Report of Survey for Doctoral Research Plan

Difficulties of Global R&D Projects and Role of Bridge Managers

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Abstract

The globalization has brought so many challenges to the business. The competitiveness is increasing and having higher pressure in the markets. The new product development process, innovation, and research and development (R&D) are implemented in the industry in order to introduce new products or services to the markets. In addition, the organizations have access to the global market to acquire more benefits from a larger demand and access to global knowledge resources. However, conducting business in foreign countries is not an easy task. There are many problems and difficulties to overcome in a global context where people from different countries and different cultures are working in different time zones and using different languages. Previous researches discussed the global R&D structure and coordination mechanisms from the organization perspective. The global R&D project requires collaboration between project members for the success of the project even though the global context is a kind of diverse environment.

In the case of offshoring IT projects, there are bridge system engineers who are working as a coordinator to enhance the relationship between client and developer teams. The bridge system engineers have to work closely with the customers and developer teams. The working process of bridge system engineer can be separated into four main phases which are 1) Planning with client and offshore project 2) Breaking down requirements; design plan and transfer 3) Problems solving, review, fix, final quality assurance and deliver the product 4) After delivery: externalizing and sharing experience. The role of bridge system engineer is considered in three different aspects. The first one is the communication aspect. The offshoring projects consist of teams from different countries and speaking different languages. Bridge system engineers should have a language skill so that they can overcome language barrier by communicating between teams and providing additional documents which explain more detailed information. Second, the cultural aspect, there is a cultural gap between people from different background. Bridge system engineers overcome this gap by encouraging both sides to solve problems together. Lastly, the social capital and networks, this is a critical role of bridge system engineer. Bridge system engineers have a strong relationship with client teams and developer teams. They are not only working as a coordinator but also as an insider of the team. Similarly, in global R&D project, the R&D bridge managers are facilitating the projects, which have different cultures, time zones, and languages environment. This research aims to identify the difficulties that R&D bridge managers have in global R&D project. The causes, effects, and solutions to those difficulties are discussed in this research.

The R&D bridge managers have to develop and utilize some skills and knowledge in the project with a global context. This situation makes the work of R&D bridge manager as a challenging task. In addition, since the world is becoming more globalize so it is indispensable to investigate a proper way to approach global R&D project. The role of R&D bridge manager is important in this situation, especially, in R&D project because this kind of project requires a high level of collaboration among the project members. Particularly, the knowledge transfer for the research process and quality control in the development process. A better understanding of R&D bridge manager work could contribute to the knowledge about this important role and help us to enhance the global R&D management practice.

This research investigates the role of R&D bridge manager in global R&D project and explains the difficulties of facilitating the projects. In addition, this research also talks about the causes and effects of those difficulties so that the solutions to approach the difficulties can be initiated. The mechanism model of difficulties is a theoretical contribution from this research. Moreover, this research is considered as a first phase of the whole research project, which aims to

propose a competency development framework for R&D bridge manager. The difficulties found from this research will be used a data sources to identify crucial competency that the R&D bridge managers should have so that they can use for solving difficulties.

The intensive literature review was conducted at the beginning of this research to find out the current trend of global R&D research. There are about fifty literature from around 1970 to 2016 were selected to cover four main topics, which are research and development (R&D), cross-cultural management, knowledge transfer, and bridge system engineer and R&D bridge manager. According to the literature, we found that previous research discussed the foundation of setting up R&D site abroad such as the objectives, criteria, and processes. The structure and coordination pattern of R&D teams are also discussed many studies. However, both of them (foundation and structure) are the organizational perspective. This research also found that there are a few researches from individual level such as from the perspective of project members. More importantly, the research direction of R&D management research is moving forward and investigate more on the incoming challenges such as the new concept of innovation, the emerging markets and countries, and the globalization of knowledge resources.

The semi-structured interviews were conducted with seven experienced R&D bridge managers who have at least three years of experience in the IT industry. This data collection method provides an opportunity to explore the insight from the interview. The list of questions was prepared but did not strictly use them as we carried on the conversation so that the managers can reveal their insightful information. The interviews were audio recorded, transcribed, and coding for qualitative analysis. Even though we have a limited number of interviews, we can make some conclusions and provide insight to some extent. The working process of R&D bridge manager was explored in order to provide a better understanding of the activities that R&D bridge manages have to do throughout the project. We found that there are four important difficulties facing by R&D bridge managers. They are 1) the quality control, 2) the communication, 3) the R&D activity facilitation, and 4) the requirement and needs transfer. The quality control is a highlight as all managers mentioned and emphasized during the interview. We also found that the causes of difficulty in quality control are 1) the unclear specification of global R&D project and 2) the different outcome expectation of headquarters and R&D team. These difficulties have effects to the R&D project in several perspectives. For example, the outcome is not satisfied by headquarter or customers, the miscommunication during the project, and using inappropriate research approaches. Thus, R&D bridge managers have to apply their knowledge and skills to establish solutions to overcome difficulties such as using several product releases to check the outcome regularly, switching the role between different teams, initiating additional documents and visualization, and providing an education or training. Finally, the mechanism model of difficulties was developed. It consisted of the causes, difficulties, and effects in global R&D project. The R&D bridge managers can utilize this knowledge in practical when they facilitate the global R&D project. In addition, the difficulties and the mechanism model found from this research will be used to identify crucial competency of R&D bridge manager and we will propose the R&D bridge manager competency development framework in the future research.

Keywords: Global R&D project, R&D bridge manager, Bridge system engineer, Project management, Cross-cultural collaboration, Competency development framework

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Chapter 1 Introduction

This chapter provides the importance of R&D management in globalization, particularly, the global R&D project. Then the role of R&D bridge manager (BM) is described together with the role of bridge system engineer (BSE) and information gatekeeper. Research questions and objectives are included in this chapter and follow by the research significance and the structure of this report.

1.1 Research Background

In a highly competitive business environment, the firms are finding ways to utilize knowledge in order to introduce new services or products to the market. The trend of open innovation (Chesbrough, 2003) accelerates the utilization of both internal and external knowledge and resources. Both domestic and international R&D activity are playing an important role in the era of globalization (Coe & Helpman, 1995). There are two main objectives to establish R&D site abroad. The first one is for knowledge exploration and the second one is knowledge exploitation (Kuemmerle, 1997). The firms could have a great benefit from acquiring knowledge from outside their home country and commercializing knowledge into the global market. Therefore, the international R&D is important for the firms to maintain and increase the level of competitiveness. Previous studies discussed from the organizational perspective about the process to setup new R&D abroad, the R&D site criteria, the types of R&D site, the team structure, and the communication patterns (Chiesa, 1996; Kuemmerle, 1997; Boutellier et al., 1998; Reger, 1999; Gassmann & Von Zedtwitz, 1999). It is beneficial to investigate the global R&D management not only from the organizational point of view but also from the perspective of individual who facilitates the project.

Huong et al. (2014) investigated the role of BSE from knowledge management perspective and explained as follows. In the case of offshore software development project, the role of BSE is employed to enhance the relationship between clients and developer team. There are four phases in the working process of BSE. The first phase is “planning with client and offshore project”. BSEs gather information about the project from both client and offshore team. The second phase is “breaking down requirements; design plan and transfer”. BSEs transfer information between the two partners. However, before transferring, BSEs have to use their knowledge and skills to minimize gaps between client and offshore team. The third phase is “problems solving, review, fix, final quality assurance and deliver the product”. BSEs get involved in almost every step of the offshoring process such as designing plan and requirements, reviewing and fixing bugs. The last

phase is “after delivery: externalizing and sharing experience”. BSEs accumulate their experience by gathering and externalizing tacit knowledge throughout the project. Then BSEs develop manuals, handbooks, guidelines, which are easier for sharing with others. In addition, the role and skills of BSE were also discussed. BSEs overcome communication gaps by using language skill, and overcome cultural gaps by their cultural understanding and encourage the offshore to adapt themselves to the custom of clients.

For the global R&D project, the role of BM is employed to facilitate the project. However, the characteristic of global R&D project and the offshore software development project are different, so BMs are facing different challenges. In the global context, BMs are dealing with the different culture, language, and time zone. The difficulties of BM arise throughout the R&D process. Many BMs in multinational companies (MNCs) based in Japan feel about the difficulties and they are finding ways to solve those difficulties by themselves. There are a few researches, that investigate the role of BM. Therefore, a deeper understanding of BM role is indispensable.

1.2 Research Objectives

This research has an aim to investigate the difficulties of BMs in global R&D projects. The difficulties will be identified as well as a deeper understanding of BM role in global R&D project will be provided. We will perform an analysis on the interviews with experienced BMs then develop the mechanism model to explain the causes and effects of difficulties in the context of global R&D project. This is a benefit for practitioners who are working as BM and contribute to the knowledge of global R&D management.

1.3 Research Questions

According to the research objectives, they can be achieved by answering the following one major research question and four subsidiary research questions.

Major research question (MRQ)

What are the difficulties that BMs face in facilitating global R&D projects and how are they important?

Subsidiary research question (SRQ)

SRQ 1: What is the working process of BMs in global R&D projects?

SRQ 2: What are the difficulties in facilitating global R&D projects and how are they caused?

SRQ 3: How have the difficulties of BMs effected on the performance of global R&D projects?

SRQ 4: What is the role of BMs to solve these difficulties?

1.4 Research Significance

The findings from this research will provide a deeper understanding of BM role in global R&D project. This study will also provide benefit for the organization strategy to employ future BMs. By understanding of the causes and effects of BM difficulties in global R&D project, the BMs could foresee and be prepared for the solutions to overcome future challenges, particularly, in the more globalized context.

Moreover, this research will provide an academic contribution to the global R&D management and role of BM by showing the mechanism model of BM difficulties. This model will be used in the future research to develop a competency development framework for BM.

1.5 Research Composition

This research report consists of two important parts. The first one is the intensive literature review and the second part is the BM interviews. The intensive literature review was conducted to explore related researches in this research field and determine the current situation and trend. There are more than fifty literature which provides broader and deeper understanding of the research. Moreover, the literature review is a foundation and building blocks of knowledge for future research.

The experiment is also included in this research to be a starting point of the research project. The interview with managers helps to develop a relationship between theoretical knowledge and practical knowledge. It also helps to validate our understanding from academic research compare to real business implications. The interview in this research has an objective to identify the difficulties of BMs when they facilitate the global R&D projects.

1.6 Organization of the Report

Chapter 2 discusses related literature, which covers four main areas, which are research and development, cross-cultural management, knowledge transfer, and BSE and BM. Chapter 3 provides overall research design and explains the research methodology, data collection, and data analysis. Chapter 4 shows the result of data analysis. Then, Chapter 5 provides the conclusion and discussion by answering each research question. Moreover, the limitation of this research is included in Chapter 5. Lastly, in Chapter 6, there is a future work, which is the investigation of crucial competency that the BM should have in order to overcome the difficulties in global R&D projects.

Chapter 2 Intensive Literature Review

The globalization becomes more important for the industry for a few decades. The company gets some advantages from accessing to the market and resources in foreign countries other than their home country. However, the industry has to overcome several barriers in globalization to gain the most efficiency. There is some related literature, which has been conducted previously. Some of them are discussed in this chapter.

The research and development (R&D) definition and its' importance are shown in section 2.1. Then, section 2.2 talks about the cross-cultural management, which is a part of globalization. After that, the R&D project is discussed from knowledge transfer perspective in section 2.3. Section 2.4 explains about the BSE and BM who are a kind of facilitator and play an important role in the success of offshoring IT projects and global R&D projects. Lastly, section 2.5, the intensive literature review was conducted and summarized in this section.

Many literature consists of information from different perspectives, which provide a broader understanding of the research. They also show the direction and trend of the research theme and studies in this field. In addition, gaps in the literature can be identified and this research would make a contribution to the body of knowledge and shed light on the further research.

2.1 Research and Development

Since the industrial revolution in 1760, the manufacturing process has changed dramatically. The production line using human power was changed to machines and other tools. The machines and steam engines have been widely used which extremely helped to improve the efficiency of manufacturing industry. That was an important time in history when people's life had changed like never before. Later on, the research and development (R&D) emerged for the competitiveness of the industry and played a vital role since then. The R&D could be different from institute to institute. Accordingly, the industry R&D is described in this section.

Before moving forward, setting mutual understand about R&D is important by starting with the definition of R&D. According to The Measurement of Scientific and Technical Activities: Frascati Manual 1980, the definition of R&D are as follow.

Basic research is an experiment to acquire new knowledge from phenomena and facts without any application.

Applied research is an investigation to acquire new knowledge for specific objectives.

Experimental development is the work using existing knowledge and experience in order to develop something new or provide improvement.

Demonstration is a prototype testing for checking a reliability and usability of the prototype before commercialization.

System development is a development to fulfill utility function of users.

Component development is a development of components that can be applied to many kinds of system.

Engineering consultancy is the technical support for operation and solving problems. It provides feedback and improvement for R&D process.

Having R&D in the industry provides advancement of knowledge and product development, which is a strategic advantage over the competitors. This is why R&D is important for the industry. First, R&D helps the industry to have a long-term strategy and to maintain competitiveness. Second, R&D leads industry toward the innovation, which is indispensable for today's business.

R&D and the innovation process have a close relationship with the initial step to discover new insight, which is useful for industry. Follow by the invention to create something new and then innovation for users to use new products or services. Lastly, the diffusion that is the adoption of innovation to the market. Consequently, Chesbrough (2003) has offered more theoretical information about a new paradigm for the advancement of traditional R&D and innovation, which is the "Open Innovation".

New Product Process: The Stage gate

Time to market is one of the most important factors in business competitiveness. The firms have a pressure from reducing cycle time and, at the same time, improve the new product success rate. The "Stage Gate" system could help to manage and accelerate the innovation efforts. This systematic process will move the new product through several stages from idea to launch. Cooper (2001) explains more detail about the Stage-Gate as following. Firstly, the seven goals of new product process are examined.

1) Quality of Execution: The quality problem could occur in any step of the process. To deal with it, the product innovation should be visualized as a process. Then apply process management and quality management techniques to that process. The quality of execution is embedded into the new product process to ensure the high-quality end product.

2) Sharper Focus, Better Prioritization: Lacking of project evaluations and the failure to set priorities could lead to the difficulty of decision making. In the Stage-Gate system, it is called the gates are weak. There are many gates along the product development process. They are considered as the quality-control checkpoints. Each gate has its own criteria, which deal with the quality of execution, business rationale and the path forward.

3) Fast-Paced Parallel Processing: Shorten cycle time and improve product quality are the dilemma of the product managers. The parallel processing is one solution that several activities can be done at the same time. Moreover, the new product process becomes a cross-functional and multidisciplinary, consists of multiple teams in the company.

4) True Cross-Functional Team Approach: As mentioned in the previous topic, the new product process is multifunctional and requires participation from all players. This is to emphasize the word "true" of the cross-functional team because there are some "fake" teams such members just show up in the meeting, do not give a release time for their job, given lots of responsibility but less authority. Therefore, the real cross-functional teams should have the following characteristics committed team players with release time, having dedicated leader with accountability and authority, dedicated resources, fluid team structure, and all members accountable for the result.

5) Strong Market Orientation with Voice of the Customer Built In: The market orientation must be built into the new product process starting from the beginning until the end of the project. It is including the following activities customer-based idea generation, preliminary market assessment, market research to determine user needs, competitive analysis, concept testing, customer reaction, user test, test market and market launch.

6) Better Homework Up-Front: This is to define the product and build the business case for development. It should be done before the project gets approval. The up-front activities are including initial screening, preliminary technical assessment, preliminary marketing assessment, detailed technical assessment, manufacturing or operations assessment, detailed market studies, resource and capabilities assessment, financial and business analysis, product definition and business case, and decision on the business case.

7) Products with Competitive Advantage: Firms have to seek for the differentiated products, unique benefits and superior value of the customer. It can be as following every gate has the criteria focusing on the product superiority, each stage includes actions to deliver product superiority, the project team has to provide evidence of product superiority, and ensure about the "value proposition" for the customer.

The stage gate process consists of two main elements, which are “Stage” and “Gate”. This process helps to improve the effectiveness and efficiency of the innovation process. The “Stage” includes a set of prescribed, cross-functional, and parallel activities. Each stage has an entrance, which is “Gate” to act as a quality control checkpoint. There are several stages through the innovation process to gather information for processing to the next gate. They are cross-functional and parallel activities to bring down the uncertainty. The activities have the best practice, success factors and goals. The typical stage gate process is consisting of six stages as shown in Figure 2.1.

1) Discovery: To discover opportunity and generate ideas.

2) Scoping: To perform initial investigation and research.

3) Building the business case: To perform detailed investigation and research on marketing and technical then derive the business case.

4) Development: To design and develop the new product, operations, and production process.

5) Testing and validation: To verify the proposed new product, marketing, production, and operations.

6) Launch: To move to the full production then selling.

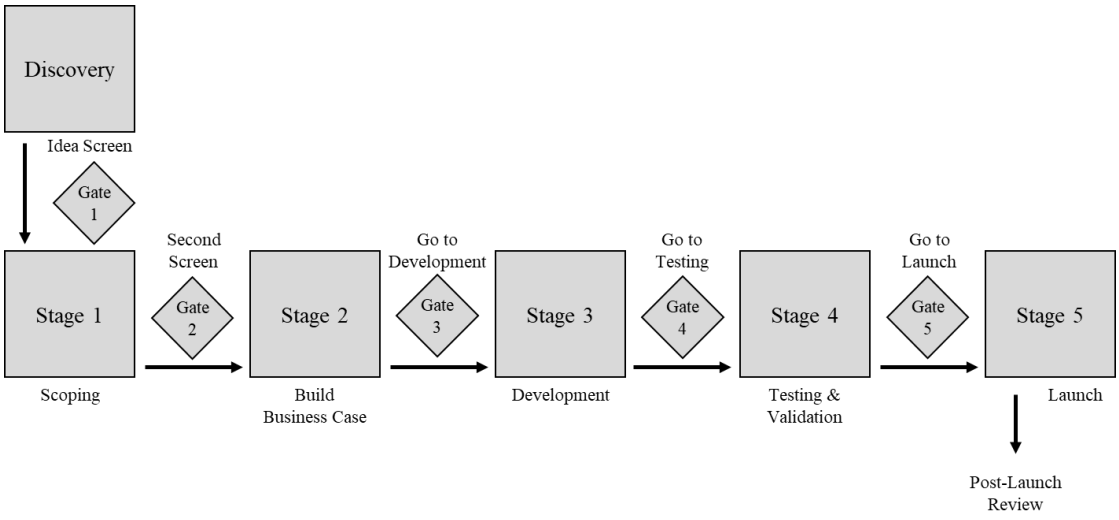

Figure 2.1 The typical Stage-Gate model (Cooper, 2001, p. 130)

Before entering each stage, there is a gate for making go/kill decision. All information will be brought to the gate to support decision making whether to move on to the next stage or not. Each gate consists of the following elements.

1) A set of required deliverables: Team members must come to the gate with deliverables, which is the output from the previous gate.

2) Criteria against which the project is judged: It includes "must-meet" criteria and "should-meet" criteria.

3) Defined output: It is the decision, approved an action plan for next stage, and list of deliverables and date for the next gate.

Once the stage gate process is successfully installed into the firms, it can be improved by applying the following six features.

1) Flexibility: The stages can be omitted and the gates can be combined, so the decision is made with full understanding of the risk. This is typically applicable to a low-risk project.

2) Fuzzy (conditional) gates: The decision from the gates can be made with some conditions. Therefore, the project can move on without waiting for a piece of information, which will come later and the result is positive.

3) Fluidity: Some activities are overlapping over several stages. The project can move from stage to stage with some conditions (Fuzzy gates).

4) Focus: Instead of paying attention to the single project, the focus should be on the entire portfolio consists of several projects and the resource is reallocated to the best project.

5) Facilitation: Facilitator is indispensable for implementing stage gate process. This role helps to ensure that the process is efficient and effective.

6) Forever green: The stage gate process is continual renew, redesign and improve by incorporating the mentioned five features. This could adjust the stage gate process to suite the specific need of the firms.

Open Innovation

Previously, the research project of a company is conducted to satisfy the company's goal, by the company's researchers, and using company's internal knowledge. The open innovation is not using only the internal knowledge but also external knowledge to improve the innovation of the company, internally. In addition, the open innovation also expands the markets and promote the external use of innovation. The internal ideas can be brought to the market through external channels. R&D would be an open system in open innovation paradigm. The valuable ideas can come from inside and outside of the company.

Chesbrough (2006) also explained that the innovation paradigm was changed from closed to open model. This open innovation concept has a great contribution in globalization and shows the potential of R&D function to be outsourced which is similar to the outsourcing of manufacturing function in many years ago. The following figures, figure 2.2 and 2.3, illustrate two different paradigms, “Closed Innovation Model” and “Open Innovation Model”.

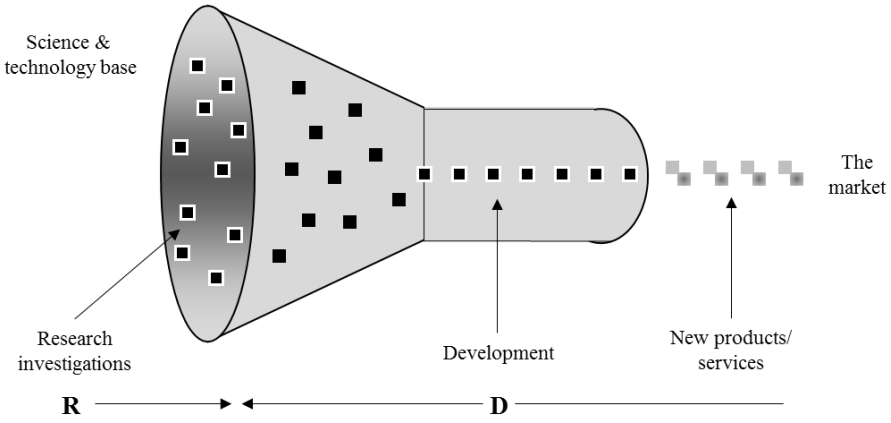

Figure 2.2 Closed innovation model (Chesbrough et al., 2006, p. 3)

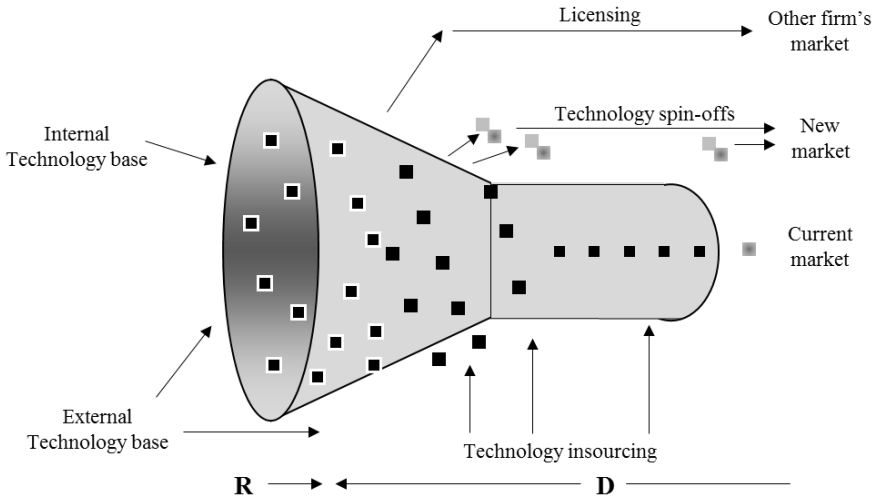

Figure 2.3 Open innovation model (Chesbrough et al., 2006, p. 3)

The open innovation has eight different points compare to the traditional innovation approach, closed innovation. According to academic literature, each different point is explained as follow (Chesbrough, 2006).

