

# Study on Special Characteristics of Japanese Firms in Adaptive Processes of Requirements Definition

From Viewpoint of Comparison of Building Trust with Stakeholders  
between Japanese and U.S. Firms

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**Abstract**— Requirements definition is an important work process for a project and it may determine the success or failure of system development project. If the requirements definition is not adequate, ambiguous conclusions may be drawn, which will lead directly to the failure of such a project. Language is used as the general method of compiling the requirements definition into drawings and documents, but a lot of cases show that a word with many meanings makes the requirements definition ambiguous. To optimize the requirements definition process, we present a model in which the trust management process is integrated into the requirements definition process, in order to minimize the gap between requirements caused due to a lack or discrepancy in communication and to use a negotiation method for solving problems of this kind. We discuss that building trust between the stakeholders in the requirements definition process is effective to optimize the requirements definition, which has been produced by the special characteristics of Japanese firms in the information system development, and we also describe the necessity and effectiveness of the information system in Japan. In conclusion, it can be said that trust management using “trust” between the stakeholders to overcome the difficulty of requirements definition is higher in Japanese firms than in the U.S firms.

**Keywords**- requirements definition; establishment of mutual trust; social uncertainty; the adaptive processes; special characteristics of Japanese firms.

## I. INTRODUCTION

### A. Background of Study

The role of the information system has increased in importance, such that the information system is now indispensable for companies to carry out work. Further, the information system has been considered as not only a useful product in companies, but also a significant infrastructure in the whole society. As the social mechanism has grown more sophisticated, the information system infrastructure has also continued to become more complicated and the difficulty of introducing it has increased steadily.

Kiritani has already advocated a model of trust management in the requirements definition that is a key success factor in the information system construction and it

is optimized through the trust relationship between the stakeholders [1]. In addition, the author believes that the trust management is fully effective because the information technology development environment and method are peculiar to the Japanese firms.

### B. Purpose of Study

The purpose of this study is to probe the following two items in order to verify the effectiveness of trust management in the requirements definition.

- To clarify the difference in the requirements definition between Japanese and U.S. firms when constructing the information technology system.
- To make sure that the trust management in the requirements definition is necessary and effective due to the special characteristics of the Japanese firms.

## II. DIFFICULTY OF EXECUTING REQUIREMENTS DEFINITION IN JAPANESE FIRMS

### A. Actual Condition of Information System Construction

The information technology system construction (ITSC) project that regards software creation as the main work is difficult to meet the needs and demands of customers through quality, cost and delivery. Approximately 70% of all ITSC projects had a problem with the quality, cost or delivery [1]. In addition, the survey results indicate that approximately 18% of all constructed IT systems have not actually been used, even after these projects were completed, or other projects were interrupted before their completion [2].

The reason ITSC is difficult to perform is considered to be the characteristics of the IT system itself: “the system is a complex aggregation of subsystems that have their own role and function relationally one another” or “the needs of customers in the IT system are always changing and a request for change is often submitted in the middle of the ITSC project” [3]. As the background of the ITSC project that ends in failure, some researchers pointed out that “this project is carried out with unclear customer needs”; “the customer needs are not easily settled”; “the grounds for estimation are ambiguous”; and “the system development plan is carelessly made”. Other researchers also pointed out

that “the original documentation is insufficient” and “the project management is not conducted” [4].

The requirements definition that belongs to the upper process in the ITSC plays a role in compiling vague requirements from stakeholders into drawings and documents including the designable content for system installation from the viewpoint of technology, operation and expense. In other words, the requirements definition is an essential process to access the system development life cycle (SDLC), which is related to the following processes (from design process to operation/maintenance process) in the ITSC, and to affect decisively the quality, cost and delivery of the ITSC project. It seems that a request for change the abovementioned is submitted because the requirements are decided unclearly in the requirements definition and there is a gap between such requirements and the ones actually needed. Many causes of project failure arise from the method of executing the requirements definition and its results. Especially, an occurrence of trouble caused by the existence of tacit requirements and ambiguous consensus building that are not expressed clearly leads directly to the project failure under the limited man-hours and time for the requirements definition process.

