

Software Engineering Center and Fujitsu's SEC Contributions

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The Software Engineering Center (SEC) was established in the Information-Technology Promotion Agency (IPA) by the Ministry of Economy, Trade and Industry (METI) in October 2004. The SEC has started activities to improve the competitiveness of the software industry in Japan, facilitated software development technology, contributed to international standardization activities, and developed human resources in software. "SEC activities cover research in software engineering for enterprise and embedded systems and practice in advanced software development projects where results from the research activities are investigated via collaboration among industry, academia, and government" (quote from the SEC Web page). As one of the leading companies in the Japanese software industry, Fujitsu has been playing a major role in these activities and playing a major role since the SEC's establishment. This paper describes the activities of the SEC and Fujitsu's SEC contributions, focusing on the SDAS technology for enterprise systems.

1. Introduction

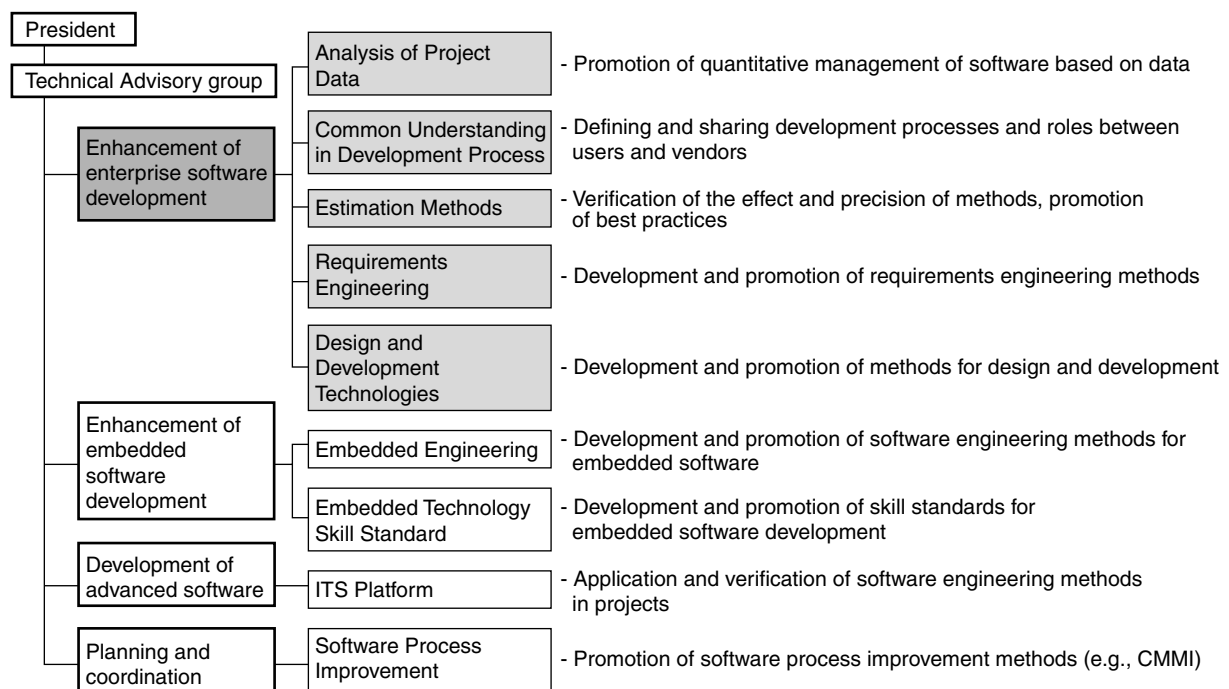
The Software Engineering Center (SEC) was established in the Information-technology Promotion Agency (IPA), an independent administrative agency, with two major purposes: to enhance software development capabilities and improve the competitiveness of Japanese software. At the same time, the SEC started the Development Capability in Enterprise Systems activity group,¹⁾ the aim of which is to create software for enhancing industrial competitiveness.

