Time Estimation as Critical Factor of Software Failure and Success: A Systematic Literature Review Protocol with Preliminary Results

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Abstract—

Context: Time estimation is always considered as one of the success factor for any software project. The study is related to software projects failure and role of time estimation in success of any software project.

Objective: The objective of this research is to find all those factors that can effect timely delivery of software and increase the actual time estimation. Findings these factors are necessary so that actions can be taken in the beginning of the project.

Research Method: Systematic Literature Review (SLR) will be conducted to achieve the aforementioned goals. SLR being more formally planned is different from ordinary literature review.

Results: SLR protocol is developed and executed in different digital libraries and as a result of inclusion and exclusion criteria applied, we have finalized more than 20 papers.

Output: The final output will be the extraction of all those factors from different research studies that can influence the estimated time of projects. The results will help us to identify any research gap where more work is possible for successful and timely delivery of software projects.

Keywords - time estimationi; project failure; success factors.

I.   INTRODUCTION

The success of software project implementation is not only defined by how much customers are satisfied with the final product and how much software meets and fulfill requirements of user but it is also associated with cost and time of the project. If the time estimation of project exceed from its deadline and the budget overruns than we can consider it as failure of management that fails to deliver the project in estimated time and cost [1]. Preventing software project failure is the main objective of software process improvement as it aims at lowering the costs of development work, shortening the time to market, and improving product quality. According to [2] , most of the failure reasons of software projects can be classified into three categories i.e. failure to meet the approved schedule, failure of achieving cost objectives and failure of defining clear project scope. The time and cost of software system are also known as process requirements. In one of the study, process requirement is considered as major reason of software failure [3]. Process requirements failure shows the failure of the management in dealing with requirements. Effective management role is managing of requirements in proper way such that proper time and cost estimated is assured. According to [4], the reason of 30 to 60 percent of projects failure is improper time and cost estimations. Overwhelming majority of researches is specified that only 10 percent were successful, 52 percent were challenged and 38 percent have failed in mega software projects. Furthermore, this indicates that software projects failure may negatively affect the whole implementing enterprise.

II.   LITERATURE REVIEW

In one of their research, author[5] conducted questionnaire survey in Indian organizations and the aim was to find and prioritize success factors of any software project. From the results, the author concluded that functionality and quality of product is consider to be high priority success factor for any organization and software project. Among functionality and quality, functionality will be given more priority because it define the core requirements of user while quality in this context is related to non-functional requirements. Scope of the project, time and cost are rated as most important and success factors for any project. Among time and cost, time estimation is consider to be the high priority success factor because cost and user satisfaction itself depends on the time estimation.

According to [6], there are three factors that define the success of any software project i.e. time, cost and requirements. In this perspective, role of effective management is very important for delivery of success projects. All the risks associated with success of any project should be evaluated.

According to [7], effective management plays an important role while making plan for any project. The success of any project is directly related and proportional to how well the project is planned in beginning. This means requirements management is the key success factor and the way they are implemented define the quality of any system.

In his paper [8] in detail the reasons of why projects fail because of time estimation. Estimation problems include the following factors. 1) Political reasons, 2) Economical reasons, 3) Technical reasons, 4) Administrative reasons and 5) cultural reasons. Due to lack of good policies and effective political management developing projects can exceed from their deadlines. Sometimes poor organization policies also become unable to convince government stakeholders. Economic problems include dollar price increase or budget problems. Technical reasons include lack of good software engineering practices and trainings of the academic staff and policy makers. Lack of documentations, designs and lack of considering customer needs. Administration problems include problems related to lack of project management effectiveness, commitments, and instability of process, planning's and project team involvement.

According to [9], selection of estimation model is very much important for estimating the time and cost of projects. Understanding the scope of project is necessary. Industrial bases survey was conducted to analyze reasons of success factors during time estimation accuracy. The results of survey shows that time estimation of core projects increase only 2.5% as compare to integrated projects which are 8% due to technical complexities involve with integrated systems. The results of survey were analyzed on type of organizations for which we develop software. How much organization is following standards is very important to know. The cost and time of such kind of organizations exceed and are more as compare to standard organizations because standard organizations follow.

III. RESEARCH METHOD

Systematic Literature Review (SLR) is being conducted to achieve the objectives. SLR is different from ordinary literature review as it is more planned and methodically executed because in ordinary literature review we randomly search publications without following any systematic and planned procedure [10][11]. In identifying, analyzing and summarizing all the available data on research questions, SLR provides a greater validity. Several other authors also used the same method to find achieved goals. In this research process, we followed the guidelines proposed by Kitchenham and Charters [12].

3.1 Research questions

To conduct the research and to analyse the challenges, the following question is finalized.

RQ. What are those factors that can affect the timely implementation of software requirements?

3.2 Planning the Review

To discuss the plan for review, a systematic review protocol was defined. The plan of research is made on the basis of research questions. The major steps included in the proposed plan are:

- To explain searching strategy
- Execute search strategy and protocol
- Define inclusion and exclusion criteria for conducting the research
- Data extraction and analysis.

3.2.1 Search criteria

Plan search strategy for SLR consist of the following steps;

Step1: This step include major terms derivation. Based on research question, we can easily derive major terms.

Step2: Finding the substitute spellings and synonyms for the major terms.

Step3: Using Boolean operators for combination if the library allows. Use "OR" in case of substitute spellings and synonyms and use "AND" in case of combination of major terms.

Results for (step1): Based on the research question RQ, the following major terms are finalized.

- Software projects
- Failure
- Success
- Factors

Results for (step2):

- **Failure or success:** challenges, risks, successful, problems, time estimation problems
- **Factors:** Elements OR parameters OR characteristics OR reasons
- **Software projects:** Software OR software systems OR requirements implementation

Results for (step3):

 ((Software OR Software projects OR software systems OR requirements implementation) AND (factors OR elements OR parameters OR characteristics) AND (Failure OR success OR risks OR successful OR problems OR time estimation problems).

The final list of sources searched, their search terms, and the number of publications found for each resource are listed in following Table 1.

3.2.2 Publication selection

For selection of particular publication, we define inclusion and exclusion criteria for that. Figure 1 shows the detail of publication selection.
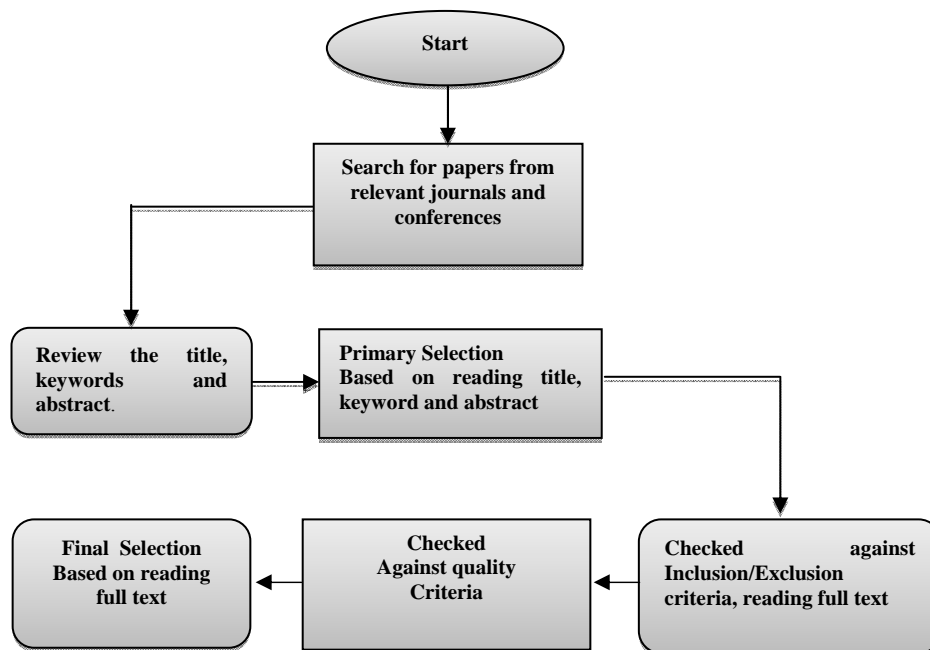

Figure 1: Publication Selection Process

A. Inclusion Criteria: Inclusion criteria are used to determine which piece of literature (papers, technical reports, etc.) found by the search term will be used for the data extraction. Papers related to success or failure of any software or IT project will be included. In this phase, papers related to time estimation of projects will also be included. The criteria are listed below:

- Studies that are reported in English language only.
- Studies that describe success factors of software projects.
- Studies that discuss reasons of failure of software projects.

B. Exclusion Criteria: Exclusion criteria are used to determine which piece of literature is found by the search term will be excluded. The criteria are listed below:

- Studies that does not discuss time estimation as success factor will be excluded.
- Studies that does not discuss time estimation as failure factor will be excluded.

C. Selecting Primary Sources: Table 1 shows final selected papers.

The planned selection process has two parts:

- **Initial selection:** It is performed by reviewing the title, keywords and abstract.
- **Final Selection:** It is performed by reviewing through full text of the papers.

D. Inter-rater reliability test: In order to reduce the researcher's, bias the inter-rater reliability test was performed where the secondary reviewer selected 5 publications randomly from the list of "total results found" and performed the initial and final selection processes.

The results were compared with the results produced by the Primary reviewer and no disagreements were found. We have identified x papers as shown in Table 1, where the duplicate papers have been removed from the finally selected list of papers.

Table1: Final selected papers

Resource	Total Results	Primary selection	Final selection
IEEE explore	90	35	8
ACM	24	15	1
Science Direct	60	23	02
Springer Link	45	18	03
Others	150	55	11
Total	369	146	25

3.3 Conducting Review

The result of search study and retrieval of information from different digital sources are presented in this section.

3.3.1 Study search selection

By applying search strategy as explained above, 369 papers were extracted from different digital libraries. In first round, we studied the abstract and conclusion portion of the studies by applying inclusion criteria and this round was named as primary selection The paper that are related to RQ are all included after primary selection and a result we got 146 papers. Then in second round, we applied further exclusion criteria by reading full papers and total of 25 papers were finalized. In this round all those papers were excluded that didn't discuss any challenge.

3.3.2 Data extraction and synthesis

We identified related information from the final list of publications by following the guidelines of Kitchenham [12]. The following data were extracted from each publication: (i) review date; (ii) title; (iii) authors; (iv) reference; (v) database; (vi) methodology (inter-view, case study, report, survey); (vii) data analysis; (xii) country/location of the analysis; and (xiii) year of publication.

IV.   RESULTS

Initial findings after reading and extraction are included in this section. Table 2 shows reasons of failure of big size software systems and reasons of delaying projects from deadlines. As shown in table, Time estimation is discussed as big challenge and failure reason in almost all papers. The reasons why time exceed from its estimated deadlines are also discussed.

Table 2: Failure reasons and factors responsible for delaying the projects

paper	Failure reasons of software's	Factors responsible for delaying projects
1	Effort / Time estimation	- Scheduling - Management - improper experience - Historical data from similar projects is not available - Incorrect estimates or improper estimation model - changes requests from clients or requirements volatility - Internal dependencies and complexities of requirements - Poor effort estimation and calculations, - company culture - Effects of individuals, effect on software process, effect in process simulation models, effect on software process improvement, lack of user involvement, improper testing,
2	• Effort / Time estimation	• Risks factors doesn't identify

	• Project scope doesn't meet • Non-functional requirements not met	• Inadequate training
3	• Project scope • unrealistic expectations of customers	• Improper requirements change management
4	• Time and budget • Requirements not met	
5	• Functionality • Quality of product • Time estimation	
6	• Time complexity	• Hidden Complexity • Requirements dependency
7	• Time and budget • Requirements not met	• Lack of proper risk management
8	• Time estimation	• Effective project management
9	• Time estimation	• Political reasons • Economic reasons • Technical reasons • Administrative reasons • cultural reasons
10	• Time estimation	• Selection of estimation model • understanding scope of the project,

V. CONCLUSION

SLR protocol is discussed in detail in this research study. The final objective of conducting SLR is to find reasons why projects due to late delivery of requirements or exceed in time estimation. After applying inclusion and excluded criteria, we have finalized set of 20 research papers from different digital libraries. The data are extracted from 10 papers as shown in table. The purpose of this SLR was to analyze all those factors that are the causes of projects exceed in time estimation and projects un-successful delivery. The factors will be analyzed using data extracted from different research studies such as company size, software size and continents in which different studies were conducted.

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