A lot of investigations and researches have reported the relationship between the final success or failure of system development project and the requirements definition. For example, B. S. Blanchard [6] has reported that decision making at an early stage in the system development life cycle determines 70% to 80% of life cycle cost (LCC).

B. W. Boehm [7] has verified that the cost of modification or alteration (rework) traced to the first project management process increases as the project progresses on the basis of statistical data analysis in the system development project. K. E. Wiegers [5] has reported that the “rework” cost of the constructed system occupies 30% to 50% of all system development cost and the rework cost caused by errors in the requirements definition accounts for 70% to 85% of all the rework costs. In addition, other researchers have tried to explain the relationship between the quality of findings from software requirements specifications and the final success or failure of system development project [8]. The requirements definition is an important work process in the ITSC and the gap between requirements is pointed out as the most important cause of failure in the failed information system construction projects [9].

As a result, the quality of requirements definition leads directly to the final success or failure of system development project.

#### *B. Difficulty of executing requirements definition causing ambiguity*

It is evident that the requirements definition for the ITSC is carried out through communication between human beings, which accounts for a very large percentage of the requirements definition [10][11]. The ITSC including many distributed cooperative projects increases its difficulty level especially due to communication problems [12].

Language is used as the general method of compiling the requirements definition into drawings and documents, but, in

a lot of cases, a word with many meanings makes the requirements definition ambiguous. A study report has pointed out that the effectiveness of communication using language is low [4]. Even if the same word is used, its meanings may be different between stakeholders because of their own background and interests.

Since the information technology system is usually equipped with massive functions, all functions of this system to be constructed are generally defined. However, it is necessary to design even the parts or components with undefined requirements to install them in the following processes and also, these undefined requirements are treated as tacit ones. The tacit requirements are often admitted in accordance with each stakeholder’s “common sense”, which brings a major cause of ambiguity of requirements definition (a gap between requirements).

The stakeholders who have really different backgrounds socially and economically take part in the requirements definition. Interests exist between the stakeholders, individual requirements of the stakeholders intertwine with their acknowledgement and thoughts on the project, and the requirements definition finishes without enabling the stakeholders to put everything in common. In this case, the stakeholders agree with one another in the style of “scrambling for the pie”. Once trouble occurs, however, the stakeholders consider excessively their interests and requirements and negotiate ineffectively with one another for a solution to the problem, so that it will cause a serious problem that affects the quality, cost and delivery of the ITSC project.

### III. PRESENTATION OF HYPOTHESIS AND RESEARCH QUESTIONS

#### *A. Hypothesis*

Because the requirements definition process indicates a lack of the necessary information on the partner’s intention, it can be said that the social uncertainty exists here [14]. In this condition, a trust relationship between the stakeholders plays a role as lubricant for the social exchange relationships [14]. Therefore, it is believed that an improvement in the communication quality based on trust can minimize the gap between requirements in the requirements definition process.

The development of trust relationships changes the negotiation style between stakeholders from “scrambling for the pie” to “solving a problem” [13], so that it seems that the latter style improves the effectiveness of negotiation to solve the problem that affects the quality, cost and delivery of the ITSC project. The information technology system construction in Japanese firms presents unusual environment and high complexity, when it is viewed from the U.S. firms point of view. The main causes are the difference in the purpose and measures of system construction between Japanese and U.S. firms, the old business custom and the characteristics of a nation. Therefore, the development of trust relationships performs validly to solve problems usually caused in the requirements definition process especially in Japan.

We think that trust is important from an example of the definition of requirements to adaptive requirements specifications of the information system development in Japan and we made a model. Furthermore, we compared the circumstances with the ones in the United States.

**B. Research Questions**

- To clarify the difference in the requirements definition between Japanese and U.S. firms when constructing the information technology system.
- To make sure that the trust management in the requirements definition is necessary and effective due to the special characteristics of the Japanese firms.

