MEASUREMENT SYSTEM ANALYSIS FOR MOTOROLA GLOBAL SOFTWARE GROUP MALAYSIA

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SESI PENGAJIAN: 2004/2005

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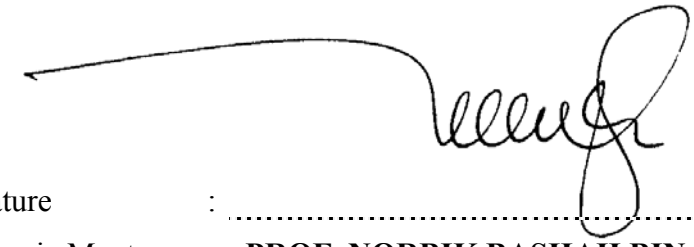

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MEASUREMENT SYSTEM ANALYSIS FOR MOTOROLA GLOBAL SOFTWARE GROUP MALAYSIA

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Master of Science in Software Engineering (Real-Time Systems)

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AUGUST, 2004

I declare that this technical report entitled "Measurement System Analysis For Motorola Global Software Group Malaysia" is the result of my own research except as cited in the references. The technical report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree

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To my beloved mother and Victor Lai

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ABSTRACT

As measurement of software metrics gradually became a vital process in software engineering, the measurement-derived information has been heavily used as an important source to support decision-making. The reliability of the derived information is subject to the variations in the measurement system which could contribute to information distortion and lead to wrong decisions. This project is to study the existing measurement system adopted by GSG Malaysia to identify the sources of variations and root causes in the system, as well as to improve the measurement system by reducing the variation errors in the measurement mechanisms. The three (3) major elements of measurement system; people, tool and process are examined via a thorough study on the existing relevant documentations, process work flows and measurement mechanism to identify the variations in the system. A respondent's opinion survey and descriptive statistical analysis are conducted to substantiate the analysis study. The results from the analysis show the major variations errors and errors root causes in the measurement system that are to be solved and improved. The outputs of measurement system analysis are essential sources to improve the quality of the software process and increase the reliability of measurement-derived information. This is to provide better and efficient decisions support system as the organization's competitive edge to sustain itself in the IT world.

ABSTRAK

Sejajar dengan perkembangan dalam pengukuran pelbagai metrik perisian yang menjadi satu proses penting dalam kejuruteraan perisian, penggunaan informasi lanjutan daripada pengukuran metric perisian secara berleluasa sebagai sumber sokongan yang penting dalam pembuatan keputusan. Keutuhan informasi lanjutan daripada perukuran perisian amat subjektif kepada variasi sukatan dalam sistem pengukuran perisian, dimana variasi akan menyumbang kepada herotan informasi dan mengakibatkan pembuatan keputusan yang kurang tepat. Projek ini mengkaji sistem pengukuran yang digunapakai oleh GSG Malaysia untuk mengenalpasti sumber-sumber variasi and puncanya dalam sistem tersebut, juga bertujuan untuk mempertingkatkan sistem pengukuran dengan mengurangkan selisih variasi dalam mekanisme pengukuran. Tiga (3) elemen utama sistem pengukuran iaitu manusia, peralatan dan proses telah diteliti rapi melalui kajian yang mendalam keatas dokumen berkaitan yang sedia ada, proses aliran kerja dan meknisme pengukuran untuk mengenalpasti variasi dalam sistem. Satu tinjauan pendapat responden dan perihalan analisis statistik telah dikendalikan untuk menyokong kajian analisis ini. Hasil dari kajian ini menunjukkan selisih variasi utama dan punca variasi dalam sistem pengukuran untuk diselesaikan dan diperbaiki. Output daripada kajian sistem pengukuran merupakan sumber penting bagi memperbaiki kualiti proses perisian serta meningkatkan keutuhan informasi lanjutan daripada pengukuran untuk menyokong pengurusan pembuatan keputusan sebagai faktor daya saingan organisasi untuk kekal dalam dunia IT.

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LIST OF ABBREVIATIONS

ANOVA	-	Analysis of Variance
CASE	-	Centre for Advanced Software Engineering
CMM	-	Capability Maturity Model
CMMI	-	Capability Maturity Model Integration
COPQ	-	Cost of Poor Quality
COQ	-	Cost of Quality
DLC	-	Delta Line Counter
GR&R	-	Gauge Repeatability And Reproducibility
GSG	-	Global Software Group
IPF	-	In Process Function
IQMEn	-	Integrated Quality Metrics Environment
LOC	-	Line of Code
MLC	-	MMSC Line Counter
MMMSB	-	Malaysia Motorola Multimedia Sendirian Berhad
MMSC	-	Motorola Malaysia Software Centre
MOL	-	Modification of Line
MSA	-	Measurement System Analysis
MSC	-	Multimedia Super Corridor
PCE	-	Phase Containment Effectiveness
QPM	-	Quality Process Management
SEI	-	Software Engineering Institute
UTM	-	Universiti Teknologi Malaysia

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CHAPTER 1

INTRODUCTION

1.1 Company Background

Global Software Group Malaysia is also known as Motorola Malaysia Software Centre (MMSC), and is a registered company under the name Malaysia Motorola Multimedia Sendirian Berhad (MMMSB). It started its operations in March 1999. GSG Malaysia, which is part of the Global Software Group (GSG), is the premier custom software house that comprises of 21 Software Development centers in 13 countries. A year later in June 2000, GSG Malaysia was inaugurated by former Prime Minister Tun Datuk Sri Dr. Mahathir Mohamad as a Multimedia Super Corridor (MSC) status company in recognition of its ICT contributions to the MSC.

