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- TAKAHASHI, N. 1
The degree of self-determination and job satisfaction of white-collar workers in Japanese firms.
- WI, John H. 9
Organization strategy of established firms for adapting to a change in product architecture: The dynamic management of subunits inside an organization.
- HELLER, Daniel A. 17
Learning from a strategically allied firm: Incorporating a teaching perspective.

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Organization Strategy of Established Firms for Adapting to a Change in Product Architecture: The Dynamic Management of Subunits Inside an Organization

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Abstract: This paper analyzes the organization strategy of an established firm when a change in product architecture occurs on a previous product. For the purpose, the paper analyzes an organizational design and management of an established firm in overcoming the restrictions from past resources and in creating heterogeneous resources required in new product architecture.

Keywords: established firm, change in product architecture, management of subunits

1. Introduction

The purpose of this paper is to analyze the organization strategy of an established firm when a change in product architecture occurs on a previous product. For the purpose, the paper analyzes the organizational design and management of an established firm in overcoming the restrictions from past resources and also in creating heterogeneous resources required in new product architecture.

Product architecture is defined as a design of

physical components and functions, which have to be arranged in the product development process (Ulrich, 1995). A change in product architecture is disruptive change in the corresponding relationship between functions and components when new functions or new components are combined into a previous product (Wi, 2001c).

An established firm that has developed and produced a previous product confronts difficulty in adapting to a change in product architecture. As an

established firm had accumulated immense knowledge through a previous product, the knowledge prevents an established firm from adapting to a change in product architecture (Henderson & Clark, 1990; Christensen, 1997; Christensen, Suarez, & Utterback, 1996; Cohen & Levinthal, 1990; Hannan & Freeman, 1977).

For example, Christensen (1997) and Christensen et al. (1996) argue the failure of established firms in American Hard-Disk Drive (HDD) industry. According to these researches, those firms failed to adapt to the change in HDD architecture because they were restrained by the customer power for the previous HDD product. Henderson and Clark (1990) also argue that the failure of established firms in the semiconductor photolithographic alignment industry was due to the rigidities of information filters and information channels in the organization. Hence, organization management is essential to an established firm in adapting to a change in product architecture.

Some researchers insist on organizational separation as an organization strategy of an established firm, which means setting up a corporate venture or a subsidiary outside an established firm (Henderson & Clark, 1990; Christensen, 1997; Christensen et al., 1996).

However, though it is possible to overcome the restrictions from past resources by organization separation, it becomes difficult to utilize the various resources accumulated in an established firm, because there exist obstacles such as increase of

transaction cost of resources (Williamson, 1975; Teece, 1982), immobility due to stickiness of knowledge (Szulanski, 1996), and path-dependency which restricts a search for new partner of transaction (Walker, Kogut, & Shan, 1997).

Therefore, the paper examines the possibility of overcoming such restrictions from past resources and utilizing various resources accumulated in an established firm through managing subunits inside an organization.

For the analysis, the paper examines a change in PC architecture from a desktop computer to a laptop computer and also analyzes NEC's case. NEC has dominated the Japanese desktop computer market in the 1980s. Market share of NEC reached about 40% in the mid-1980s. NEC is defined as an established firm in the PC industry.

In spite of being an established firm, NEC was able to develop and release a laptop model computer in October 1986 when Toshiba, a pioneer in laptop computer market, introduced the first laptop computer J-3100. After revising the functional combination of laptop computer several times reflecting the user needs at the stage of product evolution, NEC succeeded in dominating the laptop computer market. Therefore, NEC is fit for the analysis object of this paper.

2. A change in PC architecture

As product architecture changes from a previous product adapting to user's new needs or technological changes on the product, various

Adapting to a Change in Product Architecture

products with various combinations of new and old functions appear. In this case, the core concept of the product and the core component of the previous product do not change. Nevertheless, components or linkages between components are altered when a change in product architecture occurs. Core concept is defined as a core component that regulates an entire product architecture (Clark, 1985). For example, versatile CPU in a PC is defined as a core concept and do not changed in desktop computer or laptop computer.

