ISSN : 2301-5690

INTERNATIONAL CONFERENCE

The Second International Conference on Engineering and Technology Development

2nd ICETD 2013

27, 28, 29 August 2013, Bandar Lampung, Indonesia

PROCEEDINGS

In Cooperations With :

Universiti Kebangsaan Malaysia

APTIKOM

International Islamic University Malaysia

Surya Institute

Hosted by :
Faculty of Engineering and Faculty of Computer Science,
Bandar Lampung University (UBL), Indonesia

2nd ICETD 2013

The Second International Conference On Engineering And Technology Development

28 -30 January 2013
Bandar Lampung University (UBL)
Lampung, Indonesia

PROCEEDINGS

Organized by:

Faculty of Computer Science and Faculty of Engineering
Bandar Lampung University (UBL)
Jl. Zainal Abidin Pagar Alam No.89 Labuhan Ratu, Bandar Lampung, Indonesia
Phone: +62 721 36 666 25, Fax: +62 721 701 467
website :www.ubl.ac.id

 ISSN 2301-6590

PREFACE

The Activities of the International Conference is in line and very appropriate with the vision and mission of Bandar Lampung University (UBL) to promote training and education as well as research in these areas.

On behalf of the Second International Conference on Engineering and Technology Development (2nd ICETD 2013) organizing committee, we are very pleased with the very good response especially from the keynote speaker and from the participans. It is noteworthy to point out that about 80 technical papers were received for this conference.

The participants of the conference come from many well known universities, among others : University Kebangsaan Malaysia – Malaysia, APTIKOM – Indonesia, Institut Teknologi sepuluh November – Indonesia, Surya Institute – Indonesia, International Islamic University – Malaysia, STMIK Mitra Lampung – lampung, Bandung Institut of Technology – Bandung, Lecture of The Malahayati University, B2TP – BPPT Researcher – lampung, Starch Technology Center – Lampung, Universitas Islam Indonesia – Indonesia, Politeknik Negeri Malang – Malang,University of Kitakyushu – Japan, Gadjah Mada University – Indonesia, Universitas Malahayati – Lampung, Lampung University – lampung, Starch Technology Center – Lampung, Universitas Riau – Riau, Hasanuddin University – Indonesia, Diponegoro University – Indonesia, King Abdulaziz University – Saudi Arabia, Parahyangan Catholic University – Indonesia , National Taiwan University– Taiwan, Surakarta Christian University – Indonesia, Sugijapranata Catholic University – Indonesia, Semarang University – Indonesia, University of Brawijaya – Indonesia, PPKIA Tarakanita Rahmawati – Indonesia, Kyushu University, Fukuoka – Japan, Science and Technology Beijing – China, Institut Teknologi Sepuluh Nopember – Surabaya, Researcher of Starch Technology Center, Universitas Muhammadiyah Metro – Metro, National University of Malaysia – Malaysia.

I would like to express my deepest gratitude to the International Advisory Board members, sponsor and also to all keynote speakers and all participants. I am also gratefull to all organizing committee and all of the reviewers who contribute to the high standard of the conference. Also I would like to express my deepest gratitude to the Rector of Bandar Lampung University (UBL) who give us endless support to these activities, so that the conference can be administrated on time

Bandar Lampung, 29 August 2013-08-26

Mustofa Usman, Ph.D
2nd ICETD Chairman

 ISSN 2301-6590

PROCEEDINGS

2nd ICETD 2013

The Second International Conference
On Engineering And Technology Development

28 -30 January 2013

ISSN 2301-6590

PROCEEDINGS

2nd ICETD 2013

The Second International Conference
On Engineering And Technology Development

28 -30 January 2013

STEERING COMMITTEE

Executive Advisors
Dr. M. Yusuf S. Barusman
Andala R. P. Barusman, MA.Ec

Chairman
Mustofa Usman, Ph.D

Co-Chairman
Dr. Ir. Hery Riyanto, MT
Ahmad Cucus, S.Kom., M.Kom

Secretary
Marzuki, S.Kom., M.Kom
Maria Shusanti Febrianti, S.Kom., M.Kom

Technical Committee
Indyah Kumoro, ST. IAI
Ardiansyah, ST., MT
Sofiah Islamiah, ST. MT
Taqwan Thamrin, ST., MSc
Dina Ika Wahyuningsih, S.Kom
Agus Sukoco, M.Kom
Hj. Susilowati, ST. MT
Haris Murwadi, ST, MT
Robby Yuli Endra, S.Kom., M.Kom
Fenty Ariani, S.Kom., M.Kom

