

Research on Project Development Key Risk Factors of Small and Medium-Sized Software Enterprises

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Abstract. On the basis of analyzing small and medium-sized software enterprise's characteristics of project development, proposing the project development key risk factors for small and medium-sized software enterprise, investigating the risk factors by questionnaires and expert interviews, using factor analysis method to analyze the questionnaire, and summarizing 5 classes 12 key risk factors in small and medium-sized software enterprise project development.

Keywords: Small and Medium-sized Software Enterprise, Development of Software Projects, Risk Management, Risk Factor.

1 Risk of Software Develop

1.1 Frequent Staff Turnover

The frequent staff turnover not only causes higher business costs but also increases risk of project schedule, and even leads to failure of the project.

1.2 User Requirement Is Not Clear

Small and medium-sized software companies tend to have received a certain range of projects; the salient features of such projects are for specific functional requirements and to meet certain product, so if the end product of such a project does not meet user's true needs, it can be said a failure of the project. Unfortunately, many users are not clear their own needs before they used the true product, moreover, software development company itself paid insufficient attention to the definition of demand, the reason is the conduct of the closed-door development, that leads the results also can not be imagined.

1.3 Changing in User Needs

As many fast-changing needs of software projects, even many projects have not been delivered, they can not meet user needs now. Many of the software development companies are lack of awareness about this, there is no limit to the relevant provisions in the contract, resulting in the risks of changes in demand can only be undertaken by the enterprises themselves.

1.4 Plan Is Not Well

Because most of personnel in the small and medium-sized software companies have multitask, the project management is not made by professional project managers, the project plan is often a simple division of total progress, and this segmentation process is almost non-consider the risk factors.

1.5 Insufficient Cost Evaluate

In order to get orders small and medium-sized software enterprises tend to deviate from the cost of making the offer which is lower than the actual estimated cost.

1.6 Lack of Experience of Risk Management

Most small and medium-sized software enterprises project development process is very immature, regardless of the use of the model of development process or project planning; there are almost no contents of risk management.

1.7 Low Software Process Maturity

Although the software process models have been proposed for many years, but the small and medium-sized software enterprises adopt the model for project management is not long, and many companies nominally got the CMM certification, the actual project management situation is far did not meet the requirements of the corresponding level.

1.8 Excessive Use of New Technology

For small and medium-sized software enterprises, the key technology is often mastered in a few hands, and because the software development industry has been in a rapid update of the state, people are always talking about the latest technology, the best architecture, the perfect solution for program, coupled with the software development industry professionals have passion for the pursuit of new things, new technologies and customers have blind worship for almost every project using the latest technology, which allows developers to adapt to the new software development and structure, it causes system-level problems almost impossible to be solved.

1.9 Lack of Internal Communication

In many small and medium-sized software companies the fact is that the staff structure has almost beyond recognition from the beginning to the ending of the development. This condition makes the new employee don't understand the development process made by different engineers. In other cases, in order to obtain orders the management department is lack of communication with the development department, resulting in project development failure.

2 Risk Factor Survey

This paper adopts methods of qualitative and quantitative to study the risk factor survey.

Firstly, qualitative research is based on interviews who are senior experts and managers working in related businesses in Xi'an Software Park, whose purpose is to identify specific risk factors for the implementation of staff. Meanwhile, in order to ensure the integrity of research, through the study of domestic and foreign software project risk summary of the relevant literature on software project risk factors for synthesis.

Secondly, quantitative research is based on questionnaire, the research objects are the practice of software project managers, following with evaluating and summarizing the identified software project risk factors, and then analyzing the internal relationships, revealing the laws of software project risk.

2.1 Risk Factors Assumptions

We can analyze the risk factors in small and medium-sized software enterprises of project development with software life cycle. Software life cycle includes requirements analysis phase, design and planning phase, coding phase, testing phase, the running phase, acceptance inspection phase and maintenance stage. The first four phases are software development phase, which is a critical stage for software risk. This paper analyzes project risk factors in the small and medium-sized software enterprises, mainly focusing on the first four stages of software life cycle. Meanwhile factor analysis for each stage of the same risk factors may exist, but their role is not the same. We summarize the project risk from previous research findings, and at the same time, list risk factors assumptions table of project development in small and medium-sized software companies, as shown in Table 1.