1) External knowledge and internal knowledge are equally important.

2) The inventive output is not restricted to the current business model but can go into the market in several ways.

3) Type I and type II error when evaluating R&D projects within the firm.

4) The purpose of knowledge outbound flow, the technology can find ways to go to the market externally. These channels need to be managed properly.

5) The underlying knowledge landscape, important knowledge should be widely distributed with high quality.

6) The proactive role of intellectual property (IP) management. IP could be cross-licensed and becomes a critical element of innovation.

7) The rise of innovation intermediaries because the innovation process becomes more open. Other parties can transact in any stages during the innovation process.

8) The new metrics for assessing innovation capability and performance of the firm.

Since the introduction of "Open Innovation", it has been playing an important role in R&D management of the organization. The practitioners and managers apply this useful concept into their own business and gain a better competitiveness. However, because of the dynamic of the markets and social construct, several challenges of open innovation in R&D activity are needed to be resolved. Therefore, the academic researchers get involve and pay attention to the improvement of open innovation by conducting a deeper investigation in innovation activity at multiple levels ranging from individual, group, community, and institution.

Global R&D Management

For the international corporations, operating R&D in different regions of the world is a driving force for R&D process. The industry has advantages and opportunities from cultural different and other circumstances when having cross-boundary R&D teams. This is a focus of this research and that is called global R&D management.

R&D plays an important role helping the company to promote technology adoption and to support innovation (Griffith, 2000). In the past few decades, team members were working for one single organization and all of them were located in the same location (Binder, 2007). Thereafter, the internationalization has changed the structure and process of the working environment. The

objective of internationalization of business is to look for additional markets, cheap labor, localization of existing products, and fully developed R&D (Boutellier et al., 2000).

In this research, internationalization of the projects and distributed projects are included in the globalization. In global projects, the industry can get some advantages such as the utilization of global knowledge resources as Uchihira et al. (2016) classified global knowledge resources into three categories 1) Global knowledge resources (technologies and human resources) are globally acquired; 2) Global manufacturing resources for making products and services are globally utilized; 3) Global deployment resources to deploy products and services into a global market.

The globalization of R&D projects has some challenges that need to overcome. Some scholars pay attention to different perspectives such as identification of factors that influence R&D structure (Chiesa, 1996), identification of phases to initiate R&D sites and information flow between headquarter and R&D site (Kuemmerle, 1997), coordination patterns of R&D teams (Reger, 1999), management of virtual R&D teams (Von Zedtwitz et al., 2004), and the knowledge flow and R&D activities in multinational company (MNC) (Kurokawa et al., 2007).

Many studies mainly focus on the organization management perspective such as there are four types of organization for virtual R&D teams (Gassmann and Von Zedtwitz, 2003). Each type is explained as follows.

1) Decentralized self-coordination which has no strong central management and authority. This type of virtual R&D team is suitable for producing highly independent products. Those products have a standard interface between the products and the whole product system. Moreover, the standard interface should be well known by other R&D sites.

2) System integrator as coordinator which is a kind of coordinator who facilitates the R&D activities. This type of virtual R&D team eliminates the interface problem in the decentralized team. The coordinator facilitates and supports cooperation among different R&D sites.

3) Core team as system architect, in this case, the core team works together closely. In the case that team members from all teams cannot work together in the same location, then the core team is established. The core team including team leaders from several decentralized teams.

4) Centralized venture team is that the center responsible only for the strategic and very important decision making for both technical and business perspectives. The venture should be in the same location, having a strong relationship among team members in order to reach the team objective effectively.

On the other hand, the internal factors such as individual R&D facilitator is an important person in R&D strategy. The facilitators contribute to the improvement of global R&D project performance and the success of the projects. The study in this area are limited and need to be explored. In globalization of today's business, there are some challenges for the facilitators to overcome.

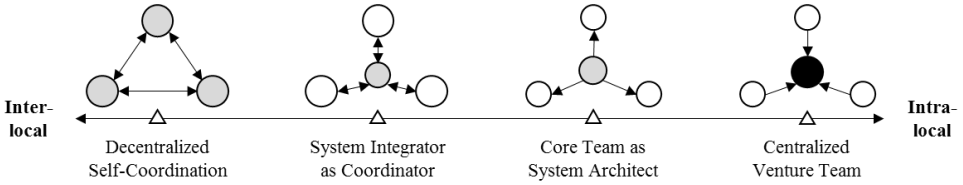

Figure 2.4 Four types of virtual project organization (Gassmann and Von Zedtwitz, 2003, p. 246)

Types of Global R&D Management

In addition, the literature study by Nobel and Birkinshaw (1998) identified three typologies of foreign R&D units. They are Local adaptor, International adaptor, and International creator.

1) Local adaptor: The existing technology will be utilized for supporting local production. The local adaptor helps to transfer technology from headquarter to subsidiary in a foreign country in order to introduce a new product into the local market. However, this type of R&D unit becomes rare because the foreign subsidiaries improve their technological innovation and expand the scope to international.

2) International adaptor: This unit is focusing on the development of new product for foreign markets. Because of the globalization, the support laboratories have a responsibility toward regional or global. Moreover, the local laboratory could provide technological enhancement for the firms, which mean subsidiary can have a leading role in product innovation.

3) International creator: The important characteristic of this type of unit is not only providing improvement and adaptation but also R&D. This unit could be a leader in a specific area, located with a particular market. It is expected to have more linkages to other R&D units and some business units as well.

Even there are some unclear points and the distinction between different types of unit, the knowledge about the characteristic of foreign R&D unit can be used for further analysis.

2.2 Cross-cultural Management

The dramatic change shift of economics, politics, and technology change the way business is managed. What happens with business in one part of the world can have an effect on the business in another part of the world which far away geographically. The manager has to deal with many challenges such as economics, politics, and technology. However, the most important and difficult topic for business management is the cultural environments. Culture is import in all aspects of international business.

Culture

According to Hofstede (1980), culture is "the collective programming of the mind" as anthropologists emphasis on culture as something that is shared by many but proposed to access it through surveying a large number of individuals. The key idea of this method is to combine the measurement from personal endorsements of a particular value. However, there are lots of definition of culture (Schneider and Barsoux, 2003). Some of them embrace everything from law and religion to art, while others focus on specific value orientation such as individualism/ collectivism. For the business, which is driven by number (for example, ROI, ROE, and P/E ratio), the culture has been seen as too soft, too vague, and too difficult to grasp. It is difficult to make it clear about the definition of culture. Although, the culture has been defined as "shared pattern of behavior" by Margaret Mead (1953). However, only behavior observation is not enough. The important thing is the meaning of that behavior. Even the same behavior, it could have a different meaning. On the other hand, the different behavior could have the same meaning.

Motivation is the core construct in organizational behavior. The difference of national values shows the relationship to the individual motivational difference between people from those nations. Basically, organizations have a system, process, and practice that motivates and control their members in the ways that consistent with national value. The content and process of motivation theories have been seen separately and link them to the cultural difference. The content theory related to the research about national differences but the process theory linked to the cultural difference. The individual values are more likely to be seen as primary by researchers in a strong individualist and materialist nation.

Cultural Expertise

Although the researchers study about the expertise typically does not analyze in the more general form of behavior beyond the specific skills, they have an analogy "the basic skills required for living in a culture" (Ericsson, Krampe, & Tesch-Romer, 1993). The children recognize the meaning of the words and separate them from the set of letters without meaning (Ericsson, 2005). People have many options for doing activities with values. However, with those options, the way people understand these options, the social constructs that have an effect to the reward for selecting societally preferable options unavoidably come to be structured into a person's cultural expertise.

Multicultural Team

Previous research on the multicultural team, the single conclusions from the single studies cannot provide the integrated understanding of the global virtual team. It is challenging to establish the integrated finding report. Moreover, the cultural diversity may have an association with the pattern of identification, communication, conflict, and performance (Van Knippenberg & Schippers, 2007). Sagiv and Elron (2001) found that the norm that emerges in newly created teams are associated with a particular composition of individual-level values that team members bring with them to the team. The value from national culture level may have a similar effect on the team norms. Therefore, the future research should not focus on the number of nationalities in a team, but pay attention to qualitative in addition to the quantitative difference in the cultural composition of the teams.

The working culture could be formulated in different level ranging from individual, team, department, organization, or even nation. In addition, it can be formulated by the members of the global organization who share a common understanding when they are working in a global work environment (Erez & Gati, 2004). It is the global work culture and its definition is that shared understanding of the visible rules, regulations, and behaviors and the deeper values and ethics of the global work context (Erez & Gati, 2004; Shokef & Erez, 2006). There is a various number of organization cultures but still lacking the global work culture. Therefore, Smith et al. (2008) use deductive approach to derive global work values from the characteristics of the global work environment. The values show that what is good or bad, right or wrong, should be rewarded or should be punished. Moreover, the global work culture represents the values that facilitate adaptation to the global work context. The difference of location and culture between headquarter and subsidiaries weaken their relationship and their identification. To overcome this challenge, the value of organizational social responsibility is adopted to the local communities and the environment they operate (Gradberg & Fombrun, 2006). There are several values can be found in

the organizational culture, however, competitive aspect of outcome orientation, organizational social responsibility, openness to cultural diversity, and trust have emerged directly from the global work environment characteristics.

Culture and International Management Research

Since 1990, there has been an increase of the interconnected economic among countries. According to the World Trade Organization (2016), there are 621 regional trade agreements (RTAs) (as of 31 December 2015) and among all of them, the complexity is increasing. The new RTAs broaden and deepen coverage, and some of them become more comprehensive. The overlapping regional trade creates the more complex situation.

The increasing of interconnected economies and organizations have an effect on the organization management such as downsizing and team-based management. The business situation in one country can have an impact on the change of business in another country more easily. For example, the company has to layoffs some employees due to the cheaper labor in other countries. Another example is mergers and acquisitions to remain competitive.

According to Thomas and Peterson (2015), the international management research can be carried out in several forms for different purposes and characteristics. There are six different types of study as shown in the table below.

Category	Description	Cultural Assumptions	Research Questions
Domestic	Management studies in a single country	Culture is ignored, or university of theory is assumed.	How can we explain and predict the behavior of people in organizations?
Replication	Management study repeated in another country	University is questioned; there is no theory available to predict the effect of culture.	Does this theory that applies in culture A also apply in culture B?
Indigenous	Individual management studies conceived and executed in one or many cultures	Cultural differences are assumed to exist; indigenous theory is needed to explain behavior.	How can we explain and predict the behavior of people in organizations in country X?
Comparative	Management study conducted in two or more countries	Similarities and differences exist; there may or may not be a theory available to predict the effect of culture.	What similarities and differences exist in the behavior of people in organizations? Is this theory universal?
International	Studies of multinational organizations	Similarities and differences exist, or culture is ignored.	How do organizations that operate in multiple countries function?
Intercultural	Studies of intercultural interactions in organizations	Specific aspect of culture are part of the theoretical framework underlying the study.	How is this theory influenced by cultural differences, and how is it universal?

Table 2.1 Six types of international management research (Thomas & Peterson, 2015, p. 14)

The international management has influenced how managers should perform their work. Dealing with cultural difference is one of the most challenging tasks for international managers. This research is focusing on the difficulties that may have in transnational R&D projects, which require an intensive collaboration among project members.

Cultural intelligence is a source of competitive advantage for both individuals and organizations (Earley et al., 2006). It is an intangible asset, which could have a profound impact on the organization management. The culture is consisting of belief, moral, knowledge, custom, and habit of human in societies. It is able to separate culture in several levels such as individual culture, team culture, organization culture, and national culture. Therefore, it is important to be more specific which types of culture that we are focusing on. In business management, particularly, international business management the national culture influences very much on business strategy (Haghirian, 2011).

The globalization causes a movement of workforces around the world from one country to another. This situation brings us to face with the cross-cultural communication. The effective communication is always crucial for any kind of collaboration because it provides a deeper understanding and effective cooperation. Language difference is considered to be one of the important barriers in cross-cultural communication. However, in many cases, there are still misunderstanding between people who speak the same language but the lack of cultural expertise (Haghirian, 2011). The cross-cultural management is indispensable in the global projects.

In global R&D project, where the intensive communication takes place, cross-cultural management plays an important role in the success of the projects because, in R&D projects, researchers and engineers are having collaboration closely to exchange their professional knowledge and ideas. The communication could be done in several ways such as face-to-face meeting, teleconference, telephone call, e-mail, etc. The detailed explanation could be described using text, voice, figure, however, the meaning or the message cannot be clearly delivered if senders and receivers have a different culture.

Cultural Dimensions

Culture can influence the business in several ways. Managing cross-cultural project becomes a challenging task for project managers because the cultural difference could affect structures and processes in the organization. Hofstede (1984) identified four value dimensions, which have an effect on the management of the organization.

1) Individualism versus collectivism shows that people prefer to take care of themselves and families (Individualism) which are opposite from the collectivism which is focusing on clan or relatives.

2) Large versus small power distance is about the different level of power distributed in the organization structure. Large power distance people tend to accept more hierarchical structure. For the small power distance people, they look for the equality of power. This dimension has an effect on the organization structure.

3) Strong versus weak uncertainty avoidance is the uncomfortable feeling of uncertainty. Strong uncertainty avoidance people tend to keep maintaining their belief and behavior and contrast with weak uncertainty avoidance people who are more flexible.

4) Masculinity versus femininity is the different approaches toward preferences. The masculinity pays attention to achievement and material success. On the other hand, femininity is focusing on the relationships and quality of life.

The four dimensions provide a framework for considering the effects of cultural differences on management and organization. This framework elaborates the differences between cultures base on those mentioned values. For example, North America and Europe are more on individualistic while Asia, Africa, and Latin America are collectivism. This could cause problems in collaboration between people who come from different cultures. This kind of difficulty requires attention and solution to handle them properly.

The cross-cultural issue can be managed at different levels such as individual level, team level, or organization level. In multinational corporations, the strategy for cultural diversity is required so that employees from different nations can work together smoothly. The individuals who can handle this situation are required to have necessary competencies. Many companies employed 'international manager' for this job. Traditionally, the international managers refer to the experienced expatriate managers who have rich experience working in several countries. However, with the expanding of international business, then the international managers are collecting more global mindset when they are managing the projects. They are not only working in different locations but also managing across cultural boundaries.

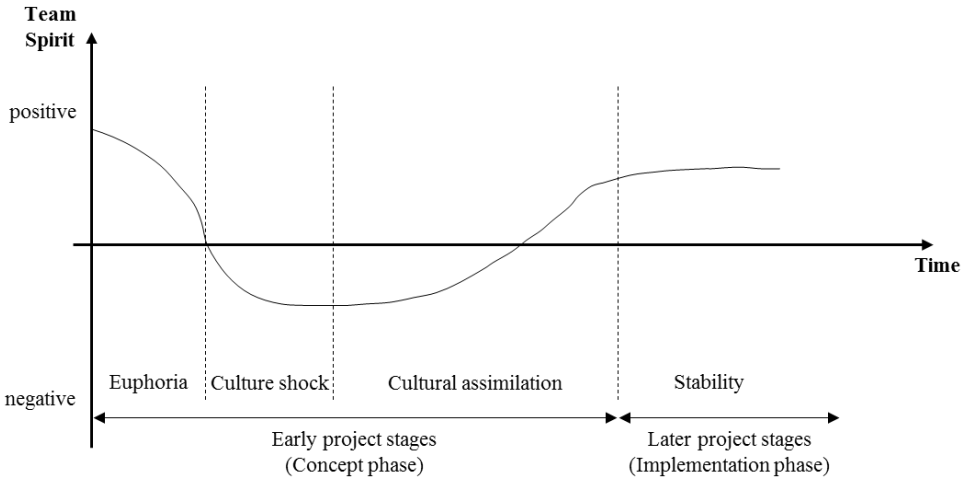

Figure 2.5 The project leader must manage the culture shock effectively at an early stage (Boutellier et al., 2000, p.216)

It is important for managers to keep in mind that the cultural difference should be managed as early as possible after starting the project, or early project stages (Figure 2.5). Building trust among project members is important for team development because of communication problems, different working styles and decision making are the causes of culture shock of team members. Several techniques such as intercultural training or seminar can be implemented to improve team spirit. The team leader needs to manage to improve and maintain a level of team morale. Thus, the high

level of team morale would turn to be a positive driving force for innovation. Experience and specific competencies of the leaders help to facilitate the smooth operation of the cross-cultural projects. It is indispensable to identify manager competencies, which support to overcome cultural different issue in global R&D project.

2.3 Knowledge Transfer

The corporate asset has been changed from tangible assets to intangible assets such as information and knowledge (Dunning, 2000). Then knowledge becomes an important resource for the organizations (Grant, 1996). This kind of intellectual capital is not easy for organizations to manage. The organizations have to deal with them more wisely to make the most effective use. In many cases, knowledge management in the organization plays an important role and it is included in organization management discipline (Nonaka & Takeuchi, 1995). In order to create and maintain knowledge in the organization, the knowledge transfer techniques are applied. There are some studies proposed knowledge transfer models and tools (Hislop, 2005; Uchihira et al., 2012; Uchihira, 2013).

Information Stickiness

The information and problem-solving capability are two important factors to solve some problems. Basically, the information itself is not easy to acquire and use, especially, when applying them to the different location of origin. “Sticky” is coined by Von Hippel (1994) and this term has an effect on the innovation-related problem-solving.

The definition of “Sticky Information” is that the information used in technical problem solving is costly to acquire, transfer, and use in a new location (Von Hippel, 1994). The stickiness of information is the incremental expenditure required to transfer that unit of information to a specific locus and usable by the information seeker. There are three reasons why information is sticky. First, the nature of the information. Second, The amount of information. Lastly, the attributes of seekers and providers. The nature of the information deals with the difference between tacit and explicit information. Polanyi (1958) explained that the human skills and expertise are often tacit, which can be perceived by observation. It can be transferred by showing an example by master to novice.

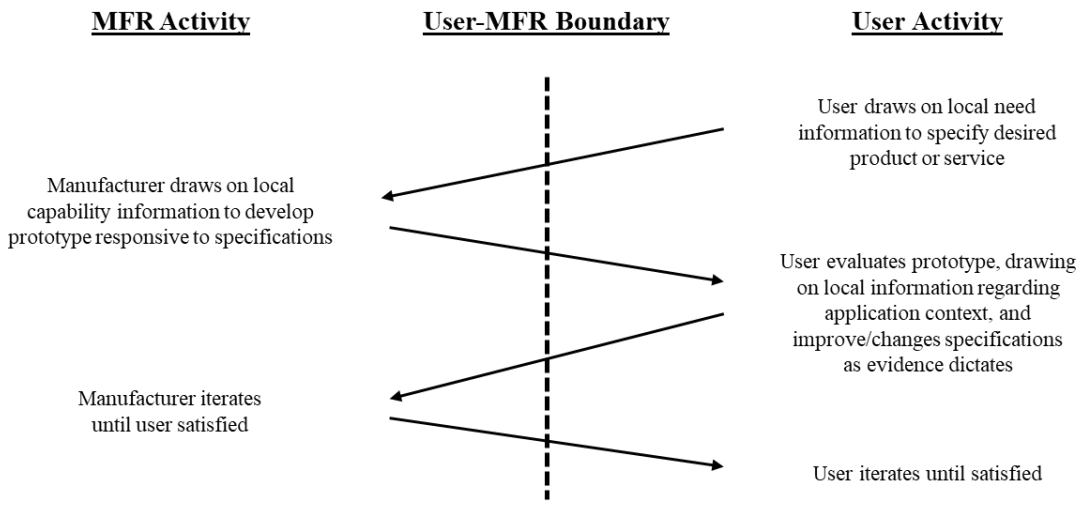

Figure 2.6 Iterative problem-solving pattern often encountered in new product and service development (Von Hippel, 1994, p. 432)

For the innovation-related problem-solving activity (Figure 2.6) that need to access to multiple locations of sticky information, sometimes, it will be "task partitioned". Each task uses only one location of sticky information. In the case of the high cost to transfer sticky information, the "Unsticking" is a solution to reduce the stickiness of information. The tacit knowledge, experience, technical expertise are converted into an explicit form, which is easier to transfer.

Barrier of Knowledge Transfer

Szulanski (1996) analyzed the internal stickiness of knowledge transfer within the organization. This research showed the major barriers to internal knowledge transfer which is the knowledge-related factors such as the absorptive capacity of the recipient, causal ambiguity, and the relationship between source and recipient of knowledge.

Transfer of best practice is considered one of the most important issues in management. The performance of different units within the firm indicated that the knowledge utilization needs to be improved. The "practice transfer" inside the firm has a concrete and fairly unambiguous meaning to practitioners. "Practice" means the organization's routine use of knowledge, which has tacit component, embedded in individual skills, and collaborate the social argument. "Transfer" is used to show the movement of knowledge in an organization. Thus, the "transfer of best practice" is a dynamic exchange of knowledge between the source and recipient units in the organization.

The transfer process can be explained as follows. Firstly, the organization has a need and the knowledge to meet that need. The discovery of the need may trigger a search for potential solutions

and lead to the discovery of the superior knowledge. After the need and the potential solutions are identified, then the feasibility of the transfer is explored. Second, the decision need to be made to start transferring knowledge. The transferred practice is adapted to meet the recipient need. This process is diminished when the recipient starts using the transferred knowledge. Third, after recipient starts using the transferred knowledge, the recipient also concerns about identifying and resolving unexpected problems, which could stop the ability to match the post-transfer performance. The recipient will gradually improve to utilize knowledge until the satisfactory level is met. Fourth, after recipient satisfied the result of using transferred knowledge, it will become a routine of the recipient.

There is a cost of knowledge transfer according to the "sticky information" (Von Hippel, 1994). The difficulty of knowledge transfer could be reflected as the cost of transferring information. Szulanski (1996) investigated the origins of internal stickiness, which occur through the four stages of best practice transfer, starting from the efforts to identify needs and identify knowledge, the efforts to bridge communication gap between source and recipient, the struggle to achieve satisfactory performance, and the efforts to achieve and preserve routine use of new knowledge.

1) Characteristics of the knowledge transferred

Causal ambiguity: It happens because the factors of production and the interaction among them during production are not clear. The key is as Polanyi (1962) suggested that the undefinable portion of knowledge is embodied in highly tacit human skills. The unclear understanding of the feature in a new context where the knowledge is used could cause the causal ambiguity as well.