Treasure
Samsul Bahri, SE
Dian Agustina, SE

ISSN 2301-6590

PROCEEDINGS

2nd ICETD 2013

The Second International Conference
On Engineering And Technology Development

28 -30 January 2013

ORGANIZING COMMITTEE

Chair Person
Dr. Ir. Hery Riyanto, MT

Vice Chair Person
Yuthsi Aprilinda, S.Kom., M.Kom

Treasure
Dian Agustina, S.E

Secretary
Aprizal, ST. MT
Ir. Tjejeng Sofyan, MM
Ir. Muhammad Zein, MT
Ir. Bambang Pratowo, MT

Special Events
Ir. Juniardi, MT
Ir. Indra Surya, MT
Ir. Sugito, MT
DR. Baginda Simaibang, M.Ed
Berry Salatar, S.Pd
Yanuar Dwi Prasetyo, S.Pd.I., M.A

Receiptionist
Ir. Najamudin, MT
Kunarto, ST. MT
IB. Ilham Malik, ST. MT
Ir.A Ikhsan Karim, MT
Ir. Asikin, MT
Usman Rizal, ST., M.MSi

Transportation and Acomodation
Irawati, SE
Desi Puspita Sari, S.E
Tanto Lailam, S.H

 ISSN 2301-6590

Ilyas Sadad, S.T., M.T

Publication and Documentation
Ir. Indriati Agustina Gultom, M.M
Noning Verawati, S.Sos
Hesti, S.H
Rifandi Ritonga, SH
Violita, S.I.Kom

Cosumption
Dra. Yulfriwini, M.T
Wiwin Susanty, S.Kom., M.Kom
Fenty Ariani, S.Kom., M.Kom
Reni Nursyanti, S.Kom., M.Kom
Erlangga, S.Kom
Arnes Yuli Vandika, S.Kom

Facility and Decoration
Siti Rahma Wati,SE
Dina Ika Wahyuningsih, S.Kom
Zainal Abidin, SE
Ahyar Saleh, SE
Eko Suhardiyanto
Wagino
Sugimin

 ISSN 2301-6590

Table Of Content

 ISSN 2301-6590

Speaker

ISSN 2301-6590

 ISSN 2301-6590

Enhancing Quality Software Through CMMI-ISO 9001:2008and ISO 9126

Agus Sukoco
Faculty of Computer Science Bandar Lampung University,Indonesia

Abstract—*One of the software development standards in use today is the Capability Maturity Model Integration (CMMI) of the Software Engineering Institute (SEI) and ISO 9126 .Based on the 2009 survey conducted by PornchaiMongkolnam, in Asia there has been a 1,901 CMMI appraisal, to the North American continent as 1328, as many as 536 Europe, and South America 289 CMMI assessment. In India alone there has been a 409 CMMI appraisal, including three world ranking, making India the more trusted by the world International for application development. Meanwhile in Indonesia CMMI implementation is not too meaningful. Only a mixture of two companies (foreign and local) that implements it. That was probably due to the application of the mandatory in the meet (mandatory) from its headquarters abroad or indeed the company began to enter into foreign markets that require CMMI certification. This study seeks to help measure the maturity of software development using an integrated approach between CMMI and ISO 9126 in a local development company. Hopefully this can be more give their views so as to facilitate its peers able to take to implement the same thing.*

ISO 9001 is a standard for quality management systems while CMMI is a model for process improvement. If an organization that has achievedISO registration wishes to improve processescontinuously, CMMI can be a strong candidatebecause it provides a more detailed roadmap forprocess improvement. However, with respect to

adopting CMMI in organizations that are familiarwith ISO 9001, there are some issues that need to beresolved. For example, ISO 9001 and CMMI havedifferent targets, intent, and quantity of detail. In thispaper, we present an integrated model of ISO9001:2000 and CMMI and ISO 9126, which would resolve the aboveproblems. We expect that this model will be a usefultool for ISO registered organizations aim to attainhigher CMMI levels.

Keywords— *Software• Software Quality • ISO9126• CMMI*

ISSN 2301-6590

INTRODUCTION

The fundamental of the software quality from the definition of software quality concept and percept that many people supporting the project affect the software quality product. One of standard is ISO 9001 registered organizations are not likely to implement CMMI with ISO 9001:2008 because such implementation would cause extra efforts brought about by the difference between the two. Therefore it would be a priority to identify the similarities and differences between ISO 9001:2008 and CMMI. Generally, a mapping table between standards to transition one to another is used.

