A New Process Model For Reuse Based Software Development Approach

Jasmine K.S, Dr. R. Vasantha

Abstract— **Software reuse enables developers to leverage past accomplishments and facilitates significant improvements in software productivity and quality [1]. The contribution of this paper is a recommended process model for the implementation of software reuse effectively. A critical problem in today's practice of software reuse is the lack of a standard process model which describes the necessary details to support reuse based software development and evolution. Our research thesis is that software development based upon a reuse-based process model improves quality of products and productivity of processes. A quantitative survey of 100 software organizations is used to test the new process model and the hypothesis of the study. The process model presented in this paper identifies process level, organizational and technical aspects which have to be improved to achieve success in the reuse world.**

Index Terms— **Software Reuse, Reuse practice, Process model, Organizational issue, Survey research.**

I. INTRODUCTION

Many software organizations realized that developing the software using reusable components could dramatically reduce development effort, cost and accelerate delivery. But the non-existence of a standard process model in this field contributed towards in large-scale failures in their approach. From the past studies on this field, it is found that very few attempts had been made to identify or measure the software reuse process level, technical and organizational factors necessary to imply reuse success. Even though some studies had tried to formulate the reference model for reuse, because of the novelty of the approach they adopted, could not achieve success in their attempt [9][10]. This paper addresses a pivotal research issue that contributes towards process improvement and quality products in reuse oriented software world.

This paper extends and integrates models from prior research by performing an empirical investigation of the key factors for success in process improvement in reuse oriented software development The paper starts with a discussion of what is meant by software reuse and a process model. The next section comprises the steps involved in developing a process model; an overview of the population and sample. Section 3 presents the proposed process model for reuse along with a discussion of each task region of process model. Section 4 provides concluding remarks. Section 5 describes some limitations of the proposed process model and section 6 suggests some directions for further research.

A. Software Reuse

Software reuse at its most basic level consists of making use of any existing information, artifact or product when designing and implementing a new system or product. There are differing opinions as to which activities constitute genuine software reuse. Reuse of assets is dependent upon both similarities and differences between the applications in which the component is being used [5].
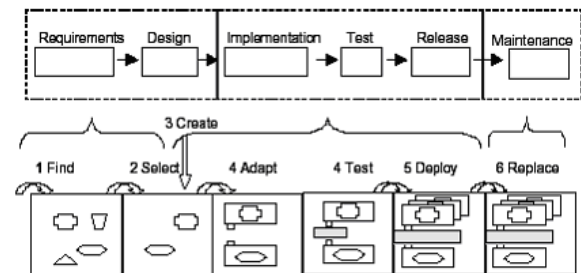

Fig1: Reuse Based Development cycle compared with the Waterfall Model

Fig 1 illustrates that the difference between the reuse based development and the traditional waterfall approach.

B. Process Model

To solve actual problems in an industry setting, software engineer or a team of engineers must incorporate a development strategy that encompasses the process, methods and tools. A process model for software engineering is chosen based on the nature of the project and application, the methods and tools to be used, and the controls and deliverables that are required [2].

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C. Related Work

One way to reduce the complexity of the software design process is to reuse previous software designs and adapt them to solve new problems [15]. The most effective form of design reuse is the reuse of architectural or high-level design [14]. Object-oriented frameworks are collections of interdependent classes that define reusable and extensible architectural designs for families of software systems or subsystems [13]. When developing software based on framework reuse, the new system is built by customizing and/or extending the generic architecture defined by the framework. The users of frameworks, and class libraries in general, face with both a terminological and a cognitive gap [12]. In order to achieve the highest degree of reusability, the framework implementation is designed to inherit code and reduce the number of changes when extending the framework (by means of functionality dispersion among classes). As a consequence, the framework implementation does not map the domain organization. In this paper, we discuss process level, organizational and technical aspects of software reuse in the organizations and propose a process model.

II. IMPLEMENTATION

A. Steps Involved

The process model is developed based on

i) The literature survey on software reuse to identify reuse technical, organizational and process level factors and explore their relationship to software development productivity, quality and time-to-market

ii) Refine the study comprising of different technical, organizational and process level activities of the software organizations.

The data is collected based on managers ratings of their software organizations with respect to factors of software process success and organizational performance and general background information and an assessment of the environment.

B. Population And Sample

Software reuse is still an immature function. There is no census bureau representing a population of software development organizations who practice software reuse. Software intensive organizations are considered as target population for this study. This population includes companies of different sizes (in terms of No. of engineers / programmers / testers), experiences and nature. A total of 100 software organizations were responded to the survey, which includes product and service oriented companies. Table 1 shows the characteristics of the survey sample.

