Chapter 5

Interviews & Survey

Interviews and surveys were conducted in order to gather data on current scenario related to software cost estimation prevailing in the market. This chapter represents the data collected by means of these interviews and surveys. The first section provides details of individuals who were interviewed and their responses while the second talks about the online survey.

5.1 Interview

Semi structured interviews (ones that do not have a fixed set of questions) were conducted in order to gather data from industry experts. These interviews were conducted face-to-face, on the telephone and via online chat. The objective was to cover as much geographical ground as possible. Names of individuals have not been disclosed as part of our confidentiality agreement with them. The table below, however, provides details around the name of the organization, location and job roles of individuals interviewed.

<table>
<thead>
<tr>
<th>Company</th>
<th>Location</th>
<th>Role</th>
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</thead>
<tbody>
<tr>
<td>Capgemini</td>
<td>Mumbai, Maharashtra, India</td>
<td>Senior software engineer</td>
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<tr>
<td>Capgemini</td>
<td>London, UK</td>
<td>Senior software engineer</td>
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<tr>
<td>TCS</td>
<td>Noida</td>
<td>Project manager</td>
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<tr>
<td>Atos</td>
<td>Mumbai, Maharashtra</td>
<td>Technical Architect</td>
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<tr>
<td>NIIT</td>
<td>Noida</td>
<td>Software engineer</td>
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<tr>
<td>Blue Star</td>
<td>Mumbai, Maharashtra</td>
<td>Senior software engineer</td>
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<tr>
<td>Accenture</td>
<td>Gurgaon, Haryana, India</td>
<td>Associate manager</td>
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</tbody>
</table>
Questions covered during Interview process:

Open ended questions were asked with the objective of finding and analyzing the software cost estimation approaches currently existing in the software industry and identifying areas of improvement/opportunity.

Following are some of the questions that were asked in order to initiate the conversation around the objective. There were a series of questions that followed based on responses the interviewees gave for the below ones:

1. *Are you directly or indirectly involved in the software cost estimation process?*
2. *What approach do you / your organization follow to estimate the cost of software?*
3. *What are some of the challenges or problems faced by your / your organization during the estimation process?*
4. *What is the risk buffer you / your organization keep so as to meet contingencies?*
5. *Has there been a case where you / your organization have had to face consequences for inaccurate estimation?*
6. *Which one among the three key factors i.e. size, time and functionality, influences the software cost estimation process the most?*
5.1.1 Findings and Feedback

Responses given by interviewees were evaluated for commonalities and clubbed into groups to be able to draw directional inferences. There were, however, situations where certain observations were out of the box and could not be grouped. Such observations have not been included in this report as they were beyond the scope of my research. Interviewee names and exact verbatim have not been used in this report owing to our confidentiality agreement. Following are some of the key findings:

**Software cost estimation techniques:** It is observed that large scale organizations prefer using in-house tools to estimate the cost of software they are to develop. These in-house tools generally use a hybrid computation methodology which is a combination of function point and the use-case model. The tools have both parametric and non-parametric components in them and a generally built in Excel. One of the reasons why larger companies like to go this formal estimation way is that they have a target to achieve a certain CMM level to sustain in the competition.

Some large scale organization interviewees also mentioned that they rely heavily on what they call *expert estimation*. This is where a group of experienced estimators and project managers are invited to evaluate client’s requirements and estimate development time and cost. Interviewees also claimed to have received far accurate results (estimates that were closer to the actual cost) using this method and have therefore built this into their QA process whereby formally derived estimates are reviewed by process experts before they are shared with the clients.

Small scale organizations, however, prefer using the price-to-win approach. This essentially means that they price the development cost in accordance with their client’s budget and manage development within that cost. One of the reasons smaller companies do not prefer formal methods are that they do not have the CMM certification pressure. Their only objective is to capitalize on the available opportunities to support their existence in the software development world. They do not have enough time and capital to invest into formal processes.
Challenges and barriers
Another important question that was asked to the interviewees was about some of the challenges they have faced while trying to develop the software within the estimate provided at the start of the engagement. Majority of the interviewees mentioned *constantly changing client requirements* as one of the key challenges. Some also mentioned that the clients are always keen to see their software being made compatible to recent technologies. Given the nature of the software world where there is a technology shift that happens every few months, it becomes increasing challenging to meet this requirement as typical software development engagements last for at least a few months if not more. For instance, the clients today want the software to be compatible to hand held devices.