In the early stage of a change in PC architecture, desktop PC manufacturers confronted difficulty in understanding the new product, laptop computer, because various interpretations had been possible. Though architecture of a laptop computer differed from that of a desktop computer, core concept was not different.

In the early stage of laptop computers, various interpretations concerning usage had been discussed. At that time, it was perceived that laptop computer usage would be different from that of desktop computer.

However, laptop computer manufacturers were not certain whether laptop computers would be used as a word-processor or a communication tool like a PDA (Personal Digital Assistant); whether being a complementary machine or a competing machine with desktop computers. As a result, various laptop

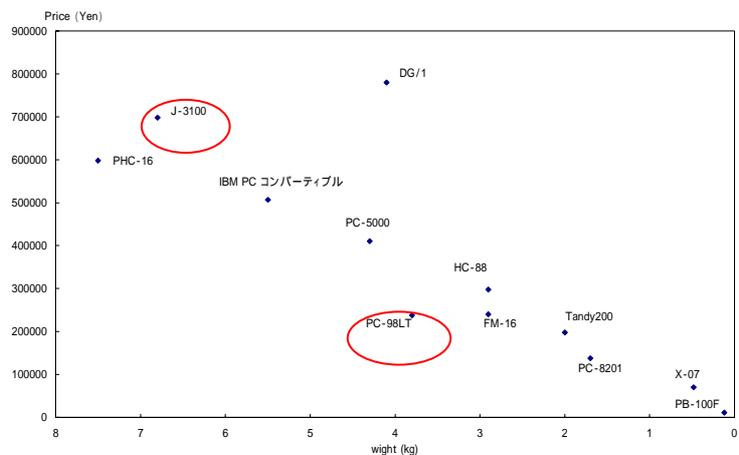
computers appeared as shown in Figure 1 according to the various interpretations by laptop computer manufacturers (Wi, 2001a, 2001b).

3. NEC's adapting process to laptop architecture

NEC introduced a laptop model computer 98LT to the Japanese market in October 1986. Compared with other manufacturer's laptop computer, 98LT emphasized information portability (see Figure 1). 98LT's display was LCD, which was light and comparatively cheap, and HDD was not combined into the hardware. Being in pursuit of information portability, information processing was sacrificed on 98LT. As a result, 98LT was not able to sustain compatibility with NEC's desktop computer 98 series, which had been the de facto standard in Japanese PC market in mid-1980s.

However, majority of laptop computer users did not support 98LT. The market share of NEC's laptop

Figure 1. Appearance of various laptop computers



computer was 19% during October 1986 to December 1987. It was too small a share compared with that of Toshiba's 50.6%, then the dominator in laptop computer market, and also considering the market share of NEC's desktop computer 42% at the same time: Toshiba's share was just 4.3%. Toshiba's laptop computer was expensive and much heavier (6.8kg) than 98LT as a result of emphasizing information processing. These results revealed that laptop computer users demanded more information processing than information portability.

Reflecting user needs, NEC transformed its product strategy from 98LT, emphasizing information portability: incompatible with desktop 98 series, to a new laptop computer 9801-LV, emphasizing information processing capability: compatible with desktop 98 series. After strategy transformation, NEC succeeded in regaining support from users and catching up with Toshiba. NEC was able to dominate Japanese laptop computer market once more in 1990.

The Laptop computer's case of NEC is different from the result of prior researches in that NEC was able to adapt to the change in PC architecture. Though Christensen (1997), Henderson and Clark (1990) argued the failure of an established firm in adapting to the change, NEC had succeeded in developing a laptop computer in the early stage and catching up with Toshiba by reflecting user needs in product evolution stage.