**IV. REVIEW OF PREVIOUS STUDIES**

**A. Study on Optimization of Requirements Definition (Study on Trust Management in Requirements Definition)**

Kiritani designed, as a model of trust management in the requirements definition, its improved model that the effective optimization of the requirements definition can be expected to enhance communication and negotiation that are the great two factors in the requirements definition process through the development of trust relationships between the stakeholders [1].

1) *Communication efficiency is improved by the development of trust relationships, minimizing the gap between requirements*

The improvement of efficiency and accuracy of communication, which depends on the stakeholders, or human beings, through the establishment of mutual trust relationship minimizes the gap between requirements caused

2) *Realization of effective negotiation process with the development of trust relationships*

Because the ITSC is limited by the quality, cost and delivery, it is difficult for the stakeholders to agree with one another after all requirements that are defined in the requirements definition process to remove completely the gap recognition between the stakeholders. A technique to allow the effective negotiation process to be performed in order to cope with the problem present in the following processes is required by mutual agreement on the assumption that there is the representative requirements gap including the tacit requirements.

Figure 1 shows an effect on the basic model of requirements definition when the mutual trust relationship is established using the trust management.

**B. Previous Studies on Comparison of Information**

Some information technology systems in the Japanese and U.S. firms are explained in the following investigations and studies: “Comparative Analysis of Japanese and U.S. Firms on IT and Management” [15], “International Comparison of IT Strategy and Company Performance between Japan, U.S. and South Korea” [16], “Survey of IT Usage in Corporate Management” [17], “Comparative Analysis of IT Management and Productivity between Japanese and U.S. Firms” [18] and the report on the system development in Japan compiled through interviews with persons having technical knowledge about the situation of system construction in both Japan and U.S. [19]. By reference to these investigations and studies, we clarify the difference in the IT system development between Japanese and U.S. firms.

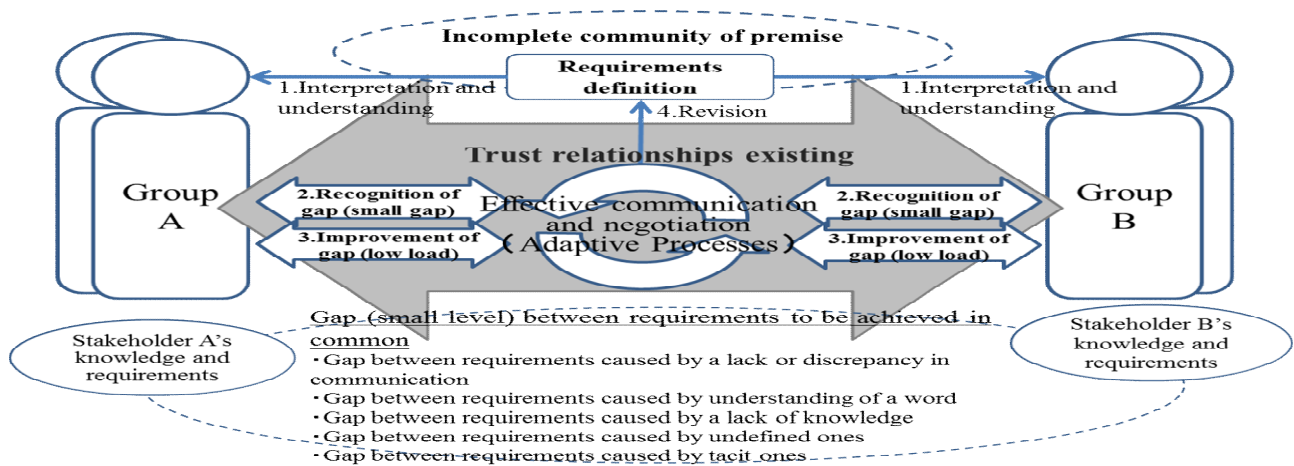


Figure 1. Basic model of requirements definition improved by trust management

by their knowledge and recognition. With the development of trust relationships, an effect of reducing gap recognition can be expected for emotional requirements/needs (especially dispensable requirements/needs).

