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# Statistical Analysis of Effort Estimation Techniques Deployed for Android Platform

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**Abstract**
Software project's work estimation as well as software project cost estimation is the very chief skill of software development houses. Cost and work guesstimate plays an active protagonist in accomplishment of the soft project deployment and also benefitted income. Cost as well as work prediction is most challenging decision making activity, as several product variables are difficult to identify and never stress-free to guess in any premature level of product Development practice. Android project development industry is growing very rapidly. Being the operating system for the number of smart phones, tabs, and embedded system, and huge apps store containing 450 million apps for end user, the Android had become a very important part of software industry. The effort and cost estimation for such huge field is an important task as the people are using Android apps in their business and other areas of life. This paper analyzes the different techniques deployed for this purpose and use statistical testing for analysis of a better technique.
**Keywords:** Android, cost estimation, time estimation, Chi-Square.

## 1-INTRODUTION

Number of cost and estimation techniques is currently being used, but none of these are given the 100% of accuracy in actual prediction, as this technique fall accurate in one development environment and fail in other one. Organizations want to automate the software effort and cost estimation procedures. The different technique of predicting cost and effort estimation based of literature review will be studied there. The different technique suited for different development environments, techniques like COCOMO-I, COCOMO-II, Back Firing method and Function point are analyzed by the researcher in various environments. But there is still no research is available that analyze the cost and time estimation of Android development. Android developments have much difference with other environments and also have similarities with other environments. Because of this difference, the cost estimation methods also varies in this field. Moreover the size of Android development industry is also vary according to apps, some of these working in development of Android operating system for smart phones and tablet computers other deals with the business apps and entertainment apps in these devices. High level software industry develop the libraries and operating system. Middle level industry deal with the development of Android business apps and small level industry create entertainment and daily usages apps that is sold to the end user online through app store. At middle level development, the estimation of cost, time and effort for business related apps that are developed according to requirement provided by the user is very necessary. Because these developments are task oriented and need to complete within specific time. So before the development, the estimation of time, cost and effort is very much important for the success of the projects. The remaining part of the paper is divided into multiple sections. Section-1 explore the theoretical foundation of two important aspect of the paper that are "estimation" and "Android development". Section-2 research methodology and research hypothesis. Section-3 analyze the project data by using statistical Chi Square test it also explain the result and discussion on research topic and in last section conclusion is drawn from analysis.

## 2. Background

### 2.1 Effort and Cost Estimation

Here are some arguments that force to analyze the android platform cost and effort estimation techniques separately from other platforms. Early research in the field of cost estimation has been made by Berry Boehm, Constructive cost model is the one of the famous technique in the software cost and effort prediction, COCOMO-I and COCOMO-II playing their great part in the estimation in software houses. (Sharma, Bhardwaj, & Kherwa, 2012) Approximately 67% of total software projects cross the software estimated cost, this failure in prediction is due to difference of development environments. Different strategies support different environment properly. So in making the cost estimation domain and area specific, we minimize the failure rate of estimation. Software cost can also be estimated in a proper way if we develop the standers of the attribute in the software estimation. Different factors are involve in the standardizing the attributes like Product factor, Project factor, Platform factor and Personnel factor. Estimation of factor rather than estimating a comprehensive estimation of integrated system is more favorable in better prediction. (Pandey, 2013)

Proceed diagram, like use-case diagram can also be thought as an emerging technique of cost estimation of s/w projects. The proceed diagram depict the use of hierarchy on objects and entities in the system. (Attarzadeh & Ow, n.d.) Unadjusted function count of the functionality can be measure in terms of component by using this

 

strategy. In software product estimation and organization method, it is significant to poise a liaison between work, timetable and excellence. These three factors combined known as "magic triangle". A Bayesian Belief Network is way of measurement of this triangle that is a form of directed graph in which the node states indicate the probabilities and the edges between these nodes represent the dependencies.(Sharma et al., 2012)

The common estimation methodologies are: Analogy method: estimated by comparing with the completed project and the type if it founds. (Nasir & Study, 2006) Top-down method: concerned with the generally individualities of the software that is going to be developed. Bottom up method: estimate every component individually and then combines all of these in the form of project. (Rashid & Zaman, 2011). We can divide these techniques in two categories that are parametric (statistical, numerical and historical analysis) and non-parametric (based on ANN, regression trees, analogy etc.) models. In algorithmic models Boehm's COCOMO model is used for forecasting the mandatory workers per month in development, also provide effort estimation needed. Boehm proposed 3 level models 1. Organic (up to 50 KDSI), 2. Semidetached (up to 300 KDSI), 3.Embedded (Kultur, Kocaguneli, & Bener, 2009).