The reason NEC was able to adapt to a change in PC architecture is that NEC separated

organizations in charge of desktop computers and laptop computers. The subunit which had been in charge of desktop computers was separated from that of laptop computers at NEC. NEC Yonezawa, a plant located in Yonezawa city, which was an independent factory of NEC, has been in charge of laptop computers from 98LT to the latest model.

As mentioned above, desktop 98 series by NEC *Johoshori* (information processing in Japanese) subunit became the de facto standard in the Japanese market. Through developing and selling 98 series, NEC Johoshori subunit accumulated huge amount of knowledge. One of these knowledge was the expertise and experience concerning sustaining of compatibility between desktop hardware.

In the mid 1980s, NEC was the only manufacturer who tried to maintain compatibility between laptop and desktop hardware. Other desktop manufacturers such as Fujitsu, Sharp and Matsushita sought higher performance of information processing rather than compatibility between hardware. For example, when Sharp developed and released X68000 with high performance AV device, compatibility between former hardware was sacrificed.

Knowledge accumulated in NEC Johoshori subunit suppressed the appearance of a new PC architecture, laptop computer. Because laptop computer had been inferior to desktop computer in the point of information processing capability, keeping perfect hardware compatibility was impossible.

Adapting to a Change in Product Architecture

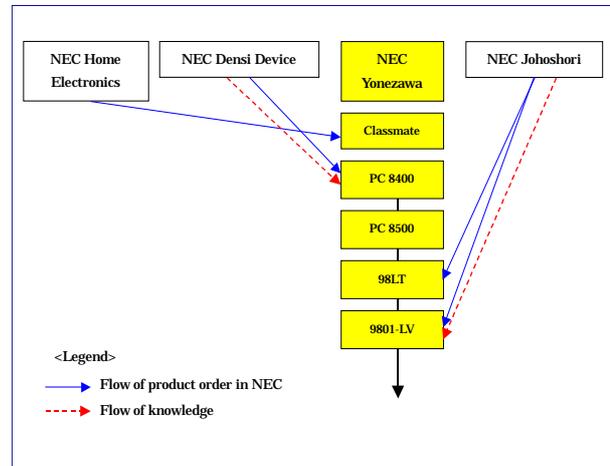
At that time, there was a rapid transition from monochrome display to colored-display in desktop computer technology. However, it was impossible to install and use software developed for colored-display desktop computer on laptop computer combined with monochrome display. Consequently, NEC Johoshori subunit made a decision to suppress development of laptop computer.

On the other hand, NEC Yonezawa had accumulated the technology required in laptop computer. As NEC Yonezawa was independent from NEC Johoshori, the knowledge concerning desktop computers did not restrict laptop computer development at NEC Yonezawa. The first laptop computer developed by NEC Yonezawa was called “Classmate” which was ordered unofficially by NEC Home Electronics, an independent subunit in charge of home electronics, in 1983. Though NEC Yonezawa succeeded in developing a prototype, transition to the development stage was interrupted for several reasons.

In 1984, NEC Yonezawa tried to develop another laptop computer PC-8400 that was ordered by NEC Densi Device, an independent subunit in charge of semiconductor, *Densi* meaning electronics in Japanese. Kiyoshi Kanoh who was chief engineer in NEC Yonezawa at that time explains the background why NEC Yonezawa began to develop laptop computer.

“In the early 1980s, we had been searching new product areas and focused on the light-weight,

Figure2. Absorbing resources from other subunits



compact-sized peripheral devices such as portable printer, portable scanner, etc. When the suggestion of developing laptop computer came from NEC Densi Device, we thought the new product would grow rapidly and the development would be possible with our accumulated know-how and resources.”

But technologies such as mounting chips in the integrated board were not sufficient in NEC Yonezawa, NEC Densi Device sent five engineers into NEC Yonezawa and made them co-work to develop PC-8400.

Figure2 shows the process by which NEC Yonezawa absorbed the resources from NEC Densi Device. Five engineers played an important role such as designing, technological advising, and developing several types of board. As a result, NEC Yonezawa became the only subunit that accumulated technological resources concerning laptop computers.