Unprovenness: The knowledge without a proven record makes it more difficult to induce the potential recipients to engage in the transfer. The proven record is helpful when selecting knowledge to be transferred.

2) Characteristics of the source of knowledge

Lack of motivation: The knowledge sources may not willing to share an important knowledge because they think they will lose an ownership, a position of privilege, superiority.

Not perceived as reliable: The sources should be reliable so that they can influence the behavior of the recipient. It is difficult to initiate the transfer from unreliable sources and the knowledge transferred from that sources could be challenged and resisted.

3) Characteristics of the recipient of knowledge

Lack of motivation: The "not invent here syndrome" makes the recipient reluctant to receive knowledge from outside. The recipient may reject the knowledge during the implementation.

Lack of absorptive capacity: Lacking of the preexisting stock of knowledge may cause the recipient unable to value and apply new knowledge successfully.

Lack of retentive capacity: It is difficult to integrate the received knowledge if the recipient does not have the retentive capacity. The integration process cannot continue and then return to the previous status.

4) Characteristics of the context

Barren organizational context: The organization context may have an effect on the transfer of best practice. Knowledge could be effective in one context but ineffective in another context. Previous studies show that formal structure and systems, sources of coordination and expertise, and behavior-framing attributes of the organizational context have an effect on the number of attempts to transfer knowledge and the outcome of those attempts.

Knowledge Management

According to Nonaka and Takeuchi (1995), there are two types of knowledge. The first one is called "explicit knowledge" which can be codified and transferred using media such as documents, processes, computer systems, etc. The second one is called "tacit knowledge". This kind of knowledge is unable to codify, articulate and difficult to transfer. The knowledge can be created and transferred by applying with SECI Model. In SECI model, it is separated into four different phases.

1) Socialization, tacit knowledge is exchanged between people through participation in social activities. The social gathering such as meeting or brainstorming is important for team members in different R&D sites.

2) Externalization, tacit knowledge is transformed into explicit knowledge by using metaphors, analogies, or models. The project procedures and knowledge from all R&D sites can be shared during the intensive communication.

3) Combination, the explicit knowledge from several sources are merged into knowledge system. The combination of concepts, specification formulate prototypes of R&D projects.

4) Internalization, the combined knowledge from the previous phase is internalized into individuals from explicit knowledge to tacit knowledge through learning-by-doing. The explicit knowledge in the form of documents and manuals become a part of project cultures, which is tacit knowledge.

The whole process keeps cycling and accumulating new knowledge like a spiral. This knowledge transfer process is a fundamental process for international R&D project.

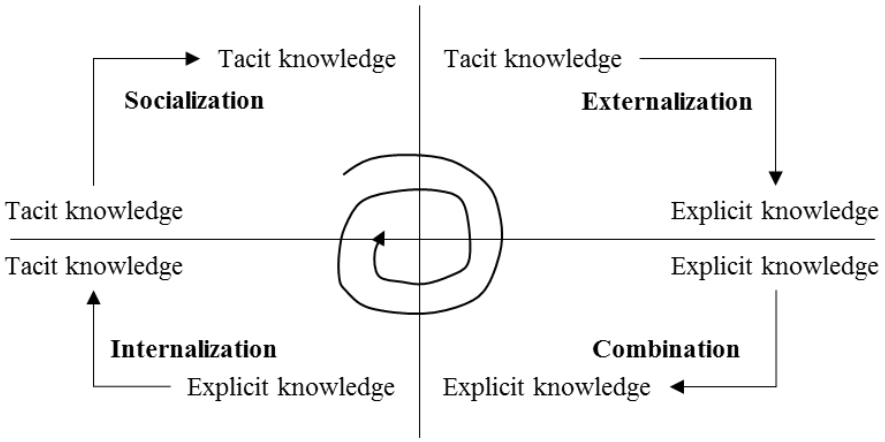

Figure 2.7 SECI Model (Adapted from Nonaka and Takeuchi, 1995, p. 62)

To be more specific in R&D project, which is a kind of knowledge-intensive project, they very much rely on the professional knowledge. Some scholars discussed R&D projects from the knowledge transfer perspective (Blecker and Neumann, 2000; Uchihira et al., 2012; Arunagiri et al., 2016) and some of them proposed solutions to mitigate the barriers to knowledge transfer (Milton, 2005; Bruneel et al., 2010).

In addition, it becomes more challenging in the context of globalization when the knowledge has to be transferred across different geographical locations and between people who are from different cultures. The studies on R&D knowledge transfer in the global environment was conducted for a few decades (Boutellier et al., 2000). The studies are mainly about the knowledge transfer by managing the human resource. Because of the hierarchical organization structure and functional of work, the knowledge is separated into several small pieces. Moreover, in globalization, the R&D team members are not working in the same location. These are the reasons of the challenges in managing global R&D projects.

In general, most of the knowledge is tacit knowledge and they are subjective, experiences, know-how, organization routine, values, culture, etc. In order to manage knowledge in global R&D projects, the human resource management is a key because the tacit knowledge is attached to a person and will be manipulated with the human resource management.

Boutellier et al. (2000) have discussed the knowledge management in global R&D projects. There are four perspectives to be considered. First, building bridges between islands of knowledge.

The collaboration among all stakeholders could drive the projects to gain more knowledge and innovative. Second, knowledge creation and project management. According to Nonaka and Takeuchi (1995), sharing knowledge and information can promote the creation of new knowledge, especially, tacit knowledge. This can be illustrated in Figure 2, the SECI model. Third, managing cultural diversity.

The cultural diversity provides advantages for innovation even though it has some disadvantages such as language barrier and misunderstanding. The higher level of cultural diversity, the more challenges in project management. Lastly, the management concepts almost impossible to transfer. Project managers of international R&D projects have to travel a lot and have meetings with team members apart from using only information technology. Such kind of knowledge to manage international R&D projects is embedded into the managers themselves.

However, other viewpoints of knowledge management should also be explored such as knowledge transfer facilitators in global R&D projects. As mentioned in the previous section that the tacit knowledge is attached to a person and it could be managed through human resource management. Arunagiri et al. (2016) investigated knowledge transfer in multinational R&D collaborative project between university and industry and showed that the geographical distance, legal frameworks, regulations, budget and timeline management are the important barriers to knowledge transfer.

Facilitators could play an important role in promoting knowledge transfer in global R&D projects. Some competencies of facilitators such as cultural understanding and expatriate experience can be utilized during the global R&D project phases.

2.4 Bridge System Engineer and R&D Bridge Manager

Bridge System Engineer

Bridge System Engineer (BSE) is a type of coordinator who mediates and enhances the relationship between clients and service providers in software development projects (Huong et al., 2014). In offshore outsourcing projects, the cultural difference is one of the factors that slow down knowledge transfer process. Bridge SEs utilize their experience and knowledge to provide advice for service provider team. As well as using the communication skill to control the information flow between two sides. Huong et al. (2014) investigated the role of Bridge SE who enhance the relationship between clients and service providers, create values, improve collaboration, bridging

knowledge gaps and decreasing cultural difference. The four working stages of Bridge SE were identified.

1) Planning with client and offshore project: In this phase, Bridge SEs work with both sides starting from listening to client team leaders about requirement overview. Then more detail of the project is provided by designers and programmers. Bridge SEs also receive a training for business domain knowledge for deeper understanding in client business. Then, Bridge SEs interact with offshore teams and project managers explain the development process. At that time, Bride SEs estimate the mindset and attitude of offshore teams.

2) Breaking down requirements, design plan and transfer: Bridge SEs use their skills, knowledge, and network they have to align information and knowledge before transferring them from client to offshore team. The objective of this step is to minimize gaps between two sides. Some techniques are used such as developing charts or graphics of the requirements and development plan, using tools like video, image simulation, mind map and memo function in Microsoft Excel, as well as learning from books, group discussion with the client team, and using familiar examples with offshore teams.

3) Problem solving, review fix, final quality assurance and delivery the product: There are several steps in software development project that Bridge SEs get involve, both client side and offshore team side. For the client side, Bridge SEs help to design the requirement, review product and evaluate product quality. For the offshore team side, Bridge SEs help the project manager to develop a plan and help development team for the reviewing, bug fixing, and quality assurance. Those activities required a high level of technical skill so it is difficult for Bridge SEs and they have to work together with the project manager. At the same time, Bridge SEs need to maintain a good relationship with the client and the social network with client's groups is more important than other required skills.

4) After delivery, externalizing and sharing experience: After the project, Bridge SEs accumulate knowledge, skills, know-how throughout the project and externalize them in the form of documents, manuals, guidelines for using in the future. Knowledge from client side such as business process and domain are created in the form of requirements. Knowledge from an offshore team such as team capacity and limitation is created in the form of reports for evaluation meeting.

In global R&D project, there are some challenges in managing such kind of projects. Accordingly, some literature discussed global R&D projects from the organization management perspective (Reger, 1999; Asakawa, 2000; Boutellier et al., 2000; Von Zedtwitz et al., 2004). For example, ten challenges and six dilemmas in organizing global R&D were identified by Von Zedtwitz et al. (2004). Moreover, knowledge transfer is another important activity in R&D projects.

Kurokawa et al. (2007) mentioned three factors that affect the level of knowledge flow between headquarter and subsidiary 1) Trustful and democratic environment 2) Autonomous 3) Network-linked. These factors have an effect on the level of knowledge accumulation in a subsidiary and then have an effect on the working performance. Uchihira et al. (2012) discussed the knowledge transfer in R&D project management and introduced knowledge transfer model to overcome barriers using boundary object and project case database.

From the issues mentioned above, organization management is not the only concern in global R&D projects, but also the knowledge transfer as well. This could bring attention to the intensive knowledge transfer and effective collaboration as the key elements for the better performance of global R&D project. Some studies discussed R&D collaboration by having support from innovation champion and BM. Hemmert et al. (2014) identified the activities of innovation champion to develop trust, which is important for research collaboration between university and industry. Arunagiri et al. (2016) discussed BM who is a kind of facilitator to support university-industry collaboration. However, in today's business, globalization encourages R&D in the industry to have a knowledge transfer among project members in different countries. The role of facilitator such as BM becomes more important to support knowledge transfer in this context. Therefore, specific skills and competencies of BM need to be investigated.

Bridge Manager Education

The emerging of new offshoring projects has created a high demand of competent bridge manager. However, the skills and competency of bridge manager require a period of time to develop, which cannot supply to the need of the market efficiently. Toyoda et al. (2007) proposed "A case study on project-management training-support tools for Japanese/Chinese/Indian offshore development engineers" because the outsourcing trend in these countries was growing rapidly. China and India are the powerhouses of development activity due to the low cost and sufficient supply of software engineers.

There are several problems between Japanese who make an order, and Indian and Chinese who accept the order. The problems are including communication, management of specifications and modifications, and project management. The different language, culture, business practices, and employment issues are also difficult to overcome. Therefore, the bridge SEs are required to have specialized skills as following.

1) Effective communication: They have to communicate with project members using the correct terminology in common language.

2) Able to think about the problem: They have to think about the problems from the perspective of order side, and then use the appropriate skills to solve those problems.

Toyoda et al. (2007) developed the training support tools, which are expected to improve the project-management and problem-solving skills of bridge SEs. These tools are using the concept of sharing project-management knowledge and problem-solving methods. The tools are evaluated by software engineers and measure their level of project-management skills had improved.

The tool is a web-based training system and consists of nine areas of common knowledge form an international project management standard (PMBOK) (Project integration management, Project scope management, Project time management, Project cost management, Project quality management, Project human resource management, Project communication management, Project risk management, Project procurement management), and five integrated project management processes.

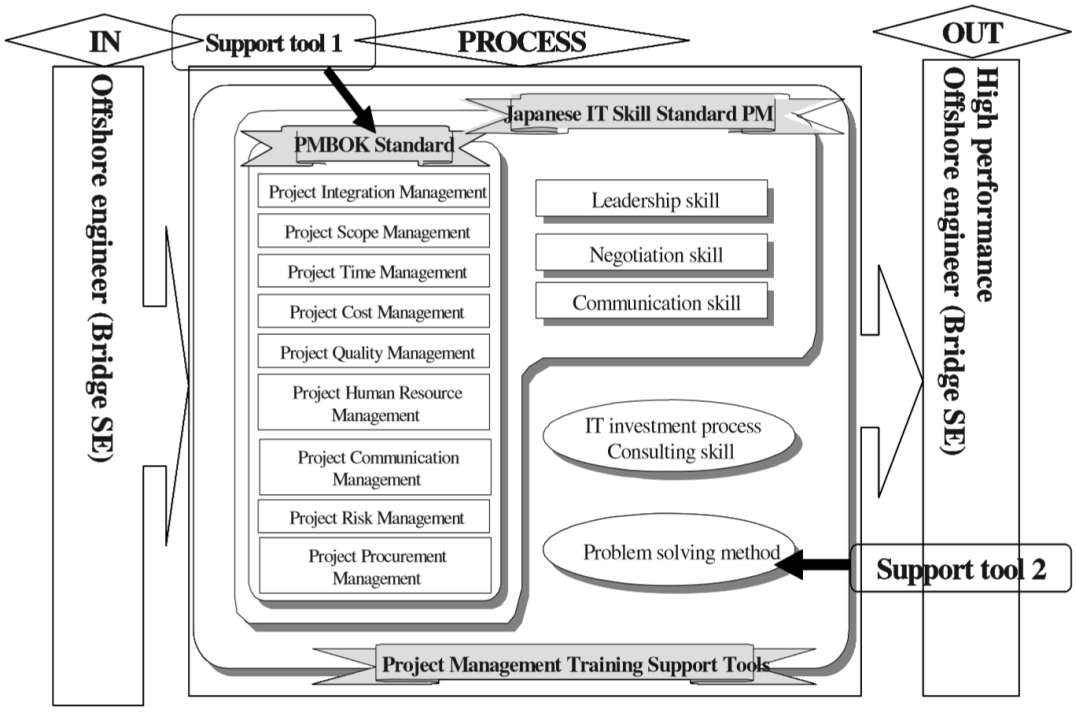

Figure 2.8 Project-management training support systems (Toyoda et al, 2007, p. 1224)

The result showed that a case study on project-management training-support tools for Japanese/Chinese offshore development engineers are effective for increasing the level of project management knowledge of bridge SEs. It is useful for bridge SEs to gain more knowledge about the de facto standard of international project management in addition to their existing knowledge about project management for offshore software development.

However, attending lecture helps bridge SEs to improve their understanding about problem-solving methods, analytical concept, and solution-action approach, but the problem-solving skills did not improve after using the training-support tools.

Bridge SEs in offshore software development project are working with team members who speak different languages, have a different culture, and use different business practice. They use skills and knowledge, which are developed during daily work. Those are tacit experiential knowledge, which is held by individual and they are not shared in the organization.

2.5 Findings based on Literature Review

Since R&D becomes more important and many companies implement the R&D activity in their organization, there are some companies that can bring the best out of R&D. Niwa (1991) studied the characteristics of the outstanding R&D organization. The outstanding R&D organization should have the following characteristic: clear vision, good researchers, enough facility, internationalization, technology introduction and cooperation, long-term research, open atmosphere, satisfied evaluation method. This research by Niwa (1991) is focusing on the domestic R&D organization. After 1990, there are some more researches discussed the global R&D management because the world becomes more globalize and there are some advantages from such kind of environment.

The international R&D structure has been identified into three categories: isolated specialization, supported specialization and integrated labs, and an external source of knowledge and internal R&D resource are the factors that influence the structure of the international R&D structure (Chiesa, 1996). In 1997, Kuemmerle explained two objectives of setting R&D site abroad. The first one is for knowledge exploration, which is to acquire new knowledge from global knowledge resource and the second is the knowledge exploitation, which is to commercialize existing knowledge into foreign markets. Moreover, Kuemmerle (1977) also mentioned about three capabilities that the company should have when establishing new R&D site: adapt global approach, establish new sites and integrate global network. Globalization is more complicated and there are some challenges for the global R&D project. Boutellier et al. (1998) investigated the challenges of dispersed teams, which are the distance between teams, the different culture and work habit, the time zone and the main challenge is the communication. The concepts and trend of international R&D organization were proposed by Gassmann and Von Zedtwitz in 1999. They concluded the reasons for internationalization of the company. There are three reasons: market globalization, region knowledge resources, and technology changes. Consequently, five forms of organization structure were identified as well ethnocentric centralized R&D, geocentric centralized

R&D, polycentric decentralized R&D, R&D hub model and integrated R&D network. In addition, they also explain the trend of R&D organization toward globalization. The R&D organizations will adapt to the international environment, access to more global resources, increase the autonomy, organizations growth on merger/acquisition and fewer leading research centers (becomes more R&D network).

Some scholars discussed the communication problem in dispersed teams such as the more distance, the less communication between teams (Allen, 1977) and the communication is the main productivity problem of R&D (De Mayer, 1991). The coordination mechanisms in international R&D were identified by Reger (1999). There are four suitable forms structural and formal, hybrid/overlaying, informal, and international market. In this research, also mentioned the differences between Japanese and European enterprises. The Japanese firms use personal contact, informal communication and employed "Liaison person" as a coordinator to overcome tacit knowledge and cultural issues.

Recent researches on global R&D management include the new concept to enhance R&D management. There are some new concepts that can be used such as open innovation, knowledge management, lean innovation, smart specialization and agile innovation. These concepts are challenged by the business environment, the dynamic of knowledge resources, the emerging markets/countries, and the cross-cultural management. Hence, it is important to investigate new solutions and be prepared for the coming challenges. A competence BM is one of the important roles who can enhance the R&D project by applying their knowledge and skills to facilitate the global R&D project.

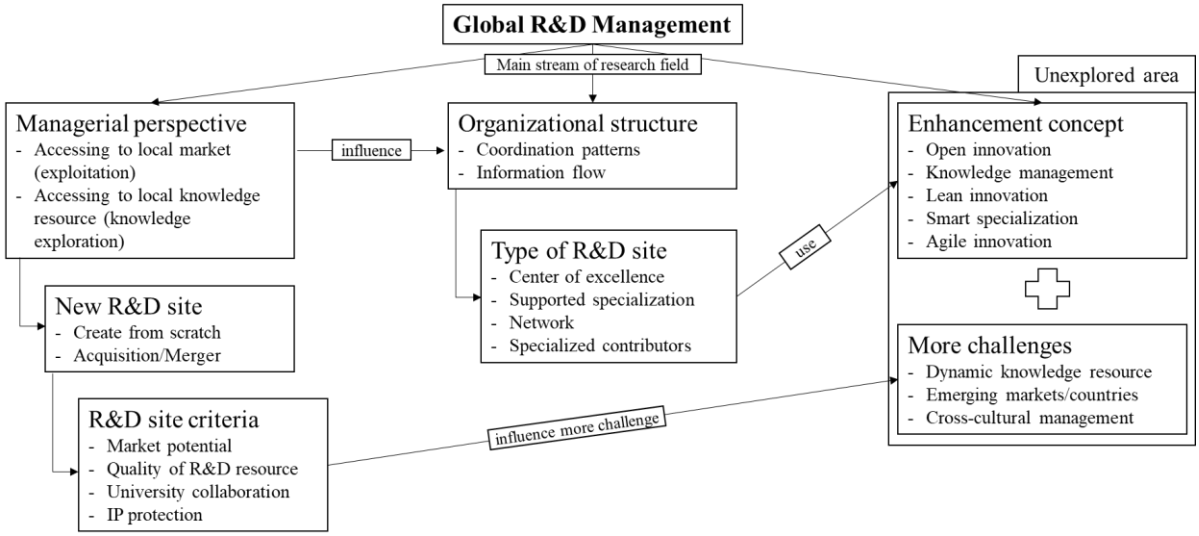

Figure 2.9 R&D management research

The literature on global R&D management can be depicted as figure 2.9. At the beginning of the knowledge era, the knowledge was considered as an important asset of the firms. The researchers started to investigate the R&D activities which is a way to create, utilize, and commercialize knowledge for the benefit of the firms, not only for domestic but also the international environment. From the left side figure 2.9, the foundation of global R&D was explored such as the objectives of global R&D, the process to setup new R&D site, and the criteria to consider when setting up R&D site. Consequently, the managerial perspective can influence the organizational structure. For example, to acquire knowledge from global knowledge resources, the information flow from R&D subsidiary to headquater should be emphasized. The organizational structure leads to a proper type of R&D site such as supported specialization can help the firms to commercialize their products because they have special knowledge about the local market. However, on the right side fo figure 2.9, there are some more challenges in the current situation and to improve the efficiency of global R&D management. Some researchers proposed the enhancement concept that can be used with management practices. Those concepts have to deal with a changing environment, therefore, it is indispensable to investigate the unexplored area of global R&D management research.

2.6 Summary

In this chapter, we review researches related to the global R&D management. The important issues were summarized as well as the research gaps. Then conclude our research direction in this study by having an intensive literature review.

In the past few decades, the industry has been focusing on the new product development process in order to make the process more effective. Scholars discuss and identify the process and then implement in the industry. However, because of the increasing business competitiveness, the industry commercialize new product or service to satisfy the customer needs. Innovation plays an important role in a business environment to introduce new product or service to the market.

The innovation requires knowledge from multidisciplinary, which the traditional innovation process cannot serve. Open innovation suggests to utilize both internal idea and knowledge and external ideas and knowledge for the benefit of new product development. The internal idea can turn to be the end product within the organization or it can go outside and turn to be the end product in other organizations. On the other hand, the ideas from outside the organization can get into the organization and turn to be the end product.

By having the concept of open innovation, the industry uses this concept by seeking for external knowledge from the global resources. The company establishes subsidiaries in foreign countries to access to the larger market and to exchange knowledge with knowledge resources around the world. Many researches discuss the global R&D management, mainly, focusing on the organization structure and collaboration when setting up new R&D sites abroad.

In managing the global project, basically, we have to consider five components global team, global communication, global organizations, collaborative tools, and collaborative techniques. In this research, we deal with the role of BM in global R&D projects to identify the difficulties of BM. The difficulties that can clearly explain the causes and the effects on the global R&D project management.

In the global R&D project, the performance depends on the collaboration among researchers who are from different cultures, organizations, countries, time zone and using different languages. BMs work in between these people. The complex environment creates many challenges on BM role. Therefore, it is necessary to carefully identify the difficulties in global R&D project facing by BM. The understanding of difficulties will be discussed in Chapter 4.

Chapter 3 Research Plan

This research aims to provide a deeper understanding of the difficulties that BMs have when they are working in global R&D projects. The empirical research investigates the difficulties from experience of managers who have been facilitating the R&D projects across different countries. The difficulties are identified from the interviews.

This chapter provides the research design followed by data collection method. The method to collect data is explained to ensure the data gathering mechanism could cover all necessary aspects of further analysis and derive the conclusions. Qualitative data analysis is used for answering research questions and formulating research findings. All methods and mechanisms will be discussed to show strong support that all of them are suitable for this research.

