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**Working Paper**

## Innovation by Defining Failures under Environmental and Competitive Pressures: A Case Study of the Laundry Detergent Market in Japan

Copenhagen Discussion Papers, No. 2011-37

**Provided in Cooperation with:**

Asia Research Community (ARC), Copenhagen Business School (CBS)

*Suggested Citation:* Fujiwara, Masatoshi (2011) : Innovation by Defining Failures under Environmental and Competitive Pressures: A Case Study of the Laundry Detergent Market in Japan, Copenhagen Discussion Papers, No. 2011-37, Copenhagen Business School (CBS), Asia Research Centre (ARC), Frederiksberg, <https://hdl.handle.net/10398/8440>

This Version is available at:

<https://hdl.handle.net/10419/208636>

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**37** 2011 April

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# Innovation by Defining Failures under Environmental and Competitive Pressures: A Case Study of the Laundry Detergent Market in Japan

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## Abstract

This paper aims to describe how a commercially successful innovation occurs with the altering of the existing competitive structure in a market under environmental and competitive pressures. I study the history of the laundry detergent market in Japan and elucidate the manner in which Kao accomplished an innovation and increased their market share during the late 1980s. Kao introduced their new detergent *Attack* through a biotechnological innovation and dramatically changed the competitive structure to their advantage. The innovations introduced were of two kinds 1) fermentation engineering technologies to improve the cleaning performance of detergents by using alkaline cellulase, and 2) concentration of detergents to four times their earlier strength through changes in their powder processing technologies. This historical innovation that occurred in the laundry detergent market in Japan has a contemporary implication because combining firms' activities and environmental sustainability has been one of the most crucial topics over recent years.

**Keywords** *Innovation, laundry detergent market, Japan, competitive strategy, environmental pressures*

## **1. The laundry detergent market in Japan**

### ***Introduction***

Innovation is a critical driver for industrial development and economic growth. It contributes to the development of countries' industries and economies and drastically changes societies and the competitive structures of product markets. From the perspective of enterprises, it is rather important to identify how an innovation occurs and the manner in which it alters a market structure. At the same time, global warming and other environmental issues are making every firm conscious of their social responsibilities and it has become rather important for firms to become environmentally conscious. However, business and environmental consciousness sometimes become incompatible, and there are certain firms that consider consciousness regarding the global environment as a type of mandatory cost. This implies that there is ample scope to study how certain firms possess a combination of business and environmental consciousness.

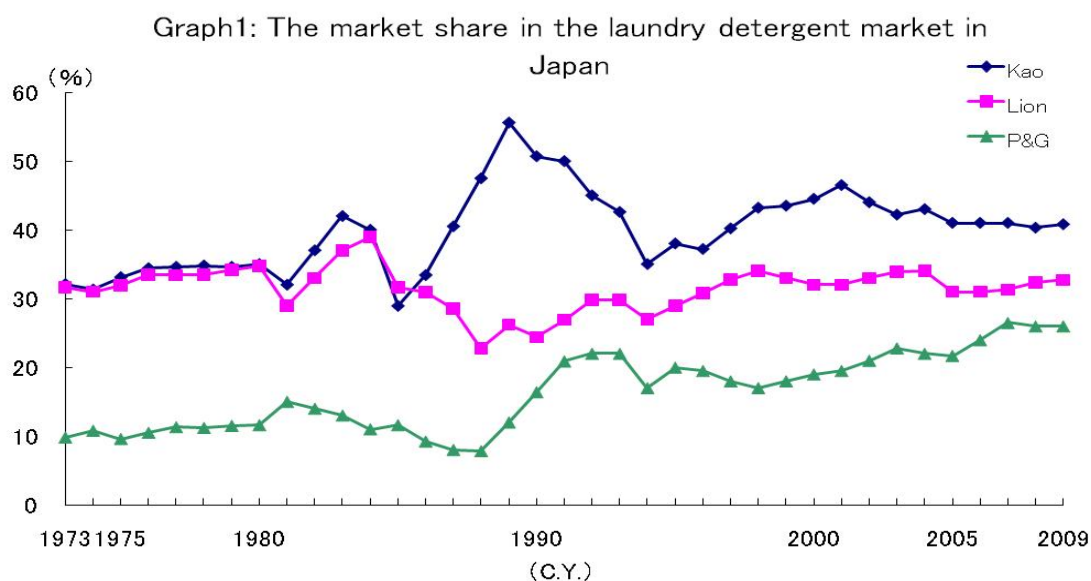
This paper examines how a firm accomplishes an innovation under environmental and competitive pressures. In order to determine this process, we study the laundry detergent market in Japan especially in the 1980s as a case. The following are the three reasons for selecting this market in the 1980s: Firstly, the market experienced a considerable change in terms of market share owing to a biotechnological innovation by Kao. This is the reason for especially investigating Kao's activities in this paper despite the existence of another leading laundry detergent company known as Lion. Secondly, this industry is closely associated with environmental issues because usually, consumers simply use detergents with water and drain the mixture. Finally, there was a huge controversy regarding the influence of detergent on the environment during the 1970s and 1980s in Japan. Therefore, it is more useful to investigate the firms' behaviours during that period rather than during the recent period. There is a significant general observation regarding the linkage between environmental pressures and innovations in the worldwide laundry detergent market (Johnson and Marcus 1996) but it does not refer to the roles of

enterprises in depth. Therefore, this paper provides a detailed account of the events at both the industry and firm levels in Japan.

