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Reasons for Innovation: Legitimizing Resource Mobilization for Innovation in the Case of Okochi Memorial Prize Winners

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Abstract:

This paper addresses reasons for innovation. Innovation requires resources to transform new ideas into products/services to be sold in the market and diffused in society. Yet in the earlier stage of innovation process uncertainty always prevails both technologically and economically. There is no objective consensus that the new idea will succeed in the end. It is thus necessary for those people who want to realize the innovation to show others both inside and outside the firm legitimate reasons for mobilizing their precious resources, including people, materials, facilities, and money, throughout the process toward commercialization. How do firms legitimize the resource mobilization for innovation? Drawing on 18 case studies on Okochi Memorial Prize winners, which our joint research project has carried out over last five years, and building upon the existing literature on internal corporate venturing, new ventures, and other related issues, this paper examines the innovation process of established Japanese firms from idea generation to commercialization with a primary focus on the process by which resource mobilization was legitimized.

1. Introduction

How have Japanese firms achieved innovation? What processes have they gone through from idea generation to commercialization? Viewing the process of innovation as that of legitimizing resource mobilization for transforming a new, uncertain idea into economic value, this study explores "reasons for innovation" that could mobilize necessary resources.

Innovation requires resources to transform new ideas into products/services to be sold in the market and diffused in society. Yet in the earlier stage of innovation process uncertainty always prevails both technologically and economically. There is no objective consensus that the new idea will succeed in the end. It is thus necessary for those people who want to realize the innovation to show others both inside and outside the firm legitimate reasons for mobilizing their precious resources, including people, materials, facilities, and money, throughout the process toward commercialization.

Cases of the Okochi Memorial Prizes winners serve as our empirical materials. Drawing on 18 case studies and building upon the existing literature on internal corporate venturing, new ventures, and other related issues, this paper examines the innovation process of established Japanese firms from idea generation to commercialization with a primary focus on the process by which resource mobilization was legitimized. Since this study is still in progress, this paper offers the results of a tentative analysis and discusses preliminary implications.

2. Research Question: Reasons for Resource Mobilization Towards Innovation[1]

Innovation is a process of introducing something new that could provide economic value (Hitotsubashi University Institute of Innovation Research 2001). Innovation involves something new, but mere newness is not enough for economic value. Invention, discovery, patents or technological development are not innovation. Any one of these could be an important component of innovation, but it does not lead to economic value by itself. Innovation is achieved only when an innovative idea is transformed into a commercial goods to be bought in the market and spread throughout society.

[1] For a more comprehensive discussion of earlier studies on which the central issues, analytical perspective and framework of this study draw, see Karube, Takeishi, and Aoshima (2007).

There are two conditions for realizing innovation. One is the effective creation of a new idea on technology, product, or business. The essence thereof lies in the creation of knowledge. The other is resource mobilization for a process of transforming a new, promising idea into a business. Economic value cannot be achieved solely by an individual or a technology development division. Collaboration from diverse functions and actors and investment of various resources are necessary for market acceptance and social diffusion.

Between these two major aspects of innovation process, knowledge creation and resource mobilization, we focus on the latter. Our particular interest is in the reality that resources of diverse actors need to be mobilized for realizing innovation from a new idea while the very innovativeness of the idea hinders the mobilization of resources from relevant actors.

Innovation starts from an idea whose technological feasibility and marketability is uncertain. There is no certain, objective prospect of achieving economic value beforehand. In addition, innovation sometimes causes opposition from the established forces because it may hurt their vested interests. Since innovative ideas are susceptible to hesitation and opposition due to their uncertainty and potential to damage vested interests, it is difficult to mobilize resources of relevant actors. Of course there are some cases that started with high expectations shared by many people and ended up with successful results as expected. The history of innovation, however, suggests that numerous cases of innovation with ex-post success indeed started as ideas and technologies with low ex-ante expectations. If a firm aims at achieving a major success, it has to be ahead of its competitors in resource mobilization for the development and commercialization of an idea that seems unpromising to other firms (Figure 1).

In other words, the process of realizing innovation can be described as a process of attracting attention to a new idea susceptible to resistance, gaining organizational and social acceptance of the idea, managing cooperation from relevant actors, and transforming the existing institutions (Van de Ven 1986). As Shumpeter (1942) points out, innovation entails “detaching productive means already employed somewhere from the existing cyclical economic activities and allotting them to new activities,” and thus realigning the flow of resource mobilization in society.

Then, we have to answer the following question to understand the process of innovation: “Why did relevant actors decide to invest scarce resources in the

development and commercialization of an innovative idea and technology even though its technological feasibility and marketability were uncertain?" In short, we have to clarify the "reasons" that enable resource mobilization in the process of innovation.

