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The Case of Japanese Handset Manufacturers in US

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Abstract

This study attempts to explore how a firm successfully exploits its accumulated technologies and product development capabilities in multiple relationships with more than a few customer firms within and beyond borders. "Closed" relationships with a few customer firms enhance the "exploration" of distinguished/novel product technologies and capabilities. Yet, growing customer/market diversity in the era of globalization requires many of firms to cope with more customer firms. A firm needs to develop products effectively assimilating knowledge specific to each of customer firms in both local and offshore markets.

Drawing on the anecdotal case of Japanese mobile handset manufacturers in US, the study argues that the customer interface process confined to upstream product development stages helps a firm manage more open close relationships with more than a few customer firms even across borders. In product development, the contrived customer interface process contributes to the effective selection and combination of specifications/technologies according to the requirements from each of domestic and oversea customer firms. These findings are explicated by knowledge/problem-solving perspectives.

1. INTRODUCTION

Collaborative interfirm relationships are critical vehicles of the “exploration” of distinguished/novel technologies and capabilities. For instance, studies on automobile development elucidate that collaborative relationships between firms enhance the knowledge exchange/sharing for exploratory problem-solving in product development process (Clark and Fujimoto 1991, Dyer and Singh 1998, Takeishi, 2002, Wasti and Liker 1999).

However, in the line of studies, critical knowledge is assumed to be bound to “closed” collaborative relationships between specific firms (Dyer and Singh 1998). Thus, we could infer that a firm in closed relationships with a few specific customer firms is likely to have difficulties when attempting to cope with other firms outside the existing relationships.

In the era of globalization, a firm needs to cope with multiple customer firms beyond closed, in many case local, interfirm relationships (Bartlett and Ghoshal 1989, Prahalad and Doz 1987, Shan and Hamilton 1991). The situation witnesses the necessity of the “exploitation” of accumulated technologies and product development capabilities in cooperation with more than a few customer firms. The attempts for the exploitation require firms to assimilate customer/market specific knowledge, particularly tacit knowledge, even across borders (Subramanian and Venkatraman 2001).

The importance of the effective exploitation of technologies and capabilities (Yasumoto and Fujimoto 2005a) is suggested in terms of the modularity/modularization of product design and engineering activities (Baldwin and Clark 1997, Cusumano and Nobeoka 1998). Yet, effective application of accumulated technologies and capabilities to multiple customer firms relies on customer relation process (Day 2000, Fujimoto 2004). For the competitive advantage, a firm needs to master market relationship capabilities to create and maintain relationships with customers (Day 2000).

Insofar, how a firm assimilates the knowledge from multiple customer firms in more open interfirm relationships is not sufficiently examined relevant to product development process. Drawing the anecdotal case of Japanese mobile phone handset manufacturers in US, the article addresses the question how customer interface process contributes to the effective exploitation of accumulated technologies and capabilities in product development projects of multinational firms.

At first, the article reviews the determinants of interfirm relationships drawing on knowledge/problem-solving perspectives, and thereby points out the role of interfirm knowledge exchange/sharing at upstream product development stages. Second, the article attempts to cultivate the concept of customer interface process in product planning process. Drawing on the proposed

perspective, the anecdotal case of Japanese mobile handset manufacturers in US is described. At last, the article summarizes findings, and thereby draws some implications.

2. LOCUS OF OVERLAPPING PROBLEM-SOLVING AND INTERFIRM RELATIONSHIPS

Interfirm relationships are associated with architectural interdependencies between the components of a product system (Brusoni and Prenicipe 2001a, 2001b, Fujimoto 2004, Sturgeon 2002, Sturgeon 2002, Takeishi 2002, Ulrich 1995). In the line of studies, firms are presumed to benefit either of two alternative types of interfirm relationships, “closed” or “open”, according to the level of interdependencies between the subsystems of the products concerned: integral/modular architecture.

