R & D Management Based on the Relationship between the Achievement of R&D and Commercialization

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***Abstract*--In this study, we will discuss R & D management which share the timeline of achievements and issues of different business cases through questionnaires, assuming business cases at the beginning of projects in order to share goals among members of an academic-industrial alliance project.**

In order for project members to share the goals about the academic-industrial alliance project which we participate in, we carried out questionnaire when one and a half years had passed since the project started. Thanks to this survey, we can share the similarities and differences of our ideas about customer needs for the businesses, the time of starting the business and the time of achievement of the necessary technical level.

I. INTRODUCTION

In general, we imagine the final products and services at the planning phase of a R & D project. However, due to the varying factors such as market and management resources, what can be completed as planned is limited [1]. One of the goals of R & D is to create products and services based on the achievements of R & D and to commercialize them. In order to achieve this goal, it is important to assume commercialization at each phase such as research, development and verification [2] [3].

In this study, we will discuss R & D management which share the timeline of achievements and issues of different business cases through questionnaires, assuming business cases at the beginning of projects in order to share goals among members of an academic-industrial alliance project.

II. THE RELATIONSHIP BETWEEN R & D PROCESS AND COMMERCIALIZATION

As shown in Fig. 1, by spiraling up "the service optimization planning loop" (consisting of observation, analysis, design and application), we can enhance the completion of an achievement of R & D and forecast commercialization [4]. "Consideration of commercialization" (shown in the bottom of Fig. 1) means that as we observe and analyze the achievement of R & D and conduct field experiments to further, understand business cases by the verification of function and performance of commercialization. It is meaningful to consider commercialization continuously and to share the information among members from the beginning an R & D project. Especially, since people from various fields participate in academic-industrial alliance projects and cross-industrial projects, it is necessary to share goals considering the difference in values among the project members [5].

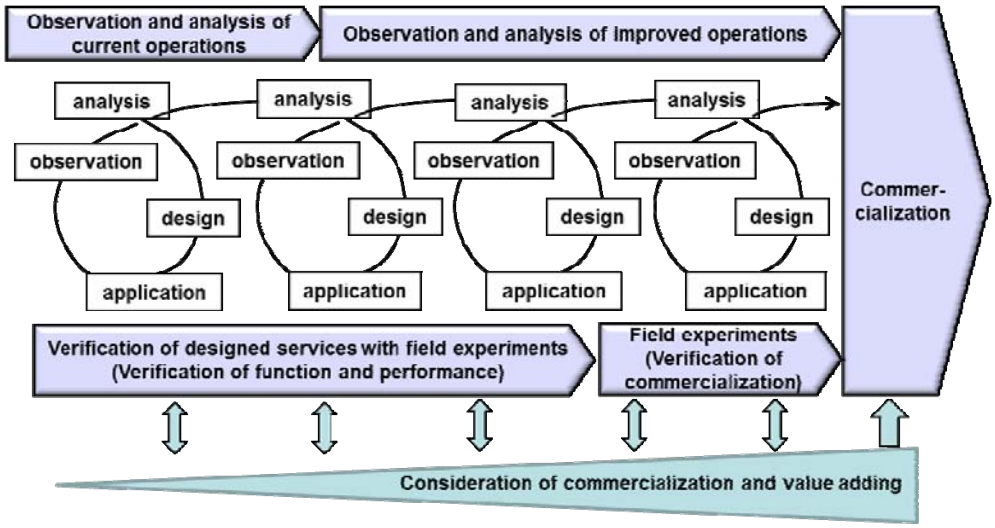

Fig. 1 The relationship between the process of research and development and commercialization

III. SUMMARY OF TWITTER SPACE PROJECT

We describe “Twitter Space Project,” which the authors participate in. The Twitter Space Project is a “Service Science, Solutions and Foundation Integrated Research Program” of Japan Science and Technology Agency (JST) project. The Twitter Space Project, which was started in October 2010, is a three-year project and one and a half years have passed. This project is carried out mainly by the Shimizu Corporation, the Toshiba Corporation and Japan Advanced Institute of Science and Technology (JAIST), and is an academic-industrial alliance project which hospitals and nursing-care facilities participate in as an alliance organization.