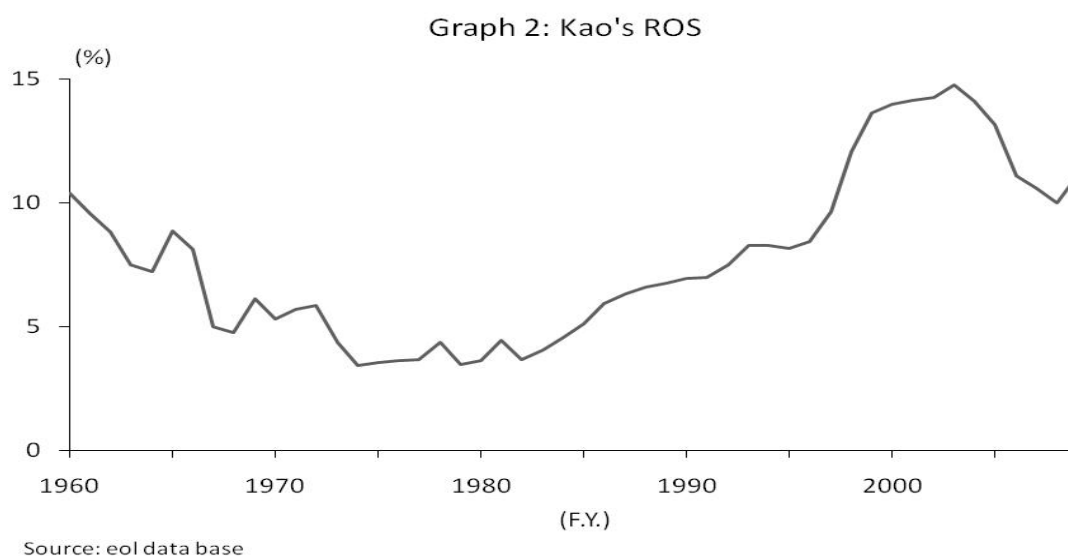
### ***Kao and the laundry detergent market in Japan***

The following were the two key characteristics of the laundry detergent market in Japan during the 1980s: First, a majority of the detergent products were available in powdered form and the proportion of liquid detergents was negligible; this has changed over recent years. Second, the market was oligopolistic; this has thus far remained unchanged. Kao and Lion are the two leading domestic laundry detergent companies in Japan.

Graph 1 indicates the market shares of different detergent brands in Japan since 1973. First, this graph indicates that the domestic market is an oligopolistic one dominated by the following three major companies: Kao, Lion and Procter and Gamble (P&G). Second, it indicates that Kao's market share in Japan dramatically soared to over 40 percent in 1988 and to 50 percent in 1989. This is because Kao launched their new brand of detergent called *Attack* in 1987. Since *Attack* is an innovative product, Kao has successfully managed to sustain their competitive advantage. *Attack* not only contributed to increasing Kao's market share but also played a role in de-maturing the industry. It was commonly believed that the laundry detergent market was rather well established and there was no further scope to de-mature the market. However, Kao's *Attack* stimulated consumer behaviour and fostered the growth of the mature market once again.



In Japan, Kao is considered exceptional. Despite the fact that numerous Japanese firms have been struggling on account of low profitability (Fujiwara 2003), Kao has been experiencing growth owing to their high profitability levels. Graph 2 indicates Kao's sales and profitability in terms of return on sales (ROS) since 1964. Kao had struggled with a decline in their ROS levels from the mid-1960s to the mid-1980s; however, their ROS levels began recovering in the mid-1980's. Their ROS is now over ten percent, which is considered to be significantly high among Japanese enterprises.



Kao is involved in a number of businesses. The laundry detergent business is one of their most traditional and prime businesses. The main product that has been supporting its competitive advantage in the laundry detergent market is *Attack*, which was introduced in April 1987. Before launching *Attack*, their market share was approximately mid-30 percent, which was very close to the market share of their main competitor, Lion. However, Kao developed innovative biotechnologies and succeeded in fundamentally improving the cleaning function of their detergent powders and in concentrating their detergent four times more compact than other detergent products as indicated in picture 1, which was a great commercial success. They delivered outstanding cleaning power with just one-fourth of the volume of conventional detergents.

The important consideration here is to determine exactly how Kao succeeded in developing these two products simultaneously. This paper aims at illustrating the longitudinal process of how the innovation occurred and changed the competitive structure of the laundry detergent market in Japan, and elucidating the manner in which Kao accomplished the innovation and increased their market share in the late 1980s. This paper will demonstrate both the internal activities within Kao as well as the external pressures for them.

*Picture 1: Zabu (on the left) and Attack (on the right)*



*Source: Presentation by Dr Moriyasu Murata (February 2010)*

In order to analyse this process, this paper follows Martin and Eisenhardt's (2010) procedure of data collection. This paper mainly employed the following data sources: interviews and archival data such as internal documents, press releases, websites and news articles. Seven informants were interviewed and 12 semi-structured interviews comprising both open- and closed-ended questions were conducted. The informants were selected through snowball sampling (Patton 2002), and all of them were highly knowledgeable. Of these, six informants worked for Kao and were involved in the development of *Attack*, and one informant worked for Lion. The information obtained by asking the same questions to the informer working in Lion was rather useful in terms of investigating the events in the detergent market.

## **2. The three challenges during the 1970s**

In the 1970s, the domestic laundry detergent market experienced three major challenges. The first challenge was the use of enzymes. The industry originally began using enzymes in the late 1960s; however, they had to temporarily suspend their use in the early 1970s because they faced criticisms for harming the environment by using enzymes. The second challenge was the development of phosphate-free detergents. During the 1970s, the detergent companies were being criticized regarding the presence of phosphate in the detergents, which were causing serious water pollution in Japan because phosphate is believed to be the main cause of eutrophication, which leads to the occurrence of red tides. In response, since phosphate contributed to the cleaning function, the detergent companies were required to identify another material for substituting phosphate in detergents. As a result, detergent companies switched to using enzymes in their detergents once again during the late 1970s. Finally, the third challenge was the introduction of concentrated product formulations. The companies attempted to decrease the size of the granules in order to reduce the product size; however, they received little success because they failed to attract consumers. The reason for failing to attract customers has been mentioned later in the paper.

