Research and Analysis of CMMI Process Improvement Based on SQCS System

Yinglan Fang¹, Bing Han², Weifu Zhou³
¹² North China University of Technology, Beijing, China
³ Jiaozuo Qianye Industry Cement Co. Ltd, Jiaozuo, China
*corresponding author, e-mail: jlufangyl@163.com

Abstract

Traditional software development methods have been unable to meet the software implementation quality guarantee with current cross-cutting and a variety of system features. Over the years using complex project, it continuously explore and in-depth study of the CMMI quality system application. The project thoughts are applied to the complicated software development process management and quality assurance. With new ideas and methods, it achieves effectively control to multi-dimensional and multi-level heterogeneous feature model system of the software engineering quality. So it can enhance software efficiency and quality of development. After the results analysis of implementation in recent years, the system has a certain degree of practicality, maneuverability and popularization.

Keywords: SQCS (software quality control system), quality system, software engineering, CMMI,

Copyright © 2012 Universitas Ahmad Dahlan. All rights reserved.

1. Introduction

In recent years, with the rapid popularization and development of science and technology, computer software technology as pillar disciplines of information technology has been constantly applied to various fields. At the same time information industry as the first productivity has gone deep into the political, economic, martial and other social fields, it led the social information construction. With the continuous expansions of the system functions and constant renovation of application technology in the development process, it made the area knowledge system more complex. The development process became more cumbersome and project management became more difficult, so that the software products can not be in accordance with the predetermined quality and progress, even in the world it once caused the "software crisis". How to ensure the software quality and how to effectively manage the software development process, it became one of problem that today's information industry must be solved.

The system is guided under the advanced CMMI system. It has chronically management to the software development process and deeply researched to quality control. Through specific software control flow, it attempt the software development and quality assure process becomes step-by-step, finally it provides a software management program. For the systems engineering, software engineering, software requirements, human resource management, product development, product integration and process improvement in the software development process, it built model. So the efficiency and quality of the software development process can be effectively protected and controlled.

2. Current Software Quality Control Deficiency

CMMI is the abbreviation of Capability Maturity Model Integration. It inherits the advantages of the CMM, uses for reference the advantages of EIA/IS731, IPD-CMM and etc, assimilated the characteristics of the TR15504 and integrated into a new theory to meet the ISO15504 international standard on software process improvement requirements. Its rigorous process management and strict process review reflected the guarantee for the software development quality. This reliability program involves every aspect of the development process, therefore it is inevitable that the whole process is procedures and establishes corresponding
information systems by means of information processing. It played a decisive role on the quality of software development. It guides the programmer engaged in the rational develop software and provides how to carry out the works management and risk control program in the software development process.

CMMI focus on process improvement and develop software maturity classification. By assessing the team’s software development capability is divided into a certain level, this level can be used as the basis of continue to the further step and specified direction to improve business management and software process improvement. CMMI is mainly used in two major aspects: ability assess and process improvement. Assess software maturity and ability can reference to project improve, it also select different difficult project according to the maturity level of each project group. In short, CMMI provides software development standardization process. At the same time through the effective implementation of the CMMI, it has ensured the quality of software development and improved enterprises competitiveness in the industry. The CMMI typical stage expression is shown in Figure 1:

![Figure 1. Stage CMMI Model Structure](image)

Stage model provides a proven process sequence. From basic management practices began to gradually increase the level of the path forward. Each level are the basis of next higher level. Its represent method makes twenty two process areas place in four levels, among seven process areas belong to the two level , eleven process areas belong to the three level, two process areas belong to the four level and two process areas belong to the five level. In continuous represent method, it makes twenty two process areas divide into four categories, including six engineering process areas, six project management process areas, five support class process areas and five process management class process areas.

Although CMMI has proven useful for many projects, there are still many problems in the multi-dimensional and multi-level heterogeneous model system development. Including structure, content and methods limits the improvement of the development process, and increase the system development process risk. Further to say, due to use these multiple models to train variety of roles , it need to effectively evaluate each process, and also improve the overall project management capabilities have to spend a lot of manpower and resources, so this multi-level model is difficult to be integrated into the heterogeneous model system.

3. Software Quality Control System Design
CMMI is a rigorous process management, it is special emphasis on the process assessment. From simple walkthrough to meeting review, it reflects mutual supervision and assistance between the various roles in the software development process, integrate resources to coordinate software development. Such reliability programs throughout every aspect of the
development process, so the procedures of this process is inevitable. By information processing means, it establishes corresponding information systems. This system not only need the guide various role what to do, but also make the project management become digital in order to achieve real-time control. In the whole CMMI Information systems implementation process, it produces large amounts data which can be used as a reference on the software development capability assessment, and statistic computing software development efficiency and project quality, but also it can be drawn from the same specifications of the software project budget costs.

The system is guided under the advanced CMMI system, through sampling and concluding various heterogeneous systems, it establishes quality control system that applies multi-level management and multi-dimensional assessment. the software development process is efficiently stage management and quality control, and through specific flow it makes software development and quality assurance process become step by step. In order to improve organizational processes, management product development, provide protection to publish and maintenance capabilities. It helps organizations objectively evaluate their own capacity maturity and process domain establishing priorities and the implementation of process improvement, process improvement. The system functional framework of the system is shown in Figure 2:

![Figure 2. System Functional Framework Figure](image)

3.1. Intelligent Workflow Engine

As the part of the application system, according to the difference of roles, labor division and conditions, the workflow engine provides core solutions scheme of decisive role transmission routing and content rating for the whole system operation flow. This system can flexibly configure business logic which accord with the current project based on system requirements. It has developed the program logic that meets the actual needs and ensures its stability, easy maintenance, and seeks modular and structured. So the application system has a powerful logic layer to ensure the normal flow of business.

