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Alternative Solutions for Improved Cost Estimation
Process in IT Projects using MADMA
Featured Paper   by Vinith Rajan

Alternative Solutions for Improved Cost Estimation Process in IT Projects using MADMA[1, 2]

Vinith Rajan

ABSTRACT

The Calculation and the maintenance of Cost estimation/Cost management in the IT projects are becoming difficult day by day due to the increased complexity of the projects. The cost estimation is previously done by a standard format. Which give the idea to the estimator a rough estimate of the project which is no longer valid for the uncertainty projects. The main purpose of the cost estimation is "The maker can decide whether the undertaking or item is practical to producer before the assembling procedure"[3]. In this paper, we have used the Multi-Attribute Decision Making analysis and with that the additive weighing technique to determine the alternative solution from the better solution to the least solutions that should be integrated into the project cost estimation. Based on the analysis the project cost estimator should know more about the cost estimation techniques and the better estimation technique and the model to use for the cost estimation. Since the better-improved process of the cost estimation/cost management in the IT projects will govern the project officials to finish the project in time, with the scope and the defined cost.

Keywords: Cost estimating, Cost management, Project budget, Resource planning, Cost estimating methods.

1) INTRODUCTION

Cost management/Cost estimating in an IT project is concerned mostly with the process, methods followed and the phases of the project. All the projects irrespective of a large or medium or small needs to be processed under certain constraints. Cost is one of the mainly focused constraints that need to be controlled while managing the project. The Cost management includes "the process required to ensure that the project is completed within the cost estimation done prior to the

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[3] (Blog- MIE solutions, David Ferguson), February 8, 2011- Purpose of cost estimating
https://blog.mie-solutions.com/2011/02/08/purpose-of-cost-estimating/

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project"[4]. The Cost estimating is the practice of "forecasting the cost of completing a project with a defined scope it is used to authorize a project's budget and manage its Cost"[5]. Cost estimating may seem like a painful process, but this is a crucial one because it is important in defining the parameters of a project. Cost management takes place throughout the lifecycle of the project from the initial phase to the closure phase, it is directly related to the project management which includes the "activities like Planning, estimating, budgeting, Financing, funding, managing, and controlling costs so the project can be completed within cost constraints"[6]. The goal of the Resource Estimating is to "have a resource for each activity" in the project[7].The High performing organizations successfully finished the projects by 89% where the low performing organization completes only 36% which uses 12 times more resources than High- performing firms because of poor cost management and estimation. Organizations lose about $109 million every year for every $1 billion invested in projects which gives us a huge loss margin[8].

According to the KPMG Canada Survey (1997) focused on the IT projects in Canada's leading 1450 public and private sector organizations has given the result as "61% of the projects undertaken in IT is a failure and more than 30% of the projects have blown up on their cost to complete the project". Another survey report, The Chaos Report (1995), revealed that "31.1% of projects have been canceled before they have been completed due to poor cost estimation and management"[9]. Further results indicate 52.7% of projects will cost over 189% of their initial estimate which showcases the serious problem of lack of cost estimating and cost management technique and the process followed in it. PRINCE 2 is the very least used methodology amount the project managers and 44% of the project managers use no software for estimating their projects[10]. As a result of IT CORTEX, the IT project cost management is highly unsuccessful than successful, about one out of five IT projects gets the satisfaction of successful completion[6]. "The larger the project becomes the more likely the failure".

The FIVE WHY'S starting with a problem and ask "why" it is occurring and continues until you reach the root cause of the problem. (i)Omit problem scope from the estimate, which would be the leading cause of every wrong estimation and the cost overruns. (ii)Omit possible risks from the analysis, both internally and externally. (iii)The unrealistic and optimistic assumption made

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[4] (Blog- cost engineering), 28th December: The role of cost estimating in project management
http://www.costengineering.eu/blog-article/the-role-of-cost-estimating-in-project-management

[5] (Blog- smart sheet): The ultimate guide of project costing, An overview of cost estimation
https://www.smartsheet.com/ultimate-guide-project-cost-estimating

[6] (Blog- cost management), 23rd February : Cost management explained in four steps
http://www.costmanagement.eu/blog-article/198-cost-management-explained-in-4-steps

[7] Bpayne and Adrienne Watt, Chapter 11 resource planning project management
https://opentextbc.ca/projectmanagement/chapter/chapter-11-resource-planning-project-management/

[8] Guest Contributor, October 14, 2015: Project Failure statistics: the shocking truth
http://www.projectmanagementworks.co.uk/project-failure-statistics/

[9] (KPMG survey 1997, Chaos report 1995): Failure rate statistics over IT projects failure rate, http://www.it-cortex.com/Stat_Failure_Rate.htm

[10] Rachel Burger, (September 26th,2016): 20 surprising project management statistics
https://blog.capterra.com/surprising-project-management-statistics/

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by the estimators leads to the cause of overruns, these three reasons contribute to the 74% of cost growths according to the RAND STUDY. (iv)Use historical low escalation projections, are the cause for 11.2% of cost growths. (v)Estimation not done by a bona fide estimator is the root cause of these problems[11]. For these kinds of complex nature projects, it is essential to have a standard methodology and process for cost estimation and cost management so that the causes for this misinterpretation will be minimized.