The attributes of interfirm relationships is further explicated by the transferability of knowledge within and between firms (Kogut and Zander 1992, 1993). The transferability explicates how the locus of problem-solving in product development is partitioned between related firms (von Hippel 1994, 1998). The necessity of closed relationships between specific firms is attributed to the tendency that knowledge required for problem-solving is dispersed across firms (Brusoni and Prenicipe 2001b, Clark and Fujimoto 1991, Takeishi 2002). The locus of problem-solving calls upon the iteration among the multiple sites of specific knowledge (e.g., sticky information, von Hippel 1994). The iteration would result in close relationships between a few firms, which each would possess related specific knowledge.

Drawing on the knowledge partitioning in automobile development projects, Takeishi (2002) finds the factor to enhance the knowledge exchange/sharing between partner firms. When an automobile project includes the development of components based on new technologies, the fluidity of the boundaries of knowledge calls for overlapping problem-solving process across firm boundaries (*e.g.,* design-in activities). The exchange/sharing of specific knowledge in the process bears closed manufacturer-supplier relationships.

On the contrary, if the knowledge required is partitioned by clear-cut boundaries between related firms, firms may rely on open interfirm relationships, such as modular production networks of firms (Sturgeon 2002). Problem-solving activities are partitioned into each of subsystem engineering/design activities when related knowledge is localized within each subsystem development group.

In the line of studies, interfirm relationships is characterized with knowledge exchange/sharing at design/engineering stages. However, closed interfirm relationships at design/engineering stages are

at best one of the options to satisfy customer firms' needs.

If partitioned by clear-cut firm boundaries, most of design/engineering knowledge is held at each of specialized firms (*e.g.*, modularity, Baldwin and Clark 1997). In the case, a supplier will attempt to respond to customers' requirements assimilating customer-specific knowledge within the limit of confined development activities such as product concept/specification planning.

The limited locus of knowledge exchange/sharing will allow the supplier to confine iterative, thus overlapping, problem-solving process with customers to the range of fluid knowledge boundaries at upstream stages. The limitation of the range of overlapping problem-solving may reduce knowledge exchange/sharing costs relevant to task interdependencies between these firms. Thus, the supplier may expand the scope of customers, to which manufacturer's technologies and development capabilities are applicable.

The logic makes us infer that the necessity of specific knowledge exchange/sharing between firms does not necessarily result in "closed" relationships between a few firms (See Fig. 1). Even if the relationship is relatively open to more than a few specific customer firms, a firm could assimilate customer-specific requirements into products. In reality, several Japanese electronic firms (*e.g.*, Denso, Omron, Roam) are dexterous at customizing products for multiple customers without changing their technological bases (Fujimoto 2004).

Figure 1 Interfirm interface and knowledge specificity

Interfirm Interface Process (interfirm Relationship)	generic	Specific
Customer specific (closed)	Pretentious closed relationship	"Closed" relationship (*e.g.*, ideal Japanese supplier system)
Versatile (open)	Market transaction	"Close" relationship based on contrived interface process

Specificity of exchanged / shared knowledge

The characteristics of interfirm relationships depend upon interfirm interface process. The interface process will enhance the exchange/sharing of specific knowledge between a few firms. In the line of automobile development studies, interfirm interface process, such as "absorptive capacity (Dyer and Singh 1998)", is presumed to be idiosyncratic to a closed interfirm relationship stretched over design/engineering or entire development process.

Yet, interfirm interface process, particularly suppliers' customer interface process, could be versatile. The process enhances the collaborative iteration confined to focused stages, particularly upstream stages, to the extent that a supplier could benefit "close", not closed, relationships with multiple customer firms even across borders.

3. CUSTOMER INTERFACE PROCESS FOR EXPLOITATION

On the base of the above discussion, the article posits that the attributes of customer interface process conditions how a firm could exploit the technologies and capabilities in close relationships with more than a few customer firms. The exploitation process demands coordination between firm and knowledge boundaries when the range of required knowledge ranges customer firms (Herstadtt and von Hippel 1992, Lilien et al. 2002, Ogawa 2000, von Hippel 1988). Thus, in the exploitation process, a firm attempts to coordinate its own accumulated technologies and capabilities and customers' requirements (Brusoni and Prenicipe 2001b, Day 2000).

