

THE ROLE OF CREATIVE THINKING IN SOFTWARE DEVELOPMENT PROJECTS

I. T. Guruge¹ and A. A. J. Chinthaka²

¹ Department of Information Technology, Faculty of Computing, Sri Lanka Institute of Information Technology (SLIIT), Sri Lanka. Email: ivantha.g@sliit.lk

² Department of Information Technology, Faculty of Computing, Sri Lanka Institute of Information Technology (SLIIT), Sri Lanka. Email: jeewan.c@sliit.lk

ABSTRACT

Software engineering processes are still not utilized in an efficient manner that outputs maximum results because of its infancy in the engineering industry as a whole. This means software development processes need to be constantly changed and fine-tuned to achieve best outputs out of it. One way of bringing up the efficiency of these processes is to encourage creative thinking within the software development groups. In addition to creative thinking it is also necessary to identify methods that can be used to constantly monitor and track the progress of project development throughout the lifecycle.

Key words: Software Development Life Cycle, Prototype Methodology, Creative Thinking,

1. INTRODUCTION

The software development industry is an ever changing set of processes and still does not have a constant or fixed methodology that is valid for all software development procedures. The reason for this is that software engineering practices started very recently compared to other engineering fields and is still in the evolution process. As a result all software organizations strive to look for best practices and methodologies that are best suited for each individual organization and their requirements. This means software organizations cannot stick to traditional processes and methodologies but evolve and fine tune their processes and procedures to fit the organizations needs accordingly. This is where the role of creative thinking comes to play. One definition of creative thinking can be seen as; a way of looking at problems or situations from a fresh perspective that suggests unorthodox solutions (which may look unsettling at first). Creative thinking can be stimulated both by an unstructured process such as brainstorming, and by a structured process such as lateral thinking [1]. Creative thinking inside the organization workers can be considered a best approach to fine tuning processes and procedures for the betterment of the organizations practices. This paper describes approaches that compliment creative thinking within software development groups in software organizations and how they can be beneficial in practical scenarios in software engineering.

2. MATERIALS & METHODS

2.1. Creative Thinking in Accordance to Prototype Methodology

The basic idea of prototyping is that instead of freezing the requirements before a design or coding can proceed, a throwaway prototype is built to understand the requirements. This prototype is developed based on the currently known requirements. By using this prototype, the client can get an “actual feel” of the system, since the interactions with prototype can enable the client to better understand the requirements of the desired system. Prototyping is an attractive idea for complicated and large systems for which there is no manual process or existing system to help determining the requirements. Prototyping is usually not complete systems and many of the details are not built in the prototype. The goal is to provide a system with overall functionality [2].

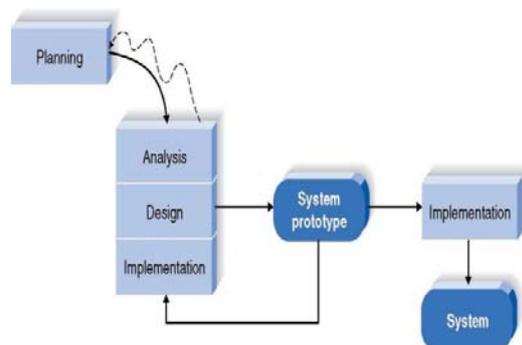


Figure 1: Prototype Methodology

Even though prototyping is not considered as an agile approach to software implementation it can

be considered as a generalized version of agile. The advantages of prototyping include;

- Have a system in place for the user at an early stage.
- Ability to quickly refine real requirements.
- Reassures the client of the work progress.

Because of the need to provide quick versions of the system, requirements have to be analyzed quickly and carefully. However because of the ability to adapt according to requirement changes, this methodology can be considered a good approach in software development in a small to medium scale projects.

When it comes to using creative thinking within software groups, the use of prototyping can be considered a very practical and effective methodology that can integrate the creative thinking process within the methodology. The software development groups need to provide quick products with effective solutions in the form of prototypes. These prototypes can then be reevaluated and improved accordingly. Because of the need for efficient and effective product outputs it is important to engage all the people involved in the development process to provide their ideas and brainstorm within the group in quick sessions if they are to produce basic prototypes as required. This form of quick sessions and brainstorming within the group enables creative thinking within each and every person in the group which will then contribute to the building of software prototypes according to the given requirements in an efficient and effective manner.

2.2. Creative Thinking in Accordance to Project Requirement Management

When scoping a project it is necessary to identify the customer's needs rather than the customer's wants. It is important to use creative thinking with the customer involvement in the planning stage. This can include use of interviews and brainstorming sessions to identify and prioritize the requirements right along with the customer and ensure no misunderstanding of requirements occur before development. The basis of requirements documenting can be thought as the System Requirement Specification documentation. This should be developed by classifying the customer requirements and identifying qualitative attributes such as availability, efficiency, flexibility etc. when coming up with these attributes factors such as past experience, past projects needs to be looked at as a baseline. This helps manage requirements

and reduce scope creep significantly. Once the project planning stage is completed the prototype methodology does not encourage coming back to make very significant changes in requirements. Although small changes are acceptable it is important to have a good idea of the requirement processes before moving on to the analysis stage of the lifecycle.

2.3. Creative Thinking in Accordance to Planning and Analysis of Requirements

During the planning phase as expressed before, customer involvement plays a major role in obtaining correct requirements. This needs major use of creative thinking and in the analysis stage creative thinking processes can be used effectively as well [3]. Creating a Work Breakdown Structure (WBS) is an important element in the analysis process. WBS template is built on prior projects and experiences. In parallel to the WBS, estimation of costs is another occurring process. Cost estimation is also done according to a given template. Usually this is created by one person. However it will be more efficient to compare the created estimations with the project team and use a creative thinking session which will help the team put in suggestions according to their personal experiences. These suggestions should again be validated and modified and used to finalize the WBS and the Cost estimations. At the end of this stage the project should have a Planned Value (PV), which can be compared with the budget at completion of previous projects. If the PV is acceptable the project can move on to the next phases. At the end of the project these should be again compared with the actual cost value to check if the estimates are accurate or should they be fine-tuned a bit more.

2.4. Creative Thinking in Accordance to Project Team Management

Creative thinking plays a major role in handling project team management. Team development should occur in an interactive manner between all the members of the team. All throughout the Forming, Storming, Norming, Performing and Adjourning stages members should have the feeling of ownership of their work [4]. Such a thing can be made by making all voices heard within the team. This means focusing more on brainstorming sessions rather than having complete interviews. During interviews some works will feel intimidated while some may be intimidating. This does not enable good creative thinking out of all people. But if there are small

group discussions before starting work every morning and in between breaks in a small group workers will not feel intimidated to propose new ideas into the group [5]. Enabling creative thinking between these small groups can help refine ideas and even find efficient ways to improve the requirements and development. When considering the methodology used, implementing the above mentioned session will make a good improvement. Additionally more detailed discussions should be held with the inclusion of the client after a prototype is released and tested so that improvements and requirement changes can be identified.

2.5. Creative Thinking in Accordance to Project Implementation Procedures

With the role of creative thinking in play within the project group, there are other factors that need to be considered. One such factor is always keeping track of the Rate of performance. Here the ratio of the actual work completed to the percentage of work planned to have been completed at any given time during the life of the project or activity. This metric should be constantly monitored so that the team can keep track of the progress of the project. As mentioned earlier holding review meetings along with the project is important so that the development team as well as the client is constantly aware of the progress of the project. After each version is completed the prototype needs to be reviewed and requirement changes should be added and approved before moving to the next implementation. This set of releases should be continued as a lifecycle until the end of the development procedure.

2.6. Methodology

The suggested methodology is to integrate creative thinking within small software groups which will enable them to come up with better solutions which are efficient and effective when it comes to tackling real world software scenarios which helps them to build software faster and with the use of fewer resources. Creative thinking must be encouraged within the groups in the above mentioned stages in the software development lifecycle. It was identified that integrating creative thinking into the prototyping methodology is most effective. The reasons for this are:

- Prototyping encourages changes after each software release which helps fine tune the software and helping to reach the user

requirements in an effective manner.