Based on the Glenn Butts analysis on how we underestimate the cost. The five why's analysis is made to find out the root cause of the problem by asking the why statements for every cause, shown in figure 1.0

PROBLEM: The Cost estimation and the Cost management in IT Projects is done very poor as a result of it the actual cost of the project is overrun by a large margin.
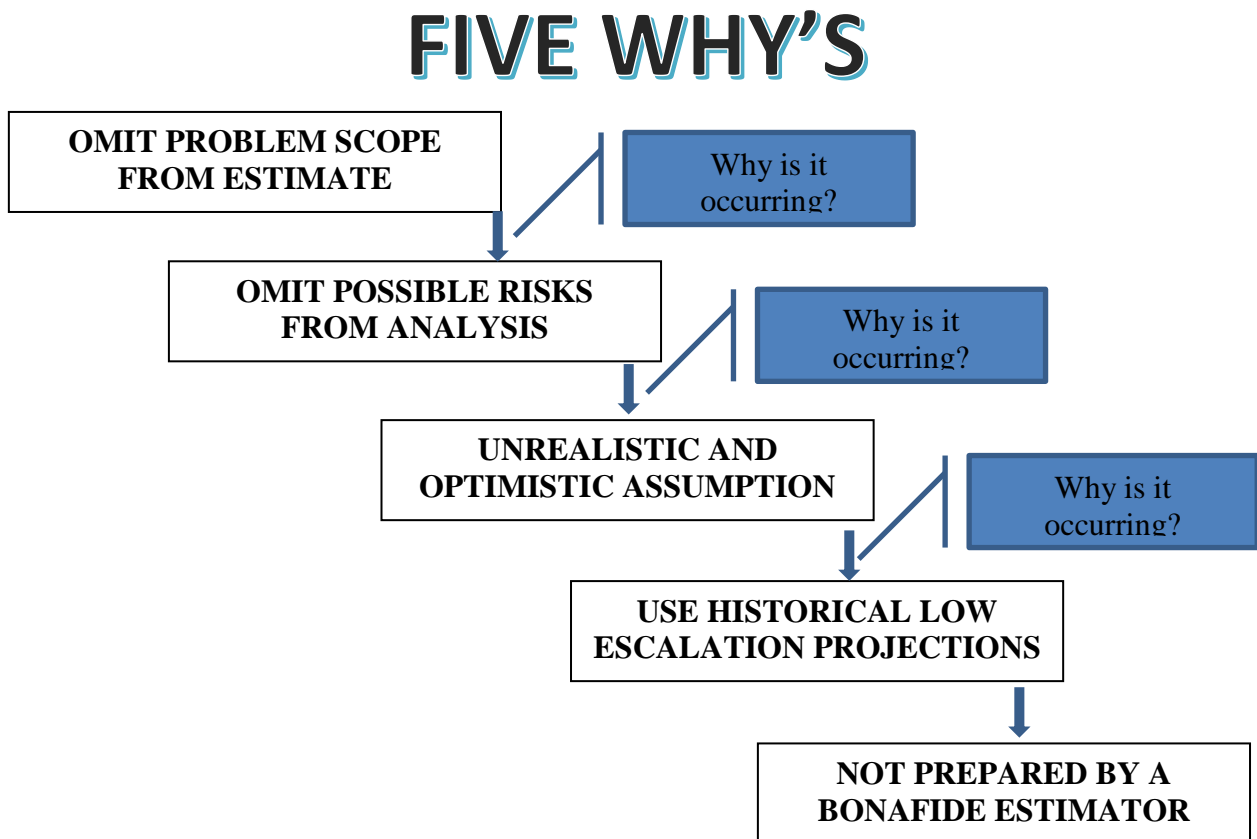
FIVE WHY'S

Figure 1.0: FIVE WHY'S analysis, what is the problem for the ineffective cost management[12].

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[11] Glenn Butts, February - 2010, Megaprojects estimates a history of denial-
http://www.build-project-management-competency.com/wp-content/uploads/2010/09/Glenn.Butts-Mega-Projects-Estimates.pdf
[12] By Author

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1.1 Thesis objective statement

Is using the various methodology, processes and tool and techniques in the IT Organization gives the better Cost estimation/ Cost management in the IT Projects.