Intelligent workflow engine of the system provides management to organizations, users, rights management, business process and roles task. It provides atomic workflow of the most basic way to achieve functions, it is shown in Figure 3. According to a specific project business processes combined to form a complete workflow control module, the core function has flow design, flow execution, flow control and thread scheduling, task assignment and notification.
As workflow electronic has greatly enhanced the system operational efficiency, solved the efficient problem of the various roles in the operation. It makes work-related business process have effective and uniform management, workflow approval opinions can integrated saves and pigeonhole. Through the adaptive flow fuzzy matching process model, it gets through open up the relationship between the various modules, and establishes an information network diagram. When using a point of information, all information relevant to the point with this information will extracted, and the information is not itself on the structure of the present, but according to the linkage effects of the business-driven model. When a business is driven, the other associated business will be driven up, center with it and provide it with the needed support and services. In other words, all the information scattered in different modules, they will be structure extracted when they needed.

Intelligent workflow engine with self-learning ability provides an efficient and flexible workflow-driven platform for the entire system. The user himself can define various process applications it needs. Based entirely on user needs, with a strong flexible definition, it can define flow, form, until the field. According to the different operation mode of different enterprises, the personnel with the appropriate permissions can process maintenance and custom and display with graphics. From created flow to pigeonhole entire tracking control, the superior may at any time approval underling request and provide the approval views so the secondary subordinates can make the appropriate decision-making.

```
input  | project team member | configure managers | project management committee | quality engineer | output

"project needs"  →  write "configuration management plan"

"configuration management plan"

→ approval "configuration management plan"

YES

→ create configure environment

NO

→ submit products

→ project team configure management training

→ identifies configure entry

→ approval work products

YES

→ create baseline

→ product release

→ project audit

"project quality report"

Figure 3. Workflow Engine Figure
```

3.2. Security Access Mechanism

The access control goal is to prevent unauthorized access to information system resources and prevent unauthorized use of information systems resources. With the increasing complexity of multi-level business processes, more and more people use the management system, then there is the safety problem which existed in the system. Because when a person who has not related to business make a mistake in non-management functions, the system will generates "dirty" data and may paralyze the whole system. Traditionally in order to improve system security needs, the system administrator set off user authority in order to achieve permissions control. So each user operate their own business according to different operating
privileges conferred by the system, but can not operate other functions. This makes different
groups maintain relative independence.

However, this solution is only applicable to small systems rights management, its main
drawbacks is the rights management personnel who are free to assign permissions to a role.
This system uses multi-level authorization idea make improvements, so that only high-level
personnel can assign his own permissions to other personnel who ruled by him. So that access
authorization control can not only control by role, but also according to actual needs and flexible
configuration complex control of cross-permissions by role. For the normal operation of the
entire system, it not only protects the system security, but also make the system rights
management becomes more orderly, structured and simplistic. Multi-level authorization rights
management entity relationship diagram is shown in Figure 4:

Although multi-level authorization rights management truly do system rights
management, but implementation is more complex and heavy workload than traditional access
management methods. In a single role or few circumstances roles it can use the former
approach. When the system is relatively large, involves a number of roles, permission to cross
between the role and requirement the safe the higher security, it should use improved multi-
level authorization rights management method to meet the system requirements.

3.3 System Efficiency Optimization

In the long-term use process, because system exists multiple project management data,
and each project contains the various stages data in the various processes, with the growing
amount of data, system’s large data will inevitably become bottlenecks that affect the system
efficiency. Simple and conventional single database and a full table make traverse database
queries inefficient. In order to improve performance and avoid the bottleneck, the system has
made the relatively independent table in logic store to a database, and used the cluster
strategies to distribute various databases on different servers. For the sake of improving e
iciency, the frequent operational data of the system is stored in high performance servers. At
the same time when the tables are designed, it estimates the table the number of records and
storage space according to the relevant business. It determines whether to split the table base
on the size of the table to. For the record very large table, if linear traversal is a more time-
consuming operation, the system will do hash processing to the table, so query it is faster than
the linear traverse. When the application performs a large amount data query and display, if it
do not paging query it will seriously affect the system efficiency. So in accordance with when it
need show the query record, the paging query SQL statement is as follows:

```
select top PageSize * from table where roweid not in (select top PageSize * (n-1) from table)
```

In which the PageSize is the amount of data which every time want to display, n refers
to the query number.

4. Conclusion

Use information technology is flow streamline of the process software. That is using
information technology tools manage the software development process. In this paper, it
combine advanced CMMI system thinking, exploration and research of long-term software
Engineering quality control. It summarizes a set of software quality control framework which adapt to multi-level, multi-dimensional heterogeneous model system. This framework has innovatively realized multi-dimensional systematic management from demand, design, development, defects, testing, evaluation, release. The effective management through the workflow engine makes the software process and software assurance becomes step by step. In order to consider the practicality of the system, expansibility and the reconstruction of the code, the system uses advanced three-layer, that is BLL, DAL, UI. Such design that divides by level not only improves the system code reuse, but also easy to maintain.

Software has been the rapid rise as an emerging high-tech industry. However, there is still a gap in terms of development capacity or management level and people's expectations. Especially behind the software project management restricted the play of development capabilities. The main reason is that software management of the development process is clearly insufficient. Therefore, using CMMI and other advanced methods which constantly improve the software process is a wise path. After the implementation of the effect in recent years, the system has a certain degree of practicality, feasibility and promotion.

References