

IMPLEMENTATION OF CAPABILITY MATURITY MODEL[®] INTEGRATION
(CMMI[®]) IN INGENUITY MICROSYSTEMS SDN BHD FOR
MEASUREMENT AND ANALYSIS, RISK MANAGEMENT, INTEGRATED
PROJECT MANAGEMENT AND INTEGRATED SUPPLIER MANAGEMENT

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

Centre for Advanced Software Engineering
Faculty of Computer Science and Information System
University Technology Malaysia

OCTOBER 2005

To my beloved family especially to *Mak* and *Ayah*,
CASE and MFT13 friends

ACNOWLEDGEMENT

In preparing this report, the intern has benefited from the help of a lot of people. The intern wishes to express her gratitude for that helps to the followings:

First of all, I owe deep thanks to all of my lecturers in Centre for Advanced Software Engineering (CASE), Universiti Teknologi Malaysia, especially to Prof. Dato' Dr. Norbik Bashah bin Idris and Mr. Mohd. Naz'ri bin Mahrin. It is a great pleasure to thank them for their beneficial comments and invaluable support in the process of understanding the CMMI[®] concept and practices.

A great appreciation also to the Process Engineering Group (PEG) of Ingenuity Microsystems Sdn Bhd (IMSB), especially to my Industrial Mentor, Miss Cindy Yaw Wai Kham and Mr. Wong Hun Liang for their unfailing advices and support during my internship. Thank you for giving me a chance to be part of the PEG team members.

I also would like to express my special thanks to those who are close to me – especially my beloved family and all CASE Student Batch 13, who have been very understanding, supportive and patient. Their constant encouragements were always at hand while I was doing the research and write up. Without them, I certainly would have lost of truthfulness in my life.

Lastly, my appreciation also goes to all those who have contributed either directly or indirectly in completing this technical report, but whom I have inadvertently failed to mention here.

ABSTRACT

Customer satisfaction has become the motto of many organizations attempting to survive and thrive in today's increasing competitive world. At the same time that organizations are focusing on customer satisfaction, there is a growing perception that software quality is the weak link in developing high-quality products or in providing high quality services. Thus, in order to improve the software development process, Capability Maturity Model Integration (CMMI[®]) Model is the best solutions that can be chosen by the organization. Besides it has been introduced by Software Engineering Institute (SEI), this model is one of Software Process Improvement that can be used as a guidance to use when developing processes, manage the development, acquisition, and maintenance of products or services. According to that, Ingenuity Microsystems Sdn Bhd has decided to endorse the CMMI[®] model for improving the organization processes to satisfy the organization's business needs. Ingenuity has planned to achieve CMMI[®]/SW Maturity Level 3 using Staged Representation, road map for CMMI[®] implementation called 'Ingenuity's CMMI[®] Implementation Roadmap' which is derived from the IDEALSM life cycle and 'Process Area Work Flow'. This technical report provides experienced-based discussions on state-of-the-art and state-of-the-practice of CMMI[®] in the SPI Project implementation in Ingenuity especially on the Measurement and Analysis, Risk Management, Integrated Project Management and Integrated Supplier Management.

ABSTRAK

‘Kepuasan pengguna’ adalah suatu slogan bagi sesuatu organisasi untuk terus bertahan dan berkembang maju di dalam dunia perniagaan yang penuh dengan persaingan. Pada masa yang sama, persepsi mereka terhadap kualiti perisian yang lemah ketika membangunkan produk yang berkualiti tinggi dan memberi perkhidmatan yang berkualiti semakin diberi perhatian. Oleh yang demikian, untuk memastikan proses pembangunan perisian dapat dipertingkatkan dan berjalan seperti yang dijadualkan, *Capability Maturity Model Integration* (CMMI[®]) ialah salah satu model yang sangat sesuai untuk dipilih sebagai jalan penyelesaian. Selain telah diperkenalkan oleh *Software Engineering Institute* (SEI), model ini adalah satu Proses Kemajuan Perisian (SPI) yang boleh dijadikan sebagai panduan ketika pembangunan proses, pemerolehan dan menyelenggara perkhidmatan atau produk sedang dijalankan. Sehubungan dengan itu, Ingenuity Microsystems Sdn Bhd telah mengambil keputusan untuk menyokong dan mempraktik model CMMI[®] demi untuk meningkatkan proses yang akan dijalankan oleh organisasi dan memenuhi kehendak perniagaan organisasi. Ingenuity telah merancang untuk mencapai CMMI[®]/SW *Maturity Level 3* dengan berasaskan ‘*Staged Representation*’, peta perjalanan ‘*Ingenuity’s CMMI[®] Implementation Roadmap*’ yang diaplikasikan daripada kitarhidup IDEALSM dan urutan kerja ‘*Process Area Work Flow*’. Laporan ini berkisar tentang perjalanan CMMI[®] yang dilalui oleh pelatih ketika mengimplementasikan projek SPI di Ingenuity terutamanya tentang proses yang berkaitan dengan *Measurement and Analysis, Risk Management, Integrated Project Management* dan *Integrated Supplier Management*.

