

A Proposed Theoretical Framework for Software Project Success



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ABSTRACT: *Software project management is one of the most challenging in software development. Software projects are important part into almost every business application. It is quality, efficiency and effectiveness of these applications will determine the failure or success of many business solutions. Over the past few decades, software projects often failed to come up to user expectations, by it were commonly late delivered, and mostly ran over the set budget. Indeed, much of this still holds true today, and it has alerted software. The literature analysis and surveys showed that there is a need for a framework to mange the software project, where software projects as the literature mentioned always run over time and budget. So in this chapter we proposed a theoretical framework to deal with previous issues. This framework considers the following issues: technical factors, organizational factors, people factors, and culture factors and their influence on software project success. Also this framework explains the relationship between previous factors and risk management and change management. The framework shows how can software project success factors be controlled and monitored. A detailed description of the framework will be showed in the next section.*

Key Words: Theoretical Framework, Culture Factor, Standard Requirements, Change Management, Risk Management, Post Software Project Evaluation.

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1.Introduction

Software development process is a major crucial as well as a challenging task. In the world of information technology, there are many examples of failure in software development. These failures occur often and the failures are realized at the later stage of the development process. To reduce or totally avoid such failures, it is important to analyse those issues involved.

2. Software Success/Failure Factors

Many researchers have become interested in researching the factors that affect on software projects success/failure. Executive support affects the process and progress of project and lack of it put the project at bad situation, [6, 8, and 9]. If project lack user involvement it fail even if it developed on time and budget, project fails if it does not meet user needs or expectation, professionals of project concern and care on this part, that lead to fail to achieve project objectives[2,10]. Past literatures showed that experienced software project manger can identify risk on project and lack of senior manger commitment seen as most critical risk on project [6,9] Boehm and Ross [11] pointed out that the present of tow different team in software

development with two different objectives, one deal with user requirements and another deal with technical challenges this leads to misunderstanding of objectives for the project. For any project time is enemy for it, since scope impacts time, if we minimize it we can impact it within time so the chance to success increases [1, 6, and 7]. In contrast to requirements which are in a changeable state, infrastructure needs stability. Standish group found that about 70% of application code is infrastructure and by using standard infrastructure, the application team concentrates on business rules rather than technology. Standard infrastructure can shortcut applications integration that many developmental teams fail to apply it. When we create a base level of requirements for our project and then develop those features we can reduce the requirement changes, help users and sponsors to see the results faster, and add benefits for project managers to prepare and link the needs and criteria for the next phase of our project [12, 10]. The use of good formal methodology provides realistic pictures about the project and some steps may be reusable so the tendency to reinvent the wheel is minimized and stability of the project is increased, also formal methodology gives managers the ability to estimate the real time so the risk is reduced [4, 12]. In order to develop a project you need to make good and realistic estimations which is hard planning and through it you purchase the requirements and components of projects, managers must use their collective knowledge and experience to get a good estimate that reflects the real effort needed. Budget and cost estimation is a crucial factor in software projects success/failure [13, 14]. These factors include small milestones, proper planning, competent staff and ownership and communication skills [3, 5]. The software packages that manage and integrate business processes across organizational functions and locations cost millions of dollars to buy, several times as much to implement, and necessitate disruptive organizational change [17]. Skok and Doring [16] suggests there has been an increase in reported software projects failures, suggesting that the implementation issues are not just technical, but encompass wider behavioural factors and Chatfield [18] suggests that the organization's culture and structure had a significant effect upon the implementation process. The concept of cultural influences on work practices in the university are portrayed by findings gathered by Beekhuyzen [19] as "There's an overall general social culture that people get on but then a work discipline culture that is focused around the areas that people are interested in". The IS literature on culture and software provides a general understanding of the possible culture concepts and its impact on software projects but these typologies of culture have inherent weaknesses and limitations [16]. Therefore, these limitations will need to be borne in mind as we consider potential cultural impact on the use of software systems, particularly software projects.

3. Research Methodologies

An empirical study as a combination of questionnaire survey and interview was applied in this research. Only 20 managers were interviewed because the others excused because they were busy or in traveling.

4. Research Model

Research model in figure 1 is built based on the combination of several past literatures. Based on these literatures the research has formed the following hypothesis: 1-There are positive relationships between (standard requirements, user involvement, executive support, clear business objective, minimized scope, reliable estimation, formal methodology, standard infrastructure, manager experience and other factors) factors And software project success.