This question is particularly important for today's Japanese firms. They have competed on quality and cost with their outstanding capabilities of product development and manufacturing in their effort to catch up with Western rivals. Now that Japanese firms have become global leaders in technological development, they need to create new products, services, and businesses by themselves. The majority of earlier studies on innovation by Japanese firms have dealt with one of the two major aspects of innovation, knowledge creation. They primarily focused on organizational management for new product development, learning, and knowledge creation.

These studies, however, have shed little light on important problems of the other aspect, resource mobilization. Such problems include: 1) How Japanese firms have worked on the development of new technologies or prototypes when uncertainty prevails (rather than on the product development when uncertainty is low), or how they worked on creating a new business (within which product development is managed); 2) How they have invested resources in learning and knowledge creation; and 3) how they have put resources for transforming created knowledge into economic value (investment for mass production, distribution, and business system).

3. Analytical Viewpoint and Framework

Previous Research

In exploring the above questions, we stand on the view that innovation is a process of obtaining legitimacy of mobilizing resources of relevant social actors for transforming a new idea into economic value.

In order to realize innovation from a new idea that doesn't offer objective prospect of success, one has to convince relevant actors inside and outside the organization of the legitimacy of putting manpower, allocating budget, and investing other precious resources for development and commercialization. One needs a "good reason" for mobilizing necessary resources. We can advance the process of innovation as far as those actors acknowledge the legitimacy. Once this legitimacy is lost, the process halts.

This viewpoint is founded mainly on two streams of studies, those on internal corporate venturing and technological innovation at large, established firms, and those

on innovation by new ventures.

Many studies of the former stream analyzed the organizational process of resource allocation (Burgelman 1983, Dougherty and Hardy 1996, Quinn 1986), and explored the roles and characteristics of "champions," persons who actively promoted and led such a process (Day 1994, Howell and Higgins 1990, Maidique 1980, Markham 2000, Schon 1963, Roberts 1980). Some studies treated product development at large firms as the process of legitimization (Dougherty and Heller 1994). Research on disruptive technology also dealt with the issue of resource allocation for innovative technology within established firms (Christensen and Bower 1996). All these studies pointed out the difficulty of mobilizing resources for new ideas at large firms. In this sense, these studies share common interests in legitimacy for innovation with us. However, legitimacy itself and ways to obtain it, which are our focus of attention, have not been fully explored. There is room for further research on organizational processes since previous studies have primarily focused on vertical interactions for establishing legitimacy across different hierarchical levels inside the organization. They have shown little interest in horizontal interactions across different divisions and multiple actors inside and outside the organization.

The latter stream of studies used the concept of legitimization in analyzing the process of securing resources by new ventures (Aldrich and Fiol 1994, Delmar and Shane 1994, McMullen and Shepherd 2006, Starr and MacMillan 1990, Yamada 2006, Zimmerrman and Zeits 2002). However, only a small number of researchers have thus far made empirical analysis on reasons for resource mobilization. Also, this stream centered on how venture companies prove the legitimacy of their innovation to outsiders and pays little attention to resource mobilization within their organizations because top executives are almost always champions of innovation.

Building upon the viewpoints and results of these earlier research works, our study would make an empirical analysis of the process of innovation at major Japanese firms. We empirically explore types and means of legitimization through vertical and horizontal interactions across relevant actors inside and outside the firms, and would like to provide some new insights on the process of innovation.

Analytical Framework

This study analyzes 1) what kind of legitimacy the firms in question obtained; 2)

how they obtained such legitimacy; and 3) to whom they proved such legitimacy, along with the process of innovation.

Suchman (1995), who has theoretically addressed the concept of organizational legitimacy, defines legitimacy as "a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions." There are three primary types of legitimacy: pragmatic legitimacy based on direct interest or preference of the people to whom it is to be appealed; moral legitimacy based on normative approval; and cognitive legitimacy based on tacit acceptance (Suchman 1995). The most important factors for resource mobilization toward innovation are expectations of earnings accrued from technological innovation and prospect of reasonable returns from investment. The more certain they are, the easier resource mobilization becomes. These factors form part of what Suchman calls pragmatic legitimacy. We call this type of legitimacy direct economic rationality. Capitalist society is a system in which social resources are mobilized based on direct economic rationality.

As pointed out above, however, it is difficult to have a clear, objective prospect of economic value to be accrued from an innovative idea before its implementation. Firms (should) decide to invest in the commercialization of innovative ideas based on direct economic rationality in the end. Yet, during the process prior to such final decisions, firms often need to ensure other types of legitimacy to secure necessary resources.