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LIST OF SYMBOLS

- ® – Registered Mark
**CMM and CMMI are registered in the U.S. Patent and Trademark
Office by Carnegie Mellon University
- SM – Service Mark

LIST OF ACRONYMS AND ABBREVIATIONS

AB	–	Ability to Perform
AM	–	Acquisition Management
CAR	–	Causal analysis and Resolution
CM	–	Configuration Management
CMM	–	Capability Maturity Model
CMU	–	Carnegie Mellon University
CMMI	–	Capability Maturity Model Integration
CMMI-SW	–	Capability Maturity Model Integration for Software Engineering
CO	–	Commitment to Perform
CRM	–	Customer Relationship Management
DAR	–	Decision Analysis and Resolution
DI	–	Directing Implementation
EPG	–	Engineering process Group
FMS	–	Financial Management Solutions
GG	–	Generic Goal
GP	–	Generic Practices
GQM	–	Goal Question Metric
ICT	–	Information and Communications Technology
IDEAL	–	Initialize, Diagnose, Establish, Acting, Leveraging
IMSB	–	Ingenuity Microsystems Sdn Bhd
IPM	–	Integrated Project Management
IPPD	–	Integrated Product and Process Development
ISM	–	Integrated Supplier Management
ISO	–	International Standards Organization
IT	–	Integrated Teaming

KPA	–	Key Process Area
MA	–	Measurement and Analysis
MSC	–	Multimedia Super Corridor
N.A	–	Not Applicable
OAL	–	Organizational Asset Library
OEI	–	Organizational Environment for Integration
OID	–	Organizational Innovation and Deployment
OPD	–	Organizational Process Definition
OPF	–	Organizational Process Focus
OPP	–	Organizational Process Performance
OT	–	Organizational Training
PA	–	Process Area
PAL	–	Process Assets Library
PEG	–	Process Engineering Group
PI	–	Product Integration
PMC	–	Project Monitoring and Control
PP	–	Project Planning
PPQA	–	Process and Product Quality Assurance
PSM	–	Practical Software and System Measurement
QAI	–	Quality Assurance Institution
QMS	–	Quality System Management
QPM	–	Quantitative Project Management
R&D	–	Research and Development
RD	–	Requirement Development
REQM	–	Requirement Analysis
RFP	–	Request For Proposal
RMT	–	Risk Management Team
RSKM	–	Risk Management
SAM	–	Supplier Agreement Management
SCAMPI	–	Standard CMMI [®] Appraisal Method for Process Improvement
SDL	–	Software Development Library
SE	–	Systems Engineering
SEI	–	Software Engineering Institute

SEPO	–	Software Engineering Process Officer
SG	–	Specific Goal
SP	–	Specific Practices
SPI	–	Software Process Improvement
SPICE	–	Software Process Improvement and Capability dEtermination
SS	–	Supplier Sourcing
SW	–	Software Engineering
SW-CMM	–	Capability Maturity Model for Software
TS	–	Technical Solution
VAL	–	Validation
VE	–	Verifying Implementation
VER	–	Verification

CHAPTER 1

INTRODUCTION

1.1 Company Background

Ingenuity Microsystems Sdn. Bhd. is an IT company that prides itself as a single-source enterprise solutions provider. The principal activities of this company are business software development, customization and deployment of hardware, research and development, professional consultancy and systems integration services.

Ingenuity's solutions are designed to automate business processes as stand alone/ modular applications or as multi-user applications, and to provide customized end-to-end enterprise workflow solutions that integrate seamlessly into today's businesses.