The results of software development in enterprises systems are often unsatisfactory on both the developer and user sides. One of the reasons for this is the difficulty in defining the roles of developers and users. The boundary between the two parties is often vague and lacks a common measure.

In order to improve this situation, the Development Capability in Enterprise Systems group has been working in five task forces

(**Figure 1**). The names and activity areas of these five are as follows:

- 1) Analysis of Project Data
Sharing price quotations by way of project statistics and pursuing engineering approaches based on quantitative data.
- 2) Estimation Methods
Demonstration of the effects, precision, and other information about modeling approaches to estimation.
- 3) Common Understanding in Development Process
Reduction of project failures by sharing life-cycle tasks for people involved in software and systems.
- 4) Requirements Engineering
Research and studies in the field of requirements engineering.
- 5) Design and Development Technologies
Research and studies regarding design and development technologies.



ITS: Intelligent Transport Systems

Figure 1
SEC activities and task forces.

In this paper, we describe the activities of the first three task forces, focusing on their achievements in fiscal 2004, the role of Fujitsu in these activities and related internal activities at Fujitsu.

2. Analysis of project data

From October 2004 through March 2005, the Analysis of Project Data task force made a statistical and analytical study based on more than 1000 items of data on development projects that were collected from 15 major IT companies in Japan. The task force published the “Software Development White Paper, 2005”²⁾ in May 2005 as a result of this activity.

The most remarkable characteristic of this activity is that the task force performed the first full-fledged study and analysis in Japan using more than 1000 items of data on project results in software development. IT companies conduct this type of research, but only for limited purposes such

as internal productivity improvement and quality measures to evaluate subcontractors. The statistical analysis by the task force, on the other hand, was performed based on a single criterion shared by 30 experts from industry, academia, and government. This was an epoch-making event in the history of software engineering in Japan.

However, because the data was collected over a short period, and for other reasons, the data was mainly collected from relatively small projects (8 out of 10 data items were collected from projects of less than 100 person-months), and the sampling of large-scale projects was insufficient. For this reason, in fiscal 2005, the task force strengthened its activities by quantitatively widening the data range and conducting in-depth qualitative analyses.

3. Estimation methods

The Estimation Methods task force surveyed and analyzed the estimation approaches (best

practices) in Japan and published a booklet containing the key points for estimation in May 2005.

The booklet, “Recommendation to do quantitative estimation for IT users and vendors — Essential points to improve estimation accuracy —,”³⁾ is intended as an introductory book that 1) sets levels for vendors and users so they can understand the importance of estimation and improve their capabilities and 2) enlightens the management layer. The booklet covers seven points regarding estimation:

- 1) Timing and risk of estimation
- 2) Relationship between estimation and contract
- 3) Clarification of estimation range and estimation procedures
- 4) Organizational efforts for estimation
- 5) Reciprocal checks by multiple estimations
- 6) Variance analysis of estimation values and actual values
- 7) Structure, division of roles, and corporate culture

Among these, 1) and 2) describe to what extent, based on the estimation timing, an estimation can be accurate and how the risk of estimation can be reduced to an appropriate point based on the timing and form of the contract.

The Estimation Methods task force has been analyzing the characteristics of successful cases in Japanese companies based on the guideline described above and has adopted the essence of the analysis results and published the “Software Development Estimation Guidebook — Implementation of quantitative estimation by both IT customers and suppliers — ”⁴⁾ using advanced methods, for example, CoBRA and OSR⁵⁾ in collaboration with Fraunhofer IESE (Institut Experimentelles Software Engineering)⁶⁾ in Germany.

4. Common understanding in development process

In May 2005, the Common Understanding in Development Process task force published a

booklet entitled, “Assuring Requirement Quality with Management Commitment — Nuts and bolts of upper stage processes — ,”⁷⁾ in the hope of providing common rules for developers and user companies.