1) Firstly, assessing what kind of process is used by the IT Organizations to make the Cost estimations
2) Secondly, analyzing the methodology or process which is ideal for cost estimation.
3) Thirdly, evaluating the top IT Cost Estimating models.

METHODOLOGY

Step 1: Summarize

As discussed, the main purpose of this paper is to find the ideal cost estimation methodology or the process in the IT PROJECTS as a result of that the effective cost estimation methodology will be practiced to minimize the over Budget problems.

Foremost we need to identify the processes followed in the IT project cost estimation methods to analyze the problems in that process which causes the Wrong estimation and leads to Over Budget problem. There are several factors that lead to Budget overrun, below are the major reasons for that.

PROBLEM STATEMENT

The problem statement is taken from the guild module 8: creating the owner's cost estimate (top down) was based on work by Glenn Butts from NASA[13].

1) **Omit probable scope:** Managing the scope is an iterative process and it is like an asset to the project which needed to be elaborated accurately as possible, what deliverables and intangible and tangible outputs.
2) **Omit probable risks:** The risks may be internal or external factors without considering the risk factors if the cost is estimated then it ends up to a financial backlog.
3) **Unrealistic and optimistic assumption:** Making the unrealistic and optimistic assumptions for the cost is a bad practice**.** The unrealistic and optimistic assumption made by the estimators leads to the cause of overruns
4) **Use of historically low escalation factors:** Use historical low escalation projections are the cause for cost growth in most of the projects. An estimator should focus on these factors and make the estimate based on that.

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[13] PP Admin, (January 6- 2016): CREATING THE OWNERS COST ESTIMATE (TOP DOWN)
http://www.planningplanet.com/guild/gpccar/creating-the-owners-cost-estimate

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5) **Use of unqualified/marginal qualified cost estimators:** the competency of cost estimation is not just passing the multiple-choice questions instead of having a real-time experience and qualification to estimate the cost for the project.

6) **Not enough time to prepare "Credible" Estimates:** The cost estimation does not become budget until it has been approved by the authorized persons. Preparing a credible estimation is an important factor for under controlled project cost.

THE COST ESTIMATING PROCESS

This is the basic process flow for the cost estimation and budgeting derived from the "**GAO's Best Practices in Capital Budgeting**"[14].

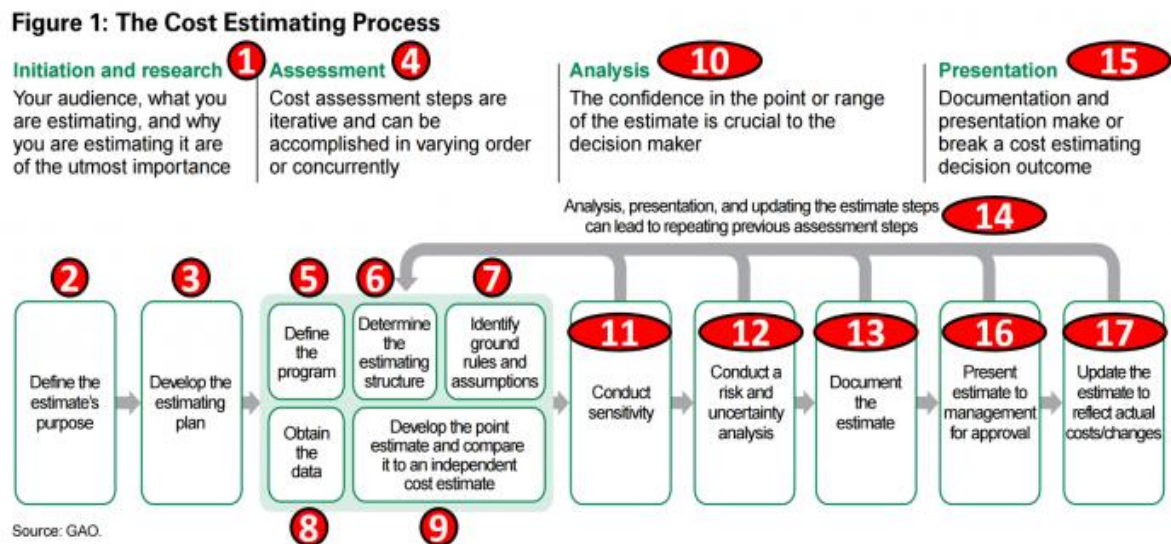
FIGURE 2.0 Cost Estimating Process as defined by the US GAO

1) Initiation and research this is where you look at the stakeholders and their needs
2) Once we know what we are estimating then we need to understand why we are estimating
3) In this step, we need to develop the estimating plan
4) You have to validate that the level of scope definition is appropriate for you to use the chosen tools and techniques.
5) Defining the program
6) Defining the estimating coding structure
7) Identify the ground rules as well as any constraints
8) Obtaining the data.