Table 1: Characteristics of population sample

Nature of work		Size of organization		Years of experience (Years)
Service Oriented	Product	No. of Engineers/ Testers/ Programmers	Ratio of Developers/ Testers	
80 %	20%	15 - 45000	12:5 to 5:1	3 to 36

C. Process model For Reuse Based Software Development

The suggested process model for reuse oriented software development demands an iterative approach to the creation of software. The proposed process model contains the following task regions:

Task region I: - Planning phase

Aim: - To maximize reuse profits, by analyzing process, organizational and technical aspects with reduced asset development cost and management cost

Task region II: - Risk Analysis

i) When and Where Capital investment is to be made
Two approaches were observed namely, proactive and reactive. 80% of identified population supported proactive approach and 20% supported reactive approach.
If the domain is stable, where the product features can be predicted, organizations can go for upfront investment to develop reusable assets (proactive approach). If the domain is unstable, reusable assets can be developed as when required (reactive approach). This approach may result in reengineering and retrofitting existing products with reusable assets, if there is no common architectural basis.
ii) Whether to go for a dedicated team for development/distribute/maintain assets or not and associated costs involved.
There were two types of approaches for establishing a reuse program: centralized and distributed.
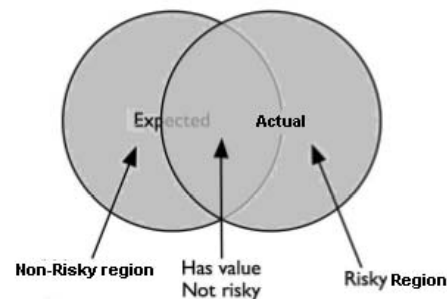

Fig2: Risky Vs Non-risky region

Fig 2 tells about the prediction region for acceptable values tend to give good information about value. Each region will coincidentally give some information about the other regions, but neither is sufficient by itself. Concentrating on the basis of expectation will not tell as much as information needs to know about risk.

Table 2: Risk factors centralized vs. Distributed

	Centralized	Distributed
Risk Factors	1) Cost of maintaining a dedicated team (60%)	1) Difficult to coordinate asset development responsibilities (40%)
	2) Cost of training employees (40%)	2) Reluctant to make their own investment for others (60%)
	3) Need for strong management commitment (55%)	3) Need of convincing cost-benefit model (45%)

Task region III: - Core asset development and evolution.

Steps involved:
I) Identification and definition of common features and variation points
ii) Extension of architecture, if needed
iii) Resolve the conflicts between functionalities and quality attributes

Task region IV: - Change requirement and Adaptation

New requirements from customers, requires changes in technology, environment. Due to the dynamic changes in the execution environment, those are not anticipated during development time, software should be adaptable to this environment and should have self-managing capability [7].

Task region V: - Customer evaluation

Task required obtaining customer feedback on evaluation of the software representations created during the engineering stage and implemented during the installation stage.

Task region II discusses about process level and organizational aspects, Task regions III & IV discusses the technical aspects, which helps in decision making regarding reuse program.
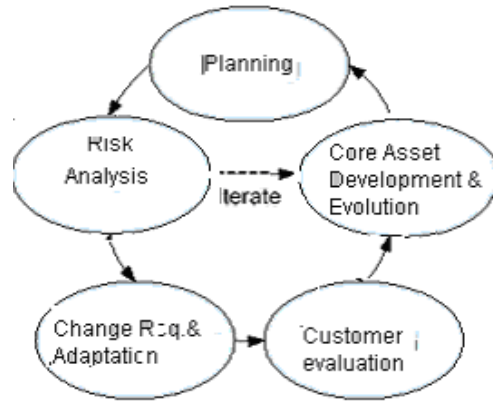

Fig3: Proposed Iterative Process Model

III. CONCLUSION

This paper presents a suggested software process model for reuse based software development approach and address a broad range of topics related to technical, organizational and process level aspects and associated risks of adopting reuse in the context of software reuse. From theoretical perspective, these findings add a new dimension to empirical software engineering research, which investigates the success factors for reuse-oriented process model. From a practical perspective, this suggests that, rather than trying to imitate technical procedures, software organizations should focus their efforts on improving organizational level and process level factors.

LIMITATIONS

Although we have discussed several aspects about software reuse implementation process model, the research reported here is not without its limitations. First, the process model is not technically justified. Second, the task regions are selected based on subjective measurements given by Project managers/project leaders.

FUTURE WORK

The complexity of managing the evolution of reusable assets developed by a third party and also the techniques for uncovering unexpected behavior of asset components integration, are the suggested areas for future research. Also by setting a separate set of questionnaires to software developers, Managers and researchers in this field, this study can even be extended. Also for the potential reuse adopters to learn which aspects are most crucial to the success of their reuse efforts, there is a need for further analysis with additional data sets. With this it may be possible to have a better measure for actual effort that organizations invest in reuse and the resultant gain in product quality. Future research can be aimed in theses directions. There are certainly other directions for further research; however, the value of any such future work depends on the specific goals of each particular investigation.

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