### ***The increased use of enzymes and subsequent temporary reluctance in the use enzymes***

The first domestic challenge was the increased use of enzymes in detergents and the subsequent temporary discontinuation of their usage. This movement initially occurred overseas in the early 1960s. The first bacterial-enzyme detergent was marketed in 1963 by a Dutch company, Kortmann and Schulte; they used Alcalase, which is a kind of Protease, that was manufactured by another Danish company, Novo. Other leading detergent companies like Procter and Gamble, Unilever, Colgate and Henkel soon followed this movement and added enzymes in their detergent preparations (Quax 2006).

In the late 1960s, Japanese companies gradually realized the advantages of adding enzymes and began adding them in their detergent preparations. The first domestic company to have introduced a powder detergent with enzymes was not a leading company like Kao or Lion, but Daiichi Kogyo Seiyaku, which held only a minor share in the market. In January 1968, Daiichi Kogyo Seiyaku introduced *Monogen-Oru*, a detergent containing enzymes, in Japan. Other companies also launched their new detergents containing enzymes around the same time; Nippon Oil and Fats (*Nihon Yushi*) introduced *Bari* in March 1968 and Asahi Denka (now ADEKA) introduced *New Adeka Soft* in March 1969.

In contrast, Lion did not follow this movement at all. They carefully assessed the effects of enzymes and concluded that it did not significantly contribute to the cleaning function of the detergent (Kondo 1973). Although Europeans have a custom of washing laundry with warm water or to initially soak and subsequently wash the laundry, which makes the enzymes in laundry detergents effective, these customs of washing laundry were not so popular in Japan and therefore, Lion concluded that adding enzymes in detergents would not be effective in Japan. Lion did not sell any detergent that contained enzymes during the 1970s. Kao was also reluctant to add enzymes to their detergents for the same reason as Lion. Kao finally began their explorative research and development

activities around the end of 1967, that is, just before Daiichi Kogyo Seiyaku had introduced *Monogen-Oru*. Even after they had begun their research activities, the progress continued to be slow. Although they purchased Alcalase from Novo and explored its potentiality, they were uncertain regarding the effectiveness of these components. In March 1970, two years after the introduction of *Monogen-Oru*, Kao finally launched *Super Zabu Koso*, which contained the enzyme that they had developed on their own.

The new product became a big success during the first year. They reported that although their initial projection for the sales of *Super Zabu Koso* in 1970 was 3.3 billion yen, the actual sales were 4.591 billion yen. In spite of their commercial success, Kao discontinued the production of *Super Zabu Koso* in 1971 owing to a doubt on the safety of all laundry detergents containing enzymes. Kao restarted the production of detergents with enzymes only once the safety of all the components of these detergents was confirmed, and introduced *Zabu XK* in March 1973. They added Protease and Amylase which breaks down starch in this new detergent; however, their efforts did not alleviate consumers' apprehensions regarding the acceptance of detergents containing enzymes. As a result, laundry detergents containing enzymes temporarily disappeared from the domestic market. The wave of adding enzymes to detergents returned when the laundry detergent companies were compelled to remove phosphate from their detergents, as is described subsequently.

### ***Environmental pressures on detergent companies***

The second challenge was removing phosphate from detergents. Phosphate was widely used as builders in detergents in order to soften hard water and improve surfactant performance; surfactant performance indicates the ability of detergents to clean laundries. Although the use of phosphate was effective, the laundry detergent industry faced a serious problem because phosphate was causing serious water pollution and leading to the occurrence of red tides in the lakes. At that time, the two biggest lakes in Japan—*Biwako* and

*Kasumigaura*—were adversely affected by the occurrence of red tides and companies and factories encountered a wave of criticism.

The reactions of Lion and Kao to this movement were contrastive; although Lion actively reacted to this movement, Kao was slow to react. As a result, Lion was the first mover in the development of phosphate-free detergents. Lion began reducing their use of phosphate in the early 1970s and introduced a phosphate-free detergent, *Seseragi*, in autumn 1973, which ended up in a poor success because of its dismal cleaning performance. However, Lion continued their research activities and introduced *Spark 25* in 1975, which was not phosphate-free but contained reduced quantities of phosphate. They used Zeolite as a non-phosphate-based builder; however, Zeolite was unable to improve the cleaning performance effectively. Lion was struggling to determine how to deliver effective cleaning performance without using phosphate.

As written above, Lion did not intend adding enzymes at all during the early 1970s. But they changed their strategy and began developing a laundry detergent with enzymes because they realized that they must reduce the proportion of phosphate in their detergents and required another material to effectively complement the cleaning performance of phosphate. They purchased Alcalase from Novo and developed a new product called *Top*. Despite using reduced quantities of phosphate *Top* was able to increase cleaning efficiency by 10 percent. Owing to functional improvements, as soon as Lion launched *Top* on 8 March 1979, it experienced phenomenal success and accounted for 40 percent of Lion's overall company sales for a short period of time. *Top* was made phosphate-free in October 1980 and succeeded in further popularizing its brand name.

Although Kao demonstrated slow progress, they were compelled to follow the phosphate-free movement around 1979, when the local ordinance banning phosphates was enacted in the *Shiga* prefecture where *Biwako* is located. That local ordinance was extremely strict in that they prohibited people in *Shiga* from selling, buying, giving and presenting synthetic detergents. *Shiga* had enacted such a strict ordinance owing to the following reason: At the time, *Biwako* was

facing serious problems due to the occurrence of red tides, and *Masayoshi Takemura*, who was 40 years old, was elected as the youngest prefectural governor in *Shiga* with the support of a few grassroot movements that aimed to purge synthetic detergents. In response, Kao finally decided to introduce phosphate-free detergents and introduced *Just Funmatsu* in March 1980, that is, half a year before Lion's introduction of *phosphate-free Top*.

However, as mentioned earlier, Lion's *Top* was rather successful, and was able to retain its competitive advantage even after Kao had introduced *phosphate-free Zabu Koso* in August 1981 and had made their extant product, *New Beads*, phosphate-free. In response, Lion made *Blue Dia* phosphate-free and launched a new detergent called *Pinky*, which was also phosphate-free. As a result of these competitive interactions, the laundry detergent industry in Japan progressed toward becoming an environmentally conscious industry.

### ***Concentrated powder detergents***

The third challenge was to produce more concentrated detergents. During the 1970s, the major competitors were continuously increasing the sizes of the package boxes because consumers could save money by purchasing larger packages. Lion, Kao and P&G were keen to sell their *Otokuyou* (meaning economic) products for a cheaper price in order to acquire greater market shares. This homogeneous competition lowered their profitability levels, and Kao was the first mover to differentiate their products by increasing the concentration of the detergent powder and scaling down its package. They began to devote additional resources into the project of increasing the concentrations of the detergents, which was initiated in around 1969.

In July 1975, Kao introduced *New Zabu* and *New New Beads*, which were concentrated twice as compact as their extant detergents. They priced a 1.66 kg package for 600 yen, which was indeed 90 yen cheaper than their extant products. In order to pursue this strategy, they soon launched two new concentrated powder laundry detergents, *New White Wonderful* and *New Popins*, in November 1975. Lion was also quick to follow Kao and launched a

new concentrated detergent, *Spark 25*, in November 1975, and *Pinky 25* and *Blue Chime 25* in 1976. In addition to that, the first oil crisis occurred in 1973. This compelled companies to reduce the use of materials and switch to concentrated detergents that fit the economic environment. The president of Lion, *Hiroshi Kobayashi* said, 'If concentrated detergents become dominant in the market, the industry will be able to reduce the use of resources by 4–4.5 billion yen per year.'<sup>1</sup> It appeared that the major dimension of competition would shift from 'bigger is better' to 'more compact is better'.

However, these new strategies did not fit consumers' needs in the least. One reason for this was that consumers did not consider the compact detergents to be economical. Consumers were accustomed to putting approximate amounts of detergents into washing machines directly from the package boxes and did not check the exact amounts that they were using. Thus, they tended to use even the concentrated detergents in the same manner and as a result would run out of detergent rather rapidly; this made the consumers believe that the prices of the compact detergent products were relatively higher. Kao discontinued the production of *New Zabu* and *New Beads* in 1977. P&G also subsequently discontinued the production of concentrated detergents, followed by Lion in 1979. Finally, concentrated detergents disappeared for some time.

### **3. Inside Kao: The product development of *Attack***

Kao analysed the reasons for a lack of success of their compact detergents with enzymes and came to the following two conclusions: One was that consumers did not experience any advantages of compactness of detergents because it was just twice as compact as the extant products. The other was that Kao failed to sufficiently improve the cleaning performance in order to compete with *Top*. In summary, they concluded that they were required to concentrate detergents more than before as well as add a larger quantity of effective enzymes. They developed a technology for concentrating detergents in their laboratory in the Wakayama prefecture and focused on

identifying and producing an effective enzyme in their laboratories in *Tochigi* and *Tokyo*.

### ***Technology transfer and the development of technology for concentrating detergents***

Researchers attempted to further concentrate detergents in Kao's *Wakayama* laboratory. After they confirmed that their extant technologies could not further concentrate detergents, they began exploring other useful technologies that were being utilized in other businesses of Kao. In the course of this project, Kao identified a technician who had experience in the toner business for printers. Since the powders of toners are much finer than that of detergents, the processing technologies accumulated in that business were superior to those in the detergent business particularly in terms of concentrating powders. Thus, this technician suggested that they transfer the processing technologies of toners and further concentrate detergents by physically compressing powders in the same manner in which toners are manufactured. The project implemented his suggestion.

However, subsequently, two challenges that were caused by employing the powder processing technologies of toners in the laundry detergent industry needed to be overcome. One challenge was that their newly compressed powder grains lost their hollow structure that their original powder particles used to possess. This hollow structure of the powder particles is important in that it improves the solubility of the powder detergents. Kao was required to identify another way to retain the solubility without this hollow structure of the detergent particles, otherwise powder detergents would not dissolve effectively and would stick to the laundry. The problem was resolved by adding a few chemicals to the detergent powders in order to foster their solubility. Another challenge was adhesion; the surface of compressed powders became adhesive and as a result would become a big ball in the package boxes, which is known as caking. On encountering this problem, Kao utilized Zeolite in a different way. Although initially Zeolite was added inside the detergent particles of the detergent

powders as a substitute for phosphate, Kao noticed that if Zeolite was applied on the surface of the particles of the detergent powders, it would effectively prevent the detergent powder from becoming sticky. Therefore, applying Zeolite not inside the particles but on their surfaces as an anti-caking agent succeeded in preventing the powder detergents from becoming sticky. The company finally succeeded in transferring the powder processing technologies from the toner business to the detergent business within Kao and also in resolving the two major problems caused by the technology transfer.

Owing to these abovementioned activities, the particles of the new concentrated powder were four times more compact than their extant one in terms of capacity; this new powder was twice as compact as the concentrated powder that had failed in 1975. The technicians at the laboratory developed these powder processing technologies in the early 1980s and established them in 1986. These technologies were an important foundation for developing *Attack*, which was introduced in 1987.

On the other hand, Dr *Moriyasu Murata*, a chief researcher at the Tokyo research laboratory of Kao, believed that only achieving this concentration was not sufficiently effective for attracting consumers. He was the researcher who had led the concentration of the detergents to twice as much as the extant detergents in terms of their compactness in 1975, which had received poor market response, and strongly believed that they must combine the following two innovative improvements: concentration and cleaning performance. Although the researchers at the Wakayama laboratory were attempting to concentrate detergents, *Murata*, who was at the Tokyo laboratory of Kao, was simultaneously making efforts to improve the cleaning performance of the detergents.

### ***The development of Alkaline cellulases***

*Murata* was struggling with how to improve the cleaning performance of their detergents. He repeatedly added and examined numerous enzymes and other possible materials into the detergents. One day in around 1980, he used

cellulase for washing laundry and was astonished to see its excellent performance. Cellulase was notably effective in increasing the cleaning power of detergents. He soon directed a research staff under him, *Akira Suzuki*, to ascertain the mechanism of the cleaning effect of cellulase and to examine the possibility of adding it in their detergent powders. Since cellulase is an enzyme renowned for hydrolyzing the cellulose from which cotton is made, most of the researchers believed that cellulase would damage clothes. In that sense, it was considered to be common sense not to use cellulase with laundry detergents. However, *Murata* directed *Suzuki* to carefully investigate the function and mechanism, and obtained the tentative hypothesis that the mechanism of the cleaning effect of cellulase may be like peeling a welsh onion. He said,

*I noticed one day that welsh onion with soil was obviously dirty but you could get it clean only by peeling the surface. ... And I thought if we cleaned every fiber of laundry like that, we would be able to improve our cleaning performance fundamentally. Based on this idea, I looked into what kind of fiber do people wear in Japan and found that 85 percent of the textile was made from cotton, which meant all we had to do was focusing on how to shift stain from cotton. So, we started examining the performance of cellulase because that enzyme hydrolyzes cotton<sup>2</sup>.*

Based on this hypothesis, *Murata* believed that the cleaning performance of detergents would definitely improve dramatically if they could clean the laundry in a manner that is similar to cleaning the soil off welsh onions by peeling them, and decided to challenge common sense. Since the water to which detergents are added is weakly alkaline, *Murata* and his colleague Dr *Shigeo Inoue* began seeking a cellulase that functioned effectively in such alkaline water. Since normal cellulase is effective only in weakly acidic water, even Novo's cellulase at that time did not suit their needs because it was most effective with warm water at 60 degrees at pH 7; therefore, they were required to identify and develop their

own alkaliphilic strain for producing alkaline cellulases that would be effective at lower degrees at higher pH on the alkaline side.

Kao did not possess sufficient biotechnologies at the time and were facing numerous problems. They were not aware whether any cellulase that could effectively function under weak alkaline water actually existed. *Murata* and *Inoue* went to libraries numerous times in order to read through as many books on cellulase as possible, and found that *Rikagaku Kenkyujo* (abbreviated as RIKEN), which is a governmental laboratory in natural science, had a patent for the alkaline cellulase-producing strain. As soon as they found that article, they visited Dr *Koki Horikoshi*, who had issued that patent and requested him to give them the alkaline cellulases and the strain. They tested it at the Tokyo research laboratory and confirmed its noteworthy performance even under weak alkaline water.

Establishing a high productivity of the strain that produced alkaline cellulases was next on the list. Since laundry detergents are daily necessities, Kao had to establish a stable mass production system; however, the strain they had received was not sufficiently productive for achieving that aim. They needed to find a more productive strain and develop their biotechnologies, which would enable the production of large volumes of alkaline cellulases in a prompt and stable manner and at a reasonable cost. In order to achieve this goal, they began establishing a few networks for researchers and professors in academic fields. They studied biotechnologies from *Kazuo Komagata* at the University of Tokyo and requested him to introduce researchers in that field. In doing so, they gradually expanded their own networks.

*Inoue* was responsible for locating a productive strain. Acquiring this strain would be like a blue bird of happiness for Kao; they believed that the strains that produced cellulases would be found in mountains and forests because cellulase decomposes the cellulose that is present in large quantities in plants. *Inoue* and his colleagues visited numerous mountains, forests and fields all over Japan including those that were located at a distance from their home laboratories in order to find useful alkaliphilic strains; however, they finally found the effective

strain in the soil near Kao's Tochigi research laboratory. This strain was significantly useful. *Inoue* and his colleagues regarded this strain as ideal and termed it KSM635. Subsequently, they began mutating the strain in order to facilitate the production of larger quantities of alkaline cellulases at the Tochigi research laboratory. Around 1982, *Inoue* relocated from *Tokyo* to *Tochigi* in order to oversee the progress of the mutation of the strain. The researchers in that project devoted almost all their efforts to this mutation activity.

However, their R&D activities with respect to this project were allocated to two different places; the Tochigi research laboratory was responsible for mutating KSM635 and the Tokyo research laboratory was responsible for testing the alkaline cellulases produced by the mutated strains in order to confirm if its use was effective and appropriate in laundry detergents. Owing to this division of work, they needed to commute between Tokyo and Tochigi rather often, which was inconvenient and inefficient, and decelerated the pace of their activities. Therefore, Kao decided to move almost all their R&D activities with respect to the improvement of the cleaning power of their laundry detergent from *Tokyo* to *Tochigi*, which enhanced the efficiency of their efforts. Around the same time, *Suzuki* had determined the washing mechanism of cellulase; the functioning of cellulase was not similar to the peeling of a welsh onion. Indeed, it acted in the amorphous regions of the cotton fibers, where the extant detergents and enzymes were unable to reach. This was the reason why cellulase could effectively remove trapped stains; this implied that the alkaline cellulases produced by this strain did not damage clothes. The properties of the alkaphilic strain fulfilled the essential requirements for the enzymes that could be used in laundry detergents (Hakamada, Koika, Yoshimatsu, Mori, Kobayashi and Ito 1997).

### ***Establishing efficient mass production engineering technologies of alkaline cellulase***

The subsequent step was to establish efficient mass production engineering technologies of alkaline cellulase. Although the researchers

fermented and produced enzymes in a flask or beaker at the Tochigi research laboratory, they actually had to conduct this experiment on a much larger scale, for example, in a plant. This scaling up was rather challenging for the researchers. It was critical to establish a few operating technologies for controlling the equality of temperature and the mixing efficiency of oxygen in their fermentation tanks. It was also important to establish the technologies for preventing various kinds of minor germs from breeding inside the tanks, otherwise the strains producing alkaline cellulase would be screened and destroyed owing to the contamination by these germs.

At that time, Kao did not have sufficient technologies and know-how for establishing these operating technologies. They discussed the possibility of outsourcing the development of these technologies; however, they ultimately decided to develop them in-house because they believed that they could not develop their own biotechnologies unless they internalized and handled these activities. Firstly, they installed fermentation tanks in the Wakayama research laboratory but they failed to operate them effectively. This was because the plant manufacturer did not have sufficient know-how of fermentation and failed to build tanks that could fulfill Kao's requirements. Subsequently, they changed their plan and installed different tanks in their plant in *Kashima* in the *Ibaraki* prefecture and began establishing the mass production engineering technologies there. *Inoue* relocated from *Tochigi* to *Ibaraki* and joined this project with a staff, *Kazuo Ishii*<sup>3</sup>, who had originally been working in *Kashima*. They continued to face several challenges in the course of their activities there. For example, they temporarily changed the usual working schedule and allocated approximately 35 workers only to the development the engineering technologies during the busiest period.

Their tension increased with every passing day. This was not only because they were continuously struggling with the establishment of efficient technologies in *Ibaraki*, but also owing to the fact that the technologies of concentrating detergent powders were almost established in *Wakayama*, as illustrated earlier in this paper. The members in *Wakayama* were eagerly

awaiting the development of alkaline cellulase, which put pressure on the researchers in *Ibaraki*. In addition to those two reasons, at that time, the potential applications of the fermentation engineering technologies to other businesses of Kao were rather limited and the laundry detergent business was the prime and almost only business to which these technologies could be applied. Thus, applying their biotechnologies to their laundry detergent business was rather critical for the researchers in that field for legitimizing their R&D activities, and they could not miss this precious opportunity. Under those pressures, *Inoue*, *Ishii* and their staff finally established almost all the technologies by the end of 1985.

#### **4. The introduction of *Attack***

##### ***The leadership of President Maruta***

In the spring of 1986, there was a huge controversy in Kao's board meeting with respect to the possibility of the success of their new product *Attack* with both the new powder processing technologies and the fermentation engineering technologies of their own alkaline cellulase. There was uncertainty on the sales side and certainty on the cost side. The growth rate of the domestic laundry detergent market was declining year after year and the market was considered to be rather saturated. Kao, Lion and P&G had been competing with each other in such a zero-sum game, which reduced the profitability of all the three players. In addition, in the 1970s, they failed to expand the market by concentrating detergents or adding enzymes. Some people who were in charge of the marketing activities insisted that launching *Attack* was extremely risky and reckless. On the cost side, it was evident that if the two major technologies were combined, the capital investment would be significant. Some people in the accounting and financing department insisted that it would be rather unlikely for Kao to recover their investments. These facts were sufficiently convincing for concluding that it was impossible to further stimulate the market growth and expect higher profitability. The outcome of introducing *Attack* in the market was rather unpredictable and *Murata* and *Inoue*,

who were mainly responsible for the product, made unrelenting attempts to convince the opponents.

The president of Kao, *Yoshio Maruta*, made this tough decision. He became the president of Kao in 1971 and continued to hold this position for fifteen years. Moreover, he was the Director of Research and Development from 1976 to 1979 and reformed the structure of research and development during this period. He aimed to enable the researchers to collaborate more frequently and freely; he established a research laboratory for life sciences in *Tochigi* and several other laboratories. He ensured that the laboratories were constructed in a ballroom style so as to not separate the researchers, and thereby permitting them to freely visit other research laboratories to conduct meetings. Furthermore, if a researcher felt the need to collaborate with another researcher, he could assign the researcher to attend the meeting with him regardless of the position of the assigned researcher. *Maruta* held an R&D meeting seven to eight times a year and this meeting was held in the R&D centre or other branches of the R&D centre. *Maruta* and the other board members would attend the R&D meetings and other field researchers were also welcome to attend these meetings. *Murata* had given presentations in the R&D centre more often than other researchers because he was eager to legitimize the development of *Attack*. In this meeting, *Maruta* was excited to observe the outstanding result of the experimentation conducted by *Murata* and his group of researchers and decided to launch *Attack*. What is noteworthy here is that although *Maruta* was excited to introduce *Attack* into the market, their sales forecasts were rather modest. They predicted that *Attack* would substitute ten percent of their extant detergents in the subsequent year of its introduction, and invested approximately 3.5 billion yen for establishing its production system in the *Kashima* plant<sup>4</sup>.

On 3 March 1987, Kao announced that they had succeeded in developing a distinguished laundry detergent. In this announcement, *Maruta* said, 'We finally achieved an innovation in the field where even we had almost given up finding a possibility of innovations. We are extremely excited about it.' One month after that press release, Kao launched *Attack* only in the Metropolitan and *Tokai* areas.

A 0.75 kg box of *Attack* was priced at 450 yen and a 1.5 kg box was priced at 870 yen. Their sales projection for the first year was 20 billion yen, which accounted for ten percent of the entire laundry detergent market in Japan.