Computers are being used in an increasingly wide variety of application areas, and their correctoperation is often critical for business success and/or human safety. Developing or selecting highquality software products is therefore of prime importance. Comprehensive specification andevaluation of software product quality is a key factor in ensuring adequate quality. This can beachieved by defining appropriate quality characteristics, taking account of the purpose of usage of thesoftware product. It is important that every relevant software product quality characteristic is specifiedand evaluated, whenever possible using validated or widely accepted metrics.(3).Among all the Software-related standards in the worlds, there are few that every person who practices software at least something about ISO standard (1), ISO standard established an influential vocabulary and conceptual for quality (4). The

ISO/IEC 9126 standard has been developed in order to address software quality issues (3), (5), (6),(7)(8)It specifies software product quality characteristics and sub-characteristics and proposesmetrics for their evaluation.

ISO 9001 registered organizations are not likelyto implement CMMI with ISO 9001:2008 becausesuch implementation would cause extra efforts broughtabout by the difference between the two. Therefore itwould be a priority to identify the similarities anddifferences between ISO 9001:2008 and CMMI.Generally, a mapping table between standards totransition one to another is used.

PREVIOUS RESEARCH

Previous research about application for a wizard based software quality measurement standard iso 9126. (10), To obtain software quality are expected, measures quality a software product is a critical element of the security device can represent basic study of the specification, design and coding. Organizations must monitor and measure the characteristics of the products to prove that the product requirements have been met. Thus, in this regard is required measurement and monitoring of effective evaluation of the software produced in accordance with existing standards.

Of several standards to evaluate the process of developing a software include Capability Maturity Model Integration and ISO 9126. Integration of these two standards would produce an evaluation standard software development process better and details of the software development process. So we need a tool to facilitate the evaluation of the measurement of software development maturity. This will help the developer and end user benefits that the process of software development is in conformity with the standards and produce a software product is good.

Corresponding Authors: Agus Sukoco, Faculty of Computer Science, Bandar Lampung University

Maturity measurement applications are tools that can help in the process used to measure the maturity of software development by presenting a few questions. Published in web-based form that allows the user to take measurements anywhere and maturity to help facilitate an evaluation process of software development.

PURPOSE OF THE INTEGRATED MODEL

ISO 9001 requires that processes to be continuously
improved even after achieving ISO registration.
CMMI can be a good to an organization in thesoftware and systems industry to achieve further
process improvement, because CMMI is quite detailed
and contains more concepts of ‘improvement of
process’ than ISO 9001:2008. Furthermore,
considering that many ISO 9001:1994 registered
organizations are trying to introduce SW-CMM,
it is expected that many ISO 9001:2000 registered
organizations will want to adopt CMMI into their
systems. As we described in the Introduction, it is simple to implement ISO 9004:2008 to ISO registered
organizations because the structure of ISO 9004:2000
is similar to that of ISO 9001:2008. Therefore, it
would be ideal for ISO registered organizations to
adopt CMMI if the structure of CMMI is similar to that of ISO 9001:2008 [15].

OVERALL VIEW OF ISO/IEC 9126

ISO/IEC 9126 describes a two-part model for software product quality: a) internal qualityand external quality, and b) quality in use. The first part of the model specifies six characteristics forinternal and external quality, which are further subdivided into subcharacteristics.
Thesesubcharacteristics are manifested externally when the software is used as a part of a computersystem, and are a result of internal software attributes. This part of ISO/IEC 9126 does not elaboratethe model for internal and external quality below the level of subcharacteristics(3).

The characteristics defined are applicable to every kind of software, including computer programs anddata contained in firmware. The characteristics and subcharacteristics provide consistent terminologyfor software product quality. They also provide a framework for specifying quality requirements forsoftware, and making trade-offs between software product capabilities.(11)

This generic quality model can then be instantiated as a model for internal quality or forexternal quality by using different sets of metrics(7). The model itself is based on the sixcharacteristics functionality, reliability, usability, efficiency, maintainability, and portability(12), (11), And A quality model is a very useful tool for qualityrequirement engineering as well as quality evaluation.ISO/IEC 9126-1 provides a software product quality model.It is intended to be used as a general purpose defaultstandard quality model(11).

Evaluation of software products in order to satisfy software quality needs is one of the processes in thesoftware development lifