# ORGANIZATIONAL MEASUREMENT OF DEFECT DENSITY

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A project report submitted in partial fulfillment of the
requirements for the award of the degree for
MSc. (Computer Science - Real Time Software Engineering)

Centre for Advanced Software Engineering
Faculty of Computer Science and Information Systems
Universiti Teknologi Malaysia

APRIL 2009

Special dedication to my beloved mother Che Saerah Rahmani and father Hasim Din.

## ACKNOWLEDGEMENT

First and foremost, thank you to Allah the Almighty because finally I managed to complete my industrial attachment and this project report.

Deep appreciation goes to my supervisor, Mr. Mohd Ridzuan Ahmad for all the guidance, support, constructive comments and valuable knowledge and motivations to write this project report.

A million of thank you dedicated to Practices and Compliance Management Department (PCM) in HeiTech Padu Berhad. Thank you very much for all the opportunity given, priceless knowledge and experience especially to my Industrial Mentor Mdm Lenny Ruby Atai, Mdm Yanti Salwani Che Saad as the head of the PCM department and other PCM team members which includes Miss Azreen Diana Abdullah and Miss Siti Fatimah Abu Bakar.

A thousand of thank you to my lovely friends who give a lot of useful opinions and thought also shared every good and bad moment together during these five months attachment period.

Thank you to my family for the continuous encouragement, full support and understanding in order for me to complete my master study in UTM. May Allah bless all of you.

# ABSTRACT

Measurement and Analysis Process is one of process areas covered in the Capability Maturity Model Integration (CMMI) Level 2. However, in order to produce the measurement a proper plan and process are required. Organizational Measurement of Defect Density is a measurement conducted in HeiTech Padu Berhad (HeiTech). This project report will be discussing the issue of defect density measurement focusing on defects found during testing phase. Issue raised with defect density measurement is that the result of the measurement tends to be imprecise because of the various ways used to count the line of codes. To this end, this project report presents a method for measurement process in order to calculate defect density which is the HeiTech Measurement and Analysis Process. These methods consist of three phases which are Planning, Implementing and Improving phase. As for the implementation, three projects has been selected which are BHEUU-CSMBBG, BHEUU-SKHD and iProcurement-Vendor Management. Line of code for all three projects has been count using selected code counter which is GeroneSoft Code Counter Pro V1.32. Moreover, along with the defect classification developed it has been useful and effective in turn to detect defect discover in a program. As for defect density measurement output, results has been gathered and presented in the Measurement and Analysis Report.

# ABSTRAK

Prosess pengiraan dan analisis adalah salah satu lapangan proses dalam *Capability Maturity Model* (CMMI) peringkat 2. Namun begitu, perancangan dan proses yang teratur amat penting bagi memastikan keputusan hasil pengiraan adalah seperti yang dijangkakan. Pengiraan Kepadatan Kecacatan Berorganisasi adalah sejenis pengiraan yang dijalankan di HeiTechPadu Berhad (HeiTech). Laporan projek ini akan membincangkan perincian tentang pengiraan kepadatan kecacatan dan penumpuan dilakukan lebih kepada kecacatan yang dijumpai semasa fasa pengujian. Isu yang berbangkit dalam pengiraan kepadatan kecacatan adalah keputusan yang diperolehi hasil daripada pengiraan tersebut adalah tidak tepat kerana wujudnya kepelbagaian dalam mengira baris kod. Selain itu, laporan projek ini juga menunjukkan kaedah bagi proses pengiraan kepadatan kecacatan iaitu Proses Pengiraan dan Analisis HeiTech. Kaedah ini terbahagi kepada tiga fasa iaitu fasa perancangan, fasa perlaksanaan dan fasa pengukuhan. Tiga jenis projek telah dipilih sebagai pembelajaran kes iaitu BHEUU-CSMBBG, BHEUU-SKHD dan iProcurement-Vendor Management. Baris kod bagi ketiga-tiga projek tersebut telah dikira menggunakan satu perisian pengira baris kod iaitu GeroneSoft Code Counter Pro V1.32. Selain itu, klasifikasi kecacatan yang telah diwujudkan juga sangat membantu dalam proses mengenal pasti kecacatan pada satu-satu program dengan lebih efektif. Akhir sekali, hasil pengiraan kepadatan kecacatan dikumpul dan dimasukkan ke dalam Laporan Pengiraan dan Analisis.