The coordination demands the assimilation of the knowledge on customer firms in the process aligned with the corresponding process of customer firms (Day 2000). As for product development, two strategies to exploit specific knowledge on customers' requirements, "lead user approach" and "customer-based mass-customization approach", are proposed in terms of knowledge/problem-solving perspectives.

Drawing on the cases of industrial machineries, network systems, test equipments, and so on, the former approach shows that customer-specific knowledge, such as sticky information on the needs and solutions of a few lead users, helps a firm create new product concepts, and/or drives product/technology innovations (Herstadtt and von Hippel 1992, Lilien et al. 2002, Ogawa 2000, von Hippel 1988). Iterative problem-solving with a few lead users is presumed to enhance the exploration of novel products/technologies.

On the contrary, user-based mass-customization (von Hippel 1998) approach focuses on the localization of problem-solving within customer firms. The case of application specific semiconductor demonstrates that a supplier firm leaves customization tasks to customer firms as

customer firms would possess the knowledge on its own needs. Whereas user-based mass-customization enables a firm to cope with more than a few customer firms, customer firms in many of industries often do not have sufficient design/engineering knowledge.

The specialization of design/engineering process still leaves knowledge boundaries overlapped between firms in concept generation and product planning process at upstream stages. In the case, iteration across firms will succeed within upstream stages until firms find satisfactory concepts/specifications for all of them.

Knowledge exchanged/shared at the stages does not range over design/engineering knowledge, but could be limited to the knowledge for product concept/specification planning. Customer interface process for the exploitation of technologies and capabilities is expected to enhance the exchange/sharing of knowledge with customer firms within upstream stages.

Amongst all, the involvement of customer firms in product planning process drives the collaboration process to search and select eligible combinations of technologies and specifications coupled with customers' requirements and strategies (Herstadtt and von Hippel 1992, Lilien et al. 2002, Ogawa 2000). The contrived customer interface process confined to product planning stages conditions the involvement process with more than a few customer firms in a consistent manner. The principle of the contrived customer interface process is to exploit the accumulated technologies and capabilities involving more than a few customer firms into product development process.

4. RESEARCH DIRECTION AND DATA COLLECTION

The article focuses on the customer interface process of two Japanese handset manufacturers in US in the early 2000s. The saturation of domestic market and the international standardization of mobile telecommunication technologies toward 3G (third generation: CDMA and WCDMA)[1] have encouraged Japanese manufacturers to advance to oversea markets since the end of the 1990s.

However, Japanese manufacturers are positioned far behind top manufacturers, such as Nokia, Samsung, Motorola, LG, Sony-Ericsson, in terms of the market share in the world. Whereas leading the evolution of handsets in accordance with advanced mobile telecommunication services, Japanese manufacturers' performances are not necessarily prominent in the global mobile phone industries.

Japanese manufacturers have enjoyed the success in the exploration of advanced product technologies and handset development capabilities.[2] However, the local manufacturer-supplier relationship as well as the telecommunication technology difference between Japan and other markets hinders the exploitation of their technologies and capabilities (Funk 2002).

In recent years, the rise of several Japanese mobile handset manufacturers, nevertheless, is reported in US. The case of these Japanese manufacturers in US casts doubt on the concept of close relationships between specific firms.

The original data on the sample handset development process was collected from 2001 to 2005 both in US and Japan. Eight Japanese handset manufacturers and four non-Japanese handset manufacturers were involved in the study. The study conducted semi-structured interview researches based on a questionnaire sheet on "platform/base-model" handset development process, which includes knowledge exchange/sharing processes with major customer providers.

Respondents were product planning managers and/or handset development project leaders, who were mostly engineering section mangers. The business/corporate information was gathered from publications on mobile phone industry, handset business, and handset manufacturers.