3.1 Research Design

According to the aim of this research to provide a deeper understanding of the difficulties that BMs have when they facilitate global R&D projects. The following three main objectives are also identified. First, to explore the difficulties in facilitating global R&D project from the perspective of BM. Second, to explain the causes of difficulties that happen in facilitating global R&D project. Third, to explain the role of BM in global R&D project to solve those difficulties. The three main objectives are achieved by answering subsidiary research questions (SRQs) and, finally, main research question (MRQ).

The qualitative data analysis with the inductive approach are used as a strategy of this research. In grounded theory, we start from specific observations to broader concepts that organize observational data and then continue to build principles or themes that connect the concepts (Neuman, 2011). The objective of the research is to identify difficulties of BM in facilitating global R&D project. The difficulties are formulated from collected data.

To investigate the issue in more detail, this research is separated into three sub-topics which are 1) the difficulties in global R&D project 2) cause of the difficulties in global R&D project and 3) the role of BM as illustrated in figure 3.1. Each sub-topic is analyzed separately to explore deeper understanding in each area. Then all three sub-topics are integrated to construct the conclusion of this research.

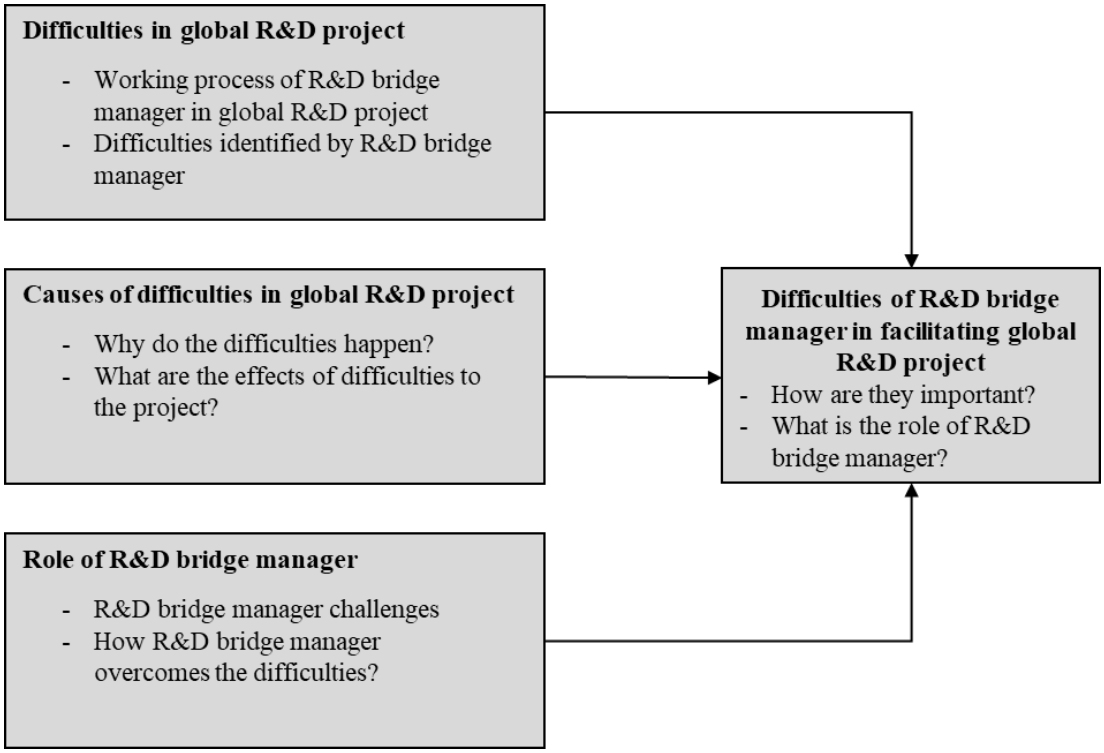

Figure 3.1 Identification of difficulties of BMs

3.2 Data Collection

The semi-structured interview is used to collect data from seven experienced managers. The objective of this interview is to find answers to the research questions. Interviewees are working in and having more than three years of experiences with R&D project management, specifically, in a global context. Five of them are Japanese, two of them are Chinese and English is used as the language for interviews. This group of managers is working in the multinational companies (MNCs) in information technology (IT) industry that has R&D subsidiaries located in several countries.

The face-to-face meeting and the telephone call are the communication channels for the interviews. Each interview spent around 45 to 90 minutes with audio recorded. All managers were asked about their experience, problems and issues, and another opinion of working in the global R&D projects. The set of questions were prepared beforehand, however, we did not keep the sequence of the questions as prepared but carried on the interview base on our conversation with the managers. This could help us to gather insight information without interruption. Lastly, the interview data is used to identify difficulties of BM in global R&D project.

3.3 Data Analysis

After data collection, the interviews were transcribed from audio to text. To answer each SRQ and support to construct the answers for MRQ in general, the interview from all managers were analyzed to formulate logical findings and conclusion. Although the number of interviews is small, the messages from each manager are analyzed using data coding. The common messages from different interviewees are put into the same group and validate the reliability of the data.

Since the context of this research is a global context, the global project management framework is used as a guideline to analyze global R&D project. This framework provides perspectives that we should cover. Binder (2007) explained about global project management as we included in below sub-section.

Global Project Management Framework

The organizations are using different methods, tools, and practices with global projects, but they still cannot reach the required quality. The reason is that they are not adapted to the global multi-cultural environment. There are asynchronous communication, different cultures, and different languages in such environment. The "Global Project Management: Communication, Collaboration, and Management Across Borders" was proposed to solve this issue (Binder, 2007). It was recognized by Project Management Institute (PMI) that it is the best project management literature of the year 2007 and received the PMI David I. Cleland project management literature award.

In the global projects, they are including team members from various cultures and organizations, locating in different countries and time zone, and using different languages. The success of the team and the quality of the project outcome contribute by those dimensions. At the same time, those dimensions add more challenges to the project.

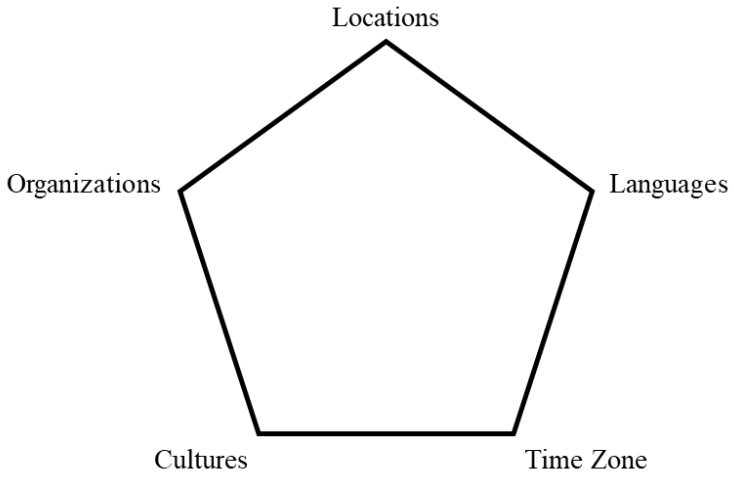

Figure 3.2 Dimensions of global projects (Binder, 2007, p. 3)

The level of innovation can be increased within the multicultural team because of the various standpoints and perspectives. The brainstorm session in the multicultural team can be very rich and provide many ideas. However, in many cases of the global project, there is some misunderstanding, which caused from conflicting views on values and behaviors. This kind of situation normally requires a period of time and effort to control.

Binder (2007) explained the challenges from the combination of international, distributes and virtual projects which are dedicated to the global projects. This category is the combination of virtual and international projects, which includes people from different organizations working in different countries around the world. These dimensions can be used to evaluate the level of complexity of the projects. In this research, the dimensions will be used to analyze the global R&D project from the perspective of BMs. The following are the detail of each dimension based on Binder (2007).

1) Locations: The face-to-face meeting is easy to organize when team members are working nearby each other. This kind of meeting can get benefit from the body language and social interaction. In the global project, the phone and video conference are essential and require the application of communication strategies to ensure the highest effectiveness.

2) Organizations: Team members may work for a single department in one organization or multiple departments in multiple organizations. The project managers have to adapt their people and leadership skills to the different policies, procedures and organization cultures as well as the commercial and contractual processes, which are increased.

3) Cultures: In addition to the organization culture, the work environment can be more diverse by the customs, traditions of different nations and regions. They are reducing the group thinking and improving the collective creativity. The motivation could increase when many people are working in the cross-cultural environment because there are a lot of exchanging information. On the other hand, the diversity can also be the source of conflicts and misunderstandings. The project managers have to apply rules and practices to get advantages from cross-cultural communication and avoid the pitfalls.

4) Languages: The way project members communicate highly depends on their own native languages even the organizations have a common language for information exchange. If the common language is English, then the effectiveness of communication of non-English native speakers will be limited by their knowledge of English, vocabulary, and the way they show some examples. At the same time, English native speakers have to limit the use of vocabulary to clear sentences and essential words and carefully confirm the understanding of their ideas by foreign colleagues. The use of online meeting and visual communication can be adopted by project managers to avoid misunderstanding and obtain high commitment level from all stakeholders, independently of their native language.

5) Time zones: It is more difficult to organize the meetings with the project team members located in different time zone. However, there are pro and con. The project can get advantages by applying the "follow-the-sun" strategy. It can reduce the duration of the sequential tasks by half or third of the time. In the group of low overlapping time zone, the procedures and communication rules must be precisely defined. On the other hand, the delay can happen, when the information exchange takes a long time instead of just a day. The standard communication rules and templates across location can be implemented to reduce the possibility of a problem occurring.

Many studies have covered many specific practices that can improve the collaboration among global project teams. These practices are grouped in "Global Project Management Framework" for a holistic analysis. There are 25 knowledge areas to consider for any global project. It will be helpful to consider some knowledge areas, which are most relevant to your situation. The framework can be used during project executing, monitoring, and controlling as a reference. This framework would be a guideline to analyze the difficulties of BMs in global R&D projects.

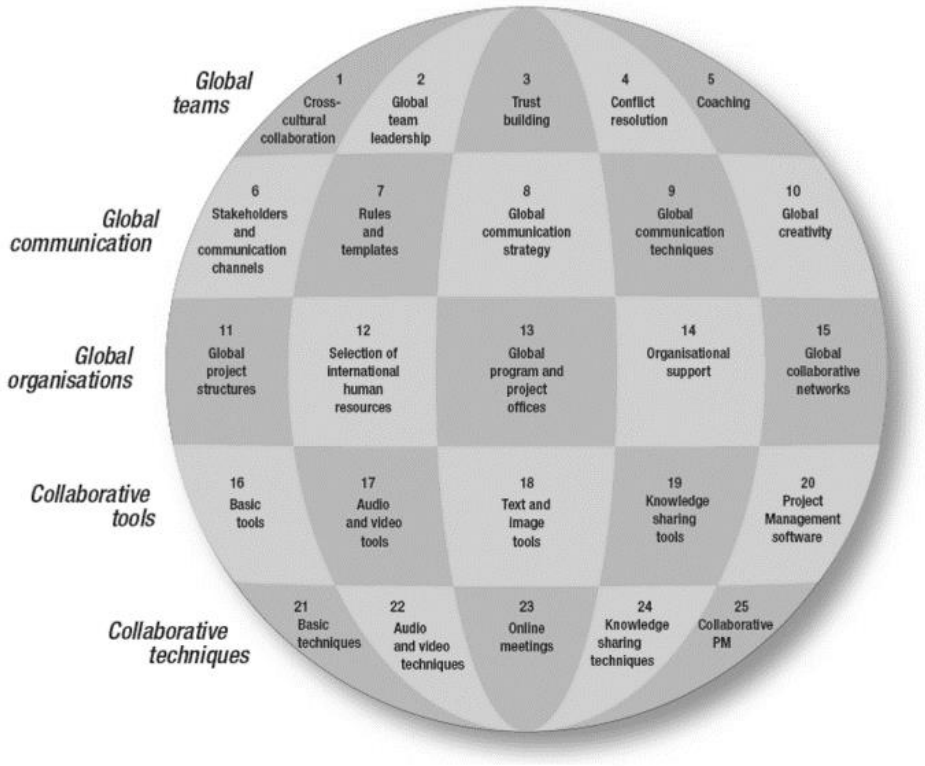

Figure 3.3 Global project management framework (Binder, 2007, p. 14)

Global team management

1) Cross-cultural collaboration

2) Global project leadership

3) Trust building

4) Conflict resolution

5) Coaching

Global communication

1) Stakeholders and communication channels

2) Rules and templates

3) Global communication strategy

4) Global communication techniques

5) Global creativity

Global organizations

1) Global project structures

2) Selection of international human resources

3) Global PMO

4) Organizational support

5) Global collaborative networks

Collaborative tools and techniques

1) Basic tools and techniques

2) Audio and video tools and techniques

3) Text and image tools, used during online meetings

4) Knowledge sharing tools and techniques

5) Collaborative project management software

Chapter 4 Interview Results for R&D Bridge Manager Difficulties

This research used a semi-structured interview as a data collection method and this chapter provides the interview conclusions. The interviews with BMs provide us an insight into the difficulties they are facing during the global R&D project.

The insight from experienced managers shows the mechanism of the difficulties. Moreover, the managers also provide some suggestions and practices how they can solve those difficulties. This Chapter will explain detailed information and shows some highlight quoted from the messages.

4.1 Interview Analysis

In order to gain more insight and deeper understanding about the role of BM, this research applies a semi-structured interview method to collect data from the managers who work in the global R&D projects. We conduct the interview and have discussions with seven BMs. They have at least three years of experience in the global R&D project management. All of them are from the information technology (IT) industry. The companies have headquarters and R&D subsidiaries in several countries. We use teleconference and telephone as the communication channels for the interview. The length of each interview is about 45 minutes to 90 minutes. All interviews were audio recorded and transcribed into text for further analysis.

We utilize the research questions as a guideline for the interview to cover the topics of this study. The main topics are including the working process of BM, the difficulties in global R&D project, the causes and effects of difficulties, and the role of BM. During the interview, we have opportunities to discuss other related issues, which provided us a broader and deeper understanding of global R&D management.

The Working Process of R&D Bridge Manager

According to the interviews, we can summarize the working process of BM into two important phases, which are the initial phase and operation phase.

The first phase is initial phase. BMs gather data and information from all related parties such as management team, marketing team, development team, customers, and suppliers. BMs collect

data from the meeting, discussion, and some documents. For example, BMs attend the meeting with the marketing team in order to understand the real needs from the customers. After that BMs have to transfer information and knowledge to R&D team because, in the global context, the scheduling is difficult to have a meeting between teams from different countries.

"For example, Japan side get the new devices and we can invite the China development people to Japan to test the application together with the real device in Japan. But in this case, the biggest problem is the schedule in Japan side the schedule and the China side schedule. The development schedule is very difficult to get together. The conflict between each other."

The data and information are summarized by BMs before transferring to another side. BMs utilize their knowledge and skills during this process such as language skill and cultural expertise. After having a meeting and transfer information and knowledge to R&D team, BMs gather information, basic ideas and feedback from R&D team and bring back to the headquarter teams and asking for some decisions and support required by R&D team.

The second phase is an operation phase. After the decision is made to carry out the R&D project then the R&D team starts working on the research. BMs have to travel between the headquarters and R&D subsidiaries to facilitate the collaboration between them. BMs work with R&D team to create the development plan so that they can propose several options to the management or headquarter team. The different options have different good and bad points, together with some support required from headquarters.

"May be they show us a document like develop plan. For example, to involve this problem we have plan 1, we have plan B, plan C. We want to do this this this and the risk is this this this. And to develop plan A, we need some support from Japan side like this this this."

During this phase, BMs have to establish the mutual agreements between headquarter and R&D subsidiary throughout the R&D process. It is difficult for BMs to convince both sides to set an agreement. BMs play an important role to facilitate in this situation.

"It is very difficult to convince with each other. This is a big problem. In Japan side, we think we are the order so China side must follow them because we are the order.

But in China side, we can follow your order but in this case, the risk is very big. So, we can follow your order. The risk is very biggest and the possibility, please take risk the possibility in Japan side."

BMs also helps the R&D team to develop some reports to provide an update to the headquarters. There are some meetings between headquarter and R&D team, which the BMs have to attend. In

some cases, BMs have to explain additional information from R&D team by themselves because the researchers or developers hesitate to talk to the headquarter team directly.

The Difficulties in Global R&D Project

We discussed several difficulties during the interview. However, the BMs emphasized four difficulties. Thus, we can draw some conclusions from the interview. There are four difficulties: the quality control, communication, the R&D activity facilitation, and the understanding of the market and requirement.

The high-quality product is one of the most important goals of the R&D project. According to the response from BMs, the quality control seems to be the most difficult activity in the project. The quality control in the basic research project is more difficult compare to the applied research project. The researchers keep working on the research to produce new knowledge for the organization. The new knowledge is not expected to transform to the end product. Therefore, the target outcome of the basic research is not quite clear.

"In the research level, it is very difficult to manage the performance because in our side we did not have the idea how to involve the problem currently. We did not have. So, it is the big problem for us right now how to check, how to control the performance in the research level. It is very difficult because we did not have idea how to involve it.

In product level, we have a very clearly specification in order. But in research level we did not have the specification to which performance is good and which performance is the best we did not know."

The approach that BMs use with this difficulties is to establish several milestones or releases along the process. The research teams are asked to propose the intermediate result, which will be evaluated. By doing so, the final goal of the project is divided into multiple sub-goal and it is clearer compare to the subjective goal of the research project. This method also provides opportunities for BMs to evaluate the quality of the result.

It is even more complicated when the expected outcome is different between headquarters and R&D team. The headquarter expect to have an outcome for customers, high quality, and high reliability. On the other hand, R&D team delivers the outcome base on the best they can do or using basic approaches.

"Not only developer in Japan side, also marketing researcher and also the high-level people will check it. And the developer will ask, it is ok or not ok. If they need to change or not.

This is the best right now. We can do it. Please check it and if you want us to change something or improve something, tell us and discuss information, give us some support."

BMs use their knowledge to balance the level of expectation between different sides. BMs have to understand the expectation, limitation, and the reasons behind each requirement so that they can deliver result and support for both sides. Sometimes they use a negotiation skill to propose an agreement, which is satisfied by all parties.

For example, when the headquarter requires to see the research result, BMs will check whether that result will be used for internal evaluation or external evaluation (by customers). If it is the internal evaluation, BMs ask research team to propose a suitable outcome. After the headquarter team decide to continue this product development, then BMs ask research team to deliver the highest quality product with a high level of reliability. At the same time, BMs may request additional support from headquarter for the research team.

The difficulty in communication between project members is another challenge of BMs. Because of the nature of the global project, this kind of project includes people from different cultures, organizations, countries, time zone, and speaking different languages. The working culture of people from different countries creates difficulty in communication when they are working in different approaches. Moreover, in the project, teamwork is important for the success of the project. BMs have to work in this kind of diverse environment and find ways to establish a smooth operation.

"The Chinese people and Japan people is the same in this case because team is very important in Asian, in East-Asian such as Korea, Japan, and Thailand. Team is very important, not process. We do not need the hero in the team. We need teamwork. Teamwork is very important. We want you to show the best teamwork. So, the India, the thinking is like America, I think. The personal idea is very important for them. It is very difficult to change their opinion, personal opinion for then."

"I am still feel similar. I mean when I meet with different culture and also languages. I think there various big issues I try to repeat my questions again and again to know what they really think. That is difficult, I think. Project proposal, may be they do not ask everything out. Sometimes, they have feeling do not tell everything. Every time, we do the formal documents. This is the method to deal with that problem."

BMs suggest the solution to this difficulty by using documentation and visualization. There are some documents initiate by BMs throughout the R&D process. These documents clarify information for all related parties. There are some unclear points during the discussion or meeting

which can be supplemented by documents and visualization. BMs elaborate more detail in written form and show to headquarter or research teams for consideration.

There is a process in global R&D project, the project members use different approaches base on their way of thinking to deliver the outcome. However, even we can have the same outcome but the process and evidence of the research approach are also very important for the R&D project. BMs do not validate only the outcome but also the process with evidence. It is difficult for BMs how to make the project members understand and work smoothly with the different way of thinking of their colleagues. This causes the difficulty in controlling and facilitating R&D activity.

"Sometimes they operation is incomplete to proof the advantage as a result. Sometimes I do not believe the result. If the result is completely good in that case is good. But Indian result usually have some problems. They have to use some approach but they do not use such approach and they use different approach. Even the different approach is completely good, no problem. But the result is not so good. It does not have an evidence. If Japanese researcher want to change the requirement approach, they may show evident that result quality is very good. Because Japanese researcher is honestly. Japanese researcher normally show the evident of their quality is good, process in detail. Indian researcher think about the rough idea. They think this approach is good, they believe, so they go to this direction different from Japanese side. This is the way of thinking."

"I have this problem as well but I solve it by I change the role between Japan and Germany. What I mean is that Japanese guy always say that they design, they write down specification and I ask Japanese to stop it and German start to write the design and the specification and the Japanese just check it and then it work better."

One of the solutions that BMs do is suggesting team members play other's role, especially, switching between people from different nations. It raises up an awareness of team members to think from another perspective and able to understand various ways of thinking.

The last difficulty is the understanding of the market. In global R&D project, R&D teams are located in different locations from the markets or the places where the result of R&D will be used. This setting creates the difficulty since the beginning of the project when BMs have to explain and transfer knowledge about the market and real need of the customers from headquarter to R&D team. Without a clear understanding of customer's needs, R&D teams cannot deliver the outcome to satisfy customers or headquarter team.

"I often say to the Japanese colleagues that is the typical Japanese's excuse. My excuse means from my point of view Japanese do not understand the global market. So they often say that the Indian say the market is bla bla bla bla but the Japanese say no do not agree. They often say that the global market some products should be bla bla bla bla something like that.

Before that, the Japanese say Japanese headquarter understand the global market bla bla bla. Then, therefore, they say they should be a leader of the product design or product planning or something like that or R&D. But I told them that is not true. I think the Japanese is weaker than other people."

Difficulty Mechanism Model

The managers explained detailed information about the difficulties they have when working in global R&D projects. In addition to the difficulties mentioned by BMs, they elaborated their insight about the causes and the effects of the difficulties. According to the managers, we can derive a mechanism model. In this section, we develop the "Difficulty mechanism model" that we found from this research.