### **Its commercial impact**

Despite the fact that they had launched *Attack* only in the Metropolitan and *Tokai* areas, its commercial impact was outstanding. *Attack* recorded a 29.7 percent monthly market share by brand in May 1987 and a 41.0 percent weekly market share for the week 18–24 May 1987. Consumers preferred *Attack* owing to its compact product size, which made it easy to purchase and transport the detergent, and the cleaning performance of the new detergent that was achieved by using only one-fourth of the amount of the extant detergents surprised them. This time, consumers did not use extra quantities of the new detergent because Kao had placed a plastic measuring spoon in each package. Wholesalers and retailers also supported *Attack* because they could save on their transportation costs and shelf spaces owing to its compactness. In particular, during this period, the number of convenience stores was increasing in Japan and they required compact products owing to the limitation of shop space. The market demand for *Attack* exceeded far beyond Kao's sales predictions.

By the end of June, *Attack* was launched throughout the country, and the sales plan was revised upward to 35 billion yen. Simultaneously, *Maruta* made a top-down decision for expanding the facilities for producing *Attack*. Inoue said, 'He (*Maruta*) said that he had never experienced this strong demand in the laundry detergent market so far and that was why he made such a daring decision to meet it.'<sup>5</sup> Initially, Kao used to produce concentrated detergents only in the *Wakayama* factory; however, subsequently, the company simultaneously established the following new facilities: the *Kawasaki* Plant in *Kanagawa*, *Kyushu* Plant in *Fukuoka* and *Sakata* Plant in *Yamagata*. They also expanded their alkaline cellulase producing facilities since they had accumulated their own know-how of fermentation engineering.

As a result, the sales of *Attack* during the first year were 35 billion, which was as per the revised sales plan. A director, *Michinori Mochiduki*, reported that 'the business was in the red three years ago because of the oil crisis, but now *Attack* absolutely got the business back.'<sup>6</sup> In February 1988, Kao marketed *Bio New Beeds* as their second concentrated detergent with enzymes. They also decided to invest 11 billion yen for further expanding their capabilities and set a sales target of 48 billion yen for 1988.

### ***Why was Lion's counterattack delayed?***

Lion's counterattack was surprisingly slow. Although they reduced the price of their major brand *Top* in order to compete with *Attack* in September 1987, they did not launch any new compatible brands like *Attack* in 1987. Lion launched *High Top* on 20 April 1988, which was their first concentrated detergent with the enzyme, alkaline lipase that was initially delivered by a subsidiary of Novo, Novo Seikagaku Kogyo. The price of a 1.5 kg package of *High Top* was 870 yen, which was exactly the same price as *Attack*. In addition, the president of Lion, *Atsushi Kobayashi*, had become the division director of their household business on 30 March 1988. This was mainly because as compared to Kao, Lion's overall corporate performance relied more heavily on their laundry detergent business.

Although the laundry detergent business was much more important for Lion than for Kao, their counterattack occurred one year after the introduction of *Attack* by Kao. What was even worse was that Lion's new product was not sufficiently strong to recover the company's market share. Although the initial plan was to produce 300 thousand cases of *High Top* by investing 1.5 billion yen at the Chiba plant, they noticed that as compared to the planned ratio, they were required to lower the operating ratio by 20–30 percent. Owing to this, Lion was able to launch *High Top* as per schedule only in *Tokyo* and *Osaka*, and managed to expand its area only to *Nagoya*, *Chugoku* and *Shikoku* areas by 20 May 1988. The nationwide launch of *High Top* took place only by the end of June 1988.

This delay was notably extraordinary in the long history of competition between Kao and Lion. Lion had originally been enthusiastic regarding and successful at the introduction of new products with new concepts. Table 1 indicates the major brands introduced by Kao and Lion since 1960. In a majority of the cases, Lion used to be the forerunner and Kao used to follow Lion's lead. Lion fell behind Kao only three times including during the introduction of *Attack* by Kao; however, in the first two cases, they lagged behind Kao for approximately only half a year. Kao's introduction of *Attack* was the only case wherein Lion's counterattack was delayed for an entire year.

Why was Lion's counterattack against Kao delayed for such a long period of time? This was not because *Attack* came as a bolt from the blue. The prices of detergents were falling in the market and Lion had been investigating the patents that were being issued by Kao. This information indicated that Kao had been working on certain innovations that would be revealed in the near future and that they had been working on concentrating detergents and 'discussing when to enter the market.'<sup>71</sup> However, Lion delayed their counterattack. The main reason for this delay was their hesitation to follow the movement of concentrated detergents with enzymes. This hesitation stemmed from 1) the success of their prime detergent *Top*, 2) their evaluation of *Attack* and 3) their experience of concentrated detergents in the 1970s.

*Table 1: Detergents by concept (From 1960 to 1988)*

	Kao	Lion	Concept
1960	Zabu (March)	New Top (March)	Cleaning power
1961			
1962		High Top (April)	Less frothy
1963	New Beads (February)		
1964			
1965		Blue Dia (March)	Colored powder
1966	New Wonderful (February)		
1967		Dash (February)	Cleaning power
1968	Super Zabu (February)		
1969		Spark (February)	600 Yen detergent
1970	White Wonderful (October)		
1971		Blue Chaim (February)	
1972		Pinky (February)	
1973	Popins (February)		
1974			
1975	Shin Zabu, Shin New Beads (July)	Spark 25, Blue Dia 25 (November)	Concentrated detergent
1976			
1977			
1978			
1979			
1980	Just Funmatsu (March)	Non-phosphate Top (October)	Phosphate free and enzyme use
1981	Non-phosphate Zabu Koso(August)		
1982			
1983			
1984			
1985			
1986			
1987	Attack(April)		Concentrated detergent with enzymes
1988		High Top (April)	

