company's core technology. Having a clear vision of matching the potential needs and the company's unique strength will be a key to innovation.
- b. In the phase of Growth, the elements needed for business progress are "ability to discover" and the enhancement of "customer value" "market value" and "social value". By the ability to discover, the market will expand, while the enhancement of the product's customer value, market value and social value will increase the demand. In the concerted

- development, the scope of the product's value will expand, consequently leading to the company's growth.
- c. In the Maturity phase of the product's life cycle, the factors such as being responsive to maintain and improve "customer value", "market value" and "social value" are important. At the same time, as the market diversifies in this phase, it requires a constant effort of upgrading the innovation concept and refining the core technology to respond to the change. When the customers' values grow into a greater variety, the company needs to take control of the balance among quality, cost and delivery. It apparently takes more strain to keep satisfying customer value and maintain upgrowth in this phase than to grow rapidly in the company phases of Foundation and Growth.

We will continue to report on the factors and the contents that will affect business growth in the later stages of "transmitting the value" and "creating a way to materialize the value leading to the society reform" in the following issues. As one of the findings of this study, we realize that further research is needed to assess the elements and make a quantitative evaluation of their effect on the overall innovation process.

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