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[14] PP Admin (November 2, 2015): Guild of project controls compendium and reference
http://www.planningplanet.com/guild/gpccar/introduction-to-managing-cost-estimating-budgeting

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9) Develop a point estimate and compare it against an independent estimate.

10) Analysis and run the test to develop the evidence

11) Conducting a sensitivity analysis

12) Add in the contingency and buffers

13) Run through the steps 1-12

14) Step 5-17 is iterative so we periodically check the scope and make sure the project is viable

15) There is two primary decision point we as cost estimators need to consider, i) Decision support package, ii) performance measurement baseline.

16) Submit the documented cost estimate for approval

17) The performance measurement baseline is approved and the Notice to Proceed has been issued.

STEP 2 – ALTERNATIVE SOLUTIONS

There are many cost estimation methods, which are divided into two groups Algorithmic and non-algorithmic. Using both methods for the estimation of the cost is better for the accurate cost estimation. If the requirements for the estimation is known clearly then the estimation will be effective.

(i) Algorithmic models

This model works based on the calculation more often than not it needs the information first and makes results by utilizing scientific relations. "The **software cost drivers** largely impress on required software effort and cost in the development of the software life cycle"[13] . Each algorithmic model uses an equation to do the estimation.

$$\text{Effort} = f(X_1, X_2, \ldots, X_n).$$

Where (X1 - Xn) is the vector factors. All the factors using these models are:

- Product factor: Required the reliability, database size, complexity.
- Computer factors: execution time constraints, storage constraints, platform volatility.
- Personnel factors: examiner ability, dialect and apparatus encounter, staff congruity.
- Project factors: various-sites development, utilization of software tools.

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[13] Zeynab Abbasi Khalifelu, Farhad Soleimanian Gharehchopogh (23 May 2012): Comparison and evaluation of data mining techniques with algorithmic models in software cost estimation, https://www.sciencedirect.com/science/article/pii/S221201731200014X

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1) SOURCE LINE OF CODE:

The source line of code estimate based on the number of all the command lines in the project code and it does not include the instructions as comments, blanks, and continuous lines. The SLOC is the base for the estimation in many complicated software estimation methods.

MEASUREMENT METHODS

Physical SLOC and the logical SLOC, where the physical SLOC counts the lines in the program code including the comment lines. The logical SOLOC measure the number of statements but their specific definitions are similar to the computer language. Mainly "the cost estimations are done using the tools"[14] because

- Extensively studded the phenomenology associated with the development and the parameters that drive costs.
- Developed. Validated estimating models that take this phenomenology into account.
- They calibrated the model using the normalized historical data.

2) FUNCTION POINT SIZE ESTIMATES:

In this, the estimation is done based on some indicators as mentioned below.

- User inputs
- User outputs
- Logic files
- Inquiries
- Interfaces

According to the previous experience, this technique could be progressively helpful on the grounds that it could be figured dependent on the necessity determination in the beginning periods of the undertaking.

"**Uses of function point**"[15]:

1) Through the function point, we can analyze and monitor the level of productivity.
2) We can do the estimation of software development cost through its life cycle.

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[14] D J Reifer (November/December 2000): web development: estimating quick to market software. Retrieved from https://ieeexplore.ieee.org/abstract/document/895169
[15] Matson, Barrett, Mellichamp (April 1994): Software development cost estimation using the function points. Retrieved from https://ieeexplore.ieee.org/abstract/document/277575

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3) WEIGHTED MICRO FUNCTION POINTS

This method of cost estimation is based on the complexity and the functionality of the code in the project it is not similar to the COCOMO and REVIC models. "The **weighted micro function point** uses a parser to understand the source code breaking it down into micro functions"[16]. It breaks the program code into many micro functions and generates the code complexity and volume metrics. Which are then interpolated into a final effort score?

4) COCOMO

The constructive cost model is based on algorithmic software cost estimation model. This model uses basic regulation formula along with the data from the previous similar projects and current project characteristics. "The COCOMO added a capability for the estimators to estimate the costs and schedules for **the incremental software development**"[17].

COCOMO uses three classes of programming venture:

- Natural undertakings: "little" groups with "great" encounter
- Semi-detached projects: "medium" team with mixed experience
- Embedded projects: developed within a set of "tight" constraints.

COCOMO EQUATION:

$$\text{Effort Applied} = a_b(\text{KLOC})^{b_b} \ [\text{man-months}]$$
$$\text{Development Time} = c_b(\text{Effort Applied})^{d_b} \ [\text{months}]$$
$$\text{People required} = \text{Effort Applied} / \text{Development Time} \ [\text{count}]$$

The coefficients a_b, b_b, c_b and d_b are given in the following table.