*Source: Kondo (1973) and the corporate history of Kao*

Firstly, they had succeeded in establishing a competitive position in the market by introducing *Top* in 1979 and did not want to disturb its sales and profitability by launching another new brand with a new concept like that of Kao's *Attack*. In

this sense, Lion was facing a dilemma at that time. Secondly, Lion recognized the existence of the following issues with *Attack*: The cost per use of *Attack* was higher than that of *Top*. For example, the 1.5 kg package of *Attack* was priced at 870 yen. Since consumers could use this 1.5 kg pack for 60 washes, the cost per use was 14.5 yen. On the other hand, in the case of *Top*, consumers could purchase the 4.1 kg package at approximately 900 yen and use it for 102 washes, which implied that the cost per use was below nine yen. The cost per use of *Attack* was 60 percent higher than that of *Top*. The issues were with respect to not only the cost but also the technical aspects of *Attack*. Since *Attack* contained numerous surface-active agents, its solubility was lowered despite the fact that Kao had incorporated solubility-enhancing agents as well. In addition, they believed that since the detergent powder particles in *Attack* were hygroscopic, it would tend to become a big ball in the box. Thus, they believed that would be more suitable to take their time and develop a much better detergent even if they were going to introduce a product that would be compatible with *Attack*. Finally, Lion failed to attract consumers by selling concentrating detergents in the 1970s and thought that the market demand for concentrated detergents was rather limited. These evaluations and facts apparently convinced Lion that consumers would not benefit by using *Attack* and its commercial success would be poor. Therefore, they delayed their counterattack and launched High Top in April 1988. Indeed, looking at *Attack*'s success, a managing director of Lion *Kazuhiko Ohkawa* said, 'we had not expected that *Attack* became that smash hit.'<sup>8</sup> Another managing director *Rikuo Terao* also expressed the same view<sup>9</sup>.

The delay in reacting to Kao's *Attack* imposed a great burden on Lion's competitiveness. Graph 1 indicates that Kao's market share soared to over 40 percent in 1987 and peaked at over 50 percent in 1989. Although Kao and Lion had been close competitors for the top spot in terms of the market share before the introduction of *Attack*, Kao began establishing sustainable competitive advantage since 1987 and have been able to retain its position ever since.

## 5. Concluding remarks

This paper illustrated the events of the laundry detergent market in Japan in the 1970s and the 1980s. At the time, the two largest lakes in Japan were polluted and the laundry detergent companies were being criticized owing to the use of phosphate in their detergents, which was leading to the occurrence of red tides in these lakes. The laundry detergent companies began reducing the use of phosphate in their detergents; however, this resulted in a reduction in the cleaning performance of their detergents as well. The two leading companies, Kao and Lion, began adding enzymes in their detergents in order to recover and improve the cleansing function of their detergents. The existence of environmental pressures was favourable at this point.

It was not Lion but Kao that was able to accomplish an outstanding technological innovation. Kao achieved a bio-technological innovation and introduced a new detergent called *Attack*, which dramatically changed their competitive structure. *Attack* was innovative because Kao developed 1) their own fermentation engineering technologies in order to get the alkaliphilic strain to stably produce alkaline cellulase, which selectively interacts with celluloses in the interfiber spaces within the fibers (Murata, Hoshino, Yokosuka and Suzuki 1991), and 2) their own powder processing technologies for concentrating detergents four times as compact as their extant detergents. These technologies were established completely relying on the trial-and-error approach.

Why did Kao achieve this innovation and not Lion? From this case it becomes clear that external pressures alone cannot explain why this technological innovation occurred in Japan. It indicates the importance of looking at individual firm behaviour in detail. What is interesting about Kao and Lion is that Kao carried out their innovative activities based on their failures in the 1970s, while Lion decided not to follow Kao as they misinterpreted the reasons for their failures resulting in the decline of their market share. Their attempt to outdo each other by making the different decisions through framing their experiences under external pressures was critical in determining innovation.

Another event that must be mentioned is that Kao conducted vertical integration by establishing their own sales function in order to reach out to their customers; however, Lion did not do this. As compared to Lion, Kao succeeded in listening to their patrons' voices much more clearly and closely. As mentioned earlier, even though Kao developed a close association with their customers, people who were in charge of marketing in Kao were not depending on the introduction of *Attack*. This implies how difficult it was even for Kao to predict the potentiality of *Attack* and that it was quite unlikely for Lion to feel any possibility because they had many wholesale dealers between their customers and them.

Considering the events that occurred in the Japanese laundry detergent market during the 1970s and the 1980s has a significantly contemporary meaning in the sense that determining the manner in which economic activities and environmental sustainability can be linked together is one of the most crucial topics. In this sense, this paper will be helpful for the future research of new-coming countries' economic and firm activities and their sustainability.

## Acknowledgement

This paper is based on the joint paper (Fujiwara and Takeishi, 2005). I wish to thank Professor Akira Takeishi (Kyoto University) for his useful comments.

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#### Notes

- <sup>1</sup> *Nihon Senzai Shimpō* (Japan Detergent News), 10 Dec. 1975
- <sup>2</sup> The author's Interview with Dr *Moriyasu Murata* (24 Feb. 2010)
- <sup>3</sup> He was the head of the research laboratory of fermentation engineering at the Kashima research laboratory at that time.
- <sup>4</sup> *Nikkei Sangyo Shimbun* (Nikkei Industrial News), 13 Mar. 1987.
- <sup>5</sup> The presentation of Dr *Shigeo Inoue*, 7 May 2004.
- <sup>6</sup> *Nikkei Kinyu Shimbun* (Nikkei Financial Daily), 19 Oct. 1987.
- <sup>7</sup> *Nikkei Ryutsu Shimbun* (Nikkei Marketing Journal), 18 Aug. 1988.
- <sup>8</sup> *Nikkei Ryutsu Shimbun* (Nikkei Marketing Journal), 11 Jun. 1988.
- <sup>9</sup> *Nikkei Sangyo Shimbun* (Nikkei Industrial News), 21 Oct. 1988.



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