The task force decided on the following five principles when developing the rules in this booklet:

- 1) Quality requirements before development

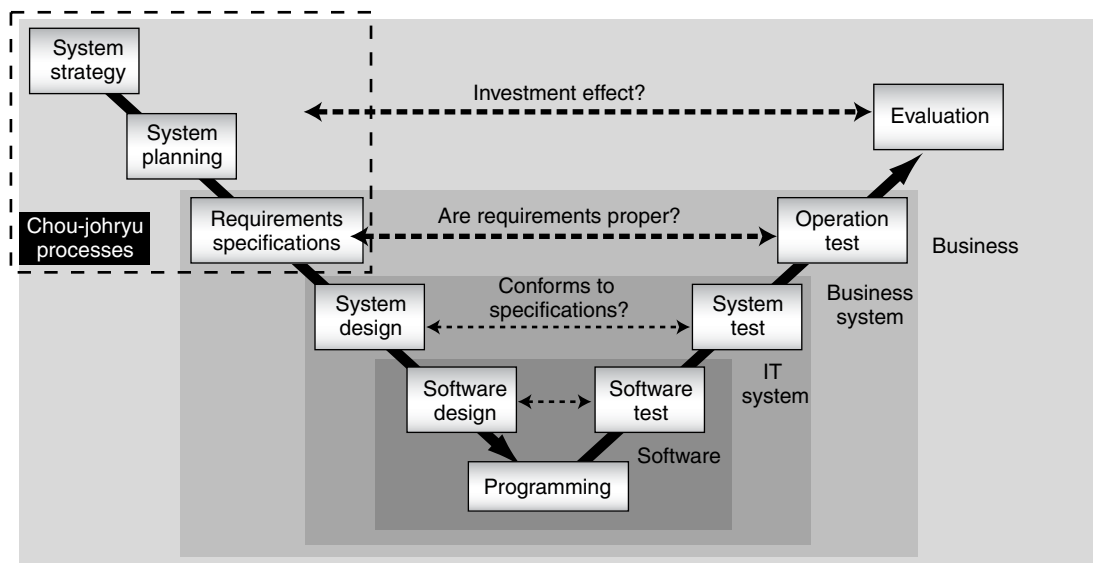
As shown in **Figure 2**, problems caused by the lack of definition of requirements in the early phases are not identified until the operation test phases. This is partly because business divisions tend to become disconnected from development work after the requirements definition phase. Discrepancies between the requirements and the developed software are found only after the operation test phase, causing a considerable loss of time and resources. The major sources of system development failures are the processes in the very early phases (i.e., phases before the requirements definition phase). These processes — called the “chou-johryu” processes — are the processes within the dashed rectangle in Figure 2. Therefore, the goal of these efforts is to solve problems that occur in chou-johryu processes.

- 2) Rules shared by IT vendors and user companies

Considering that the fundamental factor is the inadequate definition of requirements, it is difficult to cut off this “negative chain.” To achieve this, the task forces include representatives from user companies such as Tokio Marine & Nichido Systems Co., Ltd.; Tokyo Electric Power Company; Tokyo Gas Co., Ltd.; Shimizu Corporation, Recruit Co., Ltd.; and the Japan Users Association of Information Systems (JUAS). The booklet takes the form of a joint message sent from user companies, vendors, government, and academia.

- 3) Role of top management

These days, the negative aspects of the saying “A system risk is a management risk” tends to be in the forefront, but the true objective in introducing IT to management is to use it as an



Source: Assuring Requirement Quality with Management Commitment —Nuts and bolts of upper stage processes —⁷⁾

Figure 2
Processes and their interrelations.