Five Japanese and non-Japanese manufacturers provided the information on the handset development for both US and Japanese markets. After examining the collected data, the study focuses on two Japanese manufacturers, which were relatively successful in both US and Japanese markets.[3] Technological factors would be controlled to some extent since these Japanese manufacturers develop handset business based on CDMA technology in both US and Japan.[4]

5. JAPANESE MOBILE HANDSET MANUFACTURERS IN US

In recent years, Korean and Japanese manufacturers have soared as the handsets meet the demands for high-specification models in US.[5] Particularly the CDMA handset market raises these manufacturers. In the surge of the US CDMA market around the 2000s, two Japanese CDMA handset manufacturers, *Company D* and *Company X*, flourish among Japanese manufacturers. While these manufacturers are not prominent in the global total handset market, their positions in both the US handset and global 3G market exceed those of larger Japanese and non-Japanese manufacturers such as Sony-Ericsson, Siemens, NEC, Panasonic, and Sharp.[6]

The success of these manufacturers might be attributed to the manufacturer-provider relationship distinctive among both non-Japanese and Japanese manufacturers in US. In close relationships with US providers, these firms, particularly *Company D*, enjoy the high evaluations on the products and drastic sales growth in US market. *Company D* focuses on nothing but the high-end handset market in US. *Company X* covers the middle to high-end handset markets, but rather focuses on the middle market. These manufacturers make full use of their advanced features and technologies

in order to penetrate into US market.

The handsets for the Japanese provider are more advanced and complex than for US market.[7] Reflecting the difference, the product development strategy largely rests on how to apply the technologies and capabilities, which have already been verified in Japan, in the relationships with US customer providers.

As is the case of other manufacturers in Japan, *Company D* and *Company X* develop specific handsets in close relationships with customer providers, particularly CDMA providers, in US.[8] *Company D* devotes to Sprint PCS, and *Company X* copes with Verizon Wireless and other providers. Most of the advanced features and functions of their handsets, not least related to mobile telecommunication services, are transferred from Japan to US in the relationships with these providers (e.g., contents download, data transmission, music player, user-friendly color graphical interface).

Their handsets for US market are roughly divided into two types: the handsets designed specifically for US market and the applied handsets of Japanese models to US market. Both the firms adopt similar handset development process in both the projects for US and Japan.

In many cases of the former type model development, both the hardware and software are designed for specific models for each US provider. These manufacturers develop model-specific designs and components without definite basic designs and common parts.

Yet, common resources for CDMA manufacturers, which are mostly arranged or provided by a leading US CDMA technology vendor, Qualcomm, are available for these manufacturers.[9] These manufacturers exploit common components particularly related to wireless connection (*e.g.*, baseband chip) and software (e.g., BREW/JAVA applications and application platform, OS, wireless interface software) in the models for both US and Japan. Also reference designs, which layouts baseband chips, RF units, related components on basic circuit designs, may be shared among the models for both US and Japanese markets.

Based on these common resources, these manufacturers develop new product designs (circuit and mechanical design) and components mostly relevant to applications (*e.g.*, camera, display, keyboards). Software and related data are developed or modified in accordance with the services and specification requirements of customer providers (*e.g.*, model/provider-specific application, device driver, user-interface, wireless connection).

On the other hand, projects for the latter type model reuses basic hardware design, components,

and software of past models for Japanese market. Considering specifications demanded by US providers and subscribers, the manufacturers modify the portions of elements of preceding Japanese models.

In *Company D* and *Company X*, handset development activities for US are separated from those for Japan. Nevertheless, these firms adopt similar handset development process, including product planning, in both projects for US and Japan. The coordination at product planning stages is carried by product planning groups. Planning members including managers usually do not devote to a single project, but are involved in several projects.

Company D and *Company X* involve focused US providers in their development processes as is the case in Japan. These manufacturers and providers have routines to exchange/share their proposals and requests. Yet, in projects for US, intensive involvement of providers is held at product planning stages, 3-4 months, in entire handset development process (6-12 months, depending upon the novelty of the developed models concerned).

In the process, manufacturers' product planning groups and product design ones collaborate to contrive basic product concepts, exterior designs, features, specifications as well as development costs and schedules. The process draws on technologies and products already verified in Japan. Bearing the results, *Company D* and *Company X* offer handset model plans to providers.

Providers review the proposed handset development plans on the base of their product and service plans. Reflecting providers' reviews, manufacturers' product planning groups select and combine specifications and technologies to elaborate product concepts, basic designs, features, costs, and schedules, and so on. The manufacturers improve original plans in the process, and offer revised plans to providers.

