

MANAGEMENT OF RISK IN ENVIRONMENT OF DISTRIBUTED SOFTWARE DEVELOPMENT

Results of the Evaluation of a Model for Management of Risk in Distributed Software Projects

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Abstract: The objective of this article is to present the results of the evaluation of a model of management of risk for organizations that work with distributed software development – GeRDDoS. The model proposes the administration of risks properly aligned among the global unit (head office) and the distributed unit (branch) executor of the project, emphasizing that the success of the project depends on the success of the actions executed in both units. The model is an extension of the proposal of management of risks of the Software Engineering Institute – SEI, which shows a continuous and interactive process for the administration of risks, supported by coordination and communication process during the whole life cycle of the project. In that article the results of the application of the proposed model are presented, through the analysis of the results of a case study on the application of the model in a company for distributed software development located in Brazil.

1 INTRODUCTION

Countless organizations for several reasons (demand and costs, speed of responding to the market, market and global presence, multidisciplinary of the team, etc., according to Audy (Audy, 2008) and Agerfalk (Agerfalk, 2008)), they have been adopting the model of distributed software development (DSD) or global software development (GSD) searching for better results.

For some researchers: Herbsleb (Herbsleb, 2001), Kliem (Kleim, 2004), Damian (Damian, 2006), Agerfalk (Agerfalk, 2008), among others, if on one hand the adoption of the model of distributed projects brings better results, on the other hand it introduces in the software development environment, new variables which can become sources of new problems - risks.

In the context of DSD, according to some authors: Prikladnick (Prikladnick; Audy; 2004), Sangwan (Sangwan, 2007), Audy (Audy, 2008), among others, the administration of risks in itself doesn't differ from the co-located environment.

However it demands more coordination, integration and communication. Being the adaptation or the adoption of new models recommended. Thus, the purpose of this article is to present the results of the application of the model for identification and analysis of risks in environment of distributed software development - GeRDDoS. This, as a result of the extension of the approach of risk administration of the SEI (Higuera, 1994) and applied through a case study in an organization of distributed software development located in Brazil.

This article is structured in the following way: in section 2 a synthesis of the GeRDDoS model is presented; in section 3 related works is presented; in section 4 the application of the GeRDDoS model is presented; in section 5 the final considerations, future studies and limitations of the research are presented.

2 THE GERDDOS MODEL

The figure 1 presents the general structure of the

model for *Identification and Analysis of Risks in Distributed Software Development Environment - GeRDDoS*, which is divided into seven processes: identification and analysis of global risks, identification and analysis of local risks, categorization and treatment, monitoring, control, communication and coordination, and the finalization process.

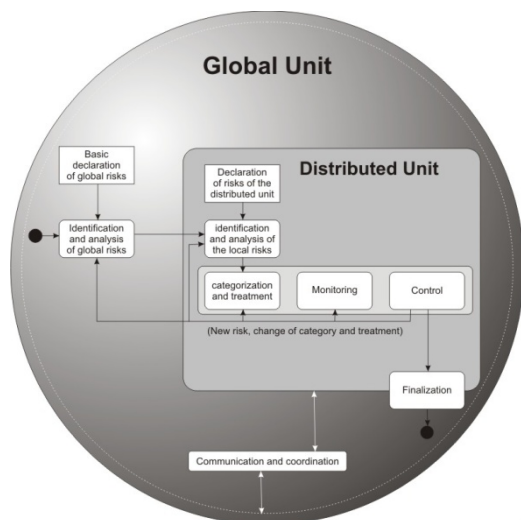


Figure 1: Structure of the GeRDDoS model.

The first process, identification and analysis of global risks, is started with the identification activity and preliminary analysis of the new risks in a global way. This activity is accomplished in the global unit (head office) and it should usually be aligned with the IT strategic planning defined by the high administration of the organization. The basic declaration of global risks is the document which works as a starting point to begin this activity.

The second process, identification and preliminary analysis of the local risks, looks like the previous process, because new local risks can be identified and there can even be changes in the existing planning of administration of risks. This activity is accomplished in the distributed unit (branch) chosen to execute the project. As subsidies for this process there are: the relationship of global risks and the basic declaration of risks of the distributed unit (branch).