Although different strategies can be adopted to gain different types of legitimacy, there are three strategies: conforming to the relevant actors; selecting the most appropriate actors; and manipulating the relevant actors (Suchman 1995). As the process of innovation advances toward commercialization, the people to whom one has to appeal for legitimacy also change —— from colleagues within the R&D division, and people in the production and sales functions to members of divisional and corporate levels. Such interactions with relevant actors to obtain legitimacy both vertically and horizontally within the firm are further extended to outside actors such as suppliers of components, complementary products, and services, and various institutions. Through the innovation process, one has to use various strategies for various actors to obtain different types of legitimacy.

This study observes the entire process of innovation from the initial stage of conceiving an innovative idea, and the development of technologies and prototypes to

product development and commercialization, and analyzes what strategies were used to obtain different types of legitimacy towards achieving economic value in the end.

4. Sample Cases: Winners of the Okochi Memorial Prize

Our empirical data are drawn from multiple cases of innovation. Samples were obtained from winners of the Okochi Memorial Prizes. The prize was founded in 1954 to commemorate the academic and industrial achievements of Dr. Masatoshi Okochi, the 3rd Director of the Institute of Physical and Chemical Research (generally know as RIKEN) and the founder of the RIKEN industrial group. Since then, the Okochi Memorial Foundation has awarded prizes to people and firms achieving outstanding technological innovation every year. A total of nearly 700 projects have won the prizes thus far. The recipients are selected based on their achievements in production and effects on industries. In this sense, they are desirable materials for an empirical study of innovation, not as mere invention or technological development but as the introduction of a new idea that realized economic value.

Individual cases have been studied jointly by faculty members and students of the Institute of Innovation Research and the Graduate School of Commerce and Management, Hitotsubashi University. Starting in the autumn of 2003, this research project has picked up a total of 25 cases. Some of them have been already completed while others are still underway. It is difficult to make a quantitative analysis of these cases to prove some hypotheses because the number of sample cases is limited, and the industry sectors and technologies covered vary greatly. This study rather intends to explore the characteristics of the process of realizing innovation through the analysis based on the above viewpoints and framework.[2]

5. Case Analysis (Provisional)

Since some case studies are still in progress, it is premature to make a full-scale analysis across all the cases at this moment. For now this paper presents some findings from a provisional comparative analysis across 18 cases, for which basic data are

[2] This research project has been financially supported by the Hitotsubashi University 21st Century COE Program “Dynamics of Knowledge, Corporate System and Innovation.” The outline of the project and the case studies completed are available at: http://www.iir.hit-u.ac.jp/researchCOEokochiprize(A).html.

available. A summary of our analysis is shown in Table 1.

Process towards Commercialization

How long did it take for the 18 cases from the start to commercialization of innovations (See Table 1-(1))? The average time taken from the start (starting idea conception or technology development) to commercialization was 8.8 years. Innovations were achieved within five years from the start in five cases, while it took more than 15 years in three cases.

Time from the start to commercialization could be divided into two periods. One is the period before starting product development, and the other is that after starting product development. The average time taken for the former was 5.3 years and the latter 3.5 years. The period before starting product development was longer than the period after it in most cases. Only four cases were exceptions. Firms usually start product development when the product's basic specifications and the market to be targeted are somewhat clearly defined. The general pattern is that innovation process proceeds relatively slowly until reaching the stage of product development and accelerates thereafter.

Obstacles to Resource Mobilization

How did the sample cases move forward through the process from the start to commercialization? Did they face any opposition or resistance against resource mobilization? If they did, what types of opposition or resistance did they face (See Table 1 (2))?

Six out of the 18 cases secured support from business divisions at the start, based on some shared expectation of business success. They include three projects launched on the request of specific business divisions (cases #2, #5 and #18 in the table) and one project initiated to meet the demand of a major potential customer (#17). Yet in the remaining 12 cases (two thirds of the whole), idea conception or technology development were started by some engineers or groups within research and development function when there was no clear prospect of specific economic value and business success. It is true in most cases that when those engineers started projects they envisioned some, if not clear, images of how their ideas/technologies would be used in the future. At that time, however, the technological feasibility and marketability of the

ideas were uncertain. In other words, the project entered the engineering work process for innovation without any firm prospect promising enough to attract support from specific business divisions.