Information exchanged/shared in the search-plan-review cycle includes materialized requirements as well as intangible requests. The information ranges from basic wireless technology specifications and costs to components, designs, and software to other miscellaneous features. These elements are related to providers' product strategies and service plans.

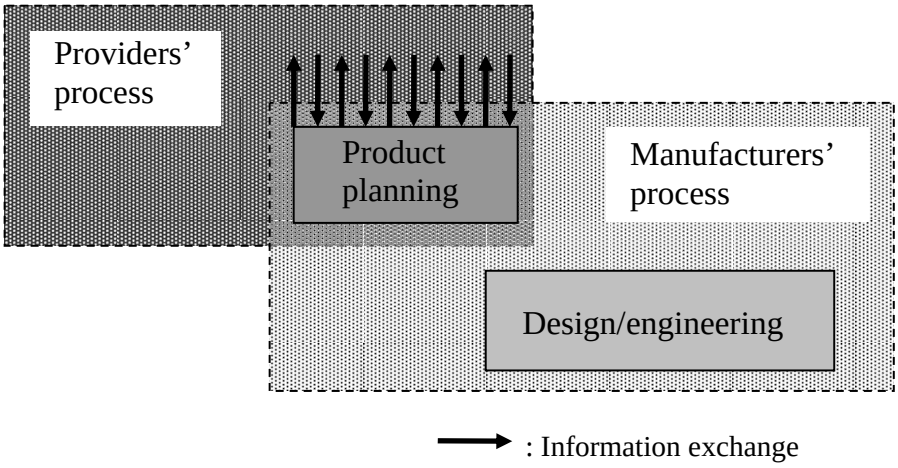
Basic requests from providers could be presented in materialized forms (*e.g.,* basic specifications, cost, schedule, technological requirements). Furthermore, providers show intangible requests (*e.g.,* application features, body color, exterior design, user-interface).

The search-plan-review cycle is usually repeated at least several times. During the process, product planners, particularly planning leaders, communicate with providers more than once in a

week. When providers accept the proposal, the handset development project is formally approved.

The intensive manufacturer-provider collaboration confined within upstream stages (See Fig. 2) is different from those of both European and US manufacturers and other Japanese manufactures. In Japanese market, manufacturers would need to develop high-specification handsets according to advanced mobile services of provider. The process requires manufacturers to develop model-specific design, components, and software and to furbish specifications and design elements by projects (Yasumoto and Fujimoto 2005a).

Figure 2 Overlapping confined to product planning process



As is the case in automobile industry, Japanese mobile handset industry is characterized with closed interfirm relationships (Funk 2002). In the closed relationship, Japanese manufacturers collaborate with domestic providers through almost entire development process including design/engineering process.

On the contrary, major global manufacturers are liable to exploit the basic product designs/platforms modifying specifications for providers in the world. The handset development process is also not adhere to any specific providers, but is applicable to multiple providers. Thus, the handset development process is rarely overlapped with providers' process.

Yet, it should be noted that *Company D* and *Company X* neither simply offer products for themselves nor simply follow providers' requirements. The differences between *Company D*/*Company X* and other manufacturers in manufacturer-provider relationships rest on the interactive process confined to product planning process. In these manufacturers, the process would boost the selection and combination of specifications and technologies aligned with providers.

6. CONCLUSIONS

The article attempts to explore how a firm could exploit its technologies and capabilities assimilating specific knowledge from more than a few customer firms. The study draws three findings from the anecdotal case.

At first, effective customer interface process does not rely on a few local customer firms. Second, the process (*i.e.*, product planning) contributes to maintaining close interfirm relationships, which enhance the assimilation of specific knowledge from more than a few customer firms. Third, the process helps a firm effectively select and combine technologies and specifications aligned with customer firms' requirements and strategies.