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| | | |
|---|---|---|
| BHEUU | - | Bahagian Hal Ehwal Undang-undang |
| CAR | - | Causal Analysis & Resolution |
| CMMI | - | Capability Maturity Model Integration |
| CMVC | - | Configuration Management and Version Configuration |
| COBOL | - | Common Business-Oriented Language |
| COCOMO | - | Cost Constructive Model |
| EPG | - | Engineering Process Group |
| FP | - | Function Point |
| GHC | - | Glasgow Haskell Computer |
| HMI | - | Human Machine Interface |
| IEEE | - | Institute of Electrical and Engineering Institute |
| KLOC | - | Kilo Line of Code |
| LOC | - | Line of Code |
| PCM | - | Practices and Compliance Management |
| PSC | - | Project Steering Committee |
| SEI | - | Software Engineering Institute |
| SLOC | - | Source Line of Code |
| SPC | - | Statistical Process Control |
| SRS | - | System Requirement Specification |
| STREW-H | - | Software Testing and Reliability Early Warning for Haskell |
| STREW-J | - | Software Testing and Reliability Early Warning for Java System |
| UAT | - | User Acceptance Test |

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# CHAPTER 1

# INTRODUCTION

## 1.1 Organizational Background

A public listed company on the main board of the Bursa Malaysia, HeiTech Padu Berhad is Malaysia's leading ICT solution s and services provider. With more than 10 years at the forefront of the ICT industry, HeiTech's local testimonies include the delivery of mission critical projects for Malaysian Government agencies such as the National Registration Department, Immigration Department and Road Transport Department.

In addition, HeiTech also one of the key player in driving the public sector leveraging on systems integration strength and capabilities. Consequently, HeiTech has further transformed itself, becoming one of the key managed services providers in Malaysia whose products include Padu*Net (Managed Network Services) and Padu*Center (Managed Data Center Services). HeiTech's portfolio of customers has expanded to the private sector customer base mainly from the financial services industry.

## 1.2 Core Business

After going through strategies changes, HeiTech business pursuit are focused towards the financial sector, health sector, defense sector, education sector as well as the manufacturing, oil and gas and utilities industries. The following areas are the products and services offered in HeiTech Padu Berhad:

i. Managed Data Center Services
ii. Managed Network & Communication Services
iii. System Integration Services
iv. Solution & Consultancy Offerings

The following business entities listed below have been established to develop, promote and deliver the respective core business of the company under the flagship of HeiTech Padu Berhad:

i. HeiTech *e**Business Solution Sdn Bhd
ii. HeiTech *i*-Solutions Sdn Bhd
iii. HeiTech Managed Services Sdn Bhd

## 1.3 Practices & Compliance Management Department Background

### 1.3.1 Practices & Compliance Management Structure

Basically as shown in Figure 1.1, Practices & Compliance Management Department (PCM) Consist of three main units which are Practices Development & Consultation, Compliance Management and Internal SOP & Knowledge Management. Table 1.1 shows the key function for each unit in PCM.