Software project	a_b	b_b	c_b	d_b
Organic	2.4	1.05	2.5	0.38
Semi-detached	3.0	1.12	2.5	0.35
Embedded	3.6	1.20	2.5	0.32

Figure 3.0: shows the equation to estimation cost faster[18].

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[16] Abbas et al (April 2012): cost estimation: A survey of well-known historic cost estimation techniques
https://www.researchgate.net/profile/Aqeel_Rehman4/publication/321462199_Cost_Estimation_A_Survey_of_Well-known_Historic_Cost_Estimation_Techniques/links/5a2266b54585155dd41b06f0/Cost-Estimation-A-Survey-of-Well-known-Historic-Cost-Estimation-Techniques.pdf
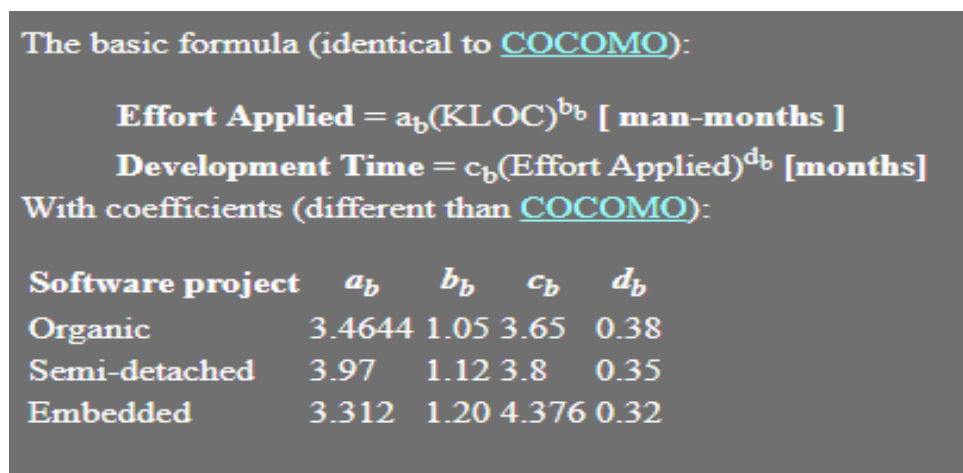[17] Boehm et al (December 1995): Cost models for future software life cycle processes: COCOMO 2.0. Retrieved from https://link.springer.com/article/10.1007/BF02249046
[18] Project code meter: COCOMO Model retrieved from,
http://www.projectcodemeter.com/cost_estimation/help/GL_cocomo.htm

5) REVIC

Revised intermediate COCOMO which predicts the development life cycle costs for the software. This method is mainly used for military projects and also adds the effort estimation for initial software specification review and final development tests. Using this method" the military project cost estimations" are done[19].

REVIC EQUATION:

The basic formula (identical to COCOMO):

$$\text{Effort Applied} = a_b(\text{KLOC})^{b_b} \ [\text{ man-months }]$$

$$\text{Development Time} = c_b(\text{Effort Applied})^{d_b} \ [\text{months}]$$

With coefficients (different than COCOMO):

Software project	a_b	b_b	c_b	d_b
Organic	3.4644	1.05	3.65	0.38
Semi-detached	3.97	1.12	3.8	0.35
Embedded	3.312	1.20	4.376	0.32

Figure 4.0: Shows the equation to calculate the cost using REVIC model[20].

(ii) NON-ALGORITHMIC MODELS:

Contrary to the algorithmic method this method is based on analytical comparisons and inferences. Usually, the estimation based on the non – algorithmic method is based on the previous database.

1) ANALOGY

In this method the previous software completed projects are taken into account their usual estimated cost and time is compared with the actual cost and time. "Cases are defined as abstractions of events that are limited in time and space"[21]. The estimation dependent on the relationship is cultivated at the aggregate framework levels and subsystem levels. The steps of this method are considered as.

     i)   Choosing of analogy

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[19] Project code meter, Differences between COCOMO, COSYSMO, REVIC, Function points, and WMFP. Retrieved from http://www.projectcodemeter.com/cost_estimation/help/GL_cocomodiff.htm
[20] Project code meter: REVIC Model retrieved from, http://www.projectcodemeter.com/cost_estimation/help/GL_revic.htm
[21] Shepperd, Schofielf (12, November 1997): Estimating software project effort using analogies. Retrieved from https://ieeexplore.ieee.org/abstract/document/637387

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ii)   Investigating the similarities and differences

iii)   Examining of analogy quality

iv)   Providing the estimation

2) EXPERT JUDGEMENT

This estimation is done by getting advice from the expert who has extensive experience in similar projects. One method which works according to this technique is Delphi. Delphi arranges the group of experts for a meeting and gets the estimation based on the debates and opinions of the experts." The limitations can be summarized as"[21].

- Subjective
- Risky and prone to error
- Use of expert judgment is not consistent and an unstructured process.
- Estimates are a black box in nature.

3) MACHINE LEARNING MODEL

Most of the estimation done for the cost analysis is based on the statistical methods, which we cannot get a strong accurate result and able to provide a strong reason. "Machine learning technique could be an answer for it since it can build the precision of evaluating via preparing principles of estimation and rehashing the run cycles"[22].

(iii) ACTIVITY BASED COSTING

The traditional cost accounting technique will allocate the indirect expenses to the product based on the specific characteristic which is not related to the type and level of work consumed. Where the activity-based costing technique recognize the indirect cost in those proportions. They focus on the work activities of people and the equipment required to make the product and the consumption of those activities.

- **ROLE OF MANAGEMENT ACCOUNTANT**

With any management technique buy-in from the executive team is important to implement the activity-based costing technique. The administration bookkeeper can play out a critical job in the plan of an ABC framework dependent on their past experience and aptitudes and preparing.

- **IMPLEMENTING ABC WITH CHANGE MANAGEMENT:**

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[21] Rush, Roy (December 1, 2001): Expert judgment in cost estimating: Modelling the Reasoning process. Retrieved from https://journals.sagepub.com/doi/abs/10.1177/1063293X0100900404

[22] Vahid Khatibi and Dayang N.A. Jawawi, (Volume 2 No.1-2010-2011): Software Cost Estimation Methods: A Review http://cisjournal.org/archive/vol2no1/vol2no1_3.pdf

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The main objective of this process is to ensure that there is support for the system at all the levels of the organization. The change management process needs to address the people's issues first which results in the implementation of the new costing system. The benefits of having the improved costing information exceed the administrative efforts. The following equation must be satisfied[23].

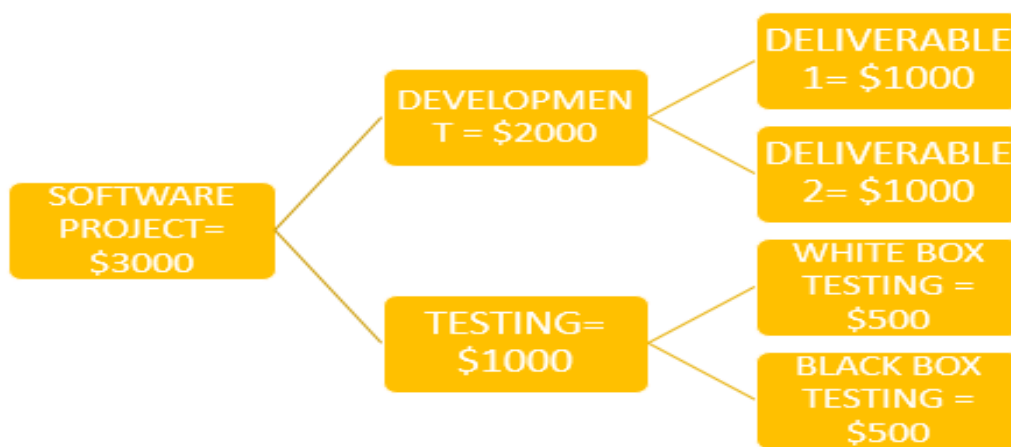$$\frac{\text{INCREMENTAL BENEFIT}}{\text{INCREMENTAL ADMINISTRATIVE COST}} \gg 1$$

Figure 5.0: Example for the activity-based costing for an IT service activity [24]

The attributes that are compared to the above-mentioned alternatives are:

1. Project size: The project size is important in consideration the alternative solution for the cost estimation, "depending mainly on the size of the project which is measured through many methods like function points, object point and line of code"[25].

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[23] Gary Cokins (2014), Implementing activity- Based Costing: https://www.imanet.org/insights-and-trends/strategic-cost-management/implementing-activity-based-costing?ssopc=1

[24] By Author

[25] AL Khalidi et al (May 2012): Selecting a standard set of attributes for cost estimation of software projects. Retrieved from https://www.researchgate.net/publication/261450420_Selecting_a_standard_set_of_attributes_for_cost_estimation_of_software_projects

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2. Complexity: "Complexity tends to be a catch-all category that is used when project results are unpredictable" the reason for the complexity may vary on many factors both objective and subjective[26].

3. Reliability of method: "The reliability of a preliminary estimate can be judged from the level of accuracy of such estimate"[27].

4. Accurate result: "The accuracy of the method can be calculated based on several factors like the cost codes used as a checklist can also be employed to measure the accuracy of an estimation"[28].