These findings make us infer that contrived customer interface process may help a firm links product strategies, such as platform/multi-project strategies (Cusumano and Nobeoka 1998), with customers' requirements in a consistent manner (Fujimoto 2004). Contrived customer interface process would also drive the coordination of spreading knowledge in overlaps between firm and knowledge boundaries (Brusoni and Prenicipe 2001a, 2001b).

The study would contribute to elucidating the characteristics and significance of customer interface process in product development activities across borders. The findings are expected to provide multinational firms with guidelines for effective exploitation of technologies and capabilities spanning the differences between customers in the diversity of global markets.

We need to further understand the attributes of customer interface process and knowledge exchange/sharing between related firms. Also the relevance of customer interface process to technological bases and strategies should be examined hereafter.

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【NOTE】

[1] CDMA means the Code Division Multiple Access technology (here including cdma One, cdma One 1x

and cdma One 1x EV-DO). WCDMA is the Wideband Code Division Multiple Access. Both are based on IMT-2000 by ITU (International Telecommunication Union).

[2] After the introductions of "ez-web" by KDDI in 1998 and "i-mode" by NTT DoCoMo in 1999 are Japanese manufacturers have preceded European and US manufacturers in the experiences of high-specification handset development. Furthermore, the introduction of 3G after 2001 accelerates high-specification handset development in Japan.

[3] The clinical data of projects for Japanese market were collected from *Company D* (Dec 26, 2002; Jun 25, 2003) and *Company X* (Oct 18, 2000; Dec 2, 2003). For the projects for US market, interviews were held at *Company D* (Dec 26, 2002) and *Company X* (Sept 24, 2004). Afterwards, additional data were successively supplemented by project managers through e-mail correspondences from 2003 to 2005. For the detail of the case, see Yasumoto and Fujimoto (2005b).

[4] CDMA subscribers account 46 % (70.5 M) in US (EMC World Cellular Data Base, Apr, 2004) and 21 % (17.25 M) in Japan (TCA, Apr, 2004).

[5] Korean and Japanese manufacturers is particularly evaluated by advanced features. Also the manufacturers are strong at other factors: durability, physical design, battery function, and usability ("U.S. Wireless Mobile Phone Evaluation Study", JD Power press releases from 2002 to 2004). The total market share of Korean and Japanese manufacturers amounts to 40% in 2004. (Strategy Analytics press release, 2004).

[6] *Company D*, the top CDMA manufacturer in Japan, is the fourth manufacturers in total Japanese handset market (unit base, see "2005 Domestic mobile market research (2005 Kokunai-idoutaitsushin-shijo-doukou-chousa)," 2005, Yano Research Institute). *Company D* provides WCDMA handsets for NTT DoCoMo instead of Vodafone since 2005. *Company D* is the top vendor of Sprint PCS and the 5th manufacturer in the global 3G handset market following LG, Samsung, Nokia, and Motorola (unit base, Strategy Analytics, Nov., 2005). On the other hand, *Company X* is positioned at the 5th in Japanese CDMA market and the 9th in Japanese total handset market (unit base, Yano Research Institute *op.,cit.*). Yet, *Company X* as well as *Company D* is the 5th manufacturer in global 3G handset market (unit base, Strategy Analytics *op.,cit.*). Their positions in North American CDMA handset market swing within the 4th to 6th, 10-15% share each, following LG, Samsung, Motorola, and sometimes Nokia (Strategy Analytics press release from 2003 to 2005).

[7] For instance, advanced handsets in Japan are equipped with complex product functions (more than 1 million step software in 2003). Handsets with equivalent functions prevail in US at least 1-2 years later than in Japan.

[8] These manufacturers have experienced in the handset business in a close relationship with the only CDMA provider, KDDI, in Japan.

[9] GSM/WCDMA manufacturers may exploit similar resources: wireless core chips, reference designs, common software applications and platforms, and so on. For instance, more than a half of GSM/WCDMA handsets in the world make use of the reference designs of EMP (Ericsson Mobile Platform) by Ericsson. Yet, many of GSM/WCDMA Japanese manufacturers apply these platform designs nothing but in the projects for offshore markets. Related data was collected in the interviews for Nippon Ericsson (3, Mar, 2006) and Qualcomm Japan (10, Mar, 2006).