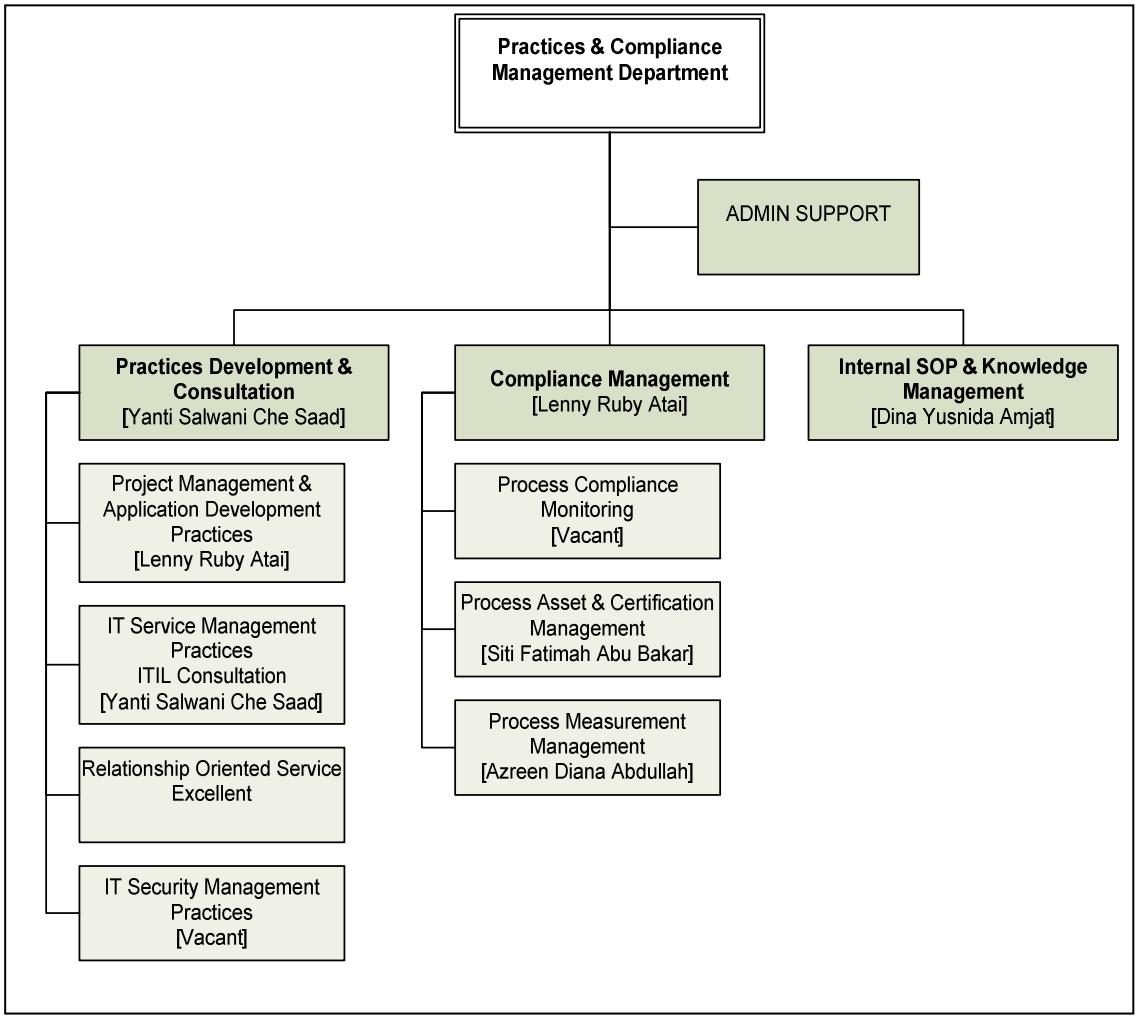


**Figure 1.1:** Organizational Structure of Practices & Compliance Management Department

**Table 1.1:** PCM Units

| Unit | Key Functions |
|---|---|
| Practices Development & Consultation | ▪ Plan and development of best practices for core business.<br>▪ Promote HeiWay program for work and culture focus in quality and professionalism.<br>▪ Work on certification CMMI Level 5<br>▪ Evaluate and promote quality tool. |
| Compliance Management | ▪ Coverage for compliance for application development and project |

| Unit | Key Functions |
|---|---|
| | management.<br>▪ Assessment on the degree of compliance to the agreed standard. |
| Internal SOP & Knowledge Management | ▪ Administration of scope.<br>▪ Review and enhance of SOP to be effective.<br>▪ Reorganization of knowledge management.<br>▪ Establishment of SIS portal. |

### 1.3.2 Practices & Compliance Management Scope of Work

Basically the scope of the implementation of best practices and compliance would only cover the HeiTech Business Solution (HBS). There are nine major scope of work concern:

i. Formulate and continuously improve in-house best practices based on the industry best practices for the following core business disciplines of HBS.

ii. Facilitate or provide consultation on HeiTech Defined Best Practices and related industry best practices in Project Management and Software Engineering (Application Development) disciplines.

iii. Provide training on HeiTech Defined Best Practices, related industries best practices in the Project Management and Software Engineering (Application Development) disciplines and Relationship Oriented Service Excellence (ROSE) practices as per Customer Services Initiative Program.

iv. Provide quality control through compliance assessment and monitoring of HeiTech Define Best Practices (process) implementation.

v. Measure and analyze organizational process performance of Project Management and Application Development related processes.

vi. Strategize and manage HBS quality roadmap, quality initiatives & quality certification. (e.g. ISO and CMMI)

vii. Facilitate the establishment and continuous improvement of HBS inter and intra standard operating procedure.

viii. Monitor Knowledge Management and play a role as the library of critical knowledge needed by the user.

ix. IT Security Management Practices (focused in application related to the security).

## 1.4 Project Background

### 1.4.1 Organizational Measurement Analysis of Defect Density

Measurements infuses everyday life and is an important part in every scientific and engineering discipline. Software measurement may serve several purposes, depending on the level of knowledge about a process of product. The very nature of software engineering makes measurement a necessity, because more rigorous methods for product planning, monitoring and control are needed. Otherwise the amount of risk software projects may become extreme, and software product may easily get out of industrial control [3,10,16]. One type of software measurement that is going to be discussed in this project report is defect density.

In Organizational Measurement Analysis of Defect Density, the focus will be on measuring the solid value for defect density. In order to perform this measurement, a

metric has been proposed which is known as the indirect measurement. Figure 1.2 shows the calculation formula for this measurement.

$$DefectDensity = \frac{DefectsFound}{SystemSize}$$

**Figure 1.2:** Defect Density Calculation

Total size of product is a normalizer that allows comparisons between different software entities examples modules, releases and products. Size is typically counted either in Line of Code (LOC) or Function Points (FP).

Essentially total size of product will be measure base on the LOC. Metric LOC is used because it is one of the most widely used techniques in cost estimation. It is known as basic metric underlying several cost estimation models by Boehm. Due to the common use, it allows a simple comparison to data from many other projects. [16]

A capable practice will be applied in turn to gain the precise result. Measurement and analysis process and procedure will be done base on the HeiTech Measurement and Analysis process that has been define in the HeiTech Measurement and Analysis Plan V-4.0. Three HeiTech project has been selected as case study for implementation purposes. Projects involved are BHEUU-CSMBBG, BHEUU-SKHD and iProcurement-Vendor Management. As for the size of the product, several LOC counter tools will be introduce and the finest tool will be selected to be utilize.

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