- Prototyping can be implemented within small software groups and the use of creative thinking is more suitable for small software groups because it allows everybody voice their opinions if the group is small.
- Because of the step by step process of recreating new prototypes and improving their ideas, even inexperienced software groups can adapt to the methodology quickly.

The experiment devised to test if integrating creative thinking into prototype methodology is to compare a set of software groups. One set of groups are encouraged creative thinking within the groups and the other set of groups use the traditional prototyping methodology without the use of creative thinking. The average number of prototypes required to build an acceptable software solution for a given set of requirements are compared to check if creative thinking will actually help reduce the number of prototypes and resources required when developing software solutions.

For this experiment, fifty undergraduate students currently studying in their 2nd year of the BSc in IT degree program at Sri Lanka Institute of Information Technology (SLIIT Computing) were evaluated. The students were divided in to ten groups (five members per group). The groups were created in such a way so that the level of intelligence within the groups were all of a similar level and can be assumed that all groups were equal in terms of performance and intelligence. All groups were given the task to build a software product with the same requirements. A set of groups were encouraged creative thinking with the Prototype Methodology which was used as the software methodology process. Groups were labeled from A – J and the first five groups (A - E) were asked to follow the prototype methodology with no creative thinking and acts as the control groups. The latter five groups (F - J) were asked to follow the prototype methodology and were encouraged to use creative thinking along with the software development process. Creative thinking was used in all stages of the life cycle as explained above. Groups from F- J were given the following rules to enable the creative thinking of their projects.

- Conduct interviews and brainstorming sessions to identify and prioritize the requirements right along with the customer and ensure no misunderstanding of requirements occur before development.

- Engage all the members for the discussions or brainstorming sessions all throughout all the stages of group development and recognize their ideas, focus on their ideas to make members to feel the ownership of their work.
- Conduct group discussions before starting work every morning and in between breaks, therefore group workers will not feel intimidated to propose new ideas into the group
- Based on the ideas of each gathering review requirement changes should be added and approved before moving to the next implementation.
- Keeping track of actual work completed to the percentage of work planned to have been completed at any given time during the life of the project or activity.
- After each version of prototype is completed the prototype needs to be reviewed and requirement changes should be added and approved before moving to the next implementation.

3. RESULTS

The experiment conducted was to test if integrating creative thinking within software methodologies were effective and would it help reduce time and resources when it comes to developing software solutions for real world problems. After giving all the groups a problem with the same set of requirements, the groups were evaluated on how many number of prototype versions were needed to complete all the given requirements and produce a satisfactory software solution from the client perspective and the developers perspective. With ten groups available five groups acted as the control groups and five groups integrated creative thinking into their development processes. After completing their assignments, the number of prototypes each group built was calculated and the average of the target groups and the control groups were compared together.

It was observed that on average, the control groups had to create five prototype versions before producing an acceptable software solution whereas the subject groups which integrated creative thinking processes into their development process came up with acceptable software solutions in an average of three prototypes. The results indicate that integrating creative thinking processes within software development methodologies produces positive results for the software development groups and enables the groups to produce software solutions

efficiently and effectively using less time and resources which can be a huge advantage for software development companies when developing software solutions.

4. CONCLUSION

The ever changing software development industry requires constant changes in the software development process in software organizations. As a result having a good development process has become very important in organizations to keep up with rival organizations. One of the main factors in developing a software solution is to have a good idea of the software requirements. This means involvement of the client with the team is an essential part of the process. The process also needs to encourage creative thinking inside the development team and should get ideas and outputs from everyone within the group. Things like brainstorming sessions are a good example of the use of creative thinking. Encouraging creative thinking within software projects by using the various methods stated in this paper in conjunction with the project development team involvement can improve the success rate of software development projects significantly.

5. REFERENCES

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