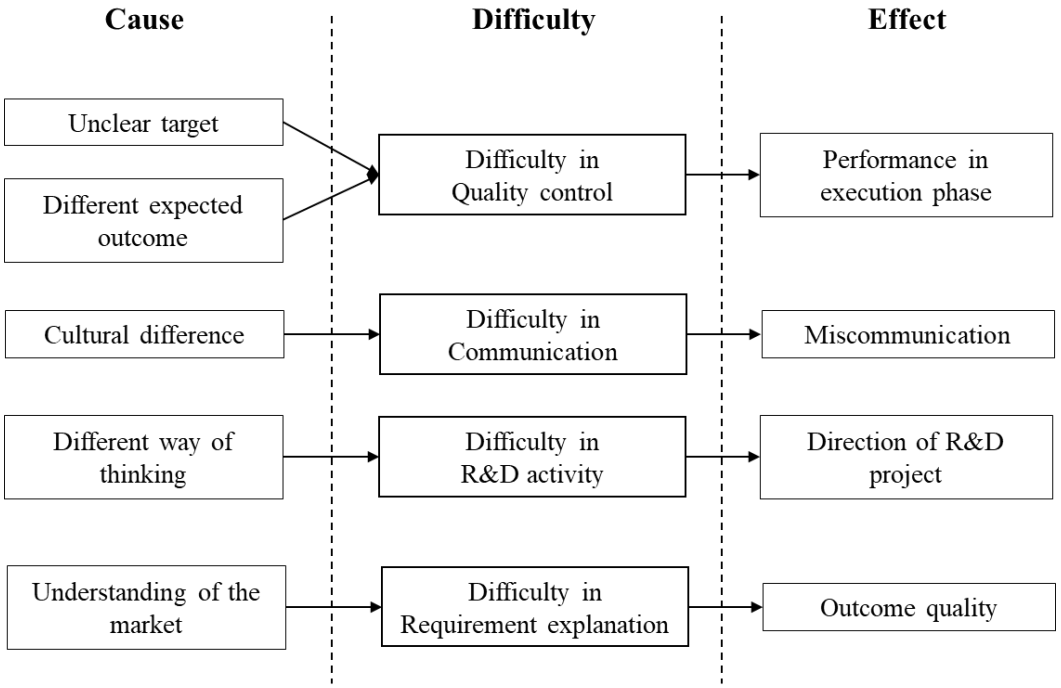

Figure 4.1 Difficulty mechanism model

As shown in figure 4.1, the difficulties have their causes and effects toward the global R&D project. The unclear target and different expected outcome are the causes of quality control issue, which effects to the performance of global R&D project, particularly, during the execution phase. The different in the national culture of team members is the cause of the communication problem. It can cause a lot of miscommunication in the project and this requires more time to clarify and establish a common understanding among project members. Moreover, researchers are having a different way of thinking, which causes the difficulty in controlling R&D activity, then has an effect on the direction of the project. This is also important because in many cases the project direction is decided by headquarter and all teams need to follow. Lastly, because the R&D teams do not understand the foreign market so it is difficult for BM to deliver the requirement and consequently effects to the project outcome quality. This is an initial step for deeper investigate the difficulties. We can apply cognitive science to further analyze the difficulty mechanism.

4.2 Summary

The interviews show four important difficulties of BMs when they are working in the global R&D projects. The insight also provides causes and effects of the difficulties together with some solutions that BMs are using in current projects.

Difficulty	Cause	Effect	Solution
Quality control	- Unclear specification - Different expected outcome	- R&D outcome is not satisfied by the headquarter team	- Establish quality measurement during several milestones
Communication	- Different cultures, countries, languages	- Misunderstanding	- Use documents and visualization
Facilitate R&D activity	- Different way of thinking and background	- Project members cannot collaborate well - Having inappropriate research approach	- Double check the result by different teams - Switch the role between researchers
Requirement and needs transfer	- Research team does not have experience or knowledge about the market - The R&D result us used in different location	- Research outcome does not satisfy the customer needs	- Educate and provide information for R&D team - Switch the role between researchers

Table 4.1 Difficulties of R&D bridge manager

Chapter 5 Conclusion and Discussion

The findings from this research are summarized in this chapter. All research questions, which are formulated in Chapter 1 are answered and follow by the conclusion to answer MRQ. The managerial implication and research limitation are at the last section. The answer for each research question is provided in the following sub-section.

5.1 The Working Process of BMs in Global R&D Projects

Firstly, we would like to understand the working process of BMs to see what are the activities that they have to do in order to facilitate global R&D projects. The answer to this question provides a background of BM's tasks.

SRQ 1: What is the working process of BMs in global R&D projects?

The global R&D activities in the projects have been done by individuals. The BMs also perform their tasks to facilitate a smooth collaboration in global R&D projects. However, there is no research, that explores the activity and working process of BMs. In our research context, global context, there are two important groups of people. The first group is working in the company, which is located in one country and the second group is the R&D teams, which are working in other countries. The result from this research shows that BMs have a particular working process, which aligns with the R&D process. In addition, the findings also indicate some challenges of BMs in each stage of the project.

Basically, we can separate the project into two parts, which are research part and development part. BMs get start by gathering information from the problem explanation from the company and these problems need R&D teams to involve. BMs have to validate the understanding of the problems from R&D teams by letting them propose some ideas and tentative solutions, which will be used for solving the problems. R&D teams provide information about the solutions together with some requirements and support needed from the company.

It would be several solutions proposed by R&D teams. Then BMs facilitate the collaboration to finalize the solutions. This stage is quite a challenging task for them because there are many issues for negotiation as one of the managers mentioned during the interview when he was explaining his working process.

"It is very difficult to convince with each other. This is a big problem."

People from different groups such as management team, marketing team, engineering team, have a different perspective for different solutions of the R&D projects.

After picking up the solution and move forward to next research activity, BMs get the development report, which indicates the progress of the project and problems occurred. At the same time, BMs attend meetings with related parties such as team leaders, management person, researchers, developers to discuss the project update and if something needs to be changed. The meeting is also challenging task for BMs because, in some cases, the developers do not show their opinion so BMs have to handle this situation as he mentioned in the interview.

"The biggest problem is the real meeting the developers didn't say their opinion."

BMs facilitate collaboration between teams from the company side and the R&D teams, which are working in another different environment.

5.2 Difficulties in Global R&D Projects and Its' Cause

The global R&D projects may have several problems in terms of project management and at the organization level. In particular, individuals who participate in the project also have their own role and responsibility. Along with the working process in global R&D projects, BMs have to overcome some difficulties, which are described in this section.

SRQ 2: What are the difficulties in facilitating global R&D projects and how are they caused?

According to the interviews, managers have discussed the difficulties that they have found during the global R&D projects. The difficulties are varied depends on the nature of the projects and stages of the projects. In order to solve the difficulties, we need to understand the root causes of them.

In here, below is the list of the difficulties.

- Way of thinking
- Quality control
- IP issue
- Understanding of requirement and market
- Communication between teams
- Cultural difference
- Lack of R&D facility

- Schedule conflict
- Complex organization structure
- Basic research vs. Product research
- Making decision for each step in working process
- Performance control
- Language

However, there are some difficulties that were mentioned during the interviews by more than one manager. Firstly, the quality control, this seems to be the most important difficulty since all managers mentioned about it. The high-quality outcome should satisfy the project requirement but the quality is, somewhat, subjective and difficult to measure and control. Second, the communication among people from different background. Third, facilitating R&D activities with researchers who have a different way of thinking is not easy. They are not working toward the same direction. Lastly, understanding of the market and requirement is very important to set the project goal. BMs have to make an effective communication with researchers who are working in a different location from other team members.

A cultural difference plays an important role in the global R&D project. In particular, the global R&D projects receive an impact from national culture because of the globalization where we are working across nations. The cultural difference in global R&D project caused from the context of the working environment. Researchers and engineers come from different nations, therefore, they have a different culture. This situation is unavoidable in global R&D projects.

The different way of thinking makes the global R&D project more challenging for BMs. There are several approaches to achieve the project objectives. The approaches are developed by the project members, who have a different background, experience, and knowledge. These are the causes of this difficulty. In some cases, thinking differently could be a positive force, which influences the innovative ideas such as new solution can be created from integrated techniques. On the other hand, it could be a barrier in R&D collaboration such as working as a team and working individually.

"They think this approach is good, they believe, so they go to this direction different from Japanese side."

Quality measurement and control are difficult for BMs not only because of the quality is subjective but also there is no certain level of expected quality in R&D project. Managers mentioned about different types of research, which are the basic research and product research. Especially, for basic research, which supports knowledge creation and innovative ideas in the

company, does not have a clear measurement because there is no target product in the market. The unclear target in R&D project causes the difficulty in quality control.

Moreover, researchers and headquarter teams have a different definition of quality because they have different objectives and concern different factors in the project. Researchers conduct the research by concerning technology but headquarter teams concern about the customer's needs as well as time to market. Seeing different things by different groups of people, it is difficult for BMs to establish a mutual understanding among them. The difficulty about quality control is also caused by the ambiguous definition of quality, which is understood by a different group of people.

Understanding of requirement and market, particularly, in product research is very important for the company to commercialize new products or services to the market and make the profit. The difficulty occurred in global R&D projects because the locus of the market and research activity are in separate locations. The needs of the customers have to be transferred from teams to teams. Therefore, it becomes a challenging task for BMs to bring the customer's need to R&D teams.

5.3 Effect of difficulties on performance of global R&D projects

BMs have been facing difficulties in global R&D projects and trying hard to overcome them. It could be several objectives to solve the difficulties. However, one of them is for the better performance of the projects. In general, project performance can be measured in many aspects such as cost-effective, time to deliver, resource utilization, etc. Therefore, understanding of the relationship between difficulties and project performance argues the reason why BMs need to handle difficulties in the most efficient way.

SRQ 3: How have the difficulties of BMs effected on the performance of global R&D projects?

As a facilitator, BMs perceive that the difficulties in global R&D project have an impact on the quality control, which related to the project performance as mentioned in the previous section. The difficulties of BMs is not only slow down the R&D process but also the lower performance of the projects in terms of outcome quality and research approach.

5.4 Role of BMs to Solve Difficulties

BMs are employed to facilitate the global R&D projects, which have many difficulties. However, by the scope of BM's responsibility, they have a particular and important role to play in

the projects. According to the four important difficulties mentioned above, the role of BMs can be explained as follows.

SRQ 4: What is the role of BMs to solve these difficulties?

Cultural difference is a crucial challenge for BM in facilitating global R&D projects as managers mentioned during the interviews that his or her role is to close cultural gap. Cultural difference is an unavoidable challenge because the R&D activities are operating with different groups of people who have a different background. To create a smooth collaboration among project members, the role of BM is to narrow down the cultural gap between headquarter and R&D subsidiaries in foreign countries.

BMs can help to narrow down the cultural gap in global R&D projects by utilizing their cultural intelligence and communication skill. They understand different cultures and apply them during facilitating the projects. Therefore, they keep learning other cultures and adapt to the global R&D collaboration. Communication is important for developing a mutual understanding among project members. BMs exercise an effective communication skill with all stakeholders to educate the way of thinking and transfer the requirements of the research.

5.5 Difficulties of BMs in Global R&D Projects

The answers to the subsidiary research questions describe how the difficulties of BMs are identified. Throughout the working process, there are several steps that the BMs have to pay attention. Those steps are important for the global R&D project in several aspects.

MRQ: What are the difficulties that BMs face in facilitating global R&D projects and how are they important?

BMs mentioned about the cultural difference as one of the difficulties. This difficulty is important because it helps to improve collaboration between teams, which have a different background, living in different countries. Consequently, the better collaboration leads to the more effective global R&D teams. BMs have to apply strategies to cope with a cultural difference to facilitate the projects. Second, the different way of thinking is considered as a difficulty. Researcher's way of thinking is important for R&D project because the continuous improvement is indispensable in order to keep generating new knowledge and innovative ideas. If there is a conflict in way of thinking, then the project may not be able to deliver a better product or service to satisfy the customer needs. Third, controlling quality is another difficulty. High-quality product

is expected by the customers and even internal company stakeholders such as managers and marketing teams. In addition, there is an unclear and no pre-defined quality target for the basic research project. Unlike the product research project which has a clear specification and pre-defined requirement so that the researchers have a precise research direction since the beginning of the project. Lastly, it is difficult for BMs to make the researchers clearly understand the market and requirements. Since the market and the R&D activity are located in different locations. The researchers do not have a direct experience in the market and cannot perceive a real need as a requirement. Managers deliver information and transfer knowledge regarding the market and requirement to the R&D teams. However, transferring experience and tacit knowledge is not an easy task. The understanding of the market is important for global R&D project because at the end of R&D process the outcome will be commercialized into the market so paying attention to the market and requirement are unavoidable.

5.6 Theoretical and Practical Implications

This research explored the difficulties of BMs in global R&D projects. The difficulties and role of BM are identified. The interviews revealed the working process, the importance of difficulties, how difficulties are caused and role of BM to solve them. There are four important difficulties, which are revealed by the previous studies about international management. However, this research is focusing on a particular role and analyze from the perspective of BMs. The difficulty mechanism model is an initial step for further analysis and contributes to the theory of global R&D management.

Product quality is considered as an important component, which is expected by customers. However, along with the R&D process, there are many activities, which effect to the quality of the product. BMs have a difficulty to maintain or improve product quality because, in a basic research project, there is an unclear target to be achieved. The basic research is conducted for creating new knowledge or introducing innovative ideas, which will be used for future products. Moreover, the way of thinking of a particular group of researchers also has an impact on the quality of the product. Lacking quality improvement mindset leads to a low-quality output.

Cultural difference is another important difficulty in global R&D projects. Bridging between different cultures is a challenging task for BMs because they have to understand the diversity of culture and then find the effective ways to establish cross-cultural collaboration between headquarter and R&D subsidiaries. Cultural intelligence skill is indispensable.

People from different background have a different way of thinking. This also applies to the global R&D projects where the project members have a diverse background. It is challenging for BMs to solve the difficulty about a different way of thinking because the way of thinking takes time to develop and it is difficult to change existing way of thinking. After understanding the existing way of thinking of team members, they have to use their skills and experience to develop a new technique for facilitating the projects.

Understanding of the market and requirement is important for R&D teams to set the goal of the project and to conduct the R&D activities so that the outcome can satisfy the real needs of customers. Because the needs of the customer and the research activity are in different location, researchers do not have a direct experience to perceive and understand the requirements. BMs have difficulty to deliver the requirement to R&D teams and transfer knowledge to them so that they can precisely understand the market.

5.7 Research Limitations

There are some limitations on this research. The research was conducted on an individual behavior in a specific working environment, which is global R&D projects. The first limitation is a small target group for empirical verification. The data collection was conducted using a semi-structured interview with seven BMs. Those managers have some experience to facilitate the global R&D projects, particularly, in Japan, India, China, and the US. The interviews provided a deeper understanding and more insight about the role and responsibility of BM and the difficulties they have faced during the projects. However, increasing number of interviewees has to be done to make a stronger support for the future research.

As well as the diversity of the target group, the potential interviewees who have working experience from all parts of the world should be included to represent the global context. Many industries from Japan have been operating R&D activity in many countries. Since we found that cultural difference is one of the important difficulties, it would be interesting to interview managers who have a diverse background and have different nationalities.

The difficulty mechanism model is simple which open room for future investigation by applying different perspective such as cognitive viewpoint. This could provide a deeper understanding and suggest proper solutions to overcome those difficulties.

This research is focusing on the BM role. However, there are other important roles in the global R&D project such as project sponsor, project manager, marketing researcher, and project administrator. They also provide some contribution and effort to the project and make the project

success. Those roles should be explored because different roles may have a different perspective to collaborate with the projects. Consequently, they may have some difficulties different from the BM role. The future research, which investigates on those roles could help them to provide a more effective contribution to the global R&D project.

Chapter 6 Future Research

Since this research report is one part of the whole research project, we have a plan to continue our research. The ultimate gold is to propose a conceptual model of BM competency development, so the research project was divided into three different phases. Therefore, each phase would study in detail, then finally integrate all findings to reach the final objective. The research project is carrying out during the five-year doctoral education program through master's program (2 years) and doctoral program (3 years). Thus, phase I (this research) is conducted during the master's program. After that, phase II and III will be conducted during the doctoral program. The research sequences are demonstrated in figure 6.1, which shows an overall picture of the research project.

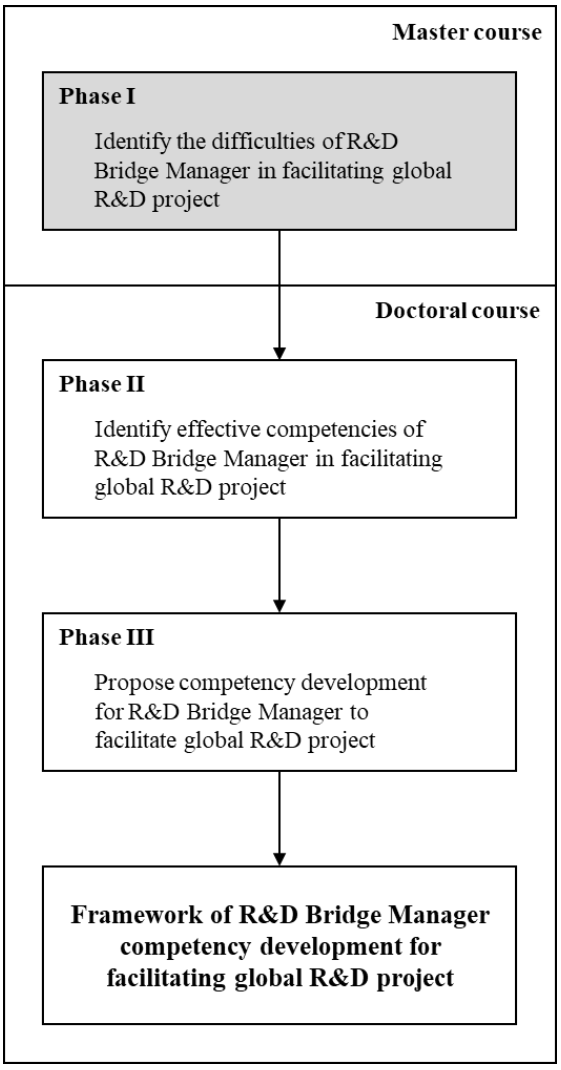

Figure 6.1 Overall research project sequences

6.1 Competency Development Framework for R&D Bridge Manager

After the difficulties of BMs are identified, the next step is to find solutions how to overcome those difficulties. According to this research, BMs exercise several skills to solve problems and facilitate the global R&D project. For the future research, we would like to develop a new competency development framework that can effectively educate BM to overcome challenges in complex global R&D environment and contribute to the knowledge of global project management framework.

The BM competency development framework utilize concept from the project management competency development framework (PMCDF). As in this research, we identify the difficulties of BM. The competence BMs can apply their knowledge and skills to solve the difficulties. In the future research, we will identify important competencies corresponding to the difficulties in this research. Then we will propose the competency development framework for BM. That framework will be a guideline to educate crucial skills for BMs so that they could facilitate and enhance the global R&D projects.

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Appendix

The literature review covered four main areas, which are R&D, cross-cultural management, knowledge transfer, BSE and BM. The list of reviewed literature and its short summary are available in this section.

The semi-structure interview was used for data collection in this research. We have both face-to-face meeting, telephone and video conference for the interview. All the interviews were audio recorded and transcribed for further analysis. This section shows some questions that we asked to the BMs and, more importantly, how they responded to our questions.

Reviewed literature list

The literature review shows some related researches and the research trend of the global R&D management research. We can conclude the direction of our research from the intensive literature review and have a strong confidence that this research will provide a great contribution to the existing knowledge. The table I shows the list of selected literature that this research has covered.

Research & Development			
Literature	Year	Author	Summary
Characteristics of Japanese R&D management excellence	1991	Fujio Niwa	The outstanding R&D corporations should take effort for the following things; basic research, specific research management, R&D decision-making by the front line, academic contribution, open R&D atmosphere, decision-making power of R&D division, relationship between R&D team and other teams, and R&D evaluation method.
Managing the internationalization of R&D activities	1996	Vittorio Chiesa	There are two factors that influence R&D structure external knowledge and internal resources. There are several factors that affect to two types of firm's structure; 1) Exploitation structure 2) Experimentation R&D structure.
Building effective R&D capabilities abroad	1997	Walter Kuemmerle	There two types of foreign R&D site and three phases to initiate R&D sites. The information flows from headquarter to both 2 types of R&D site. The R&D leaders should have knowledge about R&D and business management.
Management of dispersed product development teams: the role of information technologies	1998	Roman Boutellier, Oliver Gassmann, Holger Macho, Manfred Roux	IT can help to facilitate the development process. Different IT-tools can be used in different phases of the project. Even IT can help many things but "Socialization" is still important and cannot be replaced by IT-tools. The indirect cost such as time, opportunity, etc. should be considered before starting to have the dispersed teams.
New concepts and trends in international R&D organization	1999	Oliver Gassmann, Maximilian von Zedtwitz	Propose five R&D types and five R&D trends in organizations. However, this kind of research still needs to have a quantitative analysis.
How R&D is coordinated in Japanese and European multinationals	1999	Guido Reger	There are four coordination patterns 1) Structural and formal 2) Hybrid/overlaying 3) Informal and 4) Internal markets. There are pros and cons for each pattern.
Organizational tension in international R&D	2001	Kazuhiro Asakawa	There are two aspects for tension between headquarter and R&D subsidiary 1) information sharing 2) autonomy and control.

management: the case of Japanese firms			
Trends and determinants of managing virtual R&D teams	2003	Oliver Gassmann, Maximilian von Zedtwitz	There are four types of organizations for virtual team 1) Decentralized self-coordination 2) System integrator as R&D coordinator 3) The core team as a system architect 4) Centralized venture team.
Organizing global R&D: Challenges and dilemmas	2004	Max von Zedtwitz, Oliver Gassmann, Roman Boutellier	There are ten challenges and six dilemmas identified in this research. The framework to support decision making of managers to initiate R&D project/site is also proposed. This research provides detail and examples for each challenge and dilemma.
Collaboration for innovation in closed system industries: The case of the aviation industry	2006	Michael Kamel	In the new economy, competitors, partners, customers, suppliers will change their roles. Some combination of factors will lead to the increasing of reliance on collaboration for innovation.
Global R&D activities of Japanese MNCs in the US: A triangulation approach	2007	Sam Kurokawa, Satoshi Iwata, Edward B. Roberts	There are three factors that affect the level of knowledge flow 1) Trustful and Democratic environment 2) Autonomous 3) Network-linked. Then the level of knowledge flow will affect the level of knowledge accumulation and follow by subsidiary's performance accordingly.
Role of trust and relationships in geographically distributed teams: exploratory study on development sector	2012	Mohammad Saud Khan	This paper tries to understand the role of trust in the virtual team. How to establish trust and the role of leader. Technology that helps to create trust is also discussed.
Academic enterpreneurship - A challenge for University-Industry synergy	2014	Danut Nicolae Ilea	The process and components to initiate academic entrepreneurship.
A methodology to build an initial R&D portfolio for industry-university cooperation	2015	Jessica Castilho, Jamile Dias, Raoni Barros Bango, Jonathan Simoes Freitas, Lin Chih Cheng	How to build a portfolio of R&D project for U-I collaboration? Context: University, School of Engineering and Large multinational automotive manufacturer, setting shared R&D agenda. Co-constructed systematic view of innovation opportunities. Mutual commitment allow partners better deal. There is a 3-stage methodology: cyclically applied, refined over time, identifiable team.
Globalization of R&D and open innovation: linkages of foreign R&D centers in India	2015	Swapan Kumar Patra, Venni V. Krishna	Using secondary data and network analysis to explore the linkages between institutes in India. Findings: there are not strong linkages among the firms (MNE) and few members in the network play an important role in knowledge flow. The MNEs usually have linkages with other MNEs in India which they already have prior relationships (relationship in other countries).
Opening up the R&D process is risky - How far do you have to go in order to beat your competitors?	2016	Alexander Lang, Anna Teresa Tesch	There are 4 patterns of opening R&D of the companies 1) The large and cooperative 2) The independent and confident 3) The young and wild 4) The traditionally closed. Each pattern has its own characteristic, which could be adopted by other companies.
Cross-cultural management			
Literature	Year	Author	Summary
Collaborative research programmes: Building trust from difference	1999	Sally Davenport, John Davies, Charlotte Grimes	This research mentioned about some collaboration success factors. Those factors show that the cultural difference has a positive impact to build trust.
Expatriates and the impact of cross-cultural training	2000	Nick Forster	There are some success factors of international assignment for expatriate employees. MNC should pay attention to this issue because it is one of the important success factors of international projects (cross-cultural).