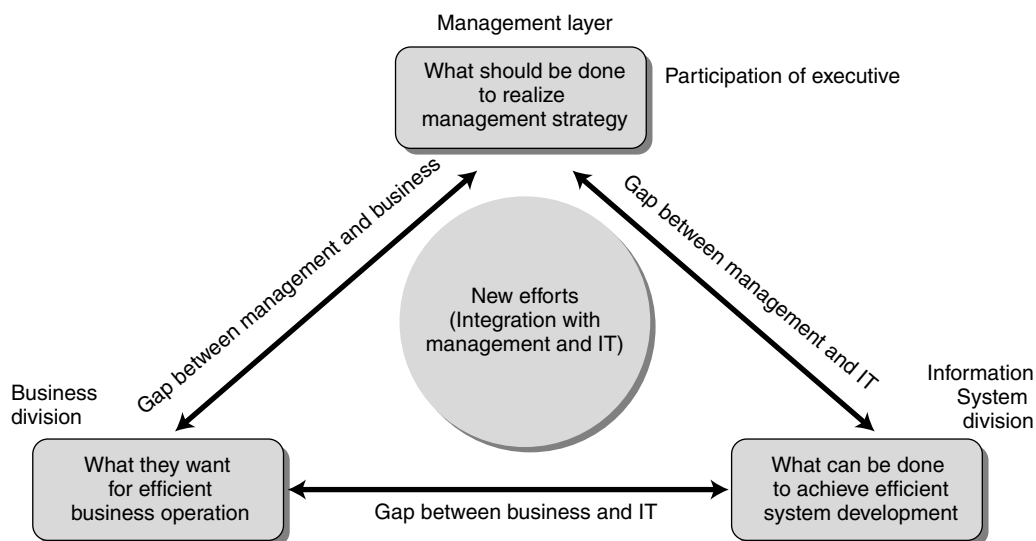


Figure 3
Significance of management's participation.

aggressive business tool. In other words, in terms of return on investment (ROI), management is required to play an important role by balancing what they want (business division) with what can be done (IT department) and deciding what should be done to realize their management strategy (**Figure 3**).

4) Definition of roles and responsibility

In the phases before requirements definition,

the most important point is to clarify the roles of the participants and share mutual responsibilities. Indeed, the importance of early phases has been pointed out repeatedly, but the most significant points — who does what and who is responsible for what — have remained unclear. In the task forces, we delved deeply into this issue and created process definitions and a matrix of roles and responsibilities (**Figure 4**). One

Division, etc./Roles		Definition of requirements	
Management layer	CEO	Enterprise requirements definition	Business system requirements definition
	Executive officers		
Business division	Division chief		
	Business promotion		
	System promotion		
	Affiliate		
Information System division	Division chief		IT system requirements definition
	System development		
	System affiliate		
Vendors	Contractor vendor		
	Outsourcer		
	Subvendor		

Source: Assuring Requirement Quality with Management Commitment —Nuts and bolts of upper stage processes—⁷⁾

Figure 4
Roles and responsibilities.

characteristic of this matrix is that there is no definition of requirements in the vendors' space. In other words, we have identified the broad principle that user companies should basically create definitions of not only enterprise requirements and business requirements but also IT system requirements by themselves. Even if they enlist the help of vendors to create these definitions, user companies should be responsible for making decisions about requirements.

5) When will requirements be clarified?

In connection with the basic stance described in 4) above, we should consider not only the outputs that user companies should create, but also the range of system-development responsibilities they should entrust when they enlist the help of vendors. Also, we should consider non-functional requirements (performance, reliability, etc.) and business function requirements.