5. Samples

The most of the sample are males (n=166) which consist (76.9%) of the sample where the females portion consists (23.1%) of the sample. For education variable, bachelor degree took the high portion (72.7%) whereas high certificates portion was (27.3%). For experience variable, the high portion went to (11-15 years) which consisted (18.5%); the lowest portion went to (5 years and less), (14.4%).

6. Reliability Test

Constancy factor was calculated according to (Cronbach's Alpha) for internal correspondence of total formulate and for each variable with all dimensions. The questionnaire was distributed to (25) subjects outside of the sample, the results as shown in Table 1.

| Variables and dimensions | Constancy factor |
|--------------------------|------------------|
| All independent variable | .91 |
| Culture factor | .86 |
| Standard requirements | .85 |
| User involvement | .88 |
| Executive support | .90 |
| Clear objective | .84 |
| Scope | .81 |
| Reliable estimation | .86 |
| Formal methodology | .83 |
| Firm infrastructure | .85 |
| Manager experience | .82 |

Table 1. Value of internal correspondence for each variable (independent and dependent) with all dimensions

The table shows that constancy factors are high and valid for statistical analysis and scientific research.

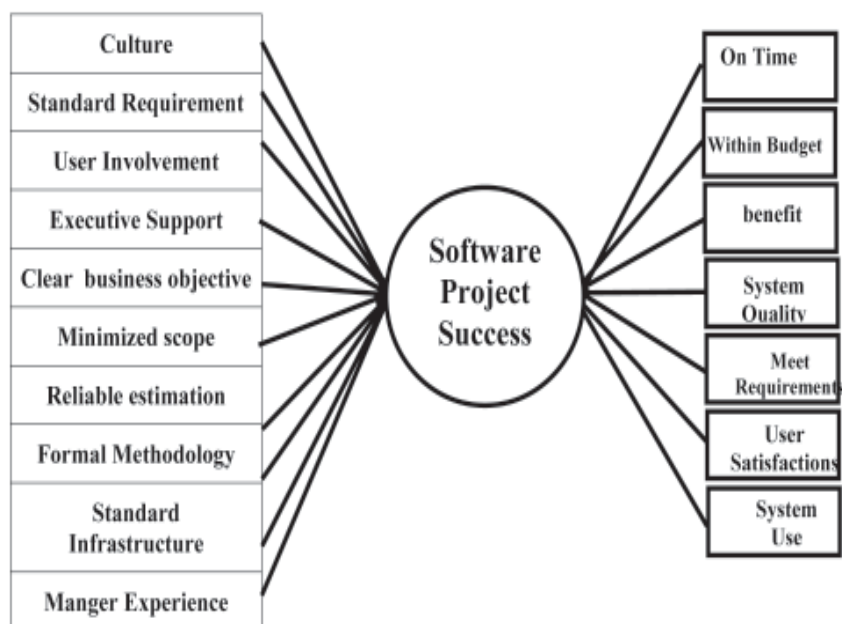


Figure 1. Research Model

6.1 Results on Factors that Contributed to Software Projects Success/Failure and the Frequency of Occurrences

Based on the research model in figure 1, and the results that we have gotten from the surveys, we summarize all factors that affect on software projects success/failure according to severity degree and frequency degree. The results show that means of influential factors in success of software engineering projects (scope, executive support, clear object, manager experience, culture, reliable estimation, standard requirement, user involvement, formal methodology, and firm infrastructure) came at high degree and the total mean of influential factors in success of software engineering projects in terms of its severity (3.63), SD (0.54); culture dimension ranked first degree with mean reached(3.96) followed by standard requirements (3.89), user involvement at third degree (3.67), executive support at fourth degree (3.64), while the dimension of manager experiences ranked tenth rank with mean (3.42) at middle degree. Also the results show that means of influential factors in success of software engineering projects (scope, executive support, clear object, manager experience, culture, reliable estimation, standard requirement, user involvement, formal methodology, and firm infrastructure) came at high degree and the total mean of influential factors in success of software engineering projects in terms of its frequency (3.56), SD (0.57); culture dimension ranked first degree with mean reached(3.87) followed by standard requirement (3.81), user involvement at third degree (3.59), executive support at fourth degree (3.58), while the dimension of manager experience ranked tenth rank with mean (3.34) at middle degree.