Managing cross-cultural issues in global software outsourcing	2004	S. Krishna, Sundeep Sahay, Geoff Walsham	How can the cross-cultural difficulties of global software outsourcing relationships be addressed? - Strategic choice of projects - Managing the relationship - Training
Knowledge creation and transfer in a cross-cultural context: Empirical evidence from Tyco Flow Control	2007	Florian Kohlbacher, Michael O. B. Krahe	Example story for knowledge creation and transfer in MNC and the cultural influence.
Investigating the factors that diminish the barriers to University-Industry collaboration	2010	Johan Bruneel, Pablo D'Este, Ammon Salter	U-I collaboration barriers can be reduced by having prior experience, high level of trust, breadth of interaction, clear IP-related issue.
The knowledge-bridging process in software offshoring from Japan to Vietnam	2014	Nguyen Thu Huong, Umemoto Katsuhiro, Dam Hieu Chi	There is a working-process for bridge system engineer to work with internal team and client. This research talks about roles and skills of bridge system engineer.
Bridging the cultural divide: trust formation in University-Industry research collaboration in the US, Japan, and south Korea	2014	Martin Hemmert, Ludwig Bstieler, hiroyuki Okamura	There are three factors related to trust formation tie strength, partner reputation, and contractual safeguards. And Innovation champion also plays an important role to facilitates trust.
Development path of University and Industry collaboration (UIC) activities: Case of Japan and Thailand	2015	Siriporn Pittayasophon, Patarapong Intarakumnerd	Two different development paths: 1) step-by-step 2) leapfrog. It depends on push and pull forces, technology capability of firms, trust, and mutual interest.
Knowledge transfer			
Literature	Year	Author	Summary
Technological gatekeepers	1987	Renu Arora	Gatekeepers control information in/out organization. The characteristics and responsibility of gatekeeper were identified. How to train gatekeepers?
"Sticky Information" and the locus of problem solving: implications for innovation	1994	Eric von Hippel	This research introduced the term “Sticky Information” which has an effect on the innovation. The situation of sticky information was explained with the solutions to solve some related problems.
Interorganizational knowledge management: Some perspectives for knowledge oriented strategic management in virtual organizations	2000	Thorsten Blecker, Robert Neumann	This paper explains what is virtual organization. How to apply knowledge management in the virtual organization for strategic management. Phases of an inter-organizational KM: Intention -> Identification -> Modification -> Organization -> (Inter-) Action.
Towards a Theory of Open Innovation: Three Core Process Archetypes	2004	Oliver Gassmann, Ellen Enkel	There are three core open innovation processes explained in this paper.
The changing role of R&D gatekeepers	2007	John Ettlie, Jorg Elsenbach	The gatekeeper role was changed from the first-line supervisor to general manager because of the emerging technology, internet (everyone can share information), more R&D talent, and open innovation concept.
Critical factors for success in University-Industry research projects	2009	Ana M. Bernardos Barbolla, Jose R. Casar Corredera	Factors for success technology transfer are 1) Technology feasibility 2) Project usefulness 3) Corporate capacity to assimilate the result 4) Confidence and experience"
Organizational learning: From experience to knowledge	2011	Linda Argote, Ella Miron-Spektor	This research introduces many research themes related to organizational learning and proposes the future research topics about organizational learning from knowledge transfer perspective.

Knowledge transfer in R&D project management: Application to business-academia collaboration project	2012	Naoshi Uchihira, Yuji Hirabayashi, Taro Sugihara, Kunihiko Hiraishi, Yasuo Ikawa	There are some difficulties in knowledge transfer between university people and industry people. Therefore, this paper introduces knowledge transfer model to overcome barriers using boundary object and project case database. Finally, apply to business-academia collaboration project.
Knowledge transfer in product-based service design	2013	Naoshi Uchihira	Propose the framework for engineers to develop new service for customers by incorporate knowledge transfer concept and value co-creation with the products, from product to service.
The motivations of research teams and their cooperation with industry	2014	Irene Ramos-Vielba, Celia Diaz-Catalan, Josefa Calero	This research identified the relationship of the behavioural motivation of research teams and knowledge transfer channel. The motivations are related to IPR-related, funding, access to equipment and materials. Knowledge transfer channels are consultancy work, research contract, joint research, exploitation of IP, and training.
Emergence of common tacit knowledge in an international IT project: A cross-cultural perspective	2015	Miwa Nishinaka, Katsuhiro Umemoto, Youji Kohda	There is a process for the emergence of tacit knowledge in the project. Headquarter and subsidiary should have mutual understanding throughout the project process.
Global knowledge transfer framework: A University-Industry collaboration perspective	2016	Srigowtham Arunagiri, Nawarerk Chalarak, Naoshi Uchihira, Yasuo Sasaki, Mary Mathew	Identify knowledge transfer barriers in U-I collaboration and the important skills for bridge managers. This research also considered the national culture, developed and developing countries as a context of this study.
Bridge system engineer and R&D bridge manager			
Literature	Year	Author	Summary
Boundary spanning roles and organization structure	1977	Howard Aldrich, Diane Herker	The meaning, the importance, and how to create "Boundary Spanning Roles" were discussed with some example cases. Boundary spanning role helps to create a connection between internal and external environment.
The skill sets required for managing complex construction projects	2011	Glen Mouchi, James Olabode Rotimi, Thanuja Ramachandra	This research identified the important skills that project manager should have to manage construction projects. Those are 1) Planning and risk management 2) Communication and people skills and leadership 3) Technical skills and experience 4) Vision and focus on the end results.
What practitioners consider to be the skills and behaviours of an effective people project manager	2011	Eddie Fisher	This research provides the list of skills that are important for people project managers. There are also behaviours with description corresponding to each skill.
Emergence of common tacit knowledge in an international IT project: A case study between Japan and Singapore	2015	Miwa Nishinaka, Katsuhiro Umemoto, Youji Kohda	The case study of international IT project was discussed in this research. The process to create common tacit knowledge of the teams in different countries was investigated.

Table I. List of reviewed literature

Interview with R&D bridge managers

R&D bridge manager A

Date: 27 April 2017

Time: 11:10 - 11:55

Channel: Telephone interview

Researcher A: What kind of research projects they are conducting at that laboratory? For example, services or new machines?

Manager A: Yes, new machine. The best sold product was multi-PC machine. And also main laboratories are software application development and also basic research laboratories.

Researcher A: I would like to move to the first question. My first question would relate to the working process. I would like to ask that when you start the research project what are the steps that you have to do from starting until the end? Can you explain on that?

Manager A: Ok. At first, planning team makes the product plan. What kind of the product that they want to announce to the customers on what products. Product plan is the first step. The price and specification of the product until the market. That is the plan of the products. The product plan is the first step. The second is the basic design. When the product plan passes to the development team, we start the basic design and we make about ten various teams and then we will test the prototype products, according to the development plan. We solve those problems and then we move next step. Then we test again. Normally, we are doing test cycle like that. The second step is about feedbacks and then we will pre-production and then we will check again and solve the problems. Then we cluster the product move to the factory for the mass production. That all our product development.

Researcher A: After production, you have a kind of testing again, right?

Manager A: Yes. Of course. The last step is move to the factory for the mass production. That is all of the flow of our R&D team.

Researcher A: Ok, move to mass production and then move to the market, right?

Manager A: Yes.

Researcher A: Ok. The next question will be during the project how the engineers and researchers communicate to each other? Are they working in the same location? Or how do they communicate?

Manager A: Ok. Sometimes, we use the vendors in Taiwan or Hong Kong and other Asian countries. In that case, we have a meeting face-to-face and fix phone. At the first step, we have a face-to-face meeting and then we fly to these countries for meetings. We also have the teleconference. Most cases, we have teleconference weekly, involve Asian countries, vendors, OEM vendors and suppliers in United State, and managers in other countries, European countries, American country and also Asian countries, of course inside in Japan. All managers are involved related to the products.

Researcher A: To be more specific, you say teleconference, is it only a voice like we are using now or you mean video-conference that we have a video screen and presentation?

Manager A: The teleconference we use from telephone as we are using now. So 4 or 5 people can join the teleconference.

Researcher A: I have two more questions about the research projects. The first one, I would like to ask about the project target. Is it possible to set the project target, and how to set it?

Manager A: What kind of target, price target, or product target? What is the meaning of the target?

Researcher A: Ok. In terms of project plan, I mean time. It is about time. Is it possible to set that your research projects have to finish in the next five months, for example?

Manager A: It depends on the projects. If the main research is a design, you have two years, for example. But in case of the security one year or 6 months.

Researcher A: You have a specific time period. The next question about the research project is about the quality. My question is how can you control the quality of work in research projects?

Manager A: We have a product assurance team. The team designs the test items to cover many problems in that team. They have a standard test plan. So, product assurance team are going to test, according to the standard. If the all problems have been solved then move to the customer team can clarify the product is ready to ship.

Researcher A: You have a specific team, which is “Product assurance team”, who responsible for the quality control. Alright, I will move to the next issue, which is about the difficulty in R&D projects. The question is that do you feel any difficulty when working in the R&D projects?

Manager A: Difficulty, then the difficulty is the communication with vendors with Asian countries. Each country has their own character, China, Taiwan, Hong Kong, Korea. The difference of the culture will make problems. In case of China, they say at first they can do anything. Yes, we can do it. We have no problem. At first, they say always. But after one week or two weeks, they cannot.

This is common for them, for us it is abnormal. The communication and misunderstanding between cultures that is the first problem.

Researcher A: Any other difficulties? The first one is about the communication and cultural difference. Any other difficulties, number two?

Manager A: Communication with United State that for myself. They have debated for discussion. So, we have difficulty to talk with them. When we have a discussion with them, we have difficulty to talk with them because they have a debate. So, we need to exercise about the debate for discussion.

Researcher A: The debate discussion problem happens with US team only, right?

Manager A: Not only, but mainly with the US.

Researcher A: Any other difficulties? Next.

Manager A: We have many competitors Apple, Microsoft. In IT industry, there are many competitors. During the development phase, we have to change our design or production plan regarding to the demanding or a competitor's education to keep the competitiveness of our products.

Researcher A: Anything else or that's all?

Manager A: We have many small problems like that but we don't have ways to solve. So, those three problems as I mentioned are the big problems for us.

Researcher A: Ok. For the next question, for those three problems you have. Can you explain when those problems happen during the R&D projects? For example, the debate discussion problem happens during the starting of the project or at the end of the project? Something like that. When the problems happen or occur? Can you explain for each problem?

Manager A: It happens as many times mainly after six months. If the problems happen at the customers or the customer's office or etc. and then return to our team. We just make the product on schedule. In that case, we ask to our development team to solve the problems. In that case, they ask us to think the performance design, the problems happen at the customers. After one week or after the mass production. In that case, they should solve the problems by themselves. They excuse to our development team. They ask to us design team, R&D team to solve the problems. We should to collect the components.

Researcher A: Once again, about those three problems, my question is those three problems have any effect to the project performance?

Manager A: The conclusion is no effect, no effect to the product quality. Because product assurance has design the product quality. Base on that, they have criteria. Of course, we have many

difficulties depend on the production. For example, those vendors are complicated difficulties because they have many projects to complete the development but product quality keeps the same level because product assurance.

Researcher A: Because at the end, you have product assurance team to check and maintain your level of quality before you launch your products to your customers, right? So that you can maintain the level of quality as expected always.

Manager A: Yes, that's right.

Researcher A: I would like to move to the question related to bridge manager. My first question is how do you feel about role of bridge manager to solve the problems in R&D projects? How bridge managers solve some problems in R&D projects?

Manager A: Bridge manager's problem is the different culture as I already explained about difficulties.

Researcher A: Is there anything else that bridge managers can help other than communication problem?

Manager A: I do not think. All of our products are designed always involving many countries. So, the difficulty of bridge manager is the different of culture.

Researcher A: Can you provide more detail about the communication problem? My question is how bridge manager helps you to solve to solve the communication problem? For example, do bridge managers have to develop documents or do bridge managers have to facilitate the communication between teams something like that? How bridge managers help in communication problem?

Manager A: We have communication between bridge managers with engineer team, or language problem also.

Researcher A: May be the last question. We just talk about communication problem, which the bridge manager can help us to solve. The last question would be about cultural difference between Japanese and vendors in other countries. My question is can bridge manager helps us to solve some kind of cultural difference issues?

Manager A: Yes, of course, bridge manager can help to solve our misunderstanding about the culture between countries. It depends on the country. For example, in some countries, they want to take the lunchtime 2 hours but bridge manager explains to us that they may use more time at lunchtime but they can work until midnight or 24 hours they can work.

Researcher A: Ok very interesting. So you mean that the bridge manager understands Japanese culture, as well as bridge manager, understand other country's culture, right? So, he can mix and he can link.

Manager A: And also, we cannot describe everything of the specification. We try to provide the education of new products to the vendors, and we think the concept to develop the product but, actually, we cannot describe everything on the education. In that case, bridge manager can bring to the vendors. That is the most important job of bridge manager. Bridge managers can understand easily. So, we cannot describe everything. Bridge manager can read the space between line and line, and explain to the vendors in other countries.

Researcher A: You mean you cannot explain everything in the contract or by the documents clearly then the bridge manager can help us to provide more detail, to explain more detail to the vendors so that the vendors can understand the contract, the vendors can understand the requirements more clearly, right?

Manager A: Right. Of course, we cannot describe anything of the education or concept. Bridge managers can help us to describe the education that we belief and also the different of the culture, etc.

Researcher A: Ok, so that would be all the questions.

R&D bridge manager B

Date: 27 May 2017

Time: 10:00 - 11:30

Channel: Face-to-face interview

Researcher A: So we can start for the question. Now, I would like you to explain your work experience about the R&D projects. Your experience, can you explain a little bit?

Manager B: I have done this bridge work for two years ago. The work is about development the new wireless technology. This is the basic need from the marketing. Because in this year wireless is very popular in the world. In our company we development the smart presenter by app. People can use in separate meeting. The application right now just can translate file. So, the animation and movie, video cannot translate by this app. The problem is about use WiFi. It cannot speed rate translate the video file to everyone. So, we need to translate the file and translate the video to everyone. This is the problem. So in this case, Japan side will development the protocol about the wireless. China side will develop application about the video player. Video player needs to use the FTP protocol because we need the translate the video file speed rate at real time. To translate the file, there are two methods, right now. One method is streaming and the other method is download.

Researcher A: Streaming is real time but download is you try to finish download one file to another location and then show.

Manager B: Streaming you can see the real time video. You cannot get the video file. This is not good because in the separate meeting the presenter sends the ppt file. This means the participant can get the ppt file. So, in this case, if we can get the ppt file, why can't we get the video file. So, this is the need to get the video file. So, they can't use the streaming but if we use the download method we have to wait until the file translate finish. It cost the time. It is very not good. So, the order to the China side is to develop method. The player can download the video file between playing the video file like Youtube.

Researcher A: Download and present at the same time. When you give a presentation, you also downloading the file and when you finish presentation you have the file save in your machine.

Manager B: This is the order to China side. So to manage this order first we need to translate, introduce the technology to China side. And then we must explain the need of the marketing why we should must download the file. And the third we must to explain our aims to China side. The big problem is the application should be download and play at the same time. And the most

difficulties is that the network is easily shelter by people. So when playing and downloading, people shelter the signal. How to involve with this problem? It is a difficulty in the project.

Researcher A: So the China side have to understand the technology so that they can use that technology in their application when they develop. How about from Japan side? Do they have to understand something from China side?

Manager B: Yes, of course. We need to understand something from China side such as the problem when they developing the project. The big problem such as the in China you can't get the device. The big problem is the technology is not popular right now. We can get the protocol device from the vendor company. But in China side, we can't get that device. So, the big problem is how do they test the application.

Researcher A: They do not have the real device to test. May be they have to work on the simulator or some development environment.

Manager B: You can use WiFi to simulate the wireless character and we can use Lan to simulate the speed. But they cannot use the real technology to simulate the application. So, this is the biggest problem. So, in China side, we can communicate with Japan side how to involve this problem. For example, Japan side get the new devices and we can invite the China development people to Japan to test the application together with the real device in Japan. But in this case, the biggest problem is the schedule in Japan side the schedule and the China side schedule. The development schedule is very difficult to get together. The conflict between each other. In the test case, we need the develop people, not the manager people came to Japan.

Researcher A: So they can learn from Japan team and they have to bring this knowledge back to China to teach or transfer this knowledge to development team in China again. The development team in China cannot come to visit.

Manager B: They can come to Japan but it really difficult because the schedule. In the fact that, we develop one project only but in China side, some people will work on many projects at the same time and the same priority.

Researcher B: How many people?

Manager B: About 10.

Researcher B: You are a manager. China members include several projects and you are bridge manager. How many members in this project?

Manager B: 5 but these 5 people have to work with different projects. The organization structure in Japan side and China side is different. But in China side we have the bridge managers, below

bridge managers, we have some team leaders. Which team leader to develop which project. Then the team leader will make a develop team to develop this project. In this case, the Vietnamese people will be chosen by different team leaders for different projects and the Vietnamese is very important for development. So we must to test them with these people because he has some experience to develop these things. To know technology such as WiFi or may be, they have some experience to develop the video player. So we want to test with these people but the schedule is very difficult because they have another project. This is a problem. Team leader also have several projects. His work is to manage the different projects at the same time.

Researcher A: Team leader manages many projects at the same time and team leader is also control the developers. Those developers also work with many projects at the same time.

Manager B: We have some advertise researchers but the advertise researcher only join one project. The reason is that our research, our order is research level, not production level order. If it is a product level, we can focus only one product to go to the market but if it is a kind of basic research you can do many research projects to support one or two products in the future. In the research level, we just have the problem. How to involve the problem we do not know in Japan side. In product level, it can get involvement to the problem. You just do it. In research level, the background is very important in this case. So we want to communication with each, we want to test them, we want discussion with them.

Researcher A: Now, before we go into detail of the project. I would like to go back a little bit about the working process. I would like to understand the working process for R&D project. Can you just briefly tell me, what are the steps since the project start until you deliver the research. What is the working step?

Manager B: The first step is from Japan side. They will explain, what is the problem and we want the China side to involve. The second step is from China side. The China side will do the basic research about this problem. They will show us some methods how to involve this problem. Not protocol, Idea level is ok in this step. In this step, the demonstration is not needed. Just idea is ok.

Researcher A: First, Japan side explain to China side and then China side shows some ideas to check that they understand the explanation from Japan side.

Researcher B: In that case, China side will make an idea. How they work in that project.

Manager B: May be they show us a document like develop plan. For example, to involve this problem we have plan 1, we have plan B, plan C. We want to do this this this and the risk is this this this. And to develop plan A, we need some support from Japan side like this this this. Such level is ok.

Researcher B: This is general, basic idea. They try to explain little schedule.

Manager B: In the first step, we have the document to discuss to choose the plan and to cover the detail of the development.

Researcher B: Step 2, China and Japan sides discuss detail of development.

Researcher A: I think step 2, China side propose many plans and explain about the conditions and requirement and support needed from Japan side for several plans. For example, they may propose 3 plans A, B, and C. After that in step number 3 Japan side and China side will discuss and select only one A, B, or C and develop document in more detail.

Manager B: When develop the application, we do not know how to download and play at the same time. In the protocol, we have TCP protocol and UTP protocol. So we want use TCP protocol to develop the application because the TCP can retry, can compare the packages when receive the packages. In TCP, we can check the package lost, and UTP we cannot. Such like this protocol there are many protocols can develop this application. We can choose the best protocol such as the transport level, also the MAC level. There are many protocols. We can choose the best protocol from each level and mix them together to develop the application. So, in this case, the China side will show us some methods. For example, plan A use TCP and plan B use UTP and plan C different solution. And in plan A use TCP, they have risk and condition. We can also discuss to use the open source in the research lab. So, in the third step, we will choose the best plan. And prepare for detail for future development. In the third step, the most difficulty is the how to choose the best plan. In China side, Vietnamese developers, the real developers will choose the most enable plan. The most possible for developers for make progress.

Researcher A: From developer perspective, they can do this for sure and they will choose that plan.

Manager B: Because we have experienced and the risk of this plan is the most smaller. But in our side, Japan side, we cannot design the best plan only by ourselves because we are not marketing researchers.

Researcher A: In Japan side, when you think about the solution that you are going to use it depends on marketing researchers. For example, we want China side to develop the video player. They just said streaming is Ok. We can make the player application within 3 weeks. But we do not want the 3 weeks because we want the video file. Japan side will say no, we do not need the download. We need the video file. You have to do another way. This is a very difficult in the first step. How to choose the best plan?

Researcher A: How you solve this problem? You need many meetings, negotiation. How can you finally select?

Manager B: It is very difficult to convince with each other. This is a big problem. In Japan side, we think we are the order so China side must follow them because we are the order. In this project, we are the order and we have carried the money for the order. But in the development side, I think the problem is also only in Japan from the marketing and the technology. So, the marketer thinks the customer need technology so must to develop this technology. May be it is impossible, it is very difficult. May be they cannot develop it right now but I do not care. You must do it. This is the customer need. It equal money. This is more important for the company. How to get the money from the customers? But in China side, we can follow your order but in this case, the risk is very big. So, we can follow your order. The risk is very biggest and the possibility, please take risk the possibility in Japan side.

Researcher A: So in this step, you may have a lot of negotiation and discussion to finalize the solution between two teams.

Manager B: I think order the developer is not good. For example, we are order and the China side is developer. Developer is developer, order is order not the same team. I think it is not good.

Researcher A: Separate two groups.

Manager B: I think the Japan side is also developer. May be, the real developer, may be, occur in China but the test in Japan because the China side can't get the new device. So we cannot think that we only order. It is not very good, I think. So in my case, I change this thing. The Japan is also developer. The Japan side and the China side is one team develop together. May be in Japan side the real development we did not do it but we can give our ideas. We can do our support to them to develop this project.

Researcher A: Not just waiting for the result. Ok, we are at the step to select the best solution. Any step after this? Start to develop?

Manager B: After that, we start to develop the technology. After we begin the project, from the China side, we will give us development report every week. Progress report every week to show us the problem in the right now. How can Japan side support?

Researcher B: How many times you have meeting, teleconference?

Manager B: We will use the TV meeting, monthly.

Researcher B: So only monthly meeting and weekly report.