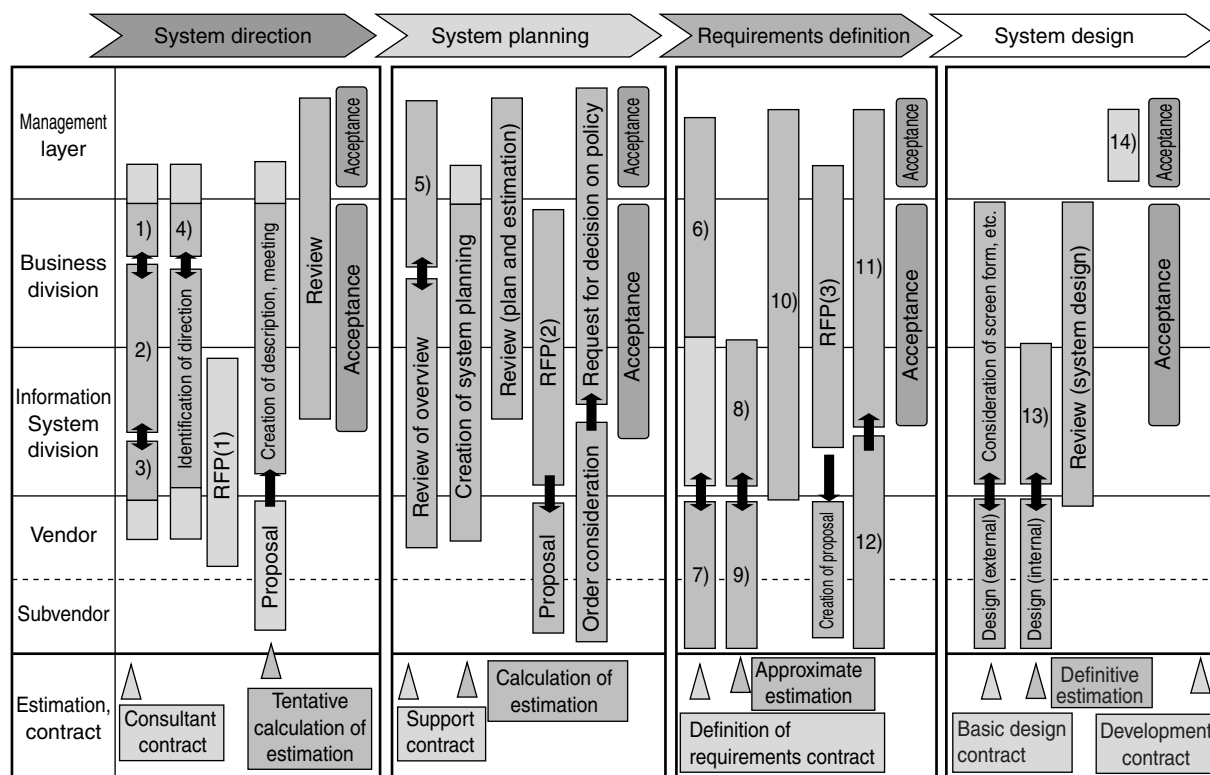
On the other hand, in relation to the definition of requirements, we have also investigated the role of contracts, which often cause problems. Our intention is that user companies and vendors share the task of clarifying the relationship between the concreteness of requirements and the estimate level and seek contractual coverage in

accordance with the precision. In this investigation, together with the achievements of the Estimation Methods task force described in the previous section, we have defined the relationships among operations in each process, the sharing of roles, and the estimate level (**Figure 5**).

To sum up the points for defining requirements sufficiently in the chou-johryu processes and to guide system developments to success through this investigation, the following five requirements are essential.

- 1) Active participation of the management layer (clear decision-making and responsibilities)
- 2) Consensus-building among stakeholders in the management layer, business division, and information system division
- 3) Common values for users and vendors and cooperation between these two groups
- 4) Efforts to create a full-length "final portrait" of systems in terms of business and IT
- 5) An awareness that customers should make the final decisions about specifications by themselves

We should keep in mind that awareness of roles and responsibilities determines whether



Source: Assuring Requirement Quality with Management Commitment —Nuts and bolts of upper stage processes—⁷⁾

- | | |
|--|---|
| 1) Policy/problem | 8) Definition of system requirements |
| 2) Business consideration | 9) Creation of definition of system requirements |
| 3) Identification | 10) Review (definition of requirements and approximate estimation) |
| 4) Consideration between divisions | 11) Request for decision on execution (definition of requirements and estimation) |
| 5) Consideration between divisions | 12) Meeting and order consideration (definition of requirements) |
| 6) Requirements definition of business and business system | 13) Design consideration |
| 7) Creation of definition of business requirements | 14) Estimation description |

Figure 5
Roles and levels of estimations in beginning processes.

these requirements are met.