Ingenuity is an MSC-Status company, operating from its head office in Kuala Lumpur, with a Research and Development Centre in Technology Park Malaysia, Bukit Jalil.

Ingenuity's research and development activities are endorsed by the Ministry of Science, Technology and the Environment and Multimedia Development Corporation through the MSC Research & Development Grant Scheme. The company has a distinguished panel of experts with significant experience in information technology research and consultancy for its R&D Advisory Panel.

With the capabilities to deliver comprehensive IT solutions for mid-tier to large businesses, Ingenuity is positioning itself as a leading enterprise software house that provides world-class, cost-competitive ICT products and services.

1.1.1 MSC and Ingenuity

In recognition of its ICT contributions to the MSC and Malaysia, Ingenuity was granted MSC-Status and was awarded the highly regarded Multimedia Grant Scheme for software R&D. The Ingenuity achievements in the MSC are:

- a. Contribution to the Borderless Marketing Flagship Application.
- b. Utilization of knowledge workers and technology transfer.
- c. MSC Smart Schools Flagship Application.
- d. R&D into Predictive CRM with Financial Data Protocol.

1.1.2 Products and Services

Ingenuity's range of software products, services and solutions under the **INGENUITY[®]** branding are:

- a. **INGENUITY[®] CRM**
- b. **INGENUITY[®] Financial and Accounting Solutions (FMS)**
- c. **INGENUITY[®] College Management Software (CMS)**
- d. **INGENUITY[®] E-business Solution**
- e. Enterprise workflow solutions
- f. Professional tax computation software
- g. Payroll and human resource management solutions
- h. Point-of-sale systems for retail and food & beverage (F&B) industries
- i. Hospitality solution with office and process automation

- j. System integration
- k. Software development services in client-server and Internet technologies

In addition, Ingenuity provides services in the areas of network solutions, data centre building and professional consultancy.

1.1.3 Research and Development

Ingenuity's involvement in the area of research and development (R&D) began when the company was awarded the MSC status in May 2000. Ingenuity's core emphasis of R&D is in the areas of:

- a. Business Intelligence Analytics and Predictive Customer Management
- b. Improved Human Computer Interaction through wireless applications
- c. Financial Application Data Interchange Protocol

A panel of experts in various industries guides the R&D team. The members of the R&D Advisory Panel are:

- a. Dr. Zahran bin Halim
- b. Dr. Zaidah binti Razak
- c. Prof Dato' Dr. Norbik Bashah bin Idris
- d. Dr. Cesar Montes
- e. Dr. Javier Segovia
- f. Ir. Azman Ahmad
- g. Mr. Yau Yat Hoong
- h. Mr. Wong Hun Liang

1.2 Background of Project Involved

“We realized that accreditation such as CMMI[®] is important for winning bids. Since then we have begun our application for CMMI[®] certification, and realize that the experience and expertise we have gained through this process needs to be shared with other local software developers.”

“If there are more Malaysian developers who can compete globally it will definitely make it easier for other local developers to begin moving into the larger market place. Systematic change and configuration management needs to be in place in these organizations first before this can happen,” said Executive Vice President of XYBASE Sdn Bhd, En Mohamed Izmi Md Said.

Source: Mr. Samuel Tan from About Communication Sdn Bhd, 2003

According to the above article, we may define that the CMMI[®] project is a project which act as a first step towards process improvement. Due to that, Ingenuity Microsystems Sdn. Bhd. endorsed the CMMI[®] model for software process improvement to satisfy the organization’s business needs. The idea of CMMI[®] was mooted to free the software product from defects before the product is delivered. By applying CMMI[®], the product derived from the model is better able to fulfill the customer’s satisfactions and meet demanding time-to-market goals. Besides, the organization can achieve a sustained competitive advantage in the local and international business by continuously built the well-trained engineers.

Therefore, a Process Engineering Group (PEG) was structured to organize the CMMI[®] project in Ingenuity. This team’s is to drive and facilitates the CMMI[®] process until it comes to a point whereby in later stages, the organization can learn themselves how to further advance to higher CMMI[®] levels.