The aim of this project is to innovate communication with speech technology in the field of nursing and patient care. This project aims at sending voice messages necessary to users on a timely manner. We will develop technique which can automatically determine to whom the voice message was sent by using action suggesting engine which uses the data of a business model and the user’s location information.

In addition, we will establish an evaluation system to record the operational and psychological stress of users which are generated and streamlined by the information system. Based on various floor planning and flow planning of facilities, we will establish the method of visualization and evaluation of the service space. By visualizing the location information and the action suggestion with data form sensor and Twitter information, we are aiming at space evaluation which compounds the evaluation of flow line, responsibility and efficiency.

IV. SETTING OF BUSINESS CASES AND TECHNICAL LEVELS

In order to share the goals among members of the Twitter Space Project, we set business cases and technical levels.

A. Setting of Business Cases

We set “Information system which supports communication with Twittering in nursing and caring service spaces” (hereinafter referred to as “Twitter System”) as the core of the business at the beginning of this project. According to the progress of the project and the progress of experimental manufacture of prototypes, interviews and experiments in the field, we have come to recognize the importance of business analysis and business improvement consultation. The business improvement consultation aims at reviewing and redesigning businesses and promoting the introduction of the Twitter System.

In addition, it is desirable that we handle these systems as "entire infrastructure business.

It is consisted by integrating business improvements, consultations, and Twitter System with various systems such as an electronic medical chart, a nursing and caring record system, a medical equipment location management system, and construction equipments.

B. Summary of Each Business Case

Fig. 2 shows the framework for the business deployment for object services as business models. Business models are summarized as who, what and how we offer services, that is, what are the target customers, the value of offering, the sales channel, sales timing, and management resources and core competence [6][7].

Case 1 is the business of the system integrator supporting systems including not only the installation of the Twitter System but also the maintenance through the Twitter System life cycle. This case requires management resources which can install the Twitter System and deal with problems. The timing to offer this System is at the time of installation or the renewal due to aging and obsolescence of the existing business support information system.

Case 2 is the business whose core is the improvement of nursing and caring operations, and we assume that businesses are commercialized and cooperating with medical welfare consulting firms. This case is the business of establishing business improvement project with customers and business improvement consulting by analyzing businesses and evaluating the effect of improvement with a business process visualization tool. In order to improve businesses, we promoted installing the Twitter System. Core competence is consulting ability with perfect understanding of nursing and caring businesses. The timing of the offer is the time when problems of nursing and caring emerge and improvement is needed.

Case 3 is the business related to a construction or an engineering business. This case is the business carried out mainly by construction and engineering companies which projects and offers “entire infrastructure” including not only an information system but also the integration of an existing information system, medical equipments and coordination with architectural equipments. This case is the business whose key is comprehensive engineering ability which integrates related systems with the Twitter System as core technology. The timing of offer is the time of rebuilding and refurbishing the business system due to aging and obsoleteness.

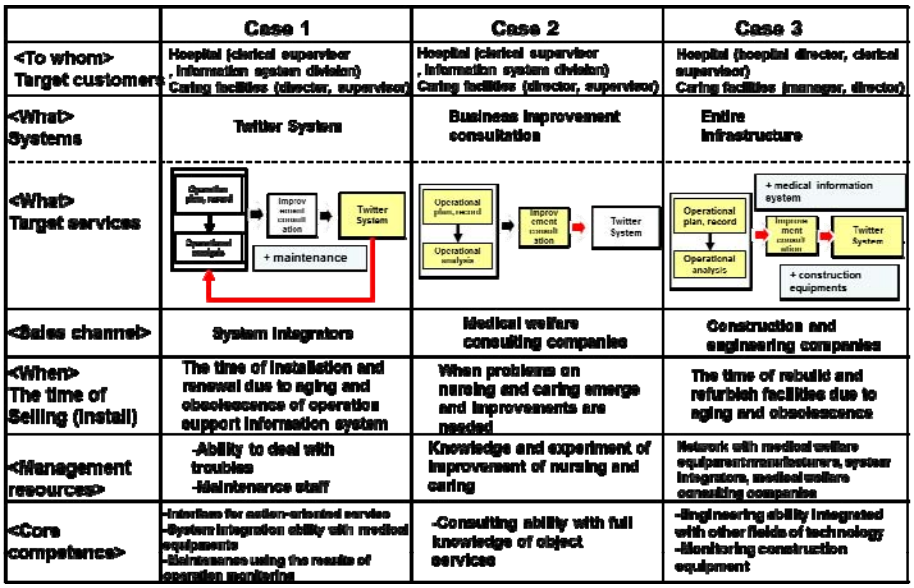

Fig. 2 Business models of each case

C. Technical Levels

The Twitter System consists of an location suggesting engine, an action suggesting engine, a keyword extraction engine and a twitter classification / sending engine. Visualization of business process is supported by techniques such as a service evaluation technique, business simulation and text mining. The Entire Infrastructure Business is also supported by integration of other information systems and of building equipment.