The third process consists of the categorization and treatment of the identified risks. This phase involves the actions of classification of the risks according to its degree of importance, verification of the state of the risk, discussion on the risks and the strategies to be adopted in the treatment of the risks.

Monitoring the risks, the fourth process, consists

of the definition action and observing the metrics, indicators and limits for each identified risk.

The fifth process consists of accomplishing the control of the identified risks. The activities of the control process aims at assuring that the management of risk plan is being proceeded as planned.

The communication and coordination process, sixth process, consists of the supporting activities to all the models which provide the necessary interaction for the correct communication and understanding of the project, as well as the accompaniment of all the activities of the management of risk plan of the organization.

The last process - finalization - it consists of the closing of the cycle of administration of the project, that firstly happens in the distributed unit (branch) and later in the global unit (head office). When concluding the local cycle of the administration of risks of the project, the obtained results and the lessons learned during the project are consolidated and passed to the global unit (head office), which after the closing of the global cycle form a knowledge base to work as subsidies to the future projects.

The extension of the GeRDDoS model in relation to the SEI approach proposed by Higuera (Higuera, 1994) it is exactly in the application of the identification process and analysis of risks in a global and local way, proposing the strategic, tactical and operational alignment for the management of risks. Besides, the GeRDDoS model proposes roles, marks, events and artifacts that aid in the process of administration of risks, and it still illustrates each process of the model with a diagram of activities with the objective of facilitating the understanding of the tasks of each process.

The GeRDDoS model is a proposal for the administration of risks in software distributed projects, and it is the result of the master's degree dissertation of one of the authors (Campos, 2009).

3 RELATED WORKS

In the bibliographical revision accomplished, we looked for works which could be to correlated to the areas management of risk in software projects and distributed software development, proposing a differentiation in the process of analysis of the risks involving the two areas.

Among the proposals researched in the literature that contemplate both areas, we highlight the MuNDDoS (Prikladnicki; Audy; 2004) and the

approach described by Sangwan (Sangwan, 2007).

3.1 The Management of Risk in the MuNDDoS Model

The use of the reference model MuNDDoS for the management of risks in DSD projects aims at facilitating this activity. The approach contains activities for the list of common risks in DSD projects and a process of management of risks that begins before the cycle of life of the project itself, through the integration of three managerial levels: strategic, tactical and operational (Audy, 2008).

Thus, considering that the reference model contains activities in those three managerial levels the creation of a model for distribution of the software development was proposed, incorporating specific activities of management of risk in each stage of MuNDDoS. More specifically in the stages of validation of the mapping of the distributed projects, decision on which distributed units will develop the project and project execution.

The use of the MuNDDoS model to formalize the management of risks in DSD begins in the phase of new projects, where the company defines the vision in long term of distributed projects to be developed. Once defined the projects, there are three stages associated to the phase of allocation of projects of the reference model. In those stages, risk analysis, cost-benefit and the decision of places are executed to develop the distributed projects. Following, there is the stage of development of projects, where the project manager should know about the principal risks identified in the previous stages, executed by the levels of superior decision. The last phase of the reference model has an evaluation and feedback stage that applied to the management of risk, is able to document all the rational one used during the process of management of risks, in the three levels, so that it can feed new cycles of management of risk and to consider the learned lessons (Prikladnicki; Audy; 2004).

3.2 Sangwan's Approach (Sangwan, 2007)

For the author, in projects of software development, besides all the traditional subjects that can be experienced in co-localized projects, the projects of GSD possess private subjects related to the coordination, resolution of problems, elucidation of requirements, knowledge sharing and identification of risks. The traditional approach of identification and monitoring of risks are many times less effective

in a GSD context and they need to be improved.

The cycle of traditional life of administration of risks proposed by SEI (Dorofee et al, 1996), needs to be altered, because this cycle should be continuous, in other words, that cycle is not only executed in the beginning a project, there should be mechanisms that allow the continuous execution of that cycle during the life of the project (Sangwan, 2007).