In addition, the fiscal 2005 themes of the task forces include 1) the connections between the detailed description of keywords and case examples for each keyword in the booklet and 2) a summary of the principles, code of conduct, and practice methods (example cases, essence, methods, techniques, etc.) that upstream processes should conform to.

5. Fujitsu's efforts

Fujitsu has sent two committee members to the three task forces described above, both of whom are playing a central part. One serves as the task force leader in the Common Understand-

ing in Development Process task force. Fujitsu has also provided data from nearly 100 projects for result data collection by the Analysis of Project Data task force and proposed the advanced function scale estimation method in the Estimation Methods task force. Moreover, Fujitsu actively advocated the promotion in industry of the booklet, "Assuring Requirement Quality with Management Commitment," for example, in a June 2005 lecture at the SEC Forum and in July 2005 lectures at Fujitsu Forum 2005 and the Japan Information Technology Services Industry Association (JISA) Symposium.

At the same time, on July 12, 2005, Fujitsu offered companies the Service-Oriented Architec-

ture (SOA) system,⁸⁾ which provides solutions and products for optimizing business processes and IT systems in each division, including the management layers of those divisions. The key concepts of this system are “speedy management” and “field innovation.”

To see these solutions and products in relation to the task-force theme of requirements definition in *chou-johryu*, a business innovation consulting service and an investment-effect analysis (IT investing management) service are provided, mainly for the management layer, to facilitate identification of the business direction in the “system direction” and “system planning” processes shown in Figure 5. For the business division, we provide business data modeling to facilitate the pursuit of a system portrait and provide business process modeling to help visualize and improve business in the “requirements definition” process. Moreover, these two services cover each process necessary for each stakeholder in user companies, including the implementation basis (TRIOLE), middleware, and various services, which can serve as reference information when considering the system’s architecture and the feasibility study in the information system division.

6. Conclusion

The activities of the SEC, in collaboration with industry, academia, and government, have just entered the latter half of their second year. However, we feel that the unity of the participating parties has never been better in terms of achieving the goals of enhancing software development capabilities and improving the competitiveness of Japanese software. This uni-

ty is evidence of genuine concern for achieving these goals within the industry. Fujitsu will continue to actively participate in SEC activities to help establish a win-win relationship between user companies and vendors and make Japan a nation with a strong software industry.

References

- 1) Software Engineering Center (SEC), Information-Technology Promotion Agency (IPA), Japan: Software Engineering for Enterprise System. <http://www.ipa.go.jp/english/sec/first.html>
- 2) Software Engineering Center (SEC), Information-Technology Promotion Agency (IPA), Japan: Software Development White Paper, 2005. (in Japanese), Nikkei Business Publications, Inc., 2005.
- 3) Software Engineering Center (SEC), Information-Technology Promotion Agency (IPA), Japan: Recommendation to do quantitative estimation for IT users and vendors — Essential points to improve estimation accuracy —. (in Japanese), Ohmsha, Ltd., 2005.
- 4) Software Engineering Center (SEC) Information-Technology Promotion Agency (IPA), Japan: Software Development Estimation Guidebook — Implementation of quantitative estimation by both IT customers and suppliers —. (in Japanese), Ohmsha, Ltd., 2006.
- 5) CoBRA (Cost estimation, Benchmarking, and Risk Assessment), OSR (Optimized Set Reduction): Methods of cost estimation of software development developed at the Fraunhofer IESE. <http://www.iese.fhg.de/COBRA/index.html> and <http://www.iese.fhg.de/osr/>
- 6) Fraunhofer IESE, Kaiserslautern, Germany. Established in 1996. This is the leading competence center for applied research and technology transfer in experimental software engineering. <http://www.iese.fhg.de/>
- 7) Software Engineering Center (SEC), Information-Technology Promotion Agency (IPA), Japan: Assuring Requirement Quality with Management Commitment — Nuts and bolts of upper stage processes —. (in Japanese), Ohmsha, Ltd., 2005.
- 8) Fujitsu PRESS RELEASE. (in Japanese). <http://pr.fujitsu.com/jp/news/2005/07/12-2.html>



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