2.2 Android Development

Android is a software development area and also OS for mobiles, tablets and other handheld devices, grounded on the base of kernel in Linux, and it is launched by "Google" and in recent the "Open Handset Alliance". This development platform permits the coders to write software code in the Java object oriented language, monitoring the devices by using Libraries that are developed by Google in Java. (Liu et al., 2013) Android codes and library codes are available in open source. One can download free software's and coding regarding to Android software stack that can be used in cell phone like devices as their operating system, middleware and other important apps grounded on Java and Linux. In 2005 Google bought platform as well as developer of Android. Android was launched in early 2007. Google uses apache's license to reviled Open source android coding.(Ding, Peng, Zhou, & Zhang, 2014)

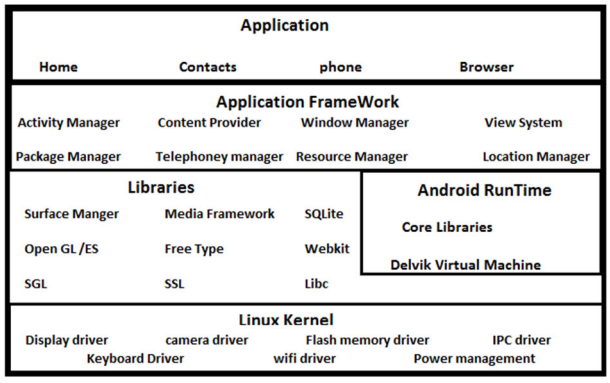


**Fig. 1. Android Platform Architecture.**

Android partakes abundant designers creating mobile apps all around the globe. The low level android developers create code for their script in Java language, then transfer application software from open source directory sites. In Feb, 2012, 4.5 million such apps existed for Android play stores, and approximately 10 billion apps have been downloaded by the user till 2010. Over 300 million users are found active on Android OS through cell phones and other devices. Android is the most popular operating system used among the users, overall 48% of the users share android as operating system. Android application software have a wide range of application types and have over 10 billion installations.(Ding et al., 2014) Android podium is the very widespread used embedded Operating System, is attached in robotics, Televisions, particularly in mobile phones. Since common Android apps are being developed in JAVA, it is very leisurely in situation where involves numerous deviousness actions such as DIP (Digital image processing). To overwhelmed such flaws, the Android Operating System is supporting JNI with the Android NDK, which makes available to use the C libraries in the Android at application level.

## 3. Research Methodology

Some school of thoughts thinks that Android platform uses JAVA language and can use same cost estimation methodologies use for desktop or web development. But other thinks that Android is different from other development environments and need to purpose new cost estimation techniques. So the purpose of research is to analyze the various techniques deployed for Android project cost estimation. For this purpose data had been taken from different software houses. Data is taken from project of different domains so that the variability can be measured. The name of project industries is confidential so not mentioned in the paper.

**Statistical Analysis:** Chi-Square test is being used for statistical analysis of different cost estimation techniques. Popular methods for estimation in software engineering include COCOMO-I, Function point, and Line of Code. The initial values are depicted in table .1 To analyze the significance difference in the actual time, cost for the projects and the estimated time and cost for different projects. For this purpose, Chi-Square test is deployed by using given equation. (Sharma et al., 2012)

$$\chi^2 = \sum_{i=0}^{k} \frac{(O-E)^2}{E}$$

 

Where

*O is the actual value in person month for completion of project*
*E is the estimated value and*
*k is the number of project tested.*

$H_0$:- Null hypothesis is that there is no significant difference between values estimated and the values,

| Sr. No. | Estimated PM with Function Point | Estimated PM with Back Firing | Estimated PM with COCOMO-I | Actual PM) provided by soft. houses) |
|---|---|---|---|---|
| **1** | 26 | 12 | 21 | 24 |
| **2** | 4 | 1 | 4 | 3 |
| **3** | 17 | 10 | 13 | 16 |
| **4** | 1.6 (48 days) | .75 (22 days) | 1.7(51 days) | .70 (21 days) |
| **5** | 10 | 9 | 9 | 9 |

**Table. 1 various values from 5 different projects**

**A- Calculation for COCOMO-I**

$\chi^2$ = (21-24)/24 + (4-3)/3 + (13-16)/16 + (1.7-0.7)/0.7 + (9-9)/9
= 1.88

Table Value for 2 degree of freedom and 2.5% level of significance is 2.815, by above values it is clear that
Calculated Value< Table Value

So there is no significant difference between actual value and estimated value thus $H_0$ is accepted for COCOMO-I

**B- Calculation for Back Firing Method**

$\chi^2$ = (12-24)/24 + (1-3)/3 + (10-16)/16 + (0.75-0.7)/0.7 + (9-9)/9
= -1.118

Table Value for 2 degree of freedom and 2.5% level of significance is 2.815, by above values it is clear that
Calculated Value< Table Value

But the value of Chi-Square is in minus, so the Null hypothesis is rejected for the back firing method.

**C-Calculation for FP**

$\chi^2$ = (26-24)/24 + (4-3)/3 + (17-16)/16 + (1.6-0.7)/0.7 + (10-9)/9
= 1.17

Table Value for 2 degree of freedom and 2.5% level of significance is 2.815, by above values it is clear that
Calculated Value< Table Value

So there is no significant difference between actual value and estimated value thus H0 is accepted for FP.

## 4. Result and Discussion

The given analysis describe that $H_0$ is accepted in COCOMO-I, and Function point cost and effort estimation methods whereas it is rejected in Back Firing method. Back-Firing method is not offering good predictions in Android because this environment is lies in fourth generation languages where we need to measure the tables, forms, queries and report along with KLOC of source code.

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