The author proposes the use of a method called "*Profile for GSD Projects*". This method describes the capacity of the organization that will develop the system, the needs of coordination contained in the system to be developed and an evaluation of the divergence degree. This divergence detaches the areas of high risk and the evaluation works as an entrance for the process of planning of risks. The planning process involves appropriate strategies of identification and mitigation for the level of exhibition of the risk which the organization is compatible with.

4 APPLICATION OF THE GeRDDoS MODEL

The GeRDDoS model was applied in an organization of distributed software development, with the objective of: first, to evaluate the global process of identification and analysis of risks; second, to evaluate the local process of identification and analysis of risks; third, to evaluate the categorization and treatment of risks process. It also aimed at knowing if the processes of the GeRDDoS model helped in those activities and if they allowed the integration of the process of administration of risks between the global (head office) and distributed (branch) units, and also between that process with the strategic planning of the organization.

In the next sections we described the research method, the characterization of the organization, the characterization of the project and the obtained results.

4.1 Method of Research

The research is exploratory and qualitative, based on a case study. According to Yin (Yin, 2005) and Santos (Santos, 2000) the exploratory research is usually used in the cases in which the theme was little researched or when the revision of the literature shows that there are only theoretical

fragments with very little relationship to the researched theme. So, an exploratory research was accomplished.

Besides exploratory, the defined research method is characterized by following a qualitative strategy.

The application of the model was led by the project management team of the chosen organization, having the author of the research as a support for the execution of the case study.

To collect the results of the research an analysis protocol was used, a questionnaire with open and closed questions, in likert scale, characterizing an exploratory research of transectional type according to Yin (Yin, 2005). This instrument was organized in eight dimensions, aiming at characterizing the respondent, the organization, the experience of the organization in management of risk and mainly, the evaluation of the processes of the GerDDoS model which were applied in the case study.

4.2 Characterization of the Organization

In the choice of the organization for application of the GerDDoS model, it was used an organization which practiced distributed software development (DSD) and that possessed a structure compatible with the organizational context - *offshore insourcing*. It was selected an organization that strongly acts offering IT services in the center-north area of Brazil.

The physical distribution of the organization happens in 7 municipal districts of Brazilian states, according to figure 2, in: Cuiabá (MT), Rio Branco (AC), Macapá (AP), Manaus (AM), Maceió (AL), Diadema (SP) and Canoas (RS).

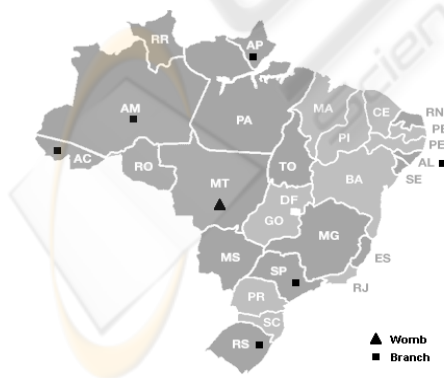


Figure 2: Presence of the organization in Brazil.

The principal representatives of the strategic levels (directors) and tactical one (product and project managers) of the organization work at the

head office, located in Cuiabá (MT). Besides the strategic and tactical levels, this unit also acts in the operational level.

4.3 Characterization of the Project

The software project which was object of the application of the GerDDoS model, is a small short-term project, (only 6 months), and the concept of software factory of the selected organization was used.

In the case study, the specification and requirements team, was located in the distributed unit (branch), and physically installed in the customer's premises, and the implementation team was in the global unit (head office) of the organization.

Once the project for the case study was defined, the distributed unit (branch) responsible for its execution was a unit which is physically installed in the customer's environment, Finance Secretary of one of the states of the area of performance of the organization. Characterizing the DSD environment as *offshore insourcing*, according to authors Freitas (Freitas, 2005) and Knob (Knob, 2007). In this unit (branch) the collaborators of the organization were responsible for accomplishing the phases of listing the requirements and specification of the project. The implementation and test phases were under the responsibility of the team located in the global unit (head office) of the organization. Later the distributed team was responsible for the approval activities and implantation together with the customer.