Ingenuity has decided to cover all the process areas in the CMMI[®] Maturity Level 2 and Level 3. To assist itself in achieving that maturity level, Ingenuity has officially appointed Quality Assurance Institution (QAI) as a professional consultant. This organization was selected by the Ingenuity because it is the largest in Asia in terms of Software Process Improvement (SPI), Capability Maturity Model[®] (CMM[®]) and Capability Maturity Model[®] Integrated (CMMI[®]) and among the top 3 in the world in this domain.

1.3 Project Vision

The intern's task during the 5 months industrial attachment is to assist Ingenuity in achieving the Capability Maturity Model Integration for Software Engineering (CMMI[®]/SW) Maturity Level 3 by originating Process Definition Document for process area in Maturity Level 2 and Maturity Level 3.

1.4 Project Objective

Ingenuity main objectives when implementing this software process improvement by using CMMI[®] framework is to achieve CMMI[®]/SW Maturity Level 3 which is known as the Defined staged. Besides, Ingenuity also sets its expectation in that,

“Through the CMMI[®] initiative, the company expects to develop a structure process methodology within the company for total quality and productivity improvement. This will improve the competency of the organization to achieve its long term business goals in delivering high quality and cost-competitive IT projects and solutions for world wide market.”

Source: Ingenuity Microsystems Sdn. Bhd.

To facilitate above major objective, the intern was required to develop her own objectives that can be achieved within 5 months industrial attachment duration. Henceforth, the following objectives were laid out:

- a. To define the respective process areas up to the Defined Stage of the CMMI those have been assigned by Ingenuity.
- b. To ensure that defined process areas can be implemented during CMMI[®] process implementation phase at Ingenuity.
- c. To implement the respective process areas in the Ingenuity pilot project.

1.5 Project Scope

Due to the Industrial Attachment period, the intern's has to set a scope those suites with the time frame, which is 5 months industrial attachment duration.

For the Staged Representation, there are 21 process areas which are included in the CMMI[®] Maturity Level 2 and Maturity Level 3. However, intern will only focus on several process areas that have been assigned by Ingenuity. Table 1.1 shows the list of process areas that been assigned to the intern.

Table 1.1: List of Process Area Assigned

No.	Process Area	Level
1.	Measurement and Analysis (MA)	2
2.	Risk Management (RSKM)	3
3.	Integrated Project Management (IPM)	3
4.	Integrated Supplier Management (ISM)	3

In order to define and ensure the readiness of the above process areas, the intern has to focus on below scope of work:

- a. Study the process areas and outlined the details for constructing the Process Definition Document.
- b. Prepare Process Definition Document that consist of purpose and scope, roles, related process area, process area procedure and measurement metrics for respective process area that have been assigned by Ingenuity.
- c. Develop document or form template for allocated process areas.
- d. Review the Process Definition Document with PA Owner, PA Lead and PEG team members.
- e. Deploy the first draft of Quality Management System.
- f. Perform the internal audit for document standard.

1.6 Planning

This industrial attachment project will be done within 5 months from 6th April 2005 until 2nd September 2005. The details of the task for this industrial attachment project are mentioned in the Gantt Chart on Appendix A.

1.7 Deliverables

The deliverables for CMMI[®]/SW project are different from other software development projects, which there are specific products to be delivered. This effort is complying with the process area; therefore it will be expected document to be published for Ingenuity benefits.

The entire work product is called as software artifacts and become as assets of Ingenuity. Table 1.2 will describe the expected deliverables for each process area that intern involve into.

Table 1.2: Expected Deliverables for Each Process Areas

No.	Process Area	Deliverables
1.	Measurement and Analysis (MA)	<ul style="list-style-type: none"> a. Process Definition Document for MA. b. Document and form template for MA.
2.	Risk Management (RSKM)	<ul style="list-style-type: none"> a. Process Definition Document for RSKM. b. Document and form template for RSKM. c. RSKM Policy.
3.	Integrated Project Management (IPM)	<ul style="list-style-type: none"> a. Process Definition Document for IPM. b. Document and form template for IPM. c. IPM Policy.
4.	Integrated Supplier Management (ISM)	<ul style="list-style-type: none"> a. Process Definition Document for ISM. b. Document and form template for ISM. c. ISM Policy.
5.	Organizational Process Focus (OPF)	<ul style="list-style-type: none"> a. Organization Assets Library (OAL)

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