Development of a quantitative model of evaluation of maturity level of processes of software projects

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Abstract

The developed model allows for quantitative assess the maturity level of processes of software projects and to identify priority areas for the development of software project processes. The model was tested on 10 companies. Spent in the company survey allowed us to estimate the level of maturity, to collect data on deviations in time and the cost of the project and build the equation of dependence of deviation from the measured level of maturity. This equation can be used by companies to predict the variation of key indicators of the project when changing the maturity of software processes.

Keywords: quantitative model, maturity level, software projects, development of a quantitative model

1 Introduction

Maturity of project management can be distributed regarded as a tool for development the company through continuous improvement project management processes. For objective assessment of the company, other words, to assess the level of maturity developed

Various models, which are based on the task of measuring progress at the momentlevel of maturity and preparation of detailed recommendations on which areas of knowledge and phases of the project is necessary to improve the company's processes. Some models allow us to estimate the financial benefits of the transition to a higher maturity level of project.To assess the maturity of existing quantitative and qualitative methods, most of which are five levels: 1 – chaotic, 2 - informal, 3 - partial formalization, 4 - complete formalization, 5 - improvement. All models assess the level of maturity determine what processes need to be improved in the field of project, but in contrast to the qualitative, quantitative methods allow us to establish which areas of priority [1].

As part of the work performed are considered high-quality models: CMM1 (assesses the level of maturity for software developers); COBIT2 (an open standard for IT management); these models are based on the verification of the presence or absence of certain characteristics processes, but does not provide a quantitative assessment of the compliance procedure. In addition, the evaluation result is not reflected in the presence of higher-level process of maturity that is also an essential shortcoming qualitative model.

Despite its flaws, quality models allow us to estimate at what stage of development of is an organization at the moment, as well just analyzing what processes are at the lowest level, to understand what the requirements model should be provided in order to achieve higher level. However, with these models is difficult to determine the vector of development of software project in the company [2, 3].

2 Main content

The developed model has 5 levels of maturity. Each level used by organizational measures and describes the result of their impact on the project (Table 1). The model consists of questions relating to 8 software development knowledge areas: content, time, value, quality, human resources, communications, risk and procurement; and five project phases: Initiating a Project, Analyze, Execution, Control and Closing a Project. Questions contain 5 options where each option corresponds to a certain level of maturity from 1 to 5.

To calculate the final mark of maturity in the model used an average of the results of answers to all questions of each of the eight areas of knowledge and the five phases.

TABLE 1

Maturity Models	Description
Initial	The processes are usually ad hoc and chaotic. The organization usually does not provide a stable environment. Success in these organizations depends on the competence and heroics of the people in the organization and not on the use of proven processes.
Managed	The process discipline reflected by maturity level 2 helps to ensure that existing practices are retained during times of stress. When these practices are in place, projects are performed and managed according to their documented plans.
Defined	The processes are well characterized and understood, and are described in standards, procedures, tools, and methods. An organization has achieved all the specific and generic goals of the process areas assigned to maturity levels 2 and 3.
Quantitatively Managed	The process performance are established and used as criteria in managing processes. Quantitative objectives are based on the needs of the customer, end users, organization, and process implementers. A quality and process performance is understood in statistical terms and are managed throughout the life of the processes.
Optimizing	The processes are continually improved based on a quantitative understanding of the common causes of variation inherent in processes.

3 Example of questions

Question 1.
Whether the project functions of the quality control requirements of the customer in the project objectives?

Answers:
1. The function of quality are not used
2. In managing customer requirements are used mapping customer requirements and objectives of the project.
3. In large projects the four-level model for small single-level.
4. The function of quality are used
5. After each project template quality function is updated.

Question 2.
Is there any quality assurance program of the project?

Answer:
1. Quality is not monitored
2. The quality is planned
3. The program is created only for large projects
4. There is a template programs and establishing procedures for its adaptation.
5. There is a template programs and establishing procedures for the adaptation, which is constantly being improved.

Question 3.
How do you monitor the cost of the software projects?

Answer:
1. The cost is not monitored.
2. Cost is controlled by a manager
3. On large software projects use control procedure cost of work performed.
4. There is a procedure for monitoring the value of work performed and analysis of control events.
5. There is a procedure for monitoring the value of work performed and analysis of control events.

TABLE 2

The range of mean scores	Assessment of the level of maturity
1 to 2	Low level
2 to 3,5	Middle level
3,5 to 5	High level

Depending on the qualitative assessment of a company can take the following actions:

TABLE 3

Maturity level	Recommendations
Low level	Create a list of processes. Document them and implement standards for their execution
Middle level	Spend the harmonization process execution to introduce a system of quantitative indicators
High level	You can invite Western companies to assess, but the pre-adapt their terminology to western terminology translation table or make one system to another system of terms

Analysis of the results showed that none of the companies surveyed did not reach the fifth level of maturity, but C9 and C10 companies meets the third and fourth level of maturity, which is also the highest, while the company C3 level of maturity in all fields of knowledge is the initial. Table 3 shows the results of the phases of the project, which correlate with the results of Table 2: C9 and C10 Companies also have a fairly high level of maturity phase, and the company C6 initial level. For other companies the level of maturity phase of the project is between the initial and the level of individual planning [4, 5].

TABLE 4 The result of evaluating the level of maturity (by the areas)

Area of expertise	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Content	1,34	1,58	1,00	2,57	2,91	1,53	1,53	1,53	3,53	3,49
Time	1,27	1,76	1,21	1,77	2,27	1,27	1,27	1,27	2,50	3,27
Value	1,29	1,33	1,29	1,69	2,29	1,29	1,29	1,29	3,29	3,29
Quality	1,00	1,23	1,00	2,00	2,85	1,00	1,00	1,00	3,00	2,00
Human resources	1,57	1,67	1,35	2,67	2,85	1,67	1,58	1,67	3,67	2,67
Communications	1,78	1,50	1,00	2,50	2,50	1,50	1,50	1,50	4,00	3,50
Risk	1,10	1,00	1,00	2,30	3,00	1,73	1,38	1,00	3,85	4,00
Procurement	1,24	1,00	1,00	1,88	2,00	1,68	1,00	1,00	1,00	3,00

TABLE 5 The result of evaluating the level of maturity (by the processes)

Processes	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Initiating	1,72	1,58	1,00	2,32	2,32	1,00	1,58	2,00	3,00	3,30
Analyze	1,67	1,67	1,27	2,67	2,38	1,67	1,22	1,38	3,67	3,67
Execution	1,58	1,50	1,30	1,50	2,75	1,50	1,50	1,65	3,50	3,75
Control	1,40	1,60	1,38	2,00	2,00	1,00	1,32	2,00	3,50	3,68
Closing	1,64	1,00	1,00	2,00	2,48	1,00	1,78	1,30	4,00	3,83

4 Conclusion

The main purpose of the work described in this paper was to demonstrate the capability of automatic classification of maturity levels based upon some characteristics of the software engineering processes used by an organization. Thus, the developed quantitative model allows evaluating the level of process maturity, identifying areas for development management, to predict the success of the project. But any company would be interesting to assess their financial benefit from the transition to a higher level of maturity. And finally, the model can be used for passing information about particular aspects of the software engineering processes, both within and among software organizations.

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