The resources necessary at the early stage of innovation are researchers and engineers, and R&D facilities, equipment, and materials. The amount of investment for such resources is relatively small, although uncertainty is high. This fact often helps innovation advance at this stage. Yet the mobilization of resources for activities with no clear outlook for future results has to be approved at least within the R&D division. Inspired by their personal interests, engineers sometimes start working for innovation as sideline projects. Even such projects need to obtain official approval within the R&D division, acquire budgets, and secure additional manpower in order to get moving. As mentioned above, the cases examined in this study on average spent more than five years on the process before starting product development. It took more than ten years before starting product development in three cases. At the very least, support within the R&D division has to be maintained in all these years.

Once key technologies are successfully developed and technological feasibility is in sight, the innovation process moves to the stage of product development, and then advances to commercialization. Only four cases out of the 18 cases faced no strong opposition or resistance during this period. Three of them managed to enlist support from a top executive or a specific business division from early on (#12, #15 and #18) while the other found a business unit desiring to undertake commercialization, soon after the establishment of technological feasibility (#4). The other 14 cases, however, faced some opposition or resistance. Four of them got a good start with support from specific business divisions, and then met obstructions on their way to commercialization because the voice of skeptics within the firms became louder due to changing circumstances, unexpectedly disappointing results, or time spent longer than expected (#1, #2, #8 and #17).

During the processes before commercialization, all one has to do is to invest limited amount of resources in R&D activities. As innovation gets closer to the stage of commercialization, many different actors should be involved. Manufacturing plants have to be tooled up. Sales/service systems have to be built. Cooperation from suppliers of components, materials, and complementary products and services has to be secured. The volume of resources invested at this stage is huge. Furthermore, the vested interests

of some business divisions might be hurt. Eleven cases encountered opposition/resistance from line of business, production, sales or accounting due to the lack of clear prospect of success and high risks. Two cases faced resistance based on possible adverse effects on existing businesses. It is not easy to overcome such opposition because it is much easier for us to be skeptical of something new than to be convinced of its success. There should be a good reason that is convincing enough to have some people agree to commit their resources.

Legitimization of Resource Mobilization

Out of the 18 cases, only two enjoyed smooth sailing throughout the whole process, starting with support from specific business divisions and reaching commercialization without facing no objection (#15 and #18). The other 16 cases were barred from mobilizing resources more or less on their ways to commercialization because they were not able to show direct economic rationality (a clear prospect of return on investment) successfully.

However, such obstacles were somehow overcome and commercialization was achieved in the end in these cases winning the Okochi Memorial Prizes. How did they legitimize resource mobilization (See Table 1 (3))?

In many cases, an important driver was technology-oriented mentality, with which engineers were keen to develop new technologies even if there was no prospect of business success. This is true for the aforementioned 12 cases that started without any certain support from business divisions. What underlay this mentality were organizational culture and traditional values to emphasize technological leadership and challenges. Examples include a strong drive for developing a can manufacturing technology without using lubricant (#3), developing a technology to diagnose pancreatic cancer (the most difficult of all cancers to detect) as a flagship technology in the medical equipment business (#5), or eliminating liquid-containing batteries from quartz watches (#7).

It should be noted that, even if the organization has such mentality, there are still many possible directions and choices to pursue technological development. In some cases, non-technical reasons affected the course of technological development. The existence of an overseas researcher or a competitor trying to develop similar technology was the main reason in a number of cases (#1, #9 and #12 and others). An intention of

revitalizing the research organization, not firm expectations of research results, was the determining factor for the budget allotment in one case (#8). Motivation to differentiate oneself from other groups within the same firm or corporate group was the reason for focusing on specific themes from among several options in two cases (#7 and #8).

What can be legitimized by technology-oriented mentality is basically limited to resource mobilization within the R&D division. One cannot move toward commercialization solely by such mentality. If a development project starts from a researcher's technological interest and an outstanding technology promising to produce substantial business results is developed, resource mobilization for commercialization would be easily legitimized without much obstacles. Yet things do not work out well like that with many cases.

One pattern of breaking walls obstructing commercialization is that a top executive exercises his or her leadership. When opposition is met, the top executive decides to mobilize resources for commercialization. Among the 18 cases, four fall under this pattern. The top executives who led these cases were those leaders well-known in the Japanese business history: President Maruta of Kao Corporation (#6), Vice President (later President) Nakamura of Seiko Epson Corporation (#7), President Shoda of Nissin Pharma Inc. (#12), and Chairman Doko of Toshiba Corporation (#17). Stories of strong leadership are fascinating. Yet such cases are few in our sample (four out of eighteen). In other cases, the role of top executives was limited to that of the final approver of investments that had already been legitimized by someone with the organizations.