We set three levels of achievement for each technique. Fig. 3 shows the achievement levels of visualization of the business process. Level 1 is the level which can be achieved in this fiscal year, level 2 is technically-feasible level, and level 3 is an ideal level. Take, for example, business simulation level 1 is modeling the current situation, level 2 is the business simulation based on data from the Twitter System, and level 3 is the business simulation including the feeling of responsibility.

Large classification	Middle classification	Technical level nacessary for businesses
Visualization of business process		L1: Visualization of current standard business process
		L2: Visualization with simulation of the effect of business improvement
		L3: Visualization of business process with the resonsibility of business
	Service evaluation technique	L1: Completion of evaluation of flow line
		L2: Completion of {flow line + evaluation of business}
		L3: Completion of {flow line + evaluation of business + evaluation of responsibility}
	Simulation of operations	L1: Simulation with modeling the current business * The level which can be achieved at the end of this fiscal year
		L2: Simulation of operaions base on the data from the Twitter System
		L3: Simulation of operations including evaluation with responsilibity
	Text mining	L1: To Understand the trend of words used in the field with text mining * The level which can be achieved at the end of this fiscal year
		L2: To utilize the results of text mining as parameters of simulation of opetaions
		L3: To connect the results of text mining with the Twitter classification / sending engine

Fig.3 Setting of technical levels

V. SUMMARY OF QUESTIONNAIRES

In order to share the goals of the project, we conduct questionnaire on the time of commercialization and on elemental technology. Two questions are prepared for each of the three business cases. Question 1 is "Please predict the time of emergence of customer needs and the start of the business, and describe challenges for realization," and question 2 is "Please choose one level from 1, 2 and 3 for each technique level necessary to the business case."

The first questionnaires were sent to 8 main members of this project (5 from industries and 3 from universities) on January 27, 2012, and the results were collected. Then, the second questionnaires were sent on January 30, 2012. In order to share the goals, we sent members the results of the first questionnaire. After they saw the results of the first questionnaire, they answered the second questionnaire.

VI. RESULTS OF QUESTIONNAIRES

A. The Time of Emergence of Customer Needs and Starting Business

Fig. 4 shows the summary of mean and standard deviation of the results of the first and second questionnaire of case 1, 2 and 3: "the time of emergence of customer needs for businesses" and "the time of starting business." Light color shows the range of the time and dark color shows items which half or more members (4 or more out of 8) answered.

The results show the following:

(1) The standard deviation of the time of the emergence of customer needs was larger than that of the time of starting the business. More than half answers were in the time of starting the business, but not in the time of the emergence of customer needs. Therefore, the time of the emergence of customer needs were more dispersed than that of starting the business.

(2) The difference between the time of the emergence of customer needs and that of starting the business in three cases ranged from 1.8 years to 2.1 years, and the time from the emergence of customer needs to the starting of the business was about 2 years.

(3) The mean of the time of achievement was earliest in case 2, followed by case 1 and case 3. The standard deviation of the time of achievement was largest in case 3, followed by case 1 and case 2.

(4) The time of achievement in the second questionnaire was earlier than in the first questionnaire.

B. The Challenges of the Emergence of Customer Needs and Starting the Business

We summarized main challenges of each business case as follows:

(1) The challenges of case 1 "Twitter System"

"To inform successful cases though exhibitions" and "to embody the effect of installation and making staff realize the effect" are the challenges in the time of the emergence of customer needs for businesses.

"Not only Twitter distribution but also combining with the function of making nursing / caring daily report" and "to establish business models which offer benefits to stake holders such as medical service workers, caretakers, patients, people who are cared for, the government, local government and system providers" are the challenges of starting business.

