Pisco Med Publishing

Original Research Article

Software Quality Management of Small Outsourcing Companies Based on CMMI Model

Chuang Chen

University of Shanghai for Science and Technology, Shanghai, 200093, PR China

Abstract: The development of outsourcing companies is stimulated by the digital trend of the industry and the penetration of digital technology.They are striving to adapt to industry application scenarios,and improving software quality has become the focus of outsourcing companies.This paper takes small outsourcing companies as the research object,adopts the Capability Maturity Model Integration(CMMI)model to conduct a comprehensive design for continuous improvement of the outsourcing company's business processes,and evaluates software quality maturity capabilities through expert scoring methods,and selects some key areas as indicators to build the model and the maturity ability level is determined.Taking the general business process of the small outsourcing company as a benchmark,comprehensively evaluate its main key domain indicators,and analyze the improved maturity level as IV,which provides a constructive basis for the small outsourcing company to further improve the software quality.
Keywords: Outsourcing company; Software quality; CMMI model

1. Introduction

In the era of digital transformation,the software industry is booming.In order to reduce the development cost of software projects,a new strategy—outsourcing model has emerged.From the China Service Outsourcing Development Report 2019,it can be known that the number of outsourcing companies in China continues to increase.The development of new technologies has prompted people to put forward higher expectations for software quality,and service outsourcing must adapt to the application scenarios of the industry. However,agile development and CMMI certification have promoted the upgrading of the outsourcing industry[1],Rian Permana et al[2] evaluated the software process of the CMMI framework and prioritized the execution of key areas,which can effectively improve software quality management and improve the hidden dangers of software quality problems.

Based on the in-depth study of the CMMI model,this article optimizes the business process of small outsourcing companies,and uses expert scoring methods to determine the maturity level of the process after the optimized process design,as the goal of process optimization.The application of the model will help small outsourcing companies optimize their software quality management business processes and lay a foundation for undertaking larger-scale outsourcing projects.

2. Problems in software projects of small outsourcing companies

In the research of this project,the following problems mainly exist in the implementation of the software project.First,unclear requirements,frequent changes,lack of document management,etc.will lead to problems such as rework and project delays.Second,there are phenomena such as lack of communication and lack of focus on overall coupling in the coding stage,resulting in weak correlation between functions.The uneven development level of members will affect the quality of the project.The progress of the project is entirely dependent on the person in charge for communication and coordination,and it is easy to lose sight of one another.Third,the delayed delivery in the coding phase will result in the compression of the testing phase,which is likely to cause dissatisfaction and conflicts among the testing department.The testing method is relatively simple,mostly through manual,lack of technical software evaluation[3].

3. Software development process improvement plan design

CMMI is a quality management standard,a model that guides the software to gradually mature.It is divided into five levels:initial level,managed level,defined level,quantitative management level,optimized management level,and progressive levels.The maturity of the software process is getting higher and higher.

With the goal of improving software quality,review is added in the requirements phase,and requirements documents are written for use in the development phase,so that document resources can be traced,and at the same time,it is convenient for later testing to develop test cases and standardize requirements changes.During the coding phase,we communicate regularly and develop and design functions in parallel.At the same time,we promote Personal Software Processes to continuously improve personal development level,and strive to reduce error rates and improve overall quality.In the testing phase,integration testing is carried out,acceptance standards are established,defect management is established,defects are classified and effectively tracked,and testing is carried out throughout the entire coding process.The improved business process is shown in Figure 2.