2.2 Experts Interview

Currently the software project risk research is still in its infancy, but foreign scholars on software project risk research findings can not properly reflect the development of China's small and medium software enterprise project features. Therefore, on the basis of preliminary studies, we primarily adopt telephone interviews and field interviews the two ways to study the problems of software project risk. By interviewing experts, managers and supervisors who are engaging in long-term software development project, know their software development experience, and understand their point of view. According to the views of experts, after adjustment, we draw the risk factor analysis table, as shown in Table 2.

Table 1. Initial Assuming Risk Factors

requirements analysis phase risk factors	A1 Insufficient communication with the users
	A2 Business managers lack support for the project
	A3 Organizational structure do not match project requirements
	A4 Lack of change management on demand
	A5 Poor quality of documents and low update frequency
	A6 Low level of technology
	A7 Unskilled business knowledge
	A8 Lack of project experience
	A9 Unreasonable information transmission within the team
design and planning phase risk factors	B1 Problems in software architecture
	B2 Low level of technology
	B3 Big changes in the project team members
	B4 No configuration management
	B5 Lack of cost and schedule control
	B6 Lack of change management on demand
	B7 Unreasonable system design
	B8 Organizational structure do not match project requirements
	B9 Business managers lack support for the project
	B10 Lack of project advocates and technical supervisors
	B11 No long-term planning and step by step fulfill
	B12 Unskilled business knowledge
	B13 Lack of project experience
	B14 Lack of project team cooperation
	B15 Unreasonable information transmission within the team
	B16 Insufficient communication with the users
	B17 Lack of quality standards
	B18 Neglected software quality supervision
	B19 No effective implementation of quality assurance system
	B20 Frequently change requirements planning
Coding phase risk factors	C1 Weak implementation of the simulation test
	C2 Lack of cost and schedule control
	C3 poor quality of documents and low update frequency
	C4 Lack of change management on demand
	C5 Organizational structure do not match project requirements
	C6 Problems in system interface
	C7 Lack of project advocates and technical supervisors
	C8 Big changes in the project team members
	C9 Unskilled technical knowledge
	C10 Lack of model testing
	C11 Development process is not standardized
	C12 Technical defects
	C13 Unskilled business knowledge
	C14 Lack of project advocates and technical supervisors
	C15 Lack of project team cooperation
	C16 Unreasonable information transmission within the team
	C17 Insufficient communication with the users
	C18 Neglected software quality supervision
	C19 No effective implementation of quality assurance system
	C20 Frequently change requirements planning
Testing phase risk factors	D1 Poor quality of documents and low update frequency
	D2 Organizational structure do not match project requirements
	D3 Not up to standard testing procedures
	D4 Lack of quality standards

	D5 Neglected software quality supervision
	D6 Technical defects
	D7 Defects in software architecture
	D8 Unreasonable information transmission within the team
	D9 No long-term planning and step by step fulfill
	D10 Lack of project team cooperation

Table 2. Risk Factor Analysis Table

requirements analysis phase risk factors	A1 Insufficient communication with the users
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design and planning phase risk factors	B1 Problems in software architecture
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	B7 Unreasonable system design
	B8 Organizational structure do not match project requirements
	B10 Lack of project advocates and technical supervisors
Coding phase risk factors	B13 Lack of project experience
	B16 Insufficient communication with the users
	B20 Frequently change requirements planning
	C2 Lack of cost and schedule control
	C4 Lack of change management on demand
	C7 Lack of project advocates and technical supervisors
	C9 Unskilled technical knowledge
	C10 Lack of model testing
	C17 Insufficient communication with the users
Testing phase risk factors	C18 Neglected software quality supervision
	C19 No effective implementation of quality assurance system
	C20 Frequently change requirements planning
	D1 Poor quality of documents and low update frequency
	D2 Organizational structure do not match project requirements
	D3 Not up to standard testing procedures
	D4 Lack of quality standards
	D5 Neglected software quality supervision

2.3 Questionnaire Distribution and Recycling

We designed two kind of questionnaires: written questionnaire and electronic questionnaires. The written questionnaire was distributed mainly in Xi'an, a total of 25 questionnaires were recovered, of which 21 were valid responses. The recovery of electronic questionnaires was a total of 110, of which 80 questionnaires were valid.