Case 1	Question	1st / 2nd	Average of the time of achivement	Standard deviation	-2011	Second half of 2011	1st / 2nd half of 2012		1st / 2nd half of 2013		2014	2015	2016	2017	2018	2019	2020-
Twitter System Business	The emergence of customer needs for business	1st	2012.8	1.10		1	2	2	1	1		1					
		2nd	2012.6	1.08		1	3	2	1			1					
	The starting of business	1st	2014.5	0.76							5	2	1				
		2nd	2014.6	0.98						1	4	1	2				

Case 2	Question	1st / 2nd	Average of the time of achivement	Standard deviation	-2011	Second half of 2011	1st / 2nd half of 2012		1st / 2nd half of 2013		2014	2015	2016	2017	2018	2019	2020-
Business Improvement Consultation Business	The emergence of customer needs for business	1st	2012.2	1.07	2	2		1	1	2							
		2nd	2012.0	1.00	2	3			2	1							
	The starting of business	1st	2014.0	0.71					1	2	3	2					
		2nd	2013.9	0.58					1	2	4	1					

Case 3	Question	1st / 2nd	Average of the time of achivement	Standard deviation	-2011	Second half of 2011	1st / 2nd half of 2012		1st / 2nd half of 2013		2014	2015	2016	2017	2018	2019	2020-
Entire Infrastructure Business	The emergence of customer needs for business	1st	2014.1	1.24			1			3	1	2	1				
		2nd	2013.6	1.38			2		1	2	1	1	1				
	The starting of business	1st	2015.9	1.61						1		3	1	1	2		
		2nd	2015.7	1.28						1		2	4		1		

Fig.4 The time of the emergence of needs and starting the business

(2) The challenges of case 2 “business improvement consulting business”

“To offer quantified benefits on flow line and business by using the Twitter System and the business improvement consultation” and “to carry out the project with successful consultants” are the challenges of the time of the emerging of customer needs for the business.

“To establish complementary relationships with medical consultants” and “to improve the accuracy of location suggestion and action suggestion technology and to develop business improvement know-how” are the challenges of the time of starting the business.

(3) The challenges of case 3 “entire infrastructure business”

“Unless there are no achievements in the case 1 and 2, constructors will not choose case 3.” and “There are individual needs, but it will take time to integrate.” are the challenges of the time of the emergence of customer needs for business. These challenges show that achievements and time are needed for integration to occur.

“To embody the services offered and to design a profit model” and “Because hospitals in Japan have little capital, we need to start businesses with a view for overseas expansion” and “Before commercialization, experiment and improvement for free and accumulation of achievements are needed” are the challenges of the time of starting the business.

C. Technical Levels Necessary to Businesses

We extracted the items which got the most answers and whose standard deviations were lowest. The bar chart shows the time of achievement of each technique of each case shown in Fig. 5.

Summary of the results are as follows:

(1) Technical levels necessary to businesses were as follows: Level 1 was 1 point, Level 2 was 8 points, and Level 3 was 5 points. Level 2 was the highest.

(2) Techniques which were different between case 3 and case 1, 2 were “Twitter System,” “location suggestion engine,” “simulation of operations.” Technical levels of case 3 were higher than those of case 1 and 2.

(3) In the three items “keyword extraction engine,” “Twitter classification / sending engine,” “integration with medical information system,” the time of achievement was longer than 2 years, while in other eight techniques the time of achievement was shorter than 2 years

(4) In the case 2, the time of emergence of customer needs was shorter than 2 years, while the time of achievement of necessary technical level was shorter than 3 years. The time of achievement of technique was later than the other cases.

In the Twitter classification / sending engine, the time needed for the achievement was 3.5 years, which was the longest of all. “Mechanism which analyzes information from human and feedbacks directly to the speaker” and “education and culture which get people to use standardized words and terminology” were the challenges to achieve this technique.