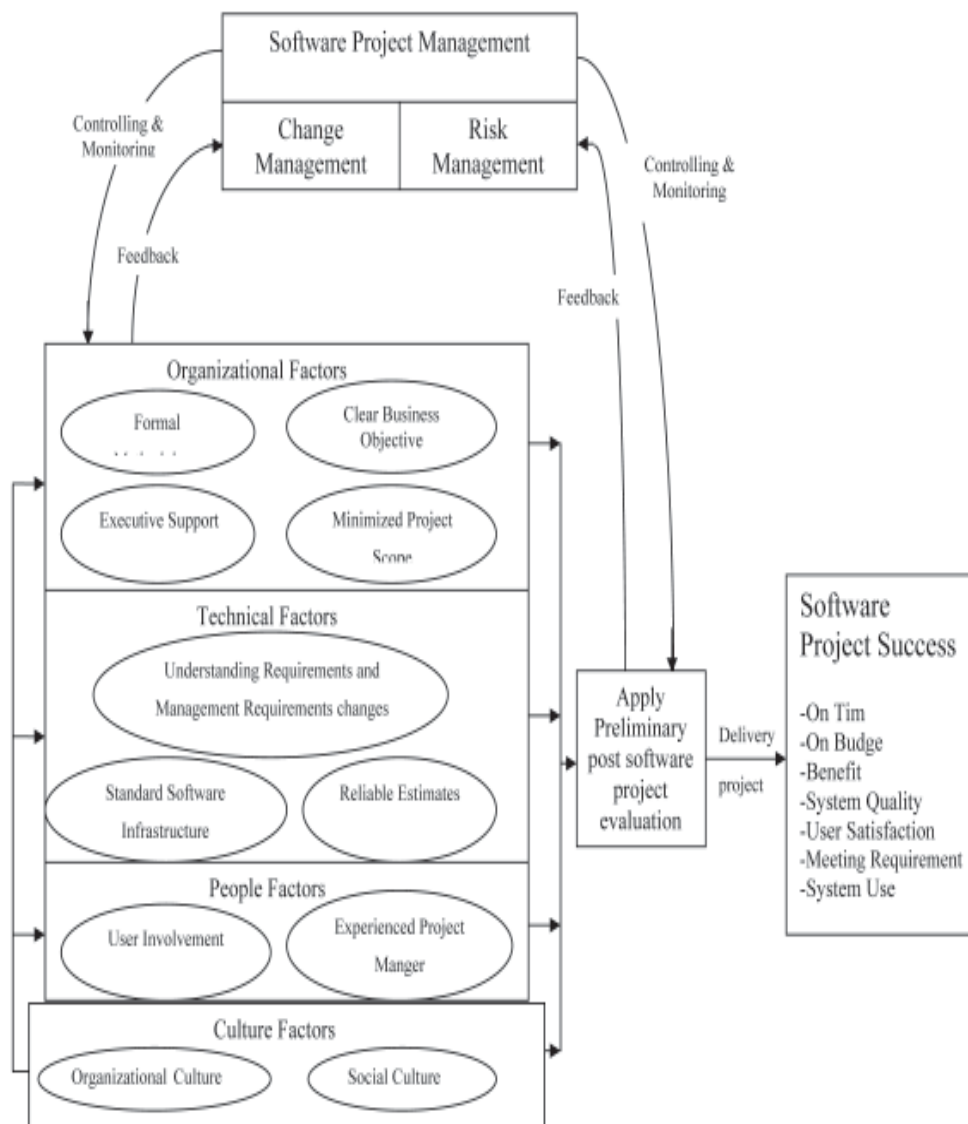


Figure 2. Theoretical Framework for Software Project Success

7. Problems to be solved

The literature analysis shows the following problems: Lack of managing and dealing with culture factors lead to software project fail, Ambiguous and changing requirements lead to software project fail, Lack of executive support lead to software project fail, Un using formal methodology lead to software project fails, Lack of reliable estimation lead to software project fail, Technology changes and infrastructure will be change lead to software project fail, Un clear business objective lead to software project fail, Un defines and minimized project scope lead to software project fail, Lack of experience manager lead to software project fail and Lacks user involvement lead to software project fail

8. Proposed framework

Based on deep analysis of the literature and investigated study in Jordanian firms, we proposed the following theoretical framework for software project success (see figure.2). We believe that Software project management is a lengthy undertaking involving a set of complex activities that take a lot of time and cost. The success in such an undertaking depends on good and reliable estimation. Based on the above analysis, we classify software project success factors into four categories: organizational factors which are the presence of formal methodology, clear business objective, executive support and project scope, technical factors that are standard software infrastructure, understanding requirements and managing requirements changes and reliable estimates, people factors that are user involvement and experienced project manager, and the cultural factors which involve organizational culture. Also in the analysis, a relationship was found between the organizational factors, people factors, technical factors and the cultural factor.