Interviewees from some smaller organizations mentioned that there is lack of good software cost models. This may be due to shortage of funds or the size of the engagement for which an estimate is required (smaller budget engagement do not have scope for using costlier estimations tools). Some interviewees also mentioned that they find it hard to collect data required as inputs for the software cost models as some of the data items are not easily available.

New software cost models & future trends
The objective of this question was to understand the satisfaction levels of interviewees with the current cost estimation models / techniques and whether or not would they be interested in a newer, comprehensive version. The responses we received were varied. Some interviewees mentioned that they were happy with the current setup while some others mentioned that it would be good to have a newer model in place that does not need too granular inputs (as some parametric models do), but, is capable enough to arrive at near actual estimates.

Following are some suggestions received from a futuristic standpoint:
1. More focus should be paid on quality attributes and how they influence cost estimates. As a standard practice, developers build basic quality features in projects, however, there are times when clients ask for more security, maintenance, flexibility etc. that haven’t been covered during initial estimation. Incorporating these features needs more effort and time. Therefore, the new tools should be scalable enough to be able to incorporate such requests at later stages.

2. There is a large amount of historical data available in the industry and the warehouse in growing day by day. In this event, it is advisable for the newer estimations tools to have inbuilt analytical capabilities that could support in selecting data points that have similar demographic details as that of our client. This will help in arriving at better estimates.

5.1.2 Conclusion

After conducting this session it is clear that different type of estimation techniques are prevailing in the market. Many organizations are not stick to one estimation techniques and prefer to use hybrid approach based on their experience or convenience. Expert estimation approach is the dominant of all. They are very much open to new hybrid approach and one which can resolve the issues they are having in incorporating quality requirements.

5.2 Survey

As mentioned earlier, a survey questionnaire was also used to gather information from different IT companies. A random survey was conducted online and offline in order to get an overview of current software cost estimation practices. The questionnaire was sent to 100 companies across country with target participants being project managers, project developers, senior software engineers and infrastructural analysts who contribute to the cost estimation process in software development. A response rate of 70% was attained.
Questionnaire content

The questionnaire was divided into two sections, A and B. Section A focused on Demographic information and captured respondent details linked to educational qualification, job experience, present designation, size of organization they are working in and if they have received some formal training in software cost estimation. Section B focused on the current practices of software cost estimation.

5.3 Result and Discussion

Company details

Some of the observations made on the survey data are:

- More than 70% participating organizations are multinational while less than 30% are of Indian origin. This data will enable us present a global view of cost estimation trends existing in the software industry

- More than 75% of the participating organizations had an employee size of greater than 1,000 enabling us to evaluate trends in medium to large sized organizations

- 95% participating organizations reflect ‘Application Development’ as their primary work domain. The other key work areas include ‘Web Development’ and ‘Systems Development’. This parameter indicates that we have the right mix of organizations helping us arrive at a conclusion (Figure 5.1)

- More than 70% of the respondents are ‘Post Graduates’ and are currently working as part of the middle management tier in their respective organizations. This reflects the maturity level of the respondent group

- More than 70% respondents feel that training in project management not only helps in cost estimation, but also enables arriving at relatively accurate results
Software Cost Prediction Analysis Conforming to Quality Requirements 2015

**Figure 5.1**: Organizations deal in different types of software development

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**Survey Questions**

The survey study tries to investigate the following research questions:

RQ1: What are the methods used by the companies for software cost estimation?

RQ2: How many people review the estimate before it is approved?

RQ3: How much size influences the effort and schedule estimation?

RQ4: How satisfied are people with current software cost estimation technique?

RQ5: To what extent do software development projects deviate from the original plan with regard to cost, schedule and functionality?

RQ6: To what extent is the level of accuracy considered a problem in the software industry?

RQ7: What are some of the barriers or challenges for software cost estimation?