5. Resources needed (based on old projects): The historical database is required for many cost estimates but sometimes the historical data is incomplete, inconsistent. [29]

6. Precision: In the designing phase the project objectives are not clearly defined so "the less precise cost estimation"[30] is only done when the objectives are not clear.

7. Time: The time is taken to find the right "estimation to have an optimal solution" [31]varies on the project size and complexity the method we choose to estimate the cost.

STEP 3- SELECTION CRITERIA

In this paper, we have used "**Multi-Attribute Decision-Making analysis method**" for selecting the best solutions accordingly with respect to the selected attributes[32]. Here the alternative solution is ranked based on the attributes as very high, high, neutral, low, very low. Here the color difference varies from green, yellow and red whereas red indicates low and very low, while the yellow indicates neutral and the green indicates high and very high.

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[26] Dao et al (December 2016): Identifying and measuring project complexity. Retrieved from
https://www.researchgate.net/publication/303391889_Identifying_and_Measuring_Project_Complexity
[27] Arijeloye et al (November 2016): Reliability of preliminary cost estimates of educational building projects in a developing economy. Retrieved from
https://www.researchgate.net/publication/309760421_Reliability_of_Preliminary_Cost_Estimates_of_Educational_Building_Projects_in_a_Developing_Economy
[28] Carl Bauman, American Cyanamid (April 1961): How to measure estimate accuracy. Retrieved from
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[29] Rani, Behel (May 2014): Comparison of cost estimation technique. Retrieved from
http://ijarcsse.com/Before_August_2017/docs/papers/Volume_4/5_May2014/V4I5-0568.pdf
[30] Duverlie, Castelain (1999): Cost estimation during design step: Parametric method versus case-based reasoning method. Retrieved from: https://link.springer.com/article/10.1007/s001700050147
[31] Hegazy, Ayed (may 01,1998): Neural network model for parametric cost estimation of highway projects.
Retrieved from: https://ascelibrary.org/doi/abs/10.1061/(ASCE)0733-9364(1998)124:3(210)
[32] Sullivan, Wickes& Kroelling (2014). Engineering Economics 15th Edition Then the second step is to calculate the relative weighting of each attribute. Retrieved from http://www.planningplanet.com/guild/gpccar/managing-change-the-owners-perspective

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Table 1- Multi-Attribute Decision Matrix

ALTERNATIVE SOLUTIONS /ATTRIBUTES	WMFP	COCOMO	FUNTION POINT	REVIC	SLOC
PROJECT SIZE	HIGH	VERY HIGH	HIGH	VERY HIGH	HIGH
COMPLEXITY	VERY HIGH	LOW	NEUTRAL	HIGH	NEUTRAL
RESOURCES REQUIRED	HIGH	NEUTRAL	NEUTRAL	LOW	NEUTRAL
ACCURATE RESULT	VERY HIGH	HIGH	NEUTRAL	VERY HIGH	LOW
RELIABILITY	VERY HIGH	NEUTRAL	LOW	HIGH	VERY LOW
PRECISION	HIGH	HIGH	NEUTRAL	HIGH	HIGH
TIME	NEUTRAL	HIGH	NEUTRAL	HIGH	VERY HIGH

ALTERNATIVE SOLUTIONS /ATTRIBUTES	ANALOGY	EXPERT ADVICE	MECHINE LEARNING	ABC
PROJECT SIZE	HIGH	VERY HIGH	NEUTRAL	HIGH
COMPLEXITY	LOW	VERY LOW	NEUTRAL	VERY HIGH
RESOURCES REQUIRED	VERY HIGH	LOW	HIGH	HIGH
ACCURATE RESULT	NEUTRAL	HIGH	HIGH	NEUTRAL
RELIABILITY	NEUTRAL	HIGH	VERY HIGH	HIGH
PRECISION	LOW	NEUTRAL	HIGH	NEUTRAL
TIME	LOW	LOW	HIGH	VERY HIGH

Algorithmic model is based on automation. So, the level of accuracy is more, than the human-based activity estimations. So, it is better to proceed with the Algorithmic model than the other feasible alternatives that cause human errors.

FINDINGS

STEP 4 - ANALYSIS AND SELECTION OF BEST ALTERNATIVE SOLUTIONS

To utilize the approach which we have shown in table 1, we need to represent the alternatives quantitatively for the analysis. So, we need to start converting the relative scorings (very high, high, neutral, low, and very low) as a dimensionless value.

Table 2- Quantitative representation of the attributes

ATTRIBUTES/ RELATIVE SCORING OPTIONS	PROJECT SIZE	COMPLEXITY	RESOURCES REQUIRED	ACCURATE RESULT	RELIABILITY	PRECISION	TIME
VERY HIGH	1	1	1	1	1	1	1
HIGH	0.75	0.75	0.75	0.75	0.75	0.75	0.75
NEUTRAL	0.50	0.50	0.50	0.50	0.50	0.50	0.50
LOW	0.25	0.25	0.25	0.25	0.25	0.25	0.25
VERY LOW	0	0	0	0	0	0	0

Now, we shall use the above-mentioned dimensionless values relative rank or weight for each of the alternatives.

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Table 3- Relative weighting

ALTERNATIVE SOLUTIONS /ATTRIBUTES	WMFP	COCOMO	FUNTION POINT	REVIC	SLOC
PROJECT SIZE	0.75	1	0.75	1	0.75
COMPLEXITY	1	0.25	0.5	0.75	0.5
RESOURCES REQUIRED	0.75	0.5	0.5	0.25	0.5
ACCURATE RESULT	1	0.75	0.5	1	0.25
RELIABILITY	1	0.5	0.25	0.75	0
PRECISION	0.75	0.75	0.5	0.75	0.75
TIME	0.5	0.75	0.5	0.75	1
TOTAL	5.75	4.5	3.5	5.25	3.75

Now, we will use the "additive weighting technique" by ranking each of the attributes by their importance[33]. The sum of each solution can be compared to the normalized weight of 1.50, which is the score to be reached out. So, the attributes are ranked from most important to the least important (Accurate result > Precision > complexity > Time > reliability > project size > resources required) according to this arrangement we can now use this technique.

Table 4- Additive weighting technique

ALTERNATIVE SOLUTIONS /ATTRIBUTES	RELATIVE RANK/ WIEGHT	NORMALIZED WEIGHT	WMFP		COCOMO		FUNCTION POINT		REVIC		SLOC	
PROJECT SIZE	6	0.60	0.75	0.45	1.00	0.60	0.75	0.45	1.00	0.60	0.75	0.45
COMPLEXITY	3	0.30	1.00	0.30	0.25	0.08	0.50	0.15	0.75	0.23	0.50	0.15
RESOURCES REQUIRED	7	0.70	0.75	0.53	0.50	0.35	0.50	0.35	0.25	0.18	0.50	0.35
ACCURATE RESULT	1	1	1.00	1.00	0.75	0.75	0.50	0.50	1.00	1.00	0.25	0.25
RELIABILITY	5	0.5	1.00	0.50	0.50	0.25	0.25	0.13	0.75	0.38	0.00	0.00
PRECISION	2	0.2	0.75	0.15	0.75	0.15	0.50	0.10	0.75	0.15	0.75	0.15
TIME	4	0.1	0.50	0.05	0.75	0.08	0.50	0.05	0.75	0.08	1.00	0.10
TOTAL	28	3.4	TOT	2.98	TOT	2.25	TOT	1.73	TOT	2.60	TOT	1.45

Step 5- SELECTING AND RE-ARRANGING THE BEST ALTERNATIVE SOLUTIONS

After ranking the attributes according to their importance for the project execution by the use of "additive weighting technique" , we can now see the difference between all alternatives has been reduced precisely and now we can say that the most important factor to be considered will be the "WMFP" and "REVIC" and then we should consider with the "COCOMO" and "FUNCTION POINT" factor and finally we should also take into consideration with the "SLOC", So according to this factors that every project must integrate this success factors to avoid Budget over and also to avoid wrong cost estimation.

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[33] Sullivan, Wickes& Kroelling (2014). Engineering Economics 15th Edition. Adapting from planning planet. Retrieved from http://www.planningplanet.com/guild/gpccar/managing-change-the-owners-perspective

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Based on the scores of the relative weighing technique and the additive weighing technique the alternative solutions have been ranked as (WMFP > REVIC > COCOMO > FUNCTION POINT > SLOC) based on the type of project and requirements and resources these alternative solutions can be chosen and used to create a proper Cost estimation for the project.

CONCLUSION

The objective of this paper is to give a solution to the subsequent queries: Assessing what kind of process is used by the IT Organizations to make the Cost estimations? Then to analyze the methodology or process which is ideal for cost estimation? Evaluating the top IT Cost Estimating models and providing the best solution for the project cost estimation.

 Through this paper analysis method, we have highlighted the most considerable alternative solution to the least considered alternative solution to resolve the problems on the cost estimation using the attribute like Project size, Complexity, Resources required, Accurate result, Reliability, Precision and Time. The standard cost estimation for budgeting is based on the GAO'S Best practices in capital budgeting and Based on the attributes we have analyzed the best alternative solutions for the cost estimation of the IT project. While considering the cost estimation for the IT projects the Weighted Micro Function Points and the REVIC models are the best alternative methods for the cost estimation. Also, with the cost estimation using the WMFP and REVIC method the detailed estimation done by the experts will reduce the probability of errors in the project.

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