# EFFORT ESTIMATION MODEL FOR FUNCTION POINT MEASUREMENT

**By**

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**Chairman : Associate Professor Hj. Mohd Hasan Selamat**

**Faculty : Computer Science and Information Technology**

*Software Cost Estimation is a practical process that is applied to find out basically the effort and development time requirements for a software product, which is going to be developed. The process starts with the planning phase activities and refined throughout the development. Various cost estimation models and methods are available to be used for software development process. The COCOMO, an algorithmic model is one example. Although it is hard to predict the exact size especially in terms of lines of code (LOC) of the project at the early stage, the COCOMO model takes LOC as an input to compute the project's effort.*

*Nowadays, software developers recognize the importance of the realistic estimates of effort to success management of software projects and having a realistic estimates at an early stage of a project life cycle which allow project managers and development organizations to manage resource effectively. This research work has generated an algorithmic effort estimation model for function points measurement. The function-point measurement metric, invented by Allan Albrecht of IBM in the middle of the 1970s was intended to help all the practitioners measure the size of a computerized business information system. Such sizes are needed as a component of a measurement of productivity in system development and maintenance activities and as a component of estimating the effort needed for such activities.*

*Generally, most of the algorithmic models were generated based on historical projects, and therefore, the same methodology has been applied in this research work. The total of 2265 historical business information systems collected by*

*International Software Benchmarking Standard Groups (ISBSG) has been used to generate and validate the model using statistical technique, known as linear regression analysis. We proposed that a project's functionality in the terms of function points has an approximately linear relationship to the final effort computation. The investigation had carried out on between the functionality and final effort before the model was generated.*

*Results show that there is an approximately linear relationship between the project's functionality and final effort that is required in the development. On the other hand, the limits with 95% level of confidence have been attached together with the model to ensure that the actual effort always falls within the predicted boundary. However, we suggest that further investigation should be carried on for the technical complexity factors in function point analysis in order to increase the accuracy of the forecasted project's effort.*

**Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains**

**MODEL PENGANGARAN USAHA BAGI PENGUKURAN MATA FUNGSI**

**Oleh**

**KOH TIENG WEI**

**Januari 2007**

**Pengerusi : Profesor Madya Hj. Mohd Hasan Selamat**

**Fakulti : Sains Komputer dan Teknologi Maklumat**

**Penganggaran kos perisian adalah proses praktikal yang telah digunakan untuk mengetahui usaha dan masa pembangunan yang diperlukan dalam pembangunan sesuatu perisian. Proses ini mula daripada aktiviti fasa perancangan dan diperincikan lagi di sepanjang masa pembangunan. Terdapat pelbagai sumber bagi model penganggaran kos and kaedah digunakan dalam proses pembangunan perisian. Contohnya, COCOMO merupakan satu model algoritmatik. Walaupun agak susah untuk meramalkan saiz sebenar terutamanya dalam bentuk *lines of code* (LOC), tetapi model COCOMO ini masih menggunakan LOC ini sebagai input untuk memperolehi usaha sesuatu projek.**

**Kini, pembangun-pembangun perisian berpendapat bahawa penganggaran realistik adalah penting untuk mengurus sesuatu projek perisian dengan berjaya dan dapat memperolehi anggaran yang realistik pada awal pembangunan supaya membolehkan pengurus projek dan organisasi pembangunan mengurus sumber**

**dengan lebih cekap. Penyelidikan ini telah menghasilkan satu model pengangaran usaha algorimatik untuk pengukuran mata fungsi. Matrik mata fungsi, merupakan hasil kajian daripada Allan Albrecht dari IBM dalam pertengahan 1970 yang cuba untuk membantu dalam mengukur saiz sistem maklumat niaga. Saiz ini merupakan komponen dalam mengukur produktiviti pembangunan sistem dan aktiviti pemuliharaan, ia juga sebagai komponen dalam menganggar usaha yang diperlukan bagi aktiviti-aktiviti tersebut.**

**Umumnya, kebanyakan model algoritmatik dibangunkan berdasarkan projek-projek yang lepas. Oleh yang demikian, kaedah yang sama digunakan dalam kerja penyelidikan ini. Sejumlah 2265 sistem maklumat niaga bersejarah yang dikumpulkan oleh *International Software Benchmarking Standard Groups* (ISBSG) telah digunakan untuk menghasil dan mengesahkan model ini dengan menggunakan teknik statistik yang dikenali sebagai analisis regressi linear. Kami telah mencadangkan bahawa fungsi sesuatu projek dalam bentuk mata fungsi mempunyai hubungan yang hampir linear dengan pengiraan usaha akhir. Penyelidikan lanjut ke atas hubungan antara fungsian dan usaha akhir telah dijalankan.**

**Keputusan menunjukkan bahawa terdapatnya hubungan yang hampir linear antara fungsi sesuatu projek dengan usaha akhir yang diperlukan dalam pembanggunan. Di samping itu, tahap keyakinan had-had 95% telah digunakan bersama model ini untuk memastikan usaha sebenar akan sentiasa dalam**

**sempadan yang dianggarkan. Walau bagaimanapun, kami mencadangkan penyelidikan lanjut perlu dijalankan ke atas factor-faktor kekompleksan teknikal di dalam analisis mata fungsi supaya dapat meningkatkan lagi ketepatan bagi usaha projek yang diramalkan.**

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**I am grateful to a friend who wants to remain anonymous. He is a down-to-earth and humble people. His willingness to share and his advice have given me confidence in completing this thesis. Without him, this research work will not be possible.**

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**I certify that an Examination Committee met on 5th January, 2007 to conduct the final examination of Koh Tieng Wei on his Master of Science thesis entitled "A Function Point-Based Effort Estimation Model Using Regression Analysis Approach" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulation 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:**

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**Date: 10 MAY 2007**

## DECLARATION

**I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.**

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**KOH TIENG WEI**

**Date: 5th January 2007**

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| | |
|---|---|
| **COBOL** | **Common Business Oriented Language** |
| **COCOMO** | **Constructive Cost Model** |
| **COSMIC** | **Common Software Measurement International Consortium** |
| **DET** | **Data Element Types** |
| **EI** | **External Inputs** |
| **ELOC** | **Effective Lines Of Code** |
| **EQ** | **External Inquiry** |
| **EO** | **External Output** |
| **EIF** | **External Interface File** |
| **FFP** | **Full Function Point** |
| **FTR** | **File Type Reference** |
| **FP** | **Function Point** |
| **FPA** | **Function Point Analysis** |
| **FTE** | **Full Time Equivalent** |
| **GSC** | **General System Characteristics** |
| **ILF** | **Internal Logical File** |
| **IFPUG** | **International Function Point Groups** |
| **ISBSG** | **International Software Benchmarking Standards Group** |
| **ISO** | **International Organization for Standardization** |
| **KLOC** | **Thousands of Lines Of Code** |
| **LOC** | **Line Of Code** |

| | |
|---|---|
| **MIS** | **Management Information System** |
| **MMRE** | **Mean Magnitude of Relative Error** |
| **NCLOC** | **Non-Commented source Line Of Code** |
| **RET** | **Record Elements Type** |
| **$R^2$** | **Correlation Coefficient** |
| **SELAM** | **Software Engineering Laboratory in Applied Metrics** |
| **SLIM** | **Software Life Cycle management** |
| **TCF** | **Technical Complexity Factors** |
| **TUFP** | **Total Unadjusted Function Point** |
| **UFP** | **Unadjusted Function Point** |
| **UFPC** | **Unadjusted Function Point Count** |
| **VAF** | **Value Adjustment Factor** |