8.1. Manage Culture Factors

From the previous studies that was obtain in chapter 2 and the applied study that done by researcher in Jordanian firms it is clear for us the importance of cultural factors. So it is important for project team to deal with these factors in serious and careful manner. Since it come in first rank in the problem that effects the success of software project. Project manager and team must have good knowledge in how to deal with these factors through:

8.1.1. Project Communication Management

8.1.1.1. Communication Planning

8.1.1.2. Information Distribution

8.1.1.3. Performance Reporting

8.1.1.4. Manage Stakeholders

8.1.2. Mange Change Resistance

8.1.3. Deal with Educational Culture

8.1.4. Studying Behaviours and Attitudes Styles

8.1.5. A Comparison between Proposed and Old System

8.2. Understanding Requirements and Management Requirements Changes

When requirements practices is good this may lead to accelerate the development of software. The process of defining business requirements birds the stakeholders with shared goals, vision and expectations. In order to increase the accuracy of requirements you have to involve substantial user in establishing and managing the changes to agree upon requirement so emphasizing that the functionality built which enable users make the important business tasks. Software requirements engineering encompasses the two major sub domains of requirements definition and requirements management: several best practices in the categories of requirements elicitation, analysis, specification, validation and management.

8.2.1. Requirements elicitation

- Define the product vision and project scope.
- Identify stakeholders, customers and users.
- Select product champions.
- Choose election techniques.
- Explore user scenarios.

8.2.2. Requirements analysis

- Create analysis model.
- Build and evaluate prototype.
- Prioritize requirements.

8.2.3. Requirements specification

- Look for ambiguities.
- Store requirements in a database.
- Trace requirements into design, code and tests.

8.2.4. Requirements validation

- Review the requirements.
- Create test cases from requirements.

8.2.5. Requirements management

- Manage requirements versions.
- Adopt change control process.
- Perform requirements change impact analysis.
- Store requirements attribute.
- Track the status requirements.

8.3. Project Scope Management

8.3.1. Scope Planning

8.3.2. Scope definition:

8.3.3. Create Work Breakdown Structure (WBS)

8.3.4. Scope Verification

8.3.5. Scope Control

8.4. Reliable Estimation

8.4.1. Project Cost Control

The project cost control deal with costing the software project through:

- 1- Affecting the factors that make and create changes to the cost of project.
- 2- Emphasizing asked changes are agreed upon.
- 3- Managing the actual changes when and as they occur.
- 4- Assuring that potential cost overruns do not exceed the authorized funding periodically and in total for the project.
- 5- Monitoring cost performance to discover and understand deviation from the cost baseline.
- 6- Recording accurately and exactly all appropriate changes against the cost.
- 7- Preventing incorrect, inappropriate, or unapproved changes from including in the report cost or resource usage.
- 8- Informing appropriate stakeholders of approved change in cost.
- 9- Working make expected cost overruns within acceptable limits.
- 10- Searching out the reason for positive and negative deviation in cost.

8.4.2. Schedule Control

Project schedule control cared with:

- 1- Determining the current and actual status of the project.
- 2- Affecting the factors that make schedule.

- 3- Determining that the project schedule has occur.
- 4- Managing the actual changes as they happening.

8.5. Executive Support

Executive support by decision maker in organization is so important for software project success. Project manager should gain executive support for software project and his developer team. It is clear to note the important cultural factors that previously discussed on software executive support.

8.6. Standard Infrastructure

Software project manager should work to get the standard infrastructure for the software project. This includes:

- 1- Hardware essential for the project like computers, improved communication channel and networking.
- 2- Software, operating system and programming language needed for work team.
- 3- Improved data base management system.

8.7. Formal Methodology

8.7.1. Template:

Template which serve in planning of software project like: project organization charts, position, description, standard conflict management and performance appraisals.

8.7.2. Checklist

Checklist which help planning of human resource include project responsibility and roles, training program, team ground rules, typical competencies reward ideas and safety consideration.