Eight cases fall under the pattern that supporters outside the organization contributed to the legitimization of resource mobilization. Examples include: the doctor who discovered a new usage of an ultrasonic endoscope, which had not been able to show very satisfactory performance for the originally-planned usage (#5); Philips who highly evaluated a computed radiography system at an overseas exhibition when the top executives within the organization were not very certain of its value (#5), NEC who placed the first order for GaAs power module for cellular phones when Matsushita Communication Industrial Co., Ltd., a company within the same corporate group, didn’t adopt it (#8).

Some cases found supporters within the same firm or corporate group. However these supporters were often from divisions or organizations that didn’t have regular

contact with the project executing entities. They include subsidiaries (#4 and #9) and local or overseas sales subsidiary companies (#1 and #7). Support from such outside or peripheral actors, gained intentionally or accidentally, is effective to end a deadlock and secure legitimacy to mobilize necessary resources.

Another pattern is of that the innovators or its supporters are under heavy pressure or in a critical condition. Seven cases fall under this pattern. The factors causing such pressure on the former include the dissolution of the organization to develop X-ray films (#13), the impending need for the short-term renewal of the blast furnace in the Chiba Works (#10), and the possibility of shutdown of the Koriyama office (#2). Those causing pressure on the latter include the decreasing sales of Toshiba Battery Co., Ltd. (#4) and Tohoku Pioneer Corporation (#9).

Decisions on whether resources should be invested in technological innovation with uncertainty are affected by the risk preference of the actors involved. Compared to high performing organizations, those under pressure or in a crisis tend to be more willing to take risk. The involvement of such actors helps the process of innovation get moving.

After Commercialization

Having traced the process toward commercialization, we now examine what happened in the 18 cases after the commercialization. As shown in Table 1 (1), for some cases more than twenty years had passed as of 2006 since the commercialization while for others just a few years. In this context, a simple comparison of all the 18 cases is rather problematic. With this limitation in our mind, we observe that the cases reached the peak of sales 10.5 years after the commercialization on average[3].

Putting together this data and the previous data, we have found that one innovation on average took eight years from idea conception to commercialization and then took following 10 years to reach the peak of sales. No case enjoyed sales growth for more than 15 years[4] except for the one that had continued to expand sales for 23

[3] This figure is smaller than the real average because some cases have not yet reached the peak of sales

[4] It should be noted, however, two cases (#2 and #5) have continued to increase sales for 13 and 14 years respectively as of 2006 since commercialization.

years as of 2006 since commercialization (#13). One case withdrew from the market, selling off the business (#4).

Various factors would cause sales slump and business discontinuity. It is impossible for this study to make a systematic, comprehensive analysis of changes after commercialization and the factors involved. However, we might be able to hypothetically argue that the legitimization process toward commercialization would affect behaviors thereafter in some cases.

Although adequate data for analysis is not available at this moment, there is some circumstantial evidence that the logic used for the process of legitimization before commercialization could hinder further growth and policy changes afterward. For example, one case achieved commercialization by support from an outside influential actor (NTT) but eventually began losing market share to overseas competitors, who came up with new technology, which had been rejected by NTT (#8). In another case, commercialization was achieved with support from an overseas sales subsidiary in spite of opposition from the headquarter marketing division, but sales leveled off eventually due to rather independent behavior of the product development function, which indeed helped the development of the technology, and its poor coordination with the marketing function (#7).

In any of these cases, the logic or idea underlying the resource mobilization process later impeded strategic response to important market changes and new technological trends. While legitimacy plays an important role in achieving commercialization, it may become a constraint when a shift in strategy is necessary (Leonard-Burton 1992).

6. Conclusion (Preliminary Discussions)

This study is still in progress. Some case studies have not been completed. We also need to deepen our analysis in a more systematic manner. It is therefore too early to draw a conclusion and address implications, but we would like to make some preliminary discussions.

Innovation is a process of achieving economic value based on an idea with uncertainty by mobilizing resources from relevant actors. The process of innovation is comprised of multifaceted factors involving different actors at different stages. This process could be analyzed by using the concept of “legitimacy,” which encompasses not

only technological and economic factors but also social and political factors. This viewpoint shows that innovation is a chaotic phenomenon that cannot be explained solely by economic rationality and is sometimes affected greatly by chance factors. It also reveals that the subjective, local reasons of particular actors to agree to mobilize resource do matter more than objective, universal reasons.

This study provides practitioners with some insights into how to prove different types of legitimacy to different actors using different strategies. The cases we examined suggest that a good reason could be found or devised to commercialize a new idea at large Japanese firms because they are comprised of various actors having local interests under specific circumstances. It is important for those seeking innovations to appeal to peripheral and outside actors to obtain legitimacy.