RQ8: What are the reasons of inaccurate estimations?

RQ9: Are re-estimates of costs performed during development?

RQ10: What is the percentage of risk buffer added to your final estimation?
A survey based on software cost estimation plays an important role for the organizations and academicians. It is through results of these surveys that organizations are made aware of current trends and the challenges faced by organizations in cost estimation. Historically, two such surveys focusing on the importance of software cost estimation were conducted and gave similar results. Lederer [56] found that 84% of the respondents felt that accurate cost determination was “Very Important” or “Moderately Important”. Molokken-Ostvold [59] found that estimation was “very important”, “extremely important” or “most important” for 78% respondents. The surveys also provided details on how satisfied were respondents with the current cost estimation practices.

When checked for satisfaction, 88% respondents said they were satisfied with current software cost estimation while only 4 % were highly satisfied. These results indicated large scope for improvement thereby impacting the satisfaction levels.

We will now analyze the survey and its results at a question level:

**RQ1. What are the methods used by the companies for software cost estimation?**

Various methods are prevailing in the market for software cost estimation like expert estimation, top down, algorithmic, bottom up, price to win etc. In my survey there are 22 project managers, 16 senior software engineers, 13 software engineers, 10 software analysts and 12 others (i.e. business analyst, software trainee, web developer) who are responded for software cost estimation techniques they use for software cost estimation and the results are:
Software Cost Prediction Analysis Conforming to Quality Requirements 2015

Figure 5.2 Cost estimation methods used by companies

Figure 5.2 reflects that “Software cost estimation tools” and “Expert Consultation” are preferred modes of cost estimation by organizations today. Some companies also use intuition and experience, analogy, price to win and capacity related estimation techniques.

Respondent comments also indicate the use of tools like R-model and story points for cost estimations (as mentioned by respondents in the open ended questions).

RQ2. : How many people review the estimate before it is approved?

Figure 5.3: Number of people reviews the estimate before finalization
More than 60% of the organizations that responded to this question claimed that it takes 2-4 people to review the prepared estimate before it is considered final. They claim that more the number of reviews, greater are the closeness to being accurate.

**RQ3. How much size influences the effort and schedule estimation?**

Software size is one of the key factors that affect the software cost. Estimating the code size of a program before it is actually built is almost as hard as estimating the cost of the program [58]. This means that there is a direct correlation between the size, effort and schedule of a software program i.e. if there is an increase in size of the software, there is an increase in the effort required and accordingly, an increase in the development time.

80% respondents in our survey indicated that size of the software directly influences the effort and schedule estimation of the software project. Figure 5.4 below reflects the magnitude of influence that software size has on the effort and schedule for the software (as indicated by the survey respondents)

![Figure 5.4: Impact of software size on effort and schedule](image)

RQ4. **How satisfied are people with current software cost estimation technique?**

Out of 73 respondents, only 5 were highly satisfied while 57 were satisfied with the current software cost estimation techniques. The balance respondents did not respond to this question. These statistics indicate that the IT industry is heading in the right
direction. This is also reflected in the latest report released by STANDISH group of CHAOS 2012. The increase in success is a result of several factors, including looking at the entire project environment of processes, methods, skills, costs, tools, decisions, optimization, internal and external influences, and team chemistry.

![RESOLUTION Table]

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<td>29%</td>
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<td>32%</td>
<td>37%</td>
<td>39%</td>
</tr>
<tr>
<td>Failed</td>
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<td>19%</td>
<td>24%</td>
<td>21%</td>
<td>18%</td>
</tr>
<tr>
<td>Challenged</td>
<td>53%</td>
<td>46%</td>
<td>44%</td>
<td>42%</td>
<td>43%</td>
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</table>

Figure 5.5: Success rate of projects from 2004 to 2012

The above figure indicates that success rate of projects has gone up by 10% over a period of 8 years while there is a decline in the challenge rate by a similar percentage. The failure percentage, though was high in the year 2008, has come down to its starting point towards the end of the reporting period.

The key objective of this survey was to identify those challenges that stop the project from being successful and gradually transition it towards failure.