3 Identification of Key Risk Factors

Identification of key risk factors is to identify those who have a significant impact on project performance, which may lead to risk the consequences of the risk factors. Identifying key risk factors, namely through the analysis of the results of the survey,

identification of projects of small and medium-sized software enterprises which have a significant effect of risk factors.

This paper extracts common risk factors from 29 project development risk factors of small and medium software enterprises, using principal component factor extraction method, the information of the first five common factors are explained in Table 3.

Table 3. Total Variance Explained

Component	Initial Eigenvalues Total	% of Variance	Cumulative %	Extraction Sums of Squared Loadings Total	% of Variance	Cumulative %
1	6.9380	39.6237	39.6237	6.9380	39.6237	39.6237
2	4.3370	24.7691	64.3928	4.3370	24.7691	64.3928
3	2.0280	11.5821	75.9750	2.0280	11.5821	75.9750
4	1.2560	7.1732	83.1482	1.2560	7.1732	83.1482
5	0.7620	4.3519	87.5000	0.7620	4.3519	87.5000

Extraction Method: Principal Component Analysis.

The five common factor loading matrix made by SPSS is showing in Table 4.

Table 4. Common Factor Loading Matrix

	Component				
	1	2	3	4	5
A1	.766	1.884E-02	3.962E-02	.152	.138
A2	-5.792E-02	.054	.598	-.289	-.141
A3	.245	-2.873E-0	.7942	.126	.426
A4	.6193	-.330	.165	-.194	-.103
B1	4.479E-02	.608	-.310	-.118	.108
B2	.116	.532	-.145	-8.924E-02	7.737E-02
B3	-3.764E-02	.803	-.234	-.223	.230
B4	.220	.209	.750	.124	-.168
B5	.562	.196	.184	.114	.295
B6	.133	.534	.307	-.140	.149
B7	.311	-9.976E-03	.527	-1.829E-02	.268
B8	.122	.198	.108	.704	-.108
B9	.131	.532	-.328	.135	-.315
B10	.541	.112	-.273	.231	-.286
B11	.762	-.129	-.125	.372	.147
C1	.178	-.287	.732	.318	5.400E-02
C2	.664	.122	.179	.188	-.134
C3	-6.183E-03	-.121	.187	.587	.109
C4	-.199	.631	.104	.364	-9.061E-02
C5	.188	.662	.127	-.148	.268
C6	.632	-.194	.142	.238	-.161
C7	-9.831E-02	.334	.166	4.895E-02	.767
C8	.324	4.692E-02	.189	-.129	.601
C9	.732	.035	-3.625E-03	.200	-8.714E-02
D1	.119	.194	-.272	.117	.554
D2	.108	.259	.587	-.188	.100
D3	.125	.846	-8.690E-02	-.104	.151
D4	-.107	-7.538E-02	.205	1.759E-02	.512
D5	.211	-.121	.103	.161	.688

Extraction Method: Principal Component Analysis.

Based on table 4, We explore its inner contact and name each factor as the following factor name :

F1 common factor consists of three risk factors which are frequent changes to requirements planning; unclear statement of user requirement; and lack of communication with the user.

These three indicators are mostly around requirement risk which is a direct encounter with the description of the project requirement analysis, requirements definition, associated risks, so the risk factor is defined as the public requirement risk.

F2 common factor contains two risk factors which are the development process is not standardized and system testing has deficiencies. This common factor is defined as the risk of technical risk.

F3 common factor contains two risk factors, namely, system scalability and lack of maintenance; lack of cost and schedule monitoring. This risk factor is defined as the project implementation risk

F4 common factor contains two risk factors, namely, team members changed frequently, the responsibilities and the rights, are unclear; not timely delivering. This risk factor is defined as organization and management risk.

F5 common factor consists of three risk factors, namely, quality control aspects are ignored; quality assurance system has not been effectively implemented; and lack of quality standards. These three indicators is about quality risk management, so it is defined as the quality management risk.

4 Conclusion

In analyzing the characteristics of small and medium-sized software enterprises, based on the reference list of existing data of risk factors, used expert interviews and questionnaire survey method, to identify risk factors for small and medium software company's project development. We proposed user requirement risk, technical risk, project implementation risk, organizational and management risk and quality management risk, which are 5 classifications and 12 risk factors. These risk factors form the small and medium-sized software enterprises project development risk index system; it plays a fundamental role in project risk assessment and analysis for small and medium-sized software enterprise, and also supports risk management and control for small and medium software companies.

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