Some cases also suggest, although only hypothetically under this study, that legitimacy obtained locally for resource mobilization could eventually hinder growth and changes after commercialization. Specific reasons are indispensable to get the process of innovation moving. If they remain special and unique, however, the economic value to be achieved may be limited and local accordingly. This is the problem of "bounded rationality" of resource mobilization (satisfied with a local optimization of resource mobilization) or that of dysfunction of legitimization.

Although this is a study on the innovation process at the micro level with individual firms as the unit of analysis, the viewpoint could also serve to examine some issues at the macro level. One example is technology-market interactions. The process of legitimizing resource mobilization can be considered as a medium to connect a specific technology with a specific market. This is somewhat similar to Numagami's (1999) argument, which viewed technological innovation as a process of consensus building across science, technology, and market among various social actors. The issue of national innovation system can also be discussed from this viewpoint. For example, the process to legitimate resource mobilization differs between Japan and the United States due to differences in national institutions. While American people are willing to seek for support from venture capital firms or angels when they are not able to find supporters inside their organizations, Japanese people usually try to find a way out within their organizations.

The research focusing on resource mobilization complements that focusing on knowledge creation. The two aspects interact with each other. The way resources are

mobilized affects the way knowledge is created,[5] and the knowledge created enables the mobilization of new resources. In order to better understand innovation, we should make research efforts to examine these two aspects in a more integrated manner.

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[5] This point seems to be related to "justification cost" of knowledge creation discussed by Nonaka and Toyama (2000).

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Figure 1: Innovation's Ex-Ante Expectation and Ex-Post Result