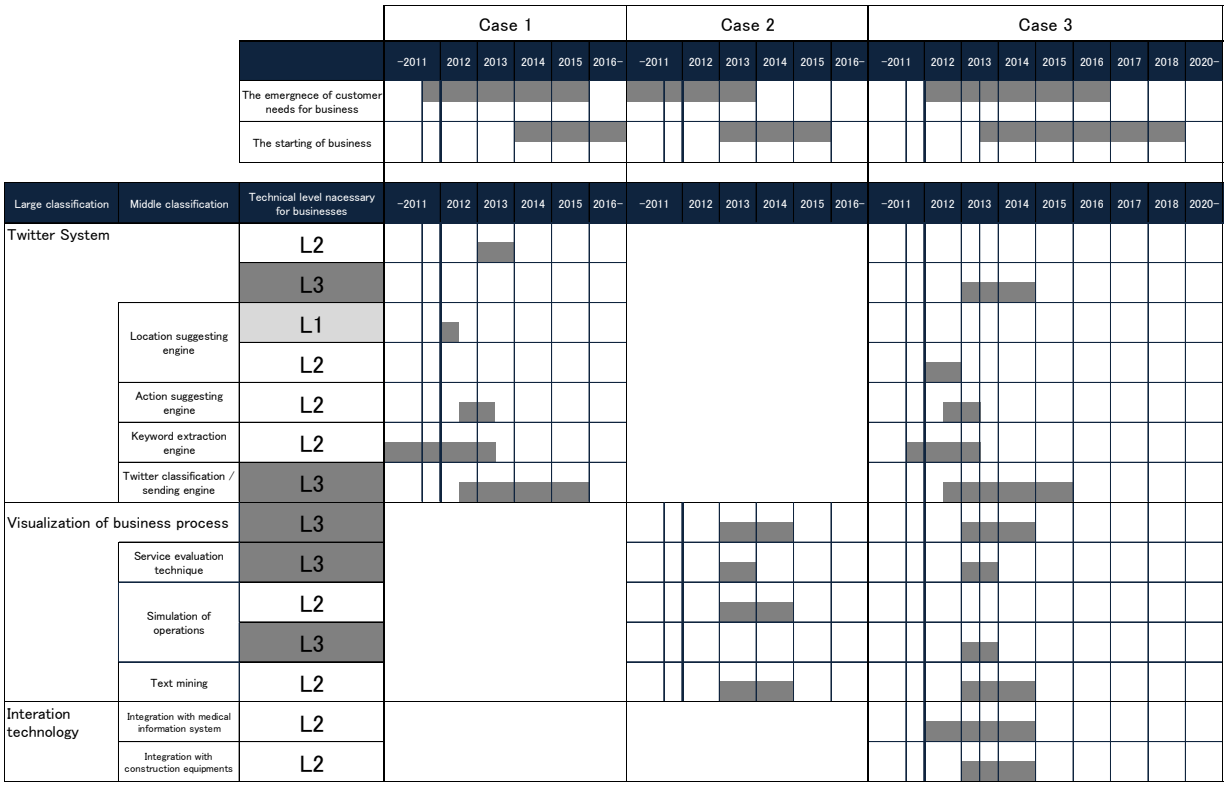

Fig.5 Technical levels necessary to businesses and the time of achievement

D. The Change of Consciousness Due To Sharing Information

Free descriptions such as feedback though the questionnaires were as follows:

(1) About the time of emergence of customer needs and the time of starting the business

With respect to the time of starting business, there were affirmative comments such as "Members share the idea that it takes time to commercialize because actual results of stable operation are needed." Also, there were comments which referred to other members answers, such as "It is natural that most of members recognize the existence of needs, but I feel differently about the time of commercialization" and "I found that I was too pessimistic about the time of commercialization."

With respect to the emergence of customer needs, there are comments such as "I feel that needs for analyzing business has already been established" and "I think we share the idea that it will take time to have actual results of stable operation for commercialization."

(2) About the necessary technical level and the estimated time of achievement

Comments were as follows: "There was little difference to what I expected," "It was impressive that most of projects members have the same idea about the necessary technical level and the estimated time of achievement," "All project members though that they could completely achieve individual techniques within the project." These comments show that they have already shared their goals.

VII. CONCLUSION

In order for project members to share the goals about the academic-industrial alliance project which we participate in, we carried out questionnaire survey when one and a half years had passed since the project started. Thanks to this survey, we can share the similarities and differences of our ideas about customer needs for the businesses, the time of starting the business and the time of achievement of the necessary technical level.

We would like to discuss these similarities and differences among the members and enhance mutual understanding in the future. In addition, by conducting demonstration experiments with end-users, we will visualize customer needs and share the achievements.

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