Manager B: Yes.

Researcher A: Report will be sent every week but meeting will have once a month.

Manager B: And the fact-to-face this way as request.

Researcher B: For the IT offshore development. So, in the case of R&D, you have to change the target.

Manager B: This is the emergency case. In this case, we can to connect with each other. This way is report weekly, TV meeting monthly, and the face-to-face quarterly.

Researcher B: You do not have any problem so it is only if you have some difficulties or need to change so timely.

Manager B: To meeting next day, if we cannot order the TV meeting system, we will use phone to call China side.

Researcher A: For emergency case or special case. Now we have problems and emergency.

Manager B: But the emergency case we must change order, if we change our order we must make a TV meeting because we need to show some pictures.

Researcher A: To make it clear and show the detail of this.

Manager B: The most difficulty we must do the face-to-face communication.

Researcher A: Who are the members in this meeting, monthly meeting?

Manager B: The report will be written by Vietnamese people. And the TV meeting the team leader and the Vietnamese people and the manager. We have the TV meeting and in face-to-face communication, there are team leaders and bridge manager.

Researcher A: To my understanding, you do not have meeting between developer in Japan side and developer in China side. In the TV meeting monthly, Japan side is bridge manager and the developer also.

Manager B: In the TV meeting, you have chance to meet with the developers. The biggest problem is the real meeting the developer did not say their opinion. Because team leader and the bridge manager will join TV meeting so it is difficult to say the real opinion. It is very difficult.

Researcher A: Like we sit in the meeting with high level manager and we do not say anything.

Manager B: This is the big problem.

Researcher A: And then in your case, for example, the developers say something or says their opinion to you and then you have to bring those ideas to Japan side. They do not say by themselves. They give it to you and you have to bring to Japan side.

Manager B: Basically, in the TV meeting, the Japan side and the China side should share their opinion in the TV meeting. But right now, they did not. We can share something but the potential idea they did not share.

Researcher A: Ok, that is about the working process and how project members communicate together. I would like to move to another point, which is about the project performance. My question is how can you control or manage the project performance?

Manager B: In the research level, it is very difficult to manage the performance because in our side we did not have the idea how to involve the problem currently. We did not have. So, it is the big problem for us right now how to check, how to control the performance in the research level. It is very difficult because we did not have idea how to involve it.

Researcher A: However, in the project management you have to control resource, money and control the time schedule in your project.

Manager B: We can control the money, control the schedule and control the human resource. It is impossible to control, to change the quality. The quality is very difficult to manage because we did not get the clearly idea how to check. In product level, we have a very clearly specification in order. But in research level, we did not have the specification to which performance is good and which performance is the best we did not know.

Researcher A: If you have a clear specification 1, 2, 3, 4, 5, and 10, ok, when you develop something you just comply with or satisfy the 10 criteria and that you get the best performance. But in research level, you don't have such kind of specification to measure the quality.

Manager B: For example, in the video player. In product level, the delay is very important but in research level, they cannot show us without TCP protocol, the package lost. How much package lost by use TCP? How much package lost use another protocol? The package lost is not equal the delay. The result is very difficult to check it to manage it. It high or low we do not know. So, in this example case, the package lost 10% is very high. First step the order is below 5+% but in the real test, we find it 8% is ok. This is big problem. So, research level did not know how to check. The specification will no carry out specification in this time.

Researcher A: So, now for this difficulty, as a bridge manager, how can you solve this problem? How can you overcome this kind of difficulty? If you do not have clear specification, then how you overcome?

Manager B: In this case, we use first release.

Researcher A: You propose something. Ok, we developed this thing. You are ok or not? Just tell me.

Manager B: So please giving me a first release and then demonstration so you will test in Japan side and then we will check it. It is ok. Not only developer in Japan side, also marketing researcher and also the high level people will check it. And the developer will ask, it is ok or not ok. If they need to change or not.

Researcher A: But in China side, they have no idea. They do not have clear specification. They just do their best. Ok, this is the best we can do. And I give you, Japan side please check and then give us feedback.

Manager B: This is the best right now. We can do it. Please check it and if you want us to change something or improve something, tell us and discuss information, give us some support.

Researcher A: Ok, I may move to another important point, which is the cultural difference. As you work with two different teams. I mean Japan team and China team. From cultural different perspective, do you have any difficulty in that?

Manager B: I think the biggest problem in cultural different is about the quality. The quality. In Japan side, we think the high quality is good. And the in China side if the demonstration is moved is good because this is the research level is this not product level. So, in research China side think the demonstration is moving is ok. In that time may be the applications have some bugs but the demonstration can know it. So it is ok we can demonstrate to a customer. This is the opinion from China side. But in Japan side we think just moving is not enough. We must higher quality to show the demonstration to the customers.

Researcher A: So the definition of quality is different between two sides.

Manager B: Yes. For example, the demonstration system in the research level. For example, work 10 times and 1 false in 10 times. So, the China side they think, oh, the quality is very high. But in Japan side, No, I cannot do this demonstration to the customers because it can feel I cannot control it.

Researcher A: And then how can you solve this problem? The different between quality definition. You have to motivate the China side to improve the quality as best as they can? Or talk to Japan side to accept the research level.

Manager B: In this case, so I decide the demonstration time. If the target is our company only, I think the quality is not very important in this case because the target is our company, not the real customers. For example, we must show the demonstration speed rate to the high-level people to get the budget. So, in this case, the quality is not important, I think. Just move is ok. But the marketing researchers will show the demonstration to the real customers. So, in this case, we must make the high quality.

Researcher B: Yes, of course, the China side and Japan side understand the internal demonstration is not so important the demonstration to the real customers. Japan side want a high quality but China side do not care.

Manager B: In this case, they follow our order. Sometimes, they do not care, do not follow our order. So in this case, we should discuss to China side, the customer is very important because our company money is from real customers. So we are researchers, our research money, our budget is from company but the company money is from real customers.

Researcher A: I just want to check my understanding. If you are going to show the product to internal company, I mean, high-level managers. Then China team can develop just research level, I mean, ok quality to show internally, just in our company is ok. But if in some situations, the marketing team will bring the products to the real customers then China team have to develop the best quality so that they will bring to the real customers outside. So the role of bridge manager like you is to control which target you are going to show the product, right? If you understand, ok, today we will show to internal team, we bring ok quality to them. Next week we show to the real customers, we ask the developer team to develop the best quality.

Manager B: No, firstly, we just choose the internal target only, firstly. In this case, demonstration moving is ok. Ok quality is enough (for internally). And we will choose several targets and get the feedback such as in order to make the demonstration to the real customers which point should we change? And which performance should we make it more higher to get the feedback just internal. Also, the high-level people will decide it should be taken to customers or not. And if the high-level people decide to make the real demonstration to the real customers, this project will “stage up”.

For China side, we will tell us our project is stage up. In the future, it may be make a real product. So we can tell our order in this case because the product, we change from research level to product level. The quality is very important. In this case, we will show our, we need some support from Japan side such as the real product developer team, how to check the quality.

Researcher A: And stage up from research level to product level. Ok, this is about the definition about the quality explain to different team. Any other problems from the cultural different perspective.

Manager B: The second problem is the language. In product level, in our company, each product level order offshore will have one brief method in product level offshore. But in research level offshore, in this case, China side and Japan side discuss with each other using English. English for Chinese, also for Japanese is second language. So the problem is that the same word, same sentence

the understanding is different. Different meaning from the same word and the same sentence. In this case, the most difficult is the how to get the potential order is very difficult thing.

Researcher A: How you solve this problem?

Manager B: In my case, this problem is not very difficult because I can speak Chinese and Japanese. Our project is special case. Basically, we discuss with each other, firstly, use English. And English I can get this communication, the same sentence, and the same word but the different understanding. I can understand it. This case I will explain in Japan side use Japanese and to China side use Chinese. This is the reason why the product level usually needs the bridge manager.

Researcher A: In some cases, I learn from other cases the bridge manager has. For example, in software development project. They said bridge system engineer has to develop two documents. They learn from team A then bridge system engineer develops a kind of requirement document and bring this document to the developer team. But in your case it is different. You do not have to develop the document. You just understand by yourself and change to another language. From Japan using Japanese and then by using your own experience, you own skill, your own language skill you translate to Chinese people.

Manager B: From my personal opinion, I think to involve the language problem. I think to know English education system in China or Japanese is very important. It also for Chinese to know English education system in Japan. To know the education style is very important.

Researcher A: So they can understand each other.

Manager B: And another method is about to use picture.

Researcher A: Can you explain more? I mean use picture in the meeting presentation instead of just say, you draw the pictures, diagrams.

Manager B: In this case, the whiteboard will help us to get the potential order, the potential need will help us, I think. In my case, it is special case because I can speak Japanese and Chinese.

Researcher A: Ok this is about the language different. Any other difficulty from cultural perspective? For example, when I visited India, another difficulty is about the way of thinking.

Manager B: I just want to say that. The Chinese people and Japan people is the same in this case because team is very important in Asian, in East-Asian such as Korea, Japan, and Thailand. Team is very important, not process. We do not need the hero in the team. We need teamwork. Teamwork is very important. We want you to show the best teamwork. So, the India, the thinking is like America, I think. The personal idea is very important for them. It is very difficult to change their opinion, personal opinion for then.

Researcher A: How about Vietnamese? You also work with Vietnamese engineers. Vietnamese developers, they work as a team the same as Chinese and Japanese.

Manager B: Yes, same.

Researcher A: So the way they work is not the big problem, right? In your opinion. I mean between Japan team and China team. The way of work, they work as a team, same for both. Is there any problem happen from this perspective, the way to work?

Manager B: I think the cultural different, right now, no fundamental solution, right now, I think. So, the bridge manager, what we can do is make it better but the fundamental solution I have no idea right now. The China do not think I am a Chinese. They just think they are developers in the team. And the Japan is also, I am just developer in the team. I am not Japanese, I am not Chinese, I am just developer of team. In the team, I am just a developer. It is very difficult to make a developer to forgot we are Chinese or we are Japanese. In the project, the people have two or more identifications. One is a develop and one is the Japanese or Chinese, nation. I think the nation is not need in the developer. How to make people forgot it, is very important.

Researcher A: They should pay attention to their role in project, BM, developer, tester. The role in the project is more important.

Manager B: We always, we are global but we are really globalized, I do not know. If you can be the real global in the global project, I think it is very good. May be the nation culture. Every country has the original culture but the global culture is worth, I do not know. If we can make a global culture in the global project. We are the same global, global and there are developer. Global and global are the same culture, no difference.

Researcher A: In that sense from your experience. Do you have to do anything to motivate to think like I am a global team member? Do you have to do something to motivate them in this perspective?

Manager B: In official case, I can do not because the orientation in Japan company is very hard. It is very hard to change. In the unofficial case, we can make some parties.

Researcher A: The way you do is informal situation, kind of free discussion or party and when you talk to them you can motivate them or tell them to think this way, that way.

Manager B: Such as the China side and Japan side can make something together. So in this case, in official case, you can do something together and to make the official global culture. With in the company, the company culture is very hard. I think the company, the high-level people should make the global culture to change this thing.

Researcher A: In your opinion, the high-level manager should support to develop global mindset for the employees when they work with people from different countries so they can adapt themselves easily. High-level people firstly I think they must know we are not just order. We are also the developer. For developer side and the order side we are the same team. First, we must understand it. And then make the best performance for the team, we must make some global culture. Such as company culture is ok.

Manager B: I think, in Japanese company, we have very very good company culture. Very very good I think. If we have the Japanese people to not the company and to make every day work harder, I think it is very useful. But the culture is not global I think. The reason is that the Japanese company have very long history.

Researcher A: They have a very strong company culture. Firstly, by Japanese culture after that when they have to work with other company they cannot get out of this scope, this original Japanese culture to work with other.

Manager B: This is our Japanese history. It is very difficult to change the culture because this is our history. History is very important. Right now, global is very important. I think the company culture must to join the global.

Researcher A: I think I can cover all my questions.

Researcher B: I want to discuss about the quality. Deep learning project Japanese side request some kind of image recognition so they select Indian researcher to share some algorithm. This algorithm is work but Japanese researcher consider several types of algorithm. In some case, quality is important, some case quality is not important.

Manager B: In our company, we divide by the product. For example, in the research level, we can imagine the product in the future. If it's a software product, the important is to show the concept to the customers. In this case, we will follow the Indian idea. Just quickly. Because the software first makes our concept and then we can update is ok, just software. For the system product, we have some hardware we need some drivers. In this case, the software is very important because the customers, the hardware down is not good, I think. The customers can't go this thing. The software has some bugs in this time.

Researcher B: Software can be modified later easy but hardware is very critical.

Manager B: In our company, we will discuss about software, system, or hardware. In this year, the App protocol is very popular for smartphone. Our researcher in India and China are also do

some App just for smartphone. So in this case, just quickly is important to show the concept to the customer. In this case, the customer, the first is very important I think.

Researcher A: To show the new concept as fast as possible. It is the software product.

Manager B: Just like game developer company we show the new game concept firstly.

Researcher A: Then the new version to improve.

Researcher B: There are three types of quality. The software case the concept is very important. Speed of the communication is very important. It is different between software and hardware.

Researcher A: So now, in this case, it's depend on our target. For example, our target is software or hardware product. Then we focus on different types of quality because of the target. But as Sensei talk about the example from India, Indian engineers focus on different types of quality because of their own culture not because of the target. Indian engineers produce product very fast because it is their culture. To finish in a very short time period. They do not care whether it is software or hardware but they just want to show the result as fast as possible. But in this case you check, ok, we develop software or hardware and then select which type of quality we are going to focus. I can see the different situation.

Manager B: China is also speed first like India. I think in this year, the software developer is very popular because smartphone is popular. The popular product in this year always use software. It changes opinion to the China people.

Researcher B: May be in Japan, so we are moving to the speed because of the business is very important now, internet, IoT.

Researcher A: Moving faster than before.

Manager B: I think the problem is very important. Sensei said experience, the experience is important. In our research center, we have a UX team for each project. The UX team will give the real experience how to make a very good product.

Researcher A: In a very short period of time.

Manager B: Firstly, we will show our concept to the internal target. Then we take it to the real customers and real customer will give us discussion with the UX team how to implement. We will connection with the real users and their work is how to make the best design for customer to use our product easily.

R&D bridge manager C

Date: 24 August 2017

Time: 14:30 - 15:00

Channel: Face-to-face interview

Researcher A: Firstly, can you explain your working process in, for example, one project? When project start, what are you going to do since the project start until that project finish. What are the activities you have to do? Please explain about that.

Manager C: For one project, first we need to propose some draft idea. What we called SIID and we need to propose the proposal. We need to write the report and to do many investigations both on the technology and on the market. And we will post this proposal to our leaders and to show if this project is possible to do that. After the researchers work and this project has been expanded now and we will do some. R&D division are not working between the real products. We have to do some helps to modify of idea. This kind of research is ok or have some problems. So most of the time we are doing the products. For perhaps, we do, not only software or source code when program and also we do the test, unit test, and finally we do the performance test about the whole system. And almost after the correlation finish, we write the final report to our leaders that we finish the project. This project is finish and if you need to propose some other issues in the final report. We continue the project. In these projects, can be just one year or half a year, cannot be long because for the technology change we need to change. So, I do not want to continue using this, you can propose another project and the technique or technology is useful in the sense. I mean it just not technology. Just analyze especially for open house and annual report and put our output into open house and to say if this kind of output can transfer to product, to the market. And we provide in some technical support. In the support, we can be in many formats such as source code or hardware devices. And when use the common schedule of the project, Software Research Center Beijing, short SRCB, we have to deal with only user in China market. And you know that in China, there are too many opportunities to propose some projects. So, we think that we use schedule a little bit small. We need to propose the reports and that reports use some long time period. So, we can have a minor path to transfer our output. We can have an incubation process and mostly output is narrow and flat. Japan side cannot test it. We can just start our own company base on your ideas. And so, 25% they choose to transfer to start-up company.

Researcher A: So now the project will finish, one way is, when the research goes to the real product, right? You will stop research at that time.

Manager C: Not every project go to that path, I make them 20% of research projects go to the product.

Researcher A: If your research project cannot transfer to the real product, what will happen with that research? Keep research more or just stop?

Manager C: It depends on the leaders or the managers. If they think it is meaningful but may be one year time period we can do a very good job we can continue the research. Some research needs to continue, may be four or five years. But, may be, you need to change direction and project situation is not good and we need to change. Two years ago, I do the wireless network and we develop WiFi and Bluetooth product so we join the organization and we put our research. After do that, I transfer to the image processing division base on deep learning because, you know, artificial intelligence becomes very hot. Many researched focus on the deep learning, AI and so on. So why I am in embedded system.

Researcher A: Basically, who identify whether your research can stop or your research can go to the real product. High level person or marketing team or CEO? Who will decide that decision, in general?

Manager C: Almost is CEO or managers to identify some projects. We have some projects and we have no cooperation before with R&D research in Tokyo to that project. And we have money and continue. And also in China, we can get the money from the outside company or outside projects. They ask me to do some researches and we can continue. Some projects may be no money and no support we have to stop. Some researchers will continue keep on doing it because some researchers are enthusiastic about their research. It is just one or two cases, not very much.

Researcher A: And you said that many times you have to go from China to Japan. What is the objective of coming to Japan? Just meeting with high-level person or what is the objective to come to Japan.

Manager C: We have the cooperation projects we need to communicate with Japan. Of course, we need to communicate with the meeting we have every week and in the period of two or three months, we need to post if we find the problems and next steps and also we do some program we involve the product. For example, we do software part and they do hardware part. We need to integrate. So, we need the face to face to test the whole system. And also every time we have the annual meeting we have to come.

Researcher A: You mentioned that you have weekly meeting. VDO conference or?

Manager C: Yes, VDO conference.

Researcher A: And of course, you have e-mail to communicate among your company?

Manager C: Yes.

Researcher A: When you develop some software, you have a kind of integrated system so a lot of developers can join and modify some coding on that system right?

Manager C: Yes.

Researcher A: How about the report?

Manager C: We have some reports and we can add the reports on the database put the report here and you can share. We also have weekly report and we talk about weekly report in more detail through the VDO conference.

Researcher A: How many countries have you worked with so far? You mentioned US, Japan, of course, China. Any other country you have developers in that?

Manager C: For the American and India we are not well cooperate with each other because we do not have project now. We just share our projects.

Researcher A: So the projects mainly between Japan and China.

Manager C: Yes.

Researcher A: That is why in your teams you have Chinese people, of course, and you also have Japanese people.

Manager C: Yes. It is belong to, actually, it depends on different teams in Tokyo and SRCB and another team we just cooperate with. May be because of the organization issues.

Researcher A: My research interest is about the problems or difficulties when you work in this kind of situation. I just asked you about working with people from different nations. Wang Yang-san said he worked with Vietnamese, Japanese, Chinese. Sometime it is difficult for him to communicate between teams. So in your case, my question is, what do you think it is difficult for you when you work in this situation? What you consider it is difficult for you when you work in this team or this project?

Manager C: I am still feel similar. I mean when I meet with different culture and also languages. I think there various big issues I try to repeat my questions, again and again, to know what they really think. That is difficult, I think. Project proposal may be they do not ask everything out. Sometimes, they have feeling do not tell everything. Every time, we do the formal documents. This is the method to deal with that problem.

Researcher A: We have talked about the quality of the product from the result of R&D projects. How do you think about the R&D result? Is that difficult for you to control or manage the quality of the outcome? Is it difficult for you or?

Manager C: You mean the quality, may be, the source code? For software development, we have our own process to keep the quality. And also for some cases, we do the test and the quality, performance test, and the third one is that we use the code review. You can show your code to your partners for the review and feedback. We also comment by ourselves too because after a half a year later when you see your code. I don't know what I write here.

Researcher A: You mentioned about the languages. When you work in Beijing, you can use only Chinese, right?

Manager C: Yes, for communication, we use Chinese and for documents, we use English. That is why we need the TOEIC test because our managers and some people can use only English.

Researcher A: How about the documents from Japan side? Did they provide in English?

Manager C: Mostly Japanese.

Researcher A: How about from your side if you have to provide some documents to Japan side? Which language you are going to use?

Manager C: English.

Researcher A: I am thinking about the different cultures which is another difficulty mentioned by other managers I have interview so far. He mentioned that when he worked with people from different nations, different culture. It is difficult for them to manage and collaborate among people from different background. How about in your opinion? Firstly, your situation may not have different culture, right? You work with Chinese people only, right?

Manager C: Sometimes, I work with Japanese people too.

Researcher A: In that case, do you have any problem or difficulty when you have to work with Japanese people other than that you tell me about the explanation of something and you solve by produce the documents. Any other problem when you work with Japanese people?

Manager C: I think it depends on the personality of people. I had some job training. My project manager is an engineer. He is open-minded. He plays rock music. I think I have no problem with him but some others may be a little bit shy or not much to express what is in their mind. I need to ask the real thinking and ask them many questions. So, may be, it is difficult to understand but if we have long time, there is no problem. You know the issues in the company is complicated. May

be someone want to promote the project but someone do not want to. It is really hard to motivate. I really do not want to do that. It can do on different methods.

Researcher A: It is a kind of political issue in the company. Again, your responsibility or your scope of work is only on software development, right, coding?

Manager C: I think software. It is complicated with embedded system. The embedded system is the software embedded in hardware parts. You have the software and you have the hardware, and the embedded system is to connect between the software and hardware. I cannot clarify which part I belong to. So, my job is mainly on the embedded system.

R&D bridge manager D

Date: 28 August 2017

Time: 16:00 - 17:30

Channel: Tele-conference interview

Researcher A: Yes, let me directly go to the questions. May be we can start with the, can you explain your experience in R&D projects, in general? How long have you worked in R&D projects, something like that, your experience.

Manager D: I work with property in India. My experience is about 4 years ago. This project is Artificial Intelligence. This is the software project. The main goal is to implement artificial intelligence such as the embedded system. I am the project leader and change leader of the AI and image processing in Company A. So, this project with India is one of the most important projects in my team.

Researcher A: So, your project is for India market or for Japan market?

Manager D: This target is all over the world.

Researcher A: Ok, may be, I will move to the next question, which is about the working process. Could you explain your working process in R&D project?

Manager D: Firstly, we Japanese make this plan and scheduling and we make the specification. And final some of them try to develop some parts. Some parts of the project (20%) will be developed in India and other parts (80%) will be developed by Japanese side and University.

Researcher A: Next step after you create your specification, what is the next step?

Researcher B: You will breakdown requirement, specification some parts. Some results came from India.

Manager D: We have many projects year by year. We review output in Japan with our members. And we evaluate the output such as program with our data. We cannot give India our data only in Japan. Every half year the projects will complete, 3 or 6 months. Japan side evaluate some software. India develops then Japan side evaluate. During our evaluation, India they will work next project. Basically, it is a big project or long time project but Japan side divide half year mini project. Mini project consists of many approaches.

Researcher A: From a large project, Japan side try to separate into small projects and every, may be, 6 months Japan side will evaluate using data in Japan, right? And many small projects combine to become a large projects.