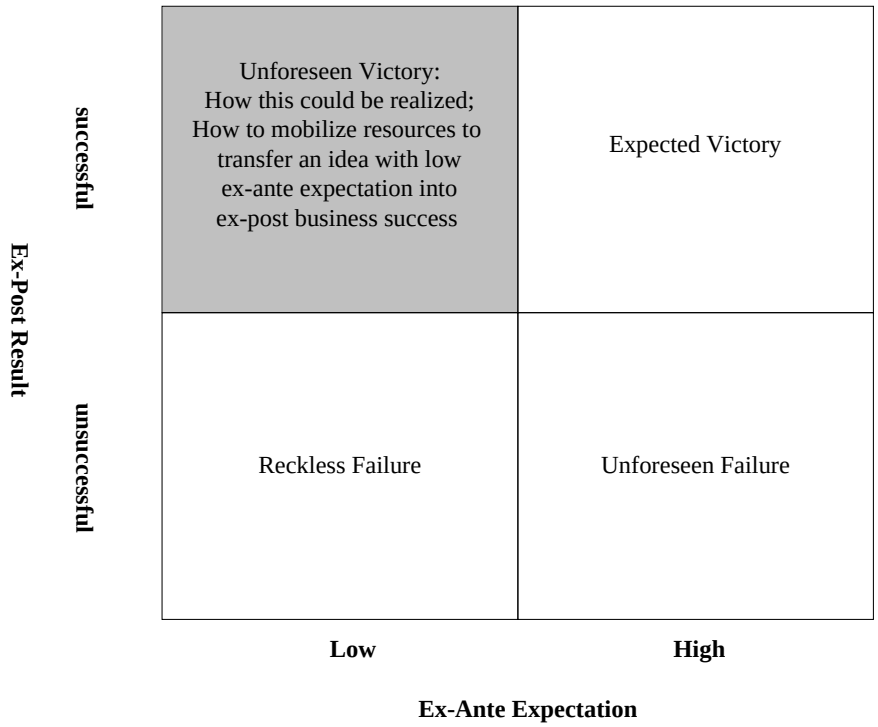

Table 1 (1) Case Summary: Innovation Process

	Cases		(1) Lead Time of Innovation Process				
			Year of commer-cialization	Start to product develop-ment (years) (A)	Product develop-ment to commer-cialization (years) (B)	Start to commer-cialization (years) (A+B)	Commer-cialization to peak of sales (years)
1	Matsushita Electric Industrial Co., Ltd.	IH (Induction Heating) Cooking Heater	1990	17	2	19	-
2	Mitsubishi Electric Corporation	Poki Poki Motor (High Performance Motor with New Core Structure and High Speed/Density Coil Wiring)*	1995	3	2	5	13
3	Toyo Seikan Kaisha, Ltd.	TULK (Metal Can Mfg Technolgy with High-Quality, Low-Cost and Low-Environment Load)*	1992	3	2	5	8
4	Toshiba Corporation	Nickel-Metal Hydride Batteries*	1991	5	6	11	-
5	Olympus Optical Co., Ltd.	Ultrasonic Endoscope*	1988	3	7	10	-
6	Kao Corporation	"ATTACK"(Super Concentrated Laundry Detergent Containing Alkaline Cellulose)*	1987	4	4	8	-
7	Seiko Epson Corporation	Quartz Watch Having an Automatic Generating System*	1988	5	1	6	7
8	Matsushita Electrics Corporation	Low-Current-Consumption Miniaturized GaAs Power Modules for Mobile Communication System*	1994	2	1	3	7
9	Tohoku Pioneer Corporation / Pioneer Corporation	Thin-Layer Emitting Organic EL Display*	1997	3	6	9	5
10	JFE Steel Corporation / Kawatetsu Machinery Co., Ltd. /Sankyu Inc.	Short Term Revamping Technique of Large Scale Blast Furnance*	1998	1	2	3	-
11	Trecenti Technologies Inc.	New 300mm Semiconductor Manufacturing Systems*	2001	12	4	16	4
12	Nisshin Pharma Inc.	Coenzyme Q10*	1974	10	8	18	9
13	Fuji Photo Film Co., Ltd.	Computed Radiography System*	1983	8	4	12	23
14	NEC Corporation	Hemispherical-Grained (HSG) Silicon Storage Electrodes	1997	5	3	8	9
15	Kyocera Corporation	Environmentally-Friendly Printer with Long-Life Electrophotographic Process*	1992	-	-	-	14
16	NEC Corporation	GaAsMESFET (Field-Effect Transistor)	1974	3	1	4	10
17	Toshiba Corporation	Microcomputer System and its LSI Family*	1977	2	4	6	13
18	Hitachi, Ltd.	Direct On-Chip Wiring Formation System for LSIs	1989	4	2	6	15
	Total / Average			5.3	3.5	8.8	10.5

Note: *The case study has been completed and available at http://www.iir.hit-u.ac.jp/researchCOEokochiprize(A).html. Some data are provisional and subject to change.

Table 1 (2) Case Summary: Obstacles to Resource Mobilization

	Cases		(2) Obstacles to Resource Mobilization			
			Support at start: business division support for idea conception/developing new technologies		Resistance against commercialization: opposition/resistance from business division before commercialization	
			No support	Support obtained	Resistance existed	No resistance
1	Matsushita Electric Industrial Co., Ltd.	IH (Induction Heating) Cooking Heater		Business unit interest triggered by a competitor's project	Pressure against the project due to poor sales	
2	Mitsubishi Electric Corporation	Poki Poki Motor (High Performance Motor with New Core Structure and High Speed/Density Coil Wiring)*		Request from Koriyama office	Repeated failures in the development of a small motor	
3	Toyo Seikan Kaisha, Ltd.	TULK (Metal Can Mfg Technolgy with High-Quality, Low-Cost and Low-Environment Load)*	Started from engineer's technological interest		No support obtained for commercialization	
4	Toshiba Corporation	Nickel-Metal Hydride Batteries*	Started from engineer's technological interest			Toshiba Battery Co., Ltd.'s interest in the technology
5	Olympus Optical Co., Ltd.	Ultrasonic Endoscope*	Developed as a flagship technology in the medical equipment business		Remained as specially customized system development due to the small size of the market	
6	Kao Corporation	"ATTACK"(Super Concentrated Laundry Detergent Containing Alkaline Cellulose)*	Started as engineer's second-chance trial for concentrated laundary detergent		Skeptical evaluation of ROI by marketing and accounting functions	
7	Seiko Epson Corporation	Quartz Watch Having an Automatic Generating System*	Started from engineer's technological interest		Opposition form the sales division (Hattori Seiko) (no prospect of sales)	
8	Matsushita Electrics Corporation	Low-Current-Consumption Miniaturized GaAs Power Modules for Mobile Communication System*		Inquiry from Matsushita Communication Industrial Co., Ltd. , a Matsushita group company	Rejected by Matsushita Communication Industrial Co., Ltd. who decided to continue to use the existing product	
9	Tohoku Pioneer Corporation / Pioneer Corporation	Thin-Layer Emitting Organic EL Display*	Started from engineer's technological interest (inspired by competitors)		Not accepted by the main business division due to conflicts with the PDP business	
10	JFE Steel Corporation / Kawatetsu Machinery Co., Ltd. /Sankyu Inc.	Short Term Revamping Technique of Large Scale Blast Furnance*	Started as a technological examination to meet urgent need for short-term revamping at the Chiba Works		Opposition from staff responsible for revamping (unproved, risky technology)	
11	Trecenti Technologies Inc.	New 300mm Semiconductor Manufacturing Systems*	Started from engineer's technological interest		Opposition from production staff disfavoring changes in production processes	
12	Nisshin Pharma Inc.	Coenzyme Q10*	Started from engineer's technological interest (inspired by research paper overseas)			Consistent support from the President, Eisai's offer for partnership
13	Fuji Photo Film Co., Ltd.	Computed Radiography System*	Started from engineer's technological interest (and reaction against organizational restructuring)		Mixed evaluation of the technology, concern about possible cannibalization with the exisiting business	
14	NEC Corporation	Hemispherical-Grained (HSG) Silicon Storage Electrodes	Started from engineer's technological interest		Not accepted by the production engineering division	
15	Kyocera Corporation	Environmentally-Friendly Printer with Long-Life Electrophotographic Process*		Decision by the printer business division		Supported by President and the business division
16	NEC Corporation	GaAsMESFET (Field-Effect Transistor)	Started from engineer's technological interest (inspired by a promising technology already developed)		Not accepted by a business unit within the company	
17	Toshiba Corporation	Microcomputer System and its LSI Family*		Inquiry from a major customer (Ford), started as a company-wide project	No formal contract with Ford, Ford's delayed decision, opposition due to high risk	
18	Hitachi, Ltd.	Direct On-Chip Wiring Formation System for LSIs		Request from the computer business division		Expectations from the most important business division
	Total / Average		12	6	14	4

