Software Outsourcing Cost Estimation Model (SOCEM). A Systematic Literature Review Protocol

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Abstract: Outsourcing software enhancement aims at developing top quality product at a low cost. This type of business is expending slowly and steadily. We have to work on developing a model called SOCEM. Its purpose is to overcome the challenges being faced by different organizations regarding cost estimation. Our work will be related systematic literature review (SLR). It will help in identifying all those challenges being faced by outsourcing software vendors' organizations. Different types of techniques and world practices will be collected in this regard. We will use a new approach of SLR in this study. The primary theme of this paper is to work on a model called software outsourcing cost estimation challenge model for the identification of all those challenges being faced by a software outsourcing vendor organization regarding cost estimation. This model will assist vendor organizations to estimate properly before contracting with client organization.

Keywords: Offshore software development outsourcing (OSDO); Vendors; Systematic literature review; critical challenges, SOCEM.

I. INTRODUCTION

We are living in the era of competition. Everyone in the field of business wants to lead other. In today's age the fulfilling of customers' needs is the primary goal of every businessman. Only outsourcing can achieve this purpose [1]. Outsourcing is defined as findings something from the outer[2]. Outsourcing has another definition as an agreement between vendor and client. Vendors then return agreed services for payment[3] .This is the right time for outsourcing innovation. At early stages, outsourcing main purpose was to focus on low cost, but nowadays it also focuses on improving services and business activities as well. It also focuses on internal and external demands [4]. Every pattern does come in with different and exclusive designs in mind therefore make them the project different. When there is a change in market price or some other competitive value in the market, an organization must also consider it by using their own core competencies[5]. Core competencies are the combination of knowledge, technologies, skills, information and methods that provide the product or services that the customer wants to take[6]. Four strong powers driving the outsourcing innovation.[7]. These powers are demand, supply of scientists and technologists, interaction capabilities and new innovations. There are so many theoretical justification for outsourcing[8]. Most important one is Transaction cost theory, agency theory etc. the impact of outsourcing is not only on international trade but it also deals in changing its pattern[9]. It is the need of today to develop high quality software. Its basic purpose should be on fulfilling customers both implicit and explicit needs[10]. In today's business world cost is the most important factor in preparing the product. In order to get survival, we have to focus on low cost[11]. There are four cost estimation methods i.e. Traditional Cost Estimating, Feature Based Costing, Parametric Estimating , Neural Network Based Cost Estimation [11]. It has become a global challenge to address software cost estimation[12]. In order to run successfully, it is necessary for software to accurately estimate its cost[13]. As outsourcing claims so many advantages, but is also not free from weaknesses[14]. Collecting low priced products from outside does not guarantee in competitive advantages[15]. So many researcher has reached on the decision that there are wide range of challenges in outsourcing results in unexpected results, unexpected raised costs, disputes, lock-in and organizational loses[14].

II. BACKGROUND

Global software development has effected every industry globally whether it is small or large[16]. GSD is like a big umbrella. Working on GSD, researchers and scientists from different time zones and culture have reached on the occasion that lack of information is the critical challenge in software outsourcing[17]. While using GSD, engineers and researchers belonging from different areas, countries and time zones are struggling for the development of software. Using GSD, the main problem is the communication and mismanagement [18]. The idea of outsourcing was first presented by Ross Perot, at the time when he did find Electronic Data Systems (EDS) in 1962[19]. Outsourcing means to produce outside one`s company[19]. Software outsourcing is gaining its popularity in a fast way, it has provided a new structure to the business activities[20].

Outsourcing comes with two types i.e. offshore outsourcing and inshore outsourcing[19]. Off shoring can be stated as combining business activities to lower cost areas across country`s boarder line. In shoring believes in combining business activities from higher paid countries to lower paid countries. Software cost estimation believes in process of identifying the effort, time and cost required to complete the project successfully[21]. There are two drivers for successful outsourcing. These drivers are cost reduction and strategic shift.

Software cost estimation is defined as it is the repetitive process in order to develop an approximation of the money related resources needed to success complete activities in project. Or we can also defined it as Software cost estimation is the process for telling whether a product will be comfortable or not[22]. Going into the depth of the history of software cost estimation, it starts its beginning in 1960s, when rule of thumb was dominating the field of business. After that Berry W. Boehm and C. Abets developed COCOMO model[23]. Soon after that Berry W. Boehm reconstruct this Model to COCOMO II[24]. It is consisted of three sub models which are named as Application Composition, Early Design and Post- architecture models. . Khan, et al[25] have developed Outsourcing Contract Management Model (OCMM) to assist outsourcing vendor organizations in addressing the challenge of poor contract management. Azeem, Muhammad Ilyas[26] has developed Intercultural Challenges Mitigation Model (ICCMM) to assist outsourcing vendor organizations in addressing intercultural challenges in outsourcing relationships. But the above tables have some limitations. Limitation of COCOMO model is that it only focuses on cost of a product. How much cost comes on developing a product? Similarly requirement elicitation model (RECM) focuses only on requirement elicitation challenges. Another model called Outsourcing contract management model (OCMM) 0nly focuses on assisting vendor organization in management and execution of contract outsourcing. There is no such model to identify the challenges while estimating a cost of a product. Improvements are continuing on regular basis up to now. Day by day competition in the business world is increasing. In such position, the need for software outsourcing cost estimation is feeling hard. There are the following attributes while working on good software cost estimation[7].

1. It is supported by project team and project manager as well.
2. It is warmly welcomed by all stakeholders.
3. It is based on well-known software cost models.

But there are also coming some difficulties with software cost estimation.[27]. i.e.
1. We don't have much historical database of cost measurement.

2. We don't have well trained estimators.

3. No more penalties associated with cost estimation etc.

4. In outsourcing cost estimation, it creates hurdles when we do estimates at early stages. [28].

There are seven steps in cost estimation[29].
1. Objective of cost estimation should be defined.
2. For required data and resources, there should be well developed project plan.
3. Software requirements should be pinned down.
4. Collect as much detail as required about the feasibility of the software system.
5. Cost estimation techniques should be used in several shapes.
6. Make comparison between estimating process.
7. Soon after starting, monitoring system must be developed for monitoring the progresses.

Cost estimation methods can be categorized in two types. Algorithmic method and non-algorithmic method. Algorithmic methods are dependendent on simple mathematical calculations[30]. Non algorithmic method works on complex mathematical computations. The challenges in exact prediction of cost, effort and time of software projects are increasingly day to day. To solve these challenges, there should be a call for well-defined software estimation process[21]. Cost estimation Outsourcing, has the following advantages and disadvantages

Advantages are: - Improved flexibility - better cash flow - Lower investment risk - Lower potential labor costs.
Disadvantages are: - choosing of wrong supplier - Intellectual property leakage- Losing in control over process - Long lead times/capacity shortages.

Our model is unique as compared to other models. Our model focuses on the challenges while estimating a cost. What type of challenges we are facing while estimating a cost of a product. Our research that we are doing may have some limitations. In performing SLR, we may have missed some relevant papers. As research in the field of software outsourcing is performed on daily basis, and there are possibilities of adding more and more papers. Due to non access to digital library and limited resources, we are unable to access all the related papers. We have planned to enhance our model to improve its usability in OSDO organization.

Our model will provide different activities for OSDO vendors. These activities are as fellow:

- To tell about the challenges of software outsourcing cost estimation in software industry.

- To tell about the practices in order to handle these challenges of software outsourcing cost estimation.
- To tell about the challenges whether they are weak or strong?
- To create different assessment reports.

III. SYSTEMATIC LITERATURE REVIEW PROCOTOL

This paper is protocol based which will give road map for the identification of challenges faced by the vendor organizations regarding cost estimation of software development. A plan is in our mind taking help from SLR as a research methodology to find challenges and practices. Practices are used for handling challenges. We use SLR as a systematic way for indentifying, extracting and evaluating the entire data[31]. It has three phases. These phases include planning, conducting and review reporting[32]. Planning phase will produce systematic literature protocol that will identify the objectives of the review.

A. Research Questions

RQ1. What and how many challenges there are faced by vendor organizations in software outsourcing cost estimation?

RQ2. What is the real world practices used to handle the cost estimation issues being faced by the vendor organization in software development outsourcing?