Manager D: Yes. So, in that case, Indian vendors they don't need to understand the whole projects. They do not know, only 20% of the project will move to Indian side. So, Indian side cannot know other 80% of the project. So, they do not know of the whole project. Because of the mobility, we cannot take them all because we must do export control. Some information abroad we must keep in Japan only. That is export control.

Researcher A: Some information cannot transfer to Indian lab for evaluation, something like that. So, you have to keep in Japan only, right? That is why when Indian engineers finish their work part, then Japan side will evaluate in Japan. I understand that there are several types of offshore R&D. May be Company A case, researchers in Company A Bangalore they share and member of the project. So, they share information.

Manager D: I think their project is very very large. May be share members. But my project is small relatively small about 4 or 5 members. So, we have to make export control ourselves. In Company A case may be they ask export control somebody else.

Researcher A: So now from that process the next question is what are the difficulties you have when you work in that kind of R&D process. What do you think it is difficult for you to manage?

Manager D: First is the language problem. May be as you know our Japanese are not good at English and the Indian English is more difficult than native English. So it is very hard to share very difficult. And management is difficult too because their thinking is different from Japanese thinking. For example, we try to make goal according to specification but they did not, sometimes they try to find another approach. May be they think a better way. This is different, may be style of culture. In that case, they satisfy the minimal requirement and sometimes they try another. They think this addition function, feature, may be good for Japanese side but there are some mismatches. Indian researchers may not make a good result. They only do minimal requirement.

Manager D: Of course, they are not responsible, my responsible, because sometimes my or our requirement is not complete.

Researcher B: It is very difficult to specify for concrete requirement so usually Japanese researcher thinks about imagine work of Japan side. Japanese researchers or Japanese university they understand the background, way of thinking then they can may be expect to requirement. But the Indian people cannot understand the background. They cannot imaging so they misunderstanding, not the compete requirement. Of course, Japan side specify all concrete requirement, no problem. But so in the case of software development, it may be flexible. Offshore

software development is possible to specify complete requirement by using UML. But R&D we have no formal specification like UML so sometimes requirement mismatch. This is the communication problem. There are two types of the difficulty. One is the communication or way of thinking. Bu the R&D itself, requirement is difficult to specify. In your case, which is the reason, communication or R&D problem?

Researcher B: This case the communication gap is the main reason of difficulty.

Researcher A: Can you explain in more detail about the communication problem? I mean how the communication problem effect to the R&D project? The effect of communication problem.

Manager D: What kind of problem do you mean?

Researcher A: For example, the communication that you cannot explain clearly about the specification so after that what is the effect, for example, Indian engineers need more time to investigate or Indian engineers work in the different direction, something like that. The effect from communication problem.

Manager D: Most problem is direction problem. Sometimes, for example, I say please use new network but they do not use but another approach such as image processing or some methods. Given method may give a not good result sometimes. So, researchers sometimes use different approach. This is the characteristic of R&D. So, R&D researchers think this approach is good. It is may be OK but sometimes our members require to use newer methods. Because I did not share the fact to India so it is my responsible. This is sometimes may be. Performance may be equal. In that case, Indian approach is good. This is the specification of R&D character. Sometimes they operation is incomplete to proof the advantage as a result. Sometimes I do not believe the result. If the result is completely good in that case is good. But Indian result usually have some problems. They have to use some approach but they do not use such approach and they use different approach. Even the different approach is completely good, no problem. But the result is not so good. It does not have an evidence. If Japanese researcher wants to change the requirement approach, they may show evident that result quality is very good. Because Japanese researcher is honestly. Japanese researcher normally shows the evident of their quality is good, process in detail. Indian researcher thinks about the rough idea. They think this approach is good, they believe, so they go to this direction different from Japanese side. This is the way of thinking. They think they are understand the Japanese direction more quality but they have some parts of evidence. They have to understand only limited information. Sometimes, they go wrong direction.

Researcher A: So, how can you overcome or solve such kind of problems. What are the solution you use when work with this kind of situation? For example, I interview some software engineers they said for the communication problem they usually create a formal document and deliver the

document to developers. So, developers can clearly understand the requirement. In your case what is the solution you use to overcome this kind of problem?

There are problems. What do you do to solve this problem?

Manager D: One approach is to evaluate same thing by our Japanese researchers and test them with Japanese result. If the result is quite different then they seem to have a problem.

Researcher B: It may be a quality control. Their quality may be not assure so Japan side can have to check the result of the Indian programmers. It is the same in the university-industry collaboration. For some cases, Japanese company asked university to do some research but university side quality of researcher may be, sometimes, master students do research so compare with the professional researcher in Company A or Company B. So, our master students or Ph.D. students sometimes they make mistake. So, the quality of the research not 100%.

Manager D: We have monthly meeting using teleconference. May be in many cases, they show slides from the PC and we discussing. Indian researcher will present the research result every month using presentation to Japan side. Lastly, Japan side clarify the direction. Sometimes we give them incentive such as patent license. In direction to teleconference patent is sometimes good incentive or motivation. Indian they understand they can get patent. If Indian researcher can get patent so some financial support given to Indian researcher. It is best to keep them motivation.

Researcher B: Ok so there are three methods to resolve the problem.

Researcher A: How about the report? The report, do they develop some kind of report for you? The Indian engineers do they provide some report.

Manager D: Yes, every half-year, every month they develop progress report and then final report.

Researcher B: Company A, Japan side, and Indian side different company. Different company means financially depend. So Japan side ask some jobs when they finish the result in half year then Japan side pay money to Indian research team. So as an evident of job Indian side make some final report to Japan side.

Researcher A: May be I will move to the last question. I would like to ask you opinion about the role of bridge manager. In you r opinion, what is the role of bridge manager in R&D project. What is the important role of bridge manager? They are a lot of roles, bridge manager and lot of thinks but what is the key role.

Manager D: One of them is to correct direction. Another one is keep motivation, sometimes they quit.

R&D bridge manager E

Date: 8 September 2017

Time: 22:00 - 23:00 (Japan time), 16:00 – 17:00 (France time)

Channel: Tele-conference interview

Researcher A: Yes, my first question would be, can you explain a little bit more on R&D management-related experience.

Manager E: R&D related management, Ok. Outside of Japan, right, or in Japan?

Researcher A: Yes, actually R&D project between Japan and other countries something like that.

Manager E: As a member of the Company A research laboratory at that time, I worked on the more like a computer science research. After I move to the business unit in Japan around 2000. I become R&D manager actually product development manager of one product of Company A which so called the middle ware of the product. I designed the product, designed the architecture, designed the team and then I designed the process of development and finally develop the product and ship it to the market. My original job in business unit. Then in the Finland, they asked me to go to Finland to change the architecture of one product, which is called the Teamware. What is the Teamware? Teamware is the Groupware from Company A. I stayed there six months as a chief architect of the product and tried to change the architecture. And also, tried to plan a new product as well. Then I am coming back to Japan and Japan asked me to work on the new product, which is the content management product. I should be R&D manager of that product. Then, this time developing by ourselves. We would take long time. So we decided to buy some products from other company. It is called M&A merge and acquisition. So what I have found is the I look for the new technology in the world and I found that one good technology in Germany. And I acquired and I bought the company and then integrated the company into Company A. For this integration, I stayed in Germany six and a half years as a vice president of the product management, which means the product planning, and project management of R&D project. After that, I went back to Japan but again, as I told you, Japan asked me to go back to Germany, in that time as CEO Chief Executive Officer. Chief Executive Officer is much more than R&D manager. With that position, I have to take care of not only the product but also company itself. The same in Paris as well, still I am taking of R&D project but mainly now more as a company management.

Researcher B: Thank you very much. I understand that now collaborate the company but before CEO. Researcher A said R&D but I understand that your position is technology management and the chief of the company.

Manager E: Yes, I think the technology management and product management, project management.

Researcher B: R&D development included such kind of things.

Manager E: What you mean R&D, more about research something?

Researcher B: Research and development include the product development.

Manager E: Yes, also included product development.

Researcher B: We try to compare the IT offshore software development and R&D development.

Manager E: Onsite and offshore development?

Researcher B: Offshore in the case of software, specification is fixed.

Manager E: I have done a lot of offshore and nearshore development together with multiple countries. The first experience is the offshore development with India. We develop a product in India and the role not quite clear. We designed the product, and we designed the architecture, and we write down the specification. The program is mainly done by Indian people. Then we have done the quality assurance for the coded program. Indian do the programming and we are the management, architecture and the product lining this is done by Japanese people.

Researcher B: In my experience, there are a lot of research about IT offshore software development but there are few researches about global R&D development. Especially, focus on the bridge manager.

Manager E: Working together with India even the research it is not so easy, honestly speaking. We also have the research project. We use the offshore research. In order to verify the concept or research output which is called the proof of concept. We need a kind of a prototype. The prototype development done by Indian people.

Researcher B: Yes, that is the point.

Manager E: That case, we experienced, generally speaking, to work with the Indian people is not easy. The reason is a lot of confusion often happens about the specification. We write down the specification when we work not with the Indian offshore but we work with Japanese sub-contract. As you know Japanese people we do not need the detailed specification. But when we have to work with the offshore people, we have to specify, we have to write down very detailed specification. And very often more communication is necessary. We check whether the Indian colleagues implementing ok or not. Very heavy job.

Researcher A: I will go to the question directly. The question is, in your opinion, what are the difficulties when you work with global R&D project? I mean when you work with R&D teams in different countries. What you consider as difficulties?

Manager E: Ok. There are a lot of problems from my point of view. I think I am sharing the my screen with you alright? One big problem as a Japanese side is English, honestly. This is the problem of the Japanese people. Japanese people is not good at speaking English. They hesitate to speak English very often. So, communication is often very difficult because of the English. If the global collaboration is led by Japanese, this is the biggest problem. The second biggest problem is so called the A-Un breathing which means very often, Japanese people is assuming a lot of implicit knowledge. Once tourism people or non-Japanese people do not understand the implicit knowledge. I think outside of the Japan people communicating with explicit knowledge while Japanese they try to communicate only with implicit knowledge. And this creates a lot of difficulties. This is one of my experience. Because of this, the Japanese specification is not clear enough and also not detailed enough. This A-Un breathing characteristic and the English are two of the big problem when I worked together with offshore and nearshore people.

Researcher A: Can you show some example? I mean example situation where Japanese use the A-Un communication.

Manager E: A-Un communication? I think if you talk to one of your Japanese friends. Some people say let's go there. So, non-Japanese do not understand where. Because the Japanese very often understand the context of the communication. They understand the assumption of the communication. They say, we should do this, we should do this way, developing this way, we should develop that way but often people do not understand what that means. This often happens when I work with the Japanese and also non-Japanese people. Most of the Indian people, some people often say what do you mean. But the Asian people do not ask. They simply assume that pretend to understand what that means. This is often happen with Indian people. So, we say that now ok we should developing this problem in this way. And they say yes I understand but actually, they do not understand. This is a typical problem of Asian people. That is my impression.

Researcher B: That is interesting. In the case of European and United State, they ask then they can understand the situation.

Manager E: I think in the business situation I believe that business situation Company A is the master and the offshore, nearshore people feel that they are the subcontract. Then, they hesitate because they are subcontract, they hesitate to ask questions. This very often happens. One case happens with Indian project. Another thing, this slide is for the Japanese people. They worked with nearshore, offshore people. As I said nearshore, offshore very often subcontract. Therefore, Company A Japan behavior is more arrogant. This is also the problem. Because of the arrogant

behavior, subcontract people cannot ask the questions properly. This is mainly from Company A. Anyway, do you have some more questions about that?

Researcher A: Regarding those difficulties, the next question would be what are the solutions or approaches you use to overcome such difficulties?

Manager E: What I normally do is, for example, when we work with Indian people. Then we ask them all members to make all everything explicit as much as possible. Also, I ask the people to communicate very open way. I often say people do not keep the order underlining assumption. Just please make everything explicit and openly discuss, nobody is master, nobody is slave. Simply, openly discuss. And also at the beginning, I often do the kind of, cultural training together with material that I show you. This kind of material, people know what is the cultural problem between Japanese and other people. How to work together. This is the Japanese oriented but I also know how to work with French, how to work with American, how to work with German, lot of people we have to consider. The most important for cultural difference was something like a history.

Researcher A: So you mean for different countries, like German, US or other countries in Europe, you apply different approaches with them, right?

Manager E: Yes, somehow yes. As for Japanese concern, I tell that German people, French people how Japanese people behave. So that German people must be careful about this consumption like this and also to the French as well I am doing the same. And for the Japanese, I am telling that how the German people behave like that like this, I tell them. How to find out their behavior or their nature is really difficult. But may be general statement about the nationality is very often helpful, actually.

Researcher A: Can you explain more about the nationality?

Manager E: For example, for the German. Do you know how to work with the German people? It is quite simple one. German people are, this is truth, German people they love regulation. You understand the regulation? Rules. They like a rule very much. In order to work together with them, we have to tell them that this is a rule. This is not the rule. And they can clearly understand what they should do.

Researcher A: Follow the rule strictly.

Manager E: Yes, they love follow the rule strictly. That is the German nature I think. I know German because I stay in German long time. French, I still studying French nature but French is, many people said French people is very complicated and I agree. They are very complicated. If I say this is blue color, they say no this is the red color. They always try to say the opposite. This is

a kind of a French nature. Very difficult to manage French people. I am sorry I do not know people from Thai. How about Thai people always smiling very friendly? I think that may be the nature.

Researcher A: Yes, honestly, we normally say yes. Everything yes, May be similar to Indian people.

Manager E: I believe that may be some problem we work together with Thai people because it is normally mean too much friendly. And if we say, ok, for Thai engineer. If we say you have to do this this this by the end of this week. They say yes but may be they cannot say that they have some big difficulties. So, in the end of that week may be someone could not finish then what happen I do not know. Indian people very similar to Thai people but if we say what is going on they always say no problem. No problem, everything is going on. Do not warry. This is the difficulty with the Indian behavior. If I ask them, tell me current status. The answer is always no problem, do not warry, do not warry, we manage, we manage. But the end of the week they say that sorry we could not finish. That is very often for the Indian people.

Researcher A: Excuse me, at such situation, when the Indian people say no problem, no problem. What do you do? You try to ask them more or something like that.

Manager E: No, I think, this is the point. If we say, if we ask what is going on? In the middle of the project, they say no problem. At the beginning of the project, I clearly define schedule and process and milestone. I also design the output of the milestone and the output of the end of the project. So I do not say to them what is going on but I say show me current output of the current milestone. They have to show. So no problem or problem I decide, not by themselves. If I ask them, they always say no problem. If I request them show me the output, current output, then they show me and I decide this is problem, this is no problem. And I tell them this is problem. You have to do this this this this. This is my experience.

Researcher A: Ok now we understand what are the approaches you use to overcome some difficulties. Let me go back a little bit before we identify the difficulties. I would like to understand from your opinion what are the causes of those difficulties? Can you say something about the cause or the reason why those difficulties happen?

Manager E: Ok, one is the cultural difference, actually. This is actually if you long time works with non native people you could aware of that. But it is not easy what is the cultural difference. I cannot say what is the cultural difference. But often one problem is the cultural difference. Another is I think the business situation. This also often create the problem. I heart that you have some experience to work with Company B, right?

Researcher A: Yes

Manager E: I believe sometimes you are in Thailand and the guy from Company B US come to your place, right?

Researcher A: Right

Manager E: Then you see that, ok this is the project but the US is the leader of the project, right?

Researcher A: Yes, we have such kind of the project.

Manager E: You feel, not such kind of slave, but this guy shows strong leadership and then sometimes you feel that you have to follow this people. Often this creates a big problem, honestly speaking. If this leader is the right person and the leader give you the right instruction then no problem. But if the leader is wrong then sometimes because of the relationship between the headquarter and subsidiary, you cannot say this is wrong. This often creates a big problem, honestly speaking. For example, I am working for the French company and this company is the subsidiary of the Company A headquarter. The headquarter guy instruct us. Sometimes I feel the headquarter guys, Japanese guys are not right. So my French side cannot say you are wrong because of relationship of something like a high-level relationship between Japan and France. To solve this problem I think I have to tell both sides ok we are equal. We should have fare discussion. And if we cannot have a fare discussion I think there is serious long time problem coming out in the end. Is this make sense? Do you understand the situation?

Researcher A: Right, right, exactly. Alright, I will move to another question very quickly. Can you explain your, sorry. I would like to understand the relationship between the difficulties and the performance of R&D project. Can you say something about relationship between the

Manager E: I think the difficulties that I mentioned often create the back track. You understand the back tracking? We have to go back to some points. We have some progress but we have to go back to some past time which often called create time lost and also money. I do not know do you understand the Agile way?

Researcher A: Agile, Scrum.

Manager E: Yes, scrum something like that. In the real work, this agility not yet so much popular. If we do the traditional way and then back tracking is really big problem. If we do the agility way not so often back track happen. Therefore, more efficient. No time lost, no money lost. No no, not no. A little time lost and little money lost I should say.

Researcher A: Ok, it will be the last question from me about the role of bridge manager. Can you explain how do you think about the role of bridge manager in R&D project?

Manager E: Bridge between different countries? Different countries like me. Role, I think some people say, moderator, some people say facilitator, but this is my opinion ok. My private opinion but I think the bridge people must be, must show very strong leadership. Otherwise, the bridge is not work, honestly speaking. Facilitation, moderation too weak that is my feeling. I try to do the facilitation, moderation at the beginning but it did not work. (Not enough) Not enough. To be honest, what I am doing is show very strong power to the both side. Otherwise, the coordination building is not possible. But this strong power should not be something like a dictator power. Very reasonable power. That is why very difficult to play bridge role. But if you not show the strong power, both sides do not follow you above. They just see you over and they just fighting each other.

Researcher A: That is why you apply, let's say power, not too strong and at the same time not too weak.

Manager E: Yes, that I think very difficult. For example, I am in France right now our project is the multinational. So, we are working together with French people, Japanese people and the German people and some Polish, Poland, Poland and of course American. For R&D we have a nearshore developers in Poland. You understand nearshore? Closer to our office. Nearshore developers in Poland we have partner developer in Germany. We have kind of partner engineer in United State. This kind of multinational and Japanese are the budget owner, money owner. In this kind of situation, coordination is very difficult. They always try to fight each other. So I have to show some strong power then I must be a kind of arbitrator. You understand the arbitrator? It is strong than coordinator, arbitrator means at the court, judge court. Arbitrator, If you go to the court just before the judge legal judge some strong guy coming out and listen to the both sides and say that you should have this time compromise. And if you cannot agree with this compromise, ok let's go to the court. This player is often called arbitrator. So this is not coordinator leave it stronger that coordinator because must show the power to the both sides and try to bring them both sides to the compromise.

Researcher B: Your opinion is very very interesting. We interview more managers from Company C and many cases they have not shown the leadership because the position is different. Manager E is CEO, higher level and fight with headquarter but many cases position is not high.

Manager E: Yes, understand. When I was not so strong the project very often failed. So now more and more successful. I think may be one of the reasons is my strong arbitration or strong leadership. Another reason is that may be CEO or title or something like that.

Researcher B: We will inform you what he do before with questionary. So, we need your feedback of the current finding. Is that ok?

Researcher A: Yes, let me start very quickly. So far we found that there are four difficulties. The first one is about the quality control. Quality control, because the R&D project normally has unclear specification at the beginning so it is difficult for bridge manager to control the quality throughout the R&D process. This is the first difficulty we found from the interview. What is your feedback on this quality control?

Manager E: We solved it about this problem. France is not yet but in Germany, we are at the beginning, we have a big quality problem. But we solved it out by introducing… like a Toyota. We try to do everything visualize, Explicit, everything explicit and open. We can achieve a very high quality, product quality. It is not easy to explain. It is a long story but finally that even Japanese quality assurance are saying that German achieved quality very high. At the beginning, they say German quality is very poor but two years after they say that perfect quality.

Researcher A: Ok, the next difficulty we found is the cultural difference. This might be the same as you just mentioned. Different culture between Japanese researchers and Indian researchers. The cultural I mentioned is the high context communication. Do you understand the high context communication? It might be a bit similar to the A-Un communication.

Manager E: Yes, I think a bit similar. I understand your high context or abstract communication or some called A-Un communication. In your case, the cultural difference how do you feel. What is your feedback on this difficulty. Important, not important something like that. I think it is important and I cannot overcome this problem. Cannot overcome but I have to say Japanese try to improve a lot about this problem.

Researcher A: So I will move to the next difficulty. The difficulty is the way of thinking. For example, the headquarter in Japan has one approach to conduct the research but at the same time when they work with the R&D team in India, Indian researchers use another approach to carry out the project. How do you feel? What do you think about the different way of thinking of people from different countries?

Manager E: I have this problem as well but I solve it by I change the role between Japan and Germany. What I mean is that Japanese guy always says that they design, they write down specification and I ask Japanese to stop it and German start to write the design and the specification and the Japanese just check it and then it works better.

Researcher A: Switch role.

Manager E: Yes, switch role. That is one way I solve it out. But it is not perfect but what we are working now.

Researcher A: Thank you. Let me move to the last one. The last one is the understanding of the market. The situation between Japan and India is when researcher in India develop product for Japan market. Indian researchers do not understand the situation and environment in Japan. What do you thin or how do you think about the understanding of the market or real need.

Manager E: I often say to the Japanese colleagues that is the typical Japanese's excuse. My excuse mean from my point of view Japanese do not understand the global market. So they often say that the Indian say the market is bla bla bla bla but the Japanese say no do not agree. They often say that the global market some products should be bla bla bla bla something like that but it is very often excuse that is the Japanese recall I think.

Researcher B: I understand that Japanese try to understand the global market and they think only the Japanese market.

Manager E: I think this question is related to the last question. I said the switch role. Why we switch role? Because I convince the Japanese that Ok Japanese is weaker than other people to understand the global market and finally the Japanese agreed. That is why we switch. We switch role. Before that the Japanese say Japanese headquarter understand the global market bla bla bla. Then, therefore, they say they should be a leader of the product design or product planning or something like that or R&D. But I told them that is not true. I think the Japanese is weaker than other people and then switch the role. May be this is not easy so I do not know most of people are not agree.

Researcher B: I want to confirm one point about quality control. In the case of product development, visualization may be easier. But for the early stages of product development or research so the specification is the moving target.

Manager E: Yes, that is true. That is the headache. Early stage of development, how to visualize is really critical problem. I think once the development started everything can be visualized pretty well. But before that, visualization is really difficult that I agree and the because I am not a specialist about software engineering. But I work together with German institute. They are thinking about how to visualize the specification, requirement and we are discussing. Because without visualization, we cannot have a good communication.

Researcher B: Yes, is not easy to visualize but we have to try to visualize the ideas, concepts.

Manager E: Yes, that is my opinion. The software engineering I hope that the software engineering research contribute to this point. I do not know, Uchihira-san know that the German research institute is very strong in the software engineering, especially, the German institute. The research in that institute is working on the visualization.

Researcher B: That is important, design thinking?

Manager E: Yes, design thinking and also the requirement management. A lot of things they are trying. Even innovation, the innovation is difficult to communicate.