1) *Recognition of importance of IT investment and purpose of IT investment*

There is a significant deference in the attitude toward “IT/information system investment” between Japanese and U.S. firms. While 75% of the U.S. firms consider this

investment as “a matter of great importance”, only 16% of the Japanese firms keep the same policy. In terms of IT expectation, the Japanese firms rank “optimization of work using IT system and cost reduction (48.2%)” at the top of their list of priorities, but the U.S. firms rank first “strengthening development of products and services (41.0%)” and second “business model evolution” [15].

2) *Role of Chief Information Officer(CIO)*

The U.S. firms “employing an expert IT manager” are 38%, i.e., the highest percentage. However, most of the IT managers of the Japanese firms also hold the manager post of a different department (38%). As to the CEO’s business career in the Japanese firms, many IT managers come from the in-house departments such as “corporate planning department”, “general affairs/finance departments” and “information processing department” and are less than 30% under the equality of opportunity. On the other hand, 35% of the IT managers of the U.S. firms are scouted from outside the company and are extremely higher than those of the Japanese firms, which indicates that the U.S. firms appoint remarkably many outside specialists [16].

3) *Software investment by type*

The packaged software is less than 10% in Japan, but it is approx. 30% in the U.S. Most of software investment in Japan is made in order software. The feature of the Japanese software industry is the multi-step system that a major software company receives a large-scale system development order and divides it into small lots to place orders with the software houses as subcontractors [17].

4) *Many Japanese firms dump everything on vendors*

*and many U.S. firms performing in-house production*

A lot of the U.S. firms have not performed IT system outsourcing activities by industrial field. As to the whole enterprise systems including the financial accounting, 58% of the U.S. firms have responded “no outsourcing activities”, and as to the supply chain management (SCM) and sales promotion support, 53% of them have not requested outsourcing services. Although there is little difference in the ordering process between the Japanese firms, many of them have used outsourcing services.

Approx. 40% of the Japanese firms usually “make an order after exchanging contracts through previous negotiations between the outsourcing companies and their own companies” in all cases of “the whole enterprise systems including the financial accounting”, “the systems by business department” and “the existing systems update”, which explains a characteristic of the Japanese firms that carry out previous negotiations with the outsourcing companies. A lot of Japanese firms have responded that the IT system outsourcing companies are “needed to reduce costs”. On the contrary, a few U.S. firms require the IT system outsourcing companies in order to reduce costs, but many U.S. firms expect these outsourcing companies to fill the role of a “technical adviser” [16].

C. *Difference in Information System Development Method between Japanese and U.S. Firms*

The difference in information system development method between Japanese and U.S.firms, including the study on the system development in Japan compiled through interviews

TABLE I. DIFFERENCE IN IT SYSTEM DEVELOPMENT METHOD BETWEEN JAPAN AND U.S. FIRMS

Comparison items	Japanese firms	U.S. firms
Recognition of importance of IT investment	“Great importance”: 16%	“Great importance”: 75%
Purpose of IT investment	Top rank: “Optimization of in-house work and reduction of working time (35%)”	Top rank: “Speedup and optimization of product and service supply (45%)”
Role of CIO	Many IT managers also hold the manager post of a different department and come from the in-house departments.	Expert IT managers. Many of them are scouted from outside the company and are remarkably appointed as the outside specialists.
Software type	Software development order: approx. 80%	Packaged software: 30% and in-house software development: 35%
Management	<ul style="list-style-type: none"> <li>· Users dump software development on vendors.</li> <li>· The system department enters between vendors and user support department in order to lead and adjust the project.</li> </ul> <hr/> <ul style="list-style-type: none"> <li>· The user support department has authority to decide main requirements such as performance and operability.</li> <li>· It is extremely important to make the user support department participate in the project in order to reflect correctly the business needs to the system.</li> <li>· Even as premises for packaged software, the system is customized to meet the present requirements.</li> </ul>	<ul style="list-style-type: none"> <li>· The in-house system development department leads the project and the inside engineers manufacture products in the company. The vendor as a technical adviser takes part in the project.</li> </ul> <hr/> <ul style="list-style-type: none"> <li>· While taking into account the requirements of the user support department, the CIO or the system department considers and determines the system design and specifications in the top-down decision-making process.</li> </ul>
Relationship between business and system	The company manufactures the system to automate the completely preset business process	Business process re-engineering (BPR) is set as a precondition. The company creates a new flow of better business process and manufactures the system to make it smooth.
Software development method	Waterfall (The company regards the document and plan as important and pushes forward the final process without changing the specifications of software once these are set out.)	· Agile (The company uses short timeboxes called an “iteration” to minimize risk.)
Preconditioned quality	The company seeks complete quality on release	The company increases quality after release
Engineers’ attitude	<ul style="list-style-type: none"> <li>· The company regards technical achievement of engineers as important (conservative).</li> <li>· The engineers accept a change in the specifications of software based on actual decisions of others because they wish to avoid trouble rather than right or wrong.</li> </ul>	<ul style="list-style-type: none"> <li>· The company regards innovativeness of engineers as important (aggressive).</li> <li>· Since the rules to change the requirements and specifications of software are clearly described in the documents attached to the contract sheets, the engineers have common sense to obey the rules when those are changed.</li> </ul>
Estimation	With unclear customer needs, the user support company requests the vendor to submit a rough estimation.	The user support company submits a rough estimation based on its business knowledge and survey.

with persons having technical knowledge about the situation of system construction in both Japan and U.S. [19], is described below by reference to the previous studies on information technology system and the survey results. See Table 1. Difference in IT system development method between Japanese and U.S. firms.

V. ASSESSMENT OF TRUST ITEMS IN REQUIREMENTS DEFINITION

A. Difference in Stakeholder Composition in Requirements Definition

According to the following information system development and management model diagram, the features of stakeholders in information system construction are as follows:

- In Japanese firms, the information system development and management model are constructed complicatedly and the interests of the stakeholders are intricately

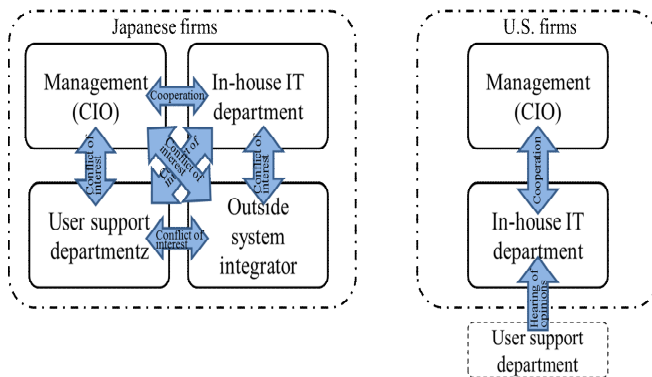


Figure 2. IT system development and management model in Japanese and U.S. firms

intertwined.

- In the U.S. firms, the information system development and management model shows that the interests of the stakeholders are basically matched.

	Japanese firms	U.S. firms
Purpose of systematization	Top rank: "Optimization of in-house work and reduction of working time (35%)"	Top rank: "Speedup and optimization of product and service supply (45%)"
Relationship between business and system	The company manufactures the system to automate the completely preset business process	Business process re-engineering (BPR) is set as a precondition. The company creates a new flow of better business process and manufactures the system to make it smooth.
Recognition of requirements definition	Preconditions of removing ambiguity and preventing regression	Preconditions of allowing ambiguity
Software development method	Waterfall method	Agile method
Quality target at completion (on release)	No bugs	A few bugs are permitted, but they are worked out during actual operation.

Figure 3. Difference in recognition of requirements and quality between Japanese and U.S. firms

B. Difference in System Development Method due to Recognition of Unclear Requirements Definition

A lot of the Japanese firms manufacture the system to automate the completely preset business process for the purpose of systematization. However, the U.S. firms tend to create a new proper business process and manufacture the system to support it.