Absorbing resources from another subunit continued after the development of 98LT. Shown in

Figure 2, NEC Yonezawa had absorbed BIOS information of desktop 98 series and expertise on product development from NEC Johoshori subunit after NEC shifted its product strategy.

4. Discussion and conclusion.

The paper analyzed NEC’s case to examine the organization strategy of an established firm. Two points have been made clear as follows.

First, NEC Johoshori subunit in charge of desktop computer was not able to develop a new architecture. This result supports the argument of a prior research such as Henderson and Clark (1990). Second, NEC was able to adapt to a change in PC architecture due to organizational separation inside an organization. As NEC Yonezawa had accumulated technological resources independently in the process of developing a laptop computer, NEC as an established firm has been able to develop and evolve a laptop computer. The second point has been made clear through the analysis.

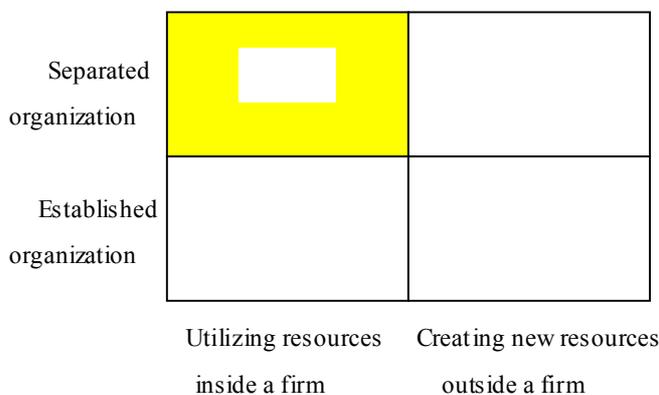
The results mentioned above show another pattern of organization strategy for adapting to a

change in product architecture. In Figure 3, four patterns of organization strategy are presented.

Vertical axis of Figure 3 is the choice of organizational pattern in charge of a new architecture, established organization and separated organization. Established organization indicates a subunit that is in charge of a previous product and separated organization is defined as an organization separated from an established organization such as a subunit inside a firm, a corporate venture, and a subsidiary. Horizontal axis is the choice between utilizing resources inside a firm and creating new resources outside a firm.

Prior researches have merely classified type 1 and type 3 according to the vertical axis. Type 1 is considered as an undesirable organizational strategy when adapting to a change in product architecture. Type 3 became a reasonable pattern of organization strategy on the case. However, if organization strategy is sought in two axes, NEC’s case does not fit in either type 1 or type 3. That is, NEC fits a new type 2, which is a combination of separated organization and utilizing resources inside a firm.

Figure 3. New pattern of organization strategy



This paper presented the new organization strategy of an established firm through dynamic management of subunits: suppressing an established subunit and utilizing or setting up another subunit at the same time inside a firm.

In type 2 such as NEC, it becomes important how to mobilize various resources accumulated in the subunits.

Adapting to a Change in Product Architecture

Modern industrial enterprises are organized based on multidivisional structure. The interactions among divisions are suppressed and each division has full function concerning production and sales (Chandler, 1990; Weick, 1976). Within the organizational structure, each division accumulates various product-related resources. However, the risk of inefficient resource-utilizing increases at a firm level.

If a firm permits each division to enclose its resources, interaction between subunits or creating heterogeneous resources required in new architecture will be difficult. Hence, the organizational rule or policy where subunits are allowed to use heterogeneous resources of one another becomes essential in adopting organizational strategy type 2.

The organizational rules or policies that expedite transfer of heterogeneous resources are permitting competition among subunits toward a new architecture (Wi, 2001a), establishing personal networks and communication channels through company-wide rotation of engineers (Kusunoki & Numagami, 1997; Lynn, Piehler & Kieler, 1993), and constructing relationship of trust in a firm (Szulanski, 1996).

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