Because of the period for the accomplishment of the research and of the schedule for execution of the project, the application of three processes of GerDDoS model was defined: "Identification and analysis of global risks", "Identification and analysis of local risks" and "Categorization and treatment", and also the use of the "Communication and coordination" process as a support to the application of the other processes.

4.4 Obtained Results

Among the dimensions of the instrument of data collection of the research - analysis protocol - in this section we highlighted the results and analysis of five dimensions: the characterization of the respondents, the characterization and experience of the organization in management of risk, the applicability of the identification process and analysis of global risks, the applicability of the

identification process and analysis of local risks and the applicability of the categorization process and treatment.

The first dimension highlighted in this article, aimed at identifying the profile of the people involved in the case study. On this dimension there were five respondents, being two of them from the strategic level, one of them from the tactical level and two others from the operational level of the organization. The respondents from the strategic level were 39 years old (average), 17 years of experience in IT and an average of 9 years in the organization. The respondent from the tactical level was 28 years old, 9 years of experience in IT and 3 years working in the organization. The respondents from the operational level were 24,5 years old (average), approximately 2,5 years of experience in IT and about 2 years working in the organization. All the respondents had finished college graduation in the area of IT, and 80% of the respondents were post-graduated in specialization level.

The second dimension highlighted in this article, aimed at characterizing the organization and also aimed at identifying the organization's experience in management of risk. In relation to the dimension of characterization of the organization, the global unit (head office) has over 500 employees and 16 years of experience in the market, while the distributed unit (branch) has between 10 and 50 employees and more than 5 years old. Regarding the experience in management of risk in the organization, 67% of respondents reported that there is awareness about the importance of management of risk in the organization. Regarding the discussion on management of risk in the organization, 100% of respondents said that this is not encouraged and they also indicated that there are no specific actions for management of risk. Regarding the formalization of management of risk in the organization, 100% of respondents concluded that management of risk is not formalized. Thus, regarding the level of awareness about the management of risks in the organization, we have found that the organization is among those which have a level of awareness about the importance of the topic, but do not put the management of risk in their projects into practice, as stated Audy (Audy, 2008).

The third dimension highlighted in this article, aimed at evaluating the applicability of the identification process and risk analysis of the global GeRDDoS model, trying to measure the alignment of management of risk with the strategic planning of the organization, the activities of the actors involved, the level of effort on its application and artifact basic

declaration of global risks. Among the respondents, both at the strategic and tactical levels, 87% agreed that the process facilitates the alignment of the management of risk with strategic planning of the organization. That is exactly what the authors Prikladnicki (Prikladnicki; Yamaguti; 2004), Audy (Audy, 2008) and Sangwan (Sangwan, 2007) say, stating that the analysis and risk assessment carried out in strategic and tactical levels must be integrated with the risk analysis performed at the operational level by project managers. Among the respondents, both at strategic and tactical levels, 80% considered that the factors, methods and techniques presented in the process facilitated the identification and analysis of global risks, and that the tasks assigned to each actor are well defined and clear process. Among the respondents, 47% considered that the level of effort spent on the process is low, and 53% considered as the average level of effort spent on the process. Among the respondents, 80% agreed that the artifact - basic declaration of global risks - is important in the process, since it helps in the identification and preliminary analysis of global risks. Thus we see that the process of identification and analysis of the global risks GeRDDoS model reached the goal of facilitating the identification of risks at the global level and allowing alignment between management of risk and strategic planning organization.

The fourth dimension highlighted in this article, aimed at evaluating the applicability of the process of identification and analysis of local risks, trying to measure the alignment of management of risk at the distributed unit (branch) level with the strategic planning of the organization, activities of the actors involved, the level of effort on your application and artifact basic declaration of local risks. Among the respondents, both at the tactical and operational levels, 67% agreed that the process facilitates the alignment of management of risk with strategic planning of the organization. This confirms the proposition of the researchers Prikladnicki (Prikladnicki; Yamaguti; 2004), Audy (Audy, 2008) and Sangwan (Sangwan, 2007), about the importance of aligning the actions of management of risk between the global unit (head office) and distributed unit (branch), and these with the organization's strategic planning. Among the respondents, both at tactical and operational levels, 67% considered that the factors that the methods and techniques presented in the process facilitated the identification and analysis of local risks, and that the tasks assigned to each actor are well defined and clear in the process. Among the respondents, 53% evaluated as average the level of effort spent on the

process and 47% rated it as low stress level. Concerning the artifact – basic declaration of local risks - 73% of respondents agree that the artifact is important in the process, since it helps in the identification and preliminary analysis of local risks. Thus, we find that the identification process and risk analysis of local GeRDDoS model reached the goal of facilitating the identification of risks at the local level and of providing alignment of the management of risk between the distributed unit (branch) and global unit (head office), and also with the strategic planning of the organization.