Therefore, there is a difference in recognition of unclear requirements definition between Japanese and U.S. firms. As a result, it seems that the Japanese firms often adopt the waterfall software development method that regression is not supposed, but the U.S. firms select the agile software development method that the improvement of software is postulated to repeat even after operation with the requirements not settled in the requirements definition process.

Because the outside system integrator as a consignee manufactures the system in Japan, this company may deliver the system at completion and aims to make a more perfect system, which affects the selection of software development method.

VI. DIFFERENCE IN INFORMATION SYSTEM DEVELOPMENT CONDITION BETWEEN JAPANESE AND U.S. FIRMS AND DISCUSSION OF TRUST MANAGEMENT IN REQUIREMENTS DEFINITION

A. Difference in Requirements Definition Process between Japanese and U.S. Firms

1) Information system development project in the Japanese firms showing the situation that "social uncertainty exists"

The information system development and management model in the Japanese firms indicates that the interests of the stakeholders are more intricately intertwined than that in the U.S. firms. This is because "the requirements definition needs information on the partner's intention, but is lacking in such information"; "it shows that the stakeholders have interests one another and social uncertainty escalates"; and "the partner's self-interest behavior makes you have a bad time". In other words, it can be said that the social uncertainty exists.

2) Information system development in the Japanese firms using the precondition and method of keeping consistent requirements

The Japanese firms select the information system development method to keep more consistent requirements as a precondition than the U.S. firms. As a result, the inconsistent requirements greatly affect the quality, cost and delivery. For this reason, it is necessary to optimize more the requirements definition process. It means that the measures used to optimize the requirements definition, such as the trust management, are extremely needed.

### 3) High quality required for the completion of information system in the Japanese firms

Since a lot of the Japanese firms order collectively the information system to an outside system integrator, the completion of information system leads to its delivery. Thus, a high quality level is needed for the information system. It can be also said that high accuracy is required for the requirements that are connected directly to the quality of information system.

## B. Special Characteristics of Japanese Firms in Requirements Definition and Assessment of Trust Management

### 1) Special characteristics of the Japanese firms in comparison with the U.S. firms

The information system development and management model, including the requirements definition, in the Japanese firms can be extremely difficult because of the following:

- In the Japanese firms, the interests of the stakeholders are intricately intertwined in the requirements definition process, and it is more difficult to collect opinions and agree in the Japanese firms than the U.S. firms.
- The waterfall method that many Japanese firms use cannot remove an effect in the quality, cost and delivery caused by the change of requirements in the following processes. Like this, it is indispensable for determining the requirements in the requirements definition process, and it is more difficult to do so in the Japanese firms than the U.S. firms.

### 2) Special characteristics of the Japanese firms and necessity of trust management

In order to optimize the requirements definition process in the Japanese firms while taking into account their special characteristics in the requirements definition, trust management may be needed to optimize the requirements definition by increasing trust between the stakeholders.

## VII. CONCLUSION

The interests of many stakeholders for the IT system construction in the Japanese firms are intricately intertwined, so that it can be clearly said that the IT system development project indicates “the situation that social uncertainty exists”.

The quality of information system is highly expected to improve in the Japanese firms and most of them use the construction method (Waterfall) with the precondition of keeping the consistent requirements, which causes finally troubles due to unclear customer needs.

On the other hand, the number of stakeholders in the U.S. firms is limited and a few conflicts of interests are considered between them. In other words, it can be said that “the social uncertainty does not exist”. As to the expectation of IT system quality to be improved, most of the U.S. firms use the construction method (Agile) with the precondition of keeping the inconsistent requirements and they can cope flexibly with the change of requirements.

In conclusion, it can be said that the trust management using “trust” between the stakeholders to overcome the difficulty of requirements definition is higher in the Japanese firms than in the U.S. firms; it is more effective and necessary to optimize the requirements definition in the information system development of Japan where a great effect is made by the change of requirements and the social uncertainty exists in the information system construction project.

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