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Table 1 (3) Case Summary: Legitimization of Resource Mobilization

	Cases		(3) Legitimization of Resource Mobilization					
			Factors in overcoming opposition/resistance against commercialization	Reason for legitimization				
				Strong priority on tech-nology	Discovery of supporter	Top executive leader-ship	Outside supporter	Organi-zational crisis
1	Matsushita Electric Industrial Co., Ltd.	IH (Induction Heating) Cooking Heater	A major breakthrough achieved by meeting the need of a local sales subsidiary company in Hokkaido		1			
2	Mitsubishi Electric Corporation	Poki Poki Motor (High Performance Motor with New Core Structure and High Speed/Density Coil Wiring)*	Koriyama office on the brink of shutdown, verification by a charismatic engineer		1			1
3	Toyo Seikan Kaisha, Ltd.	TULK (Metal Can Mfg Technolgy with High-Quality, Low-Cost and Low-Environment Load)*	Reevaluation and commercialization due to emerging interest in environment protection	1	1			
4	Toshiba Corporation	Nickel-Metal Hydride Batteries*		1	1			1
5	Olympus Optical Co., Ltd.	Ultrasonic Endoscope*	Market expansion and streamlining of production system triggered by the accidental discovery of a new usage by a doctor	1	1		1	
6	Kao Corporation	"ATTACK"(Super Concentrated Laundry Detergent Containing Alkaline Cellulose)*	President's decision	1	1	1		1
7	Seiko Epson Corporation	Quartz Watch Having an Automatic Generating System*	Support from a charismatic engineer and interest shown by a sales company in Germany (found by accident)	1	1	1		
8	Matsushita Electrics Corporation	Low-Current-Consumption Miniaturized GaAs Power Modules for Mobile Communication System*	Orders from outside customers (NEC, Sony)		1		1	1
9	Tohoku Pioneer Corporation / Pioneer Corporation	Thin-Layer Emitting Organic EL Display*	Tohoku Pioneer, which was experiencing sales decline, decided to adopt the product	1	1			1
10	JFE Steel Corporation / Kawatetsu Machinery Co., Ltd. /Sankyu Inc.	Short Term Revamping Technique of Large Scale Blast Furnance*	Thorough examination and conviction at the special technology evaluation meeting and the board meeting	1	1			1
11	Trecenti Technologies Inc.	New 300mm Semiconductor Manufacturing Systems*	Joint venture with UMC, expectations for the foundry business	1	1		1	
12	Nisshin Pharma Inc.	Coenzyme Q10*		1	1	1	1	
13	Fuji Photo Film Co., Ltd.	Computed Radiography System*	High evaluation by Philips at an international confenrence and fair	1	1		1	1
14	NEC Corporation	Hemispherical-Grained (HSG) Silicon Storage Electrodes	The engineer's move to the production engineering division, recognition at academic conferences	1	1		1	
15	Kyocera Corporation	Environmentally-Friendly Printer with Long-Life Electrophotographic Process*						
16	NEC Corporation	GaAsMESFET (Field-Effect Transistor)	Orders from foreign firms via overseas sales agent	1	1		1	
17	Toshiba Corporation	Microcomputer System and its LSI Family*	Support from the president ("Do it to the last.")		1	1	1	
18	Hitachi, Ltd.	Direct On-Chip Wiring Formation System for LSIs						
	Total / Average			12	16	4	8	7

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