The fifth dimension highlighted in this article, aimed at evaluating the applicability of the process of categorization and treatment of risks, trying to measure the actions recommended for the treatment, mitigation strategies and if the process allows the identification of new risks. Among the respondents, both from the tactical and operational levels, 67% agreed that the activities of categorization and treatment described in the process help to mitigate the risks and the same percentage of respondents agree that the recommended actions contribute to the categorization process. Regarding the strategies for mitigating risks, the respondents, 67% consider them sufficient. Regarding the identification of new risks, 53% disagreed that the process helps to identify new risks, and 47% agree that the process helps to identify new risks. The process also allowed the generation of a plan for treatment of risks, which is also what was proposed by Boehm (Boehm 1989), SEI (Higuera, 1994), PMI (Project Management Institute, 2004) and CMMI (Software Engineering Institute, 2006), for management of risk where after the qualitative and / or quantitative analysis phase, the planning of risk response is prepared. Thus, we find that, in general, the process of categorization and treatment of risks GeRDDoS model, reached the objective of facilitating the definition and classification of risk treatment measures of risk, allowing the generation of the plan for mitigating risks.

5 FINAL CONSIDERATIONS

In the context where the organizations execute their projects with dispersed teams, the research area on the distributed software development (DSD) or global software development (GSD), has been several researchers' objective aiming at understanding how this environment has been affecting the software production in the last decades. These researchers have reaffirmed the problems

inherent to the software development, considering the width of those problems in the DSD or GSD environment, as well as the new challenges of that new scenery.

In that context, managing problems - risks - is a recommendation to try to minimize the impact of an unexpected event. If in the traditional environment, co-located, to execute this discipline was already a challenge, authors such as: Damian (Damian, 2006), Sangwan (Sangwan, 2007), Audy (Audy, 2008) and Ågerfalk (Ågerfalk, 2008), affirm that in the DSD or GSD context this becomes more critical and they recommend an adaptation in the classic model. This way, in this article we tried to synthesize the results of a case study of evaluation of GeRDDoS model for identification and analysis of risks in distributed software development environment. This model is an extension of the approach management of risk of the SEI, adapted to the environment DSD or GSD.

Thus, in this paper we summarize the results of a case study of evaluation GeRDDoS model for identification and risk analysis in distributed software development environment. We believe that this article contributes to the area of software engineering in the sub areas management of risk in software projects and distributed software development, combining these two areas of knowledge and drawing attention to management of risk in distributed software projects, and further expanding the publications involving these subareas.

It is also believed that this article contributes towards the vision of the complementary area of distributed software development, referencing a specific model for management of risk.

5.1 Limitations of the Research and Future Studies

As factors of limitation of the research, we highlighted: the impossibility of its generalization, for characterizing as a qualitative research; the application of the model through the case study in just one project of the selected organization; the application of the model in just one organization; the application of only three processes of GeRDDoS model due to the factor: time for the research; and also, the fact of the national coverage of the selected organization, because it does not experience the critical factors of success in a global way.

As opportunities of future studies, we identified: the adaptation of the proposed model to other methodologies management of risk; the incorporation of new techniques, methods, identification of risks in the processes of GeRDDoS

model; the application of the model in more than a project of dimensions superior to the project that was object of the case study; the application of the model accompanying the whole global and local cycle in at least one project; the accomplishment of multiple case studies, applying the model in different organizations, allowing the degree of generalization of the results to be enlarged; the construction of a tool prototype which can be a support to the application of the model; and the analysis of the impact of the understanding of analysis of risks, using semiotics concepts and ontology.

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