B. Construction of Search Terms

We will use the following options while working on designing a search term specific to our research questions.

Population: Outsourcing Software vendors, suppliers and clients.

Intervention: Challenges, practices, features.

Outcomes of relevance: useful software outsourcing, quick responsive software outsourcing model.

Experimental design: studying empirical field, SLR (systematic literature review), studying Theoretical field, opinion of software experts, applying case studies.

In order to indentify the above details, an example is presented regarding research questions.

RQ1.

[What challenges/ problems] "INTERVENTION", which are to be side lined by [Outsourcing software vendor]… "POPULATION" for the purpose of designing an [Effective outsourcing software cost estimation]..." RELEVANCE OUTCOMES".

RQ2.

[What are the practices faced by practical world] "INTERVENTION", as noted in [Software Outsourcing

Literature]…, "POPULATION", for successful [Software Outsourcing Cost Estimation]... "OUTCOMES OF RELEVANCE".

C. Search Strategies

1. *Trial Search*

Work done by conducting trial search by using search string in Science Direct, IEEEXplore, Web of Science and ACM digital library.

2. *Trial Search String*

(("software outsourcing" OR "information systems outsourcing" OR "IT outsourcing") AND ("cost estimation" OR "price prediction" OR "price forecasting") AND (challenge OR risk OR barriers OR threat) AND (practice OR solution))

Retrieval of the paper by using this search string will guide us for the development and validation of some large search terms and wanted protocol.

D. Characteristics of Search Terms

Search terms/strings constructed under the following search strategy.

1. For the inheritance of major terms, focus on research questions, by pointing out population, intervention and Outcome;

2. For these major terms, search out the alternate spellings and same meaning words.

3. Also focus on Verifying major words in any related articles.

4. Notice should be taken whether the database allows Use of Boolean Operators for conjunction to use "OR" operator for the Concatenation of alternative spellings and same meaning words whereas "AND" for the concatenation of most used terms.

5. Summarize form should be adopted in search strategy.

Results for a)

RQ1: Outsourcing Software, cost estimation, challenges, process of vendor selection.

RQ2: Software outsourcing, cost estimation, solution.

Results for b)

RQ1:

Software outsourcing: ("software outsourcing" OR "information systems outsourcing" OR "information

Technology outsourcing" OR "IS outsourcing" OR "IT outsourcing" OR "CBIS outsourcing" OR "computer-based information systems outsourcing" OR "software facility management") AND ("cost estimation" OR "price estimation" OR "cost prediction" OR "price prediction" OR "forecasting cost" OR "price forecasting"))

Challenges: (challenges OR challenges OR difficulties OR Risks OR "risk analysis" OR "critical factors") Vendors: (Vendors OR service-providers OR dealers OR traders OR marketers OR sellers OR Developers).

RQ2:

Software Outsourcing: ("Software outsourcing" OR "Outsourcing software" OR "Outsourcing software Management") AND ("cost estimation" OR "price estimation" OR "cost prediction" OR "price prediction" OR "forecasting cost" OR "price forecasting")).

Practice:(Reasonable Solution OR "good practice" OR practice OR "Lessons learned" OR "Process improvement" OR "Process enhancement" OR "Process innovation").

Result for c)

IT Outsourcing, criteria for selection of vendors, challenge analysis, outsourcing cooperation, vendor testing, relationships software outsourcing, Software outsourcing, software outsourcing suppliers, cost estimation technique, governance, real practice, possible solution.

Result for d)

RQ1:

((("Outsourcing software" OR "software outsourcing" OR "information systems outsourcing" OR "information Technology outsourcing" OR "IS outsourcing" OR "IT outsourcing" OR "CBIS outsourcing" OR "computer-Based information systems outsourcing") AND ("cost estimation "OR "price estimation "OR "cost prediction" OR "price prediction" OR "forecasting cost" OR "price forecasting")AND (challenge OR risk OR barriers OR threat) AND(outsourcing estimation" OR "price estimation")).

RQ2:

((Software Outsourcing "OR "software outsourcing") AND ("cost estimation" OR "price estimation" OR "cost prediction" OR "price prediction" OR "forecasting cost" OR "price forecasting") (Solution)).