**RQ5: To what extent do software development projects deviate from the original plan with regard to cost, schedule and functionality?**

This question is important to find the deviation of original software development plan in terms of cost, schedule and functionality. By this question one can easily find the main culprit or factor because of which the chance of deviation increases.

The respondents answer this question on a scale of 5 (i.e. Very Low, Low, Average, High, Very High and Don’t Know)
Figure 5.6: Deviation of cost, schedule and functionality from original plan

The above graph shows that functionality impacts the project plan from average to high levels as any change in scope requested by the client would directly impact schedule. The graph also shows that a change in the cost of the engagement may not necessarily impact the overall development plan.

**RQ6: To what extent is the level of accuracy considered a problem in the software industry?**

There are different methods available for software cost estimation; however, accuracy still remains the key area of concern. Accuracy also depends on what phase of the software life cycle is the estimation done. As we can see in the following figure the level of accuracy, software professionals attained during software development life cycle [55].
High accuracy in software cost estimation is achievable if estimation is done at coding or implementation stage because most of the things are clear by that time. As clearly shown in the above figure, accuracy of cost estimation is low initially, however, increase to up to 70% as the development lifecycle matures. At later stages, only 10 to 20% contingency is required.

Figure 5.8: level of accuracy

The figure above indicates that accuracy of the cost estimate continues to be a concern for most of the organizations.

RQ7: What are some of the barriers or challenges for software cost estimation?
More than 50% of the survey respondents feel that cost estimation models cost a lot of effort to collect data and estimate and see this as a major challenge in effective estimation. Respondents also feel that there is lack of appropriate investment on part of the organization in areas of cost estimation. The following figure shows percentage impact of top barriers as provided by survey respondents.
RQ8: what are the reasons of inaccurate estimations and project failures?
The main reason for inaccurate estimation in software cost estimation is that the clients and developers often don’t realize that software development is a process of gradual refinement and the estimates made at the early stage of a project lifecycle are “fuzzy”. Even good estimates are only guesses, with inherent assumptions, risks, and uncertainty, and yet they are often treated as though they are cast in stone.

There are many reasons of inaccurate estimations like requirements are unclear, changing technologies, overlooked tasks, insufficient time for testing and so on[57]. In the survey, respondents said that more than 80% time’s actual effort is more than estimated effort due to ambiguous/changing requirements thereby leading to project failure.
It would not be incorrect to say that clients or customers majorly influence estimation accuracy. Researches done in the past also support the fact that clients can impact vendor’s estimation accuracy by frequently changing requirements [54].

**RQ9: Are re-estimates of costs performed during development?**

It is a very important question from software cost estimation point of view. Accuracy in software cost estimation is always an area of concern. Both clients and software developers fail to realize that the estimate provided is purely an estimate and not a final number to target at. The software development process is both iterative and evolving and greater clarity is obtained at the development progresses (Figure 5.10).

![Estimation life cycle with respect to Project life cycle](image)

The figure clearly illustrates that estimation made at the start of the engagement is revisited during the preparation of the project plan and in the course of the development process.

“The main cause of the re-estimation is the uncertainty at the beginning. The ‘Cone of Uncertainty’ (figure 5.11) explains how estimates by experts may vary with high degree of error (i.e., -4x to +4x) at the beginning of the project” [55]
Other areas where re-estimation becomes important are:
any change in requirements initially stated by the client,
any change in the technology used after the execution has started,
change in the project development team, i.e., experienced resources leaving the project. The survey results reflected 90% respondents in favor of re-estimation.

**RQ10: What is the percentage of risk buffer added to your final estimation?**

“Risk is a potential problem that can impact the success of any project, a problem that hasn't happened yet, and you'd like to keep it that way” [60]. Risk management has been identified as one of the most important practices for software development process [4]. It is not enough to be able to identify possible risks. It is very important to manage each risk by identifying actions to reduce its impact and by making some plans for contingencies if the risk control activities are not effective enough [61].

In software cost estimation, the main risk is to manage the cost so; it is advisable to keep some percentage of risk buffers in addition to the cost estimation. The percentage of estimated costs being kept aside as risk buffers ranges between 5% to 30%.