8.8. User Involvement

User involvement processes that organize and manage user involvement should be including in project management. Customer involvement includes people who have assigned responsibilities and role in order to complete the project. In software project user should involved in many decisions making and project planning. User involvement should be early as possible bee it help expertise during planning phase and commitment for project increase.

8.9. Clear Business Objectives

Clear business objective it's important for software project success because this factor effect on the clear and standard requirements and define the project scope, to determine business objectives project developers must work on:

- 1- Exactly determination of the objectives of system
- 2- Determination of required system output.
- 3- Determination of required system inputs that needed to make project objectives and outputs.
- 4- Project observation and objective improvement to serve project success through:
 - A - Plan improvement according to changes that occur.
 - B - Check on changes that occur in the project.
 - C - Accept the change that helps project success.
 - D - Reject the changes that help some person while project not benefits.
 - E – Frequently plan review to serve project objective.

8.10. Experience of project Manager

Although experience project manager come in the last rank according to applied study researcher consider the experience project manager is one of most important point for software project success. Since manager experience play major essential role for project success. Project manger should be some thing to guaranty project success:

- 1- Managing the team efficiently.
- 2- Good knowledge of present organizational culture and decision maker rank in organization that want to do software project.
- 3-Focusing on the union team spirit.
- 4-Reviewing the documents present in organization
- 5-Taking benefits from his last managing experience and use it in new projects.
- 6-Taking benefits from existing improved technology in software project management
- 7-Using clear formal methodology in project management.

8.11 The Framework Processes

- 1- Start with managing culture factors.**
- 2- Define Clear business objective.**
- 3- Understanding requirements and management requirements change.**
- 4- User involvement.**
- 5- Minimized project scope.**
- 6- Determine the standard infrastructures.**
- 7- Using Formal Methodology.**

8.12- Apply preliminary post software project evaluation

These activities of theoretical framework components we suggest to preliminary apply of post implementation evaluation for software project in initial operational phase of software project. Since this activity have benefits in mistake knowledge that may occur in system implementation. Activity also determines control mechanism for project and gets feedback about system delivery on time and within budget. Project manager have to plan for this activity and put it in official plan with reliable estimation of time and cost and integrate it within total project budget. So if we apply this activity in software project development give us many important benefits like:

Software project delivery identical for user requirements.

Software project delivery with high quality

Software project delivery with investment retard enlargement

Decrease software project maintenance cost since project is evaluated by project manager, work team and final user of project.

Decrease software project upgrade cost .

9- Monitor and Control Project Work

This is the process of essential in order to collect measure, disseminate performance information, and assess measurements and trends to effect improvements process. Also it include monitor of risk to emphasize that risks are early identified, their status is reported, and plans are being done to these risks. Monitoring includes status reporting, progress measurements, and forecasting. Which include estimation or predictions of conditions and events in the projects future, according to information available at the forecast time? Forecasts also are updated and reassessed upon the work performance, information supplied as the project is executed. This information is about the projects past performance that could apply in the project in the future.

The monitor and control project work is done in order to monitor project processes that associated with starting, planning, executing, and closing. Correctable or preventable actions are done to control performance of project. Monitoring is an issue of project management that done over the whole project. Monitoring should be continuous to give the team full insight into the project, also identify areas that need special attentions. The monitors have a lot of role like:

- 1- It compares real project performance against the project management.

- 2- It assesses performance to recommend whether any corrective or preventive actions are needed.
- 3- It analyzes and track risks to emphasize the risks are identified, their status is reported, and appropriate risk action plans are being executed.
- 4- It maintains an exact timely information base concerning the projects and their associated documentation through project.
- 5- It provides information to support status reporting, measurements of progress and forecasting.
- 6- It provides forecasts to update current cost and current schedule information.
- 7- It monitor application about agreed changes when and as the occur.

10. Change Management

Change management is integrated process essential for controlling factors that make change and emphasis that those changes have good benefits, determine if those changes occur or not and manage the approved changes. Change management process is done throughout the project.

Change control is essential because projects seldom flow exactly the project management plan. All deliverables must be kept in continuous and careful change management either by rejection or approving changes, those approved change incorporated into a revised baseline. The integrated change control process includes the following change management activities in differing levels of detail, according to the completion of project execution:

- 1- Identifying the need for changes that needed to occur.
- 2- Affecting the factors that rounded integrated change control so that only approved changes are applied.
- 3- Reviewing and approving asked changes.
- 4- Managing the approved changes when and how they happen, by regulating the flow of asked changes.
- 5- Keeping the integrity of baseline by releasing only approved changes for incorporation into project products or services, and maintaining their related configuration and planning documentation.
- 6- Reviewing and accepting all advised corrective and preventive actions.
- 7- Controlling and updating the scope, cost, budget, schedule and quality requirements according to changes that approved,by coordinating changes in entire project.