IV. RESOURCES TO BE SEARCHED

We have searched the following search engines.

1. IEEEXplore (http://ieeexplore.IEEE.org/explore).

2. Google Scholar (www.googlescholor.om).

3. Springer Link (www.springerlink.com).

4. ACM (www.acm.org/).

5. Science Direct (www.sciencedirect.com).

6. Research Gate (www.researchgate.com).

V. SELECTION OF PUBLICATION

This part of the research tells about the criteria that included inclusion, exclusion and selection of primary resources. This paper will be focusing on software outsourcing cost estimation.

A. Inclusion Criteria

Purpose of this criterion is to focus on which portion of the research papers will be used for data extraction. Criteria defined as under.

1. Studies that tell supplier's capability for software cost estimation.

2. Studies that describe the critical challenges of software outsourcing Vendor.

3. Studies that focuses on motivations for software outsourcing.

4. Studies that define challenges in software outsourcing.

5. Studies that tell about the effect in the outsourcing software cost estimation.

6. Papers written in English language included.

7. Those papers be Included whose title may match with software outsourcing cost estimation.

8. Those papers be Included which contain keywords that may match with those defined in the search string.

B. Exclusion Criteria

Purpose of this criterion is to focus on which portion of the research papers will not be used for data extraction. Criteria defined as under.

1. Studies which are not relevant to the research questions.

2. Literature not matches to the Client or Suppliers.

3. Studies don't identify challenges of the outsourcing software cost estimation suppliers` perspective.

4. Studies not related to offshore outsourcing.

5. Studies not satisfy the outsourcing software cost estimation.

6. Studies which based on the expert opinions.

7. Exclude all duplicate papers.

VI. SELECTING PRIMARY SOURCES

Reviewing of titles, keywords and abstracts of the papers will be performed by initial selection of primary resources. Exclude all those things which are irrelevant to the problems. Through complete review of the article inclusion and exclusion criteria will be checked. As there were not related papers in cost estimation outsourcing challenges, therefore a large difference between initial selection and primary selection came.

TABLE I. Summary of Search Results

Resource to be searched	Initial selection	Primary Selection	final selection
Google Scholar	513	200	117
IEEE Explore	14	10	04
Springer	1934	20	03
ACM	22	11	02
Science Direct	12	09	07
Research Gate	13	8	6
Total	2508	258	140

VII. PUBLICATION QUALITY ASSESMENT

Performance of quality measurement is done at final selection of publication. It goes parallel with data extraction. Its performance is based on the following questions.
1. Is it with no doubt how the seller screening performed?

2. Is it with no doubt how the challenges of the outsourcing software cost estimation were identified?
3. Is it with no doubt that opinion expert was not taken?

The factors pointed out above will be done as 'YES' or 'NO' or 'NA'.

VIII. DATA EXTRACTION STRATEGY

A. Primary Study Data

Gathering of data from the publication is performed through this study. The data given below will be extracted from the publications.

1. Detail about Publication i.e. Title, Authors, Journal/Conference title, etc.

2. Data that address the research questions.

The research questions will be addressed by the following data extraction:

RQ1. What are the challenges observed by vendor organizations in cost estimation in software development outsourcing?

RQ2. What is the real world practices used to handle the cost estimation issues faced by the vendor organization in outsourcing software development?

In the data extraction, the data to be captured is presented as follow:

TABLE II. Data to Be Extracted

1. Review Date
2. Title
3. Authors
4. Database
5. Reference
6. Sample Population
7. Publication Quality Description
8. Methodology
9. Company size
10. Country / State
11. Year
12. Challenges that have a positive result on software development outsourcing vendors in outsourcing cost estimation. Challenges that have a negative result on software outsourcing clients in screening/selection of software development outsourcing vendors in outsourcing cost estimation.

IX. DATA SYNTHESIS

In data synthesis stage, one summary table will be created having columns including S.NO., risk or challenges, barriers, frequency etc. highlighting the list of all the challenges in software outsourcing cost estimation with their frequencies and percentages.

X. DIVERGENCE

If there come any change in the protocol, we will mention it and will put it to the new Appendix.

XI. ACKNOWLEDGMENT

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