doi: 10.18282/l-e.v10i3.2396

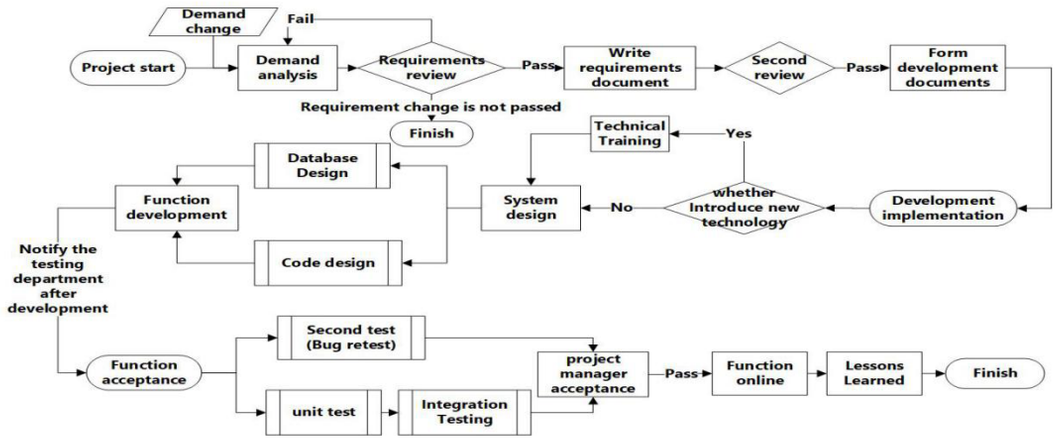

Figure 2 Diagram of business process improvement

4. Model construction and index selection

In the actual evaluation process,establish an index system with develop-nodes as the first-level indicators and quantitative work in each node as the second-level indicators,as shown in Table 1.

Table 1 Software Quality Management Evaluation System

Serial number	Target layer(T)	First level indicator(FI)	Secondary indicators(SI)
1	Small outsourcing company management maturity（M）	Requesting research（M1）	Demand management（M11）
2			Configuration management（M12）
3		Development implementation（M2）	Project Plan（M13）
4			Code design（M21）
5			Database Design（M22）
6			function development（M23）
7			Risk Management（M24）
8		Function test（M3）	QC（M25）
9			Unit Test（M31）
10			Integration Testing（M32）
11			Function maintenance（M33）

Experts with development experience are invited to score the indicators according to the grading principle of analytic hierarchy process,and build an indicator matrix,that is,if factor A is equal to factor B,the score is 1,if it is slightly more important,the score is 3,the more important is 5,and strongly important is 7.Calculate the weights by column,and then take the arithmetic average of each index,construct a multi-level fuzzy evaluation matrix[4]and associate it with the maturity level,and finally obtain the quality maturity evaluation value.

Table 2 Judgment matrix of first-level indicators

	M1	M2	M3
M1	1	1/5	1/3
M2	5	1	5
M3	3	1/5	1

Table 3 Calculation results of the weights of first-level indicators

	M1	M1	M1	Weights(W)
M1	0.1111	0.1429	0.0527	0.1022
M2	0.5556	0.7143	0.7895	0.6865
M3	0.3333	0.1429	0.1578	0.2113

Based on the CMMI level,each indicator is divided into five levels I-V,and the corresponding scores are 1-5 points,that is,the higher the level,the higher the score.Invite three experts with develop experience to judge and score the established index system.If the index meets the conditions of level I,score 1 point,and so on,and calculate the proportion of each level after aggregating,as shown in Table 4.

Table 4 Indicator weights and expert scoring statistics

T	FI	W	SI	W	Scoring index				
					1	2	3	4	5
M	M1	0.1022	M11	0.2829	0.0000	0.3333	0.6667	0.0000	0.0000
			M12	0.2357	0.0000	0.6667	0.3333	0.0000	0.0000
			M13	0.4813	0.0000	0.3333	0.3333	0.3333	0.0000
	M2	0.6865	M21	0.0531	0.0000	0.6667	0.3333	0.0000	0.0000
			M22	0.0573	0.0000	0.6667	0.3333	0.0000	0.0000
			M23	0.1878	0.0000	0.3333	0.3333	0.3333	0.0000
			M24	0.3615	0.0000	0.0000	0.6667	0.3333	0.0000
			M25	0.3405	0.0000	0.0000	0.3333	0.3333	0.3333
	M3	0.2113	M31	0.4403	0.3333	0.3333	0.3333	0.0000	0.0000
			M32	0.3267	0.0000	0.0000	0.6667	0.3333	0.0000
			M33	0.2352	0.0000	0.0000	0.6667	0.3333	0.0000