11. Risk Management

The risk management process is essential process for flow and removes known risks includes the following activities:

- 1- Monitor residual risks
- 2- Identify new risks and assess the effectiveness of executing risk response plans.
- 3- The project manager and his team should be updating the scope, cost, schedule and requirements based upon changes that approved and entire this change in the plans of projects.

10. Problems Solved By the Framework

The literature and surveys in this research revealed many problems in software projects. The ability of this framework to solve the problems could be inherent in the following points (see table 2):

11. Framework Limitations

- 1- This framework needs knowledge in software project management.
- 2- Adoption of this framework by software organization needs along time (change process required time)
- 3- This framework is a theoretical framework.

| Problem | Solved |
|--|---|
| Lack of managing and dealing with culture factors, problem with communications skills, society culture and resistance change. | Applying the Managing Culture Factors, Risk Management and Change Management through Controlling and Monitoring work. |
| Ambiguous and Changing Requirements, new ideas come from the last user after finishing the system, new administrative decision and lack of documentation of requirements. | Applying Standard Requirements and Management Change of Requirements, user involvement, formal methodology, Risk Management and Change Management through Controlling and Monitoring work. |
| Lack of user involvement, customers changes their thoughts towards projects plan of its features. | Applying User involvement, Risk Management and Change Management through Controlling and Monitoring work. |
| Lack of Executive support, the necessary things don't be available in need | Applying managing culture factors and Executive support, Risk Management and Change Management through Controlling and Monitoring work. |
| Un clear objectives, Missions and tasks aren't planned in the project don't have limited time | Applying managing culture factors, understand requirements, user involvement, define clear objectives, formal methodology, Risk Management and Change Management through Controlling and Monitoring work. |
| Un define project scope, Teamwork plans for project at the beginning but doesn't measure the extent of development comparison to the plan and Teamwork usually delayed starting with critical points | Applying managing culture factors, understand requirements, user involvement, define clear objectives, formal methodology, Risk Management and Change Management through Controlling and Monitoring work. |
| Lack of reliable estimations, playing with project plan and cost estimation losing them their reliability | Applying reliable estimation Risk Management and Change Management through Controlling and Monitoring work |
| Technology changes and infrastructure will be change lead to software project fail and Specifics and measures for required equipment and sets are considered early, and they are changed after the starting of the project | Applying standard infrastructure, Risk Management and Change Management through Controlling and Monitoring work |
| Lack of experience manager and The manager isn't able to put the plan and defining the objectives early | Applying proposed theoretical frame work |

12. Conclusion

In this paper a theoretical framework was proposed to deal with software project success/failure factors. The literature analysis showed many problems related to software project management like: Lack of managing and dealing with culture factors, Ambiguous and changing requirements, Lack of manager experience....etc. The survey analysis also showed many problems related to software project management like: Team work is distributed to the project and all parts seem busy in spite of the project doesn't deserve that, Lack of spirits of team work and corporation among teams of different projects, Data inputs that are given to team works are not clear, contrastive, unsuitable and surface ...etc. Based on deep analysis of the literature and investigated study in Jordanian firms, we proposed a theoretical framework for software project success.

software project success factors were classified into four categories: organizational factors which are the presence of formal methodology, clear business objective, executive support and project scope, technical factors that are standard software infrastructure, understanding requirements and managing requirements changes and reliable estimates, people factors that are user involvement and experienced project manager, and the cultural factors which involve organizational culture. Also in the analysis, a relationship was found between the organizational factors, people factors, technical factors and the cultural factor.

The framework contains the following activities: the Monitor and Control Project Work activity is the process of essential in order to collect measure, disseminate performance information, and assess measurements and trends to effect improvements process. The Change Management activity is integrated process essential for controlling factors that make change and emphasis that those changes have good benefits, determine if those changes occur or not and manage the approved changes. Change management process is done throughout the project. The Risk Management activity is essential process for flow and removes known risks, monitor residual risks, identify new risks and assess the effectiveness of executing risk response plans.

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