GSG Malaysia is a highly matured organization with more than 65% of its centers at Software Engineering Institute (SEI) Maturity Level 4 and 5. MMMSB attained SEI-CMM Level 5 in October 2001 and it was the first MSC status company out of 676 MSC-status companies which has achieved the SEI-CMM Level 5 with a score of close to 700 on a 1000-point scale using the Malcolm Baldrige Balanced Score Card Approach for Performance Excellence. The score is one of the highest within Motorola and in the world. Two (2) years later in October 2003, GSG Malaysia achieved CMMI Level 5, the highest level of software process maturity developed by the SEI. GSG Malaysia is the only company in Malaysia to achieve CMMI Level 5 using the continuous representation model and one of about 15 software companies around the world to achieve this status. With these great

achievements, GSG Malaysia is putting itself as one of the two percent (2%) of top world-class software company.

Motorola prides itself in delivering a cost effective software solution on time and on budget to meet the changing demands of software industries on short-term and long-term projects worldwide. With strong emphasis on timely, cost-effective and high-quality software development, it has consequently increased customer satisfaction.

1.2 Core Strength, Capability And Experience

The domain of excellence and competency of GSG Malaysia are:

(i) Operation Software & Services that includes Network Management & Applications;
(ii) Embedded Software solutions that includes Wireless Data Applications, Drivers and Protocols;
(iii) Mobile Billing Applications;
(iv) System and Software Integration;
(v) Ground-breaking Software Applications & Services;
(vi) Strategic Software Process Consultancy;
(vii) High Availability Systems; and
(viii) Project Management.

1.3 Project Overview

With the lackluster growth of customers' demand for better, faster and cheaper software products and services, many IT companies have been motivated to improve the quality of their software engineering process by setting goals to achieve higher Capability Maturity Model (CMM) levels or Capability Maturity Model

Integration (CMMI) levels. Software measurement is the basic software engineering practice in the present day where it has been absorbed in maturity requirements of CMMI Level 2 by SEI. Software measurement is a key component of software process improvement activity where it provides great deal of objective information that helps management decision making and technical activities. Effective use of good quality measurement-derived information increases the competitive edge of the organization to sustain and keep up with the rapidly changing technology in a competitive environment.

Thus the quality of the measurement data collected is very important to guarantee the reliability of the information derived from the measurement metrics. Poor data and analysis lead to poor decisions. Leading companies continuously improve the quality of their measurement system and analysis capabilities to increase the reliability and the significance of information to achieve the organization goals. As a common approach to increase the quality of the measurement metrics, variations in the system measurement should be reduced.

Measurement system analysis is one of the software process improvement activities that assess the measurement system to find out the reliability of the collected metrics, which involves identifying the sources of variation and the errors root causes in the measurement system. The outputs of this analysis contribute to software improvement process, where the analysis results will be used as a guideline for further improvement on the targeted problem areas to reduce the variations in the measurement system and subsequently increase the quality of the measurement metrics.

This project is intended to perform the measurement system analysis on the reliability of the measurement system currently adopted by GSG Malaysia in order to improve the quality of the measurement system that serves the goals of quantitative management and continuous process improvement of CMMI, as well as to increase the confidence of users of the measurement-derived information in organization operational activities.

1.4 Background of Problem

As a well established organization with the capability maturity of Level 5, Motorola is well equipped with complete measurement systems to measure their software process performances and has no doubt in producing any quantifiable values to prove their performance. However, after reaching the top level of capability maturity, they should not just stopped at this point and no longer invest in or pay attention to disciplined, systematic software development and management practices. This will cause them to slip back to the lower levels.

At the capability of Level 4 and above, it is insufficient to just identify and measure the key metrics in order to know the process performance status. The company must be able to predict the results of critical process and manage the process variation. Data is a very important component in decision making. Therefore, the software quality engineers are constantly making sure that what they have measured are in conformance to the actual performance facts, including the awareness of the occurrence of measurement variation errors in a measurement mechanism. These errors must be clearly identified and reduced within the measurement variation error tolerance limits. These can only be done via a prudent study on the data collection mechanisms and statistical analysis on the collected data in order to make sure the measurement systems are accurate. Improvements must be continuously done to come up with better solutions to provide concrete proof of process performance measurements.

GSG Malaysia uses the Integrated Quality Metrics Environment (IQMEn) to integrate the tools to keep all the measured data. Four (4) key metrics used for measurement are size, cycle time, effort and fault. Various kind of tools have been used to support the data collection activities for each metric, such as:

(i) Size measurement is based on Line of Code, which uses the Delta Line Counter (DLC), MMSC Line Counter (MLC) and the *ta_pr* (enhanced from SuperCell's code_inspect utility);

(ii) Cycle Time measurement, which uses the Teamplay;

(iii) Effort measurement, which uses the TeamPlayer; and

(iv) Fault measurement, which uses IQMEn, other inspection tools, clearQuest and etc.

To serve the purpose mentioned above, this project is carried out to study on the existing measurement mechanisms and identify the error sources as well as to improve the measurement system by reducing the measurement variation errors in measurement mechanisms.

1.5 Project Objectives

The objectives of the project are listed as follows:

(i) To classify the sources of measurement error for the data collection mechanisms;

(ii) To predict the implications of the measurement error on the key metrics;

(iii) To establish measurement variation model as a percentage of total variation;

(iv) To provide recommendations to improve the measurement system; and

(v) To introduce data validation templates to eliminate data measurement.

1.6 Project Scope

The project scope focuses mainly on the following areas:

(i) Study of the existing data collection mechanisms for the process measurements, this includes the data entries and the data transfers during the measurement process;

(ii) Analyze and identify the potential sources that cause the measurement variation errors as well as the impacts caused by these errors;

(iii) Perform statistical study to find out the percentage of variation errors that contributes to the total variation in the measurement mechanism; and

(iv) Development of the data validation template for problem solutions.

1.7 Project Plan

This project commenced on 12 April 2004 and was estimated to be completed in 18 weeks, which was on 30 August 2004. The following Table 1.1 shows the major tasks break down schedule of the project and the details of the project plan gantt chart can be found in Appendix A.

Table 1.1 : Time Table of Task Break Down

Task No.	Task Description	Duration
T1	Literature Review	12 Days
T2	Preliminary Study	30 Days
T3	Fact Findings	12 Days
T4	Recommendations and Implementation	18 Days
T5	Report Writing	14 Days

1.8 Expected Contribution

The outcome of this project will be able to contribute to GSG Malaysia measurement standards by:

(i) Providing concrete evidence on the process performance measurement with a quantifiable value of variation errors in the measurement mechanisms;

(ii) Improving the quality of metrics collection by eliminating and reducing measurement variation errors in measurement mechanism; and

(iii) Providing a set of guidelines in creating better alternative solutions to the targeted problems as a way of continuous software process improvement.

1.9 MSA Project Team Structure

During the project assignment, the author was attached to Quality and Software Engineering department which was headed by the quality and software engineer manager, Mr. Rajashekara Swamy. For this MSA project, the author has reported directly to Mr. Vishy Narayana, the site manager as well as industrial mentor. At the same time, the author was also under the supervision of Prof. Norbik Bashah Idris as the academic mentor from CASE, UTM throughout the industrial training. The attachment program was coordinated by Mr. Wong Wai Tong. The following Figure 1.1 shows the project team structure for MSA study.

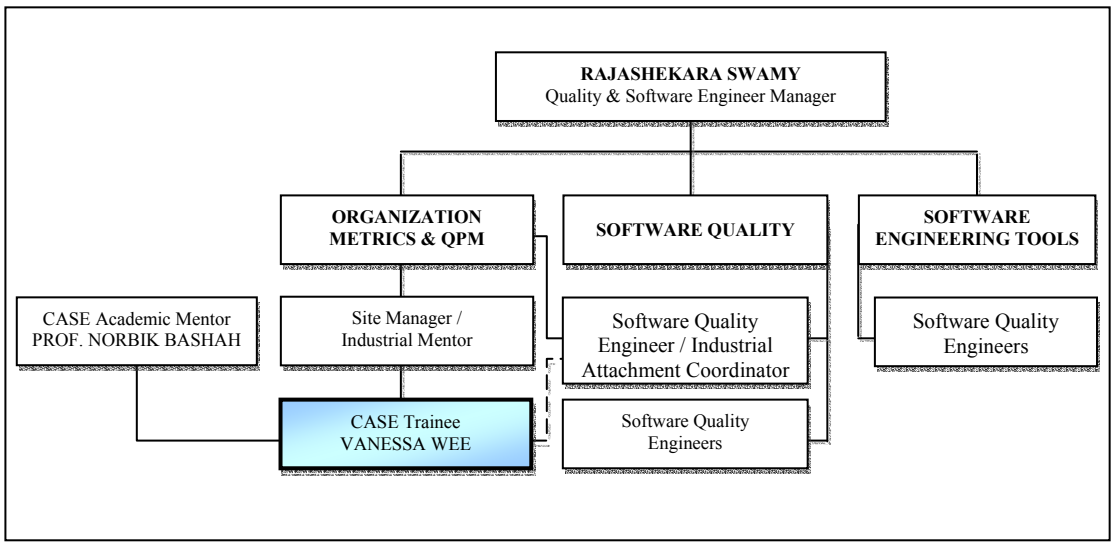

Figure 1.1 : MSA Project Team Structure

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