Taking the multi-level fuzzy evaluation matrix as the benchmark,Calculate the matrix product of the secondary index and the proportion of expert scores.Take the three second-level indicators of the first-level indicator M1 as an example,use the ordinary matrix product algorithm to calculate the score value,and P is the matrix established by the score ratio corresponding to M11,M12,and M13,calculate $M_1 * P$

$$=[0.2819 \quad 0.2357 \quad 0.4813]_{\times}\begin{bmatrix}0.0000 & 0.3333 & 0.6667 & 0.0000 & 0.0000\\ 0.0000 & 0.6667 & 0.3333 & 0.0000 & 0.0000\\ 0.0000 & 0.3333 & 0.3333 & 0.3333 & 0.0000\end{bmatrix}$$

$$= [0.0000 \quad 0.4118 \quad 0.4276 \quad 0.1604 \quad 0.0000]$$

In the same way,calculate the score value of the secondary index of M2=

$$[0.0000 \quad 0.1362 \quad 0.4539 \quad 0.2966 \quad 0.1135]$$

In the same way,calculate the score value of the secondary index of M3=

$$[0.1468 \quad 0.1468 \quad 0.5214 \quad 0.1873 \quad 0.0000]$$

Calculate the score value of the first-level indicator in the same way,matrix P' is the matrix established by the score value of the secondary index,calculate $M * P$

$$= [0.1022 \quad 0.6865 \quad 0.2113] \times \begin{bmatrix} 0.0000 & 0.4118 & 0.4276 & 0.1604 & 0.0000 \\ 0.0000 & 0.1362 & 0.4539 & 0.2966 & 0.1135 \\ 0.1468 & 0.1468 & 0.5214 & 0.1873 & 0.0000 \end{bmatrix}$$

$$= [0.0310 \quad 0.1666 \quad 0.4654 \quad 0.2596 \quad 0.0779]$$

Multiply the final score of the first level indicator by the maturity level,calculate the maturity evaluation value MV,calculate MV

$$= [0.0310 \quad 0.1666 \quad 0.4654 \quad 0.2596 \quad 0.0779] \times [1 \quad 2 \quad 3 \quad 4 \quad 5]^T = 3.1883$$

Judge the maturity level of MV based on the original maximum membership degree.The improved process quality management maturity level is IV,indicating that the small outsourcing company can achieve a quantitative level of software project development according to this improved process.

5. Conclusion

This article takes small outsourcing companies as the research object,carries out a comprehensive design for continuous improvement of business processes based on the CMMI model,and continues to promote the improvement of the PSP. The software quality maturity capability is evaluated by expert scoring and other methods.The quality maturity evaluation value is calculated by the fuzzy evaluation method to be 3.1883,that is,the maturity level is Level IV,indicating that the company's management has reached the quantitative management level,and it is a small outsourcing company.The next process improvement goal provides strong support.

References:

[1] Shang Qingchen(2021).The new characteristics and countermeasures of the transformation and upgrading of my country's service outsourcing industry under the new situation[J].Economic Review,(07):94-101.

[2] Permana R,Budiardjo E,Ferdinansyah A(2019).Assessment of Software Engineering Process Based on CMMI-QFD Framework,2019[C]. ACM.

[3] Ding Ning(2021).Quality Control Analysis of Software Testing Process[J].Network Security Technology and Application,(05):65-66.

[4] Chen Yang,Miao Tong,Ma Xin(2020).Research on Performance Evaluation of Pension Institutions Based on AHP Fuzzy Comprehensive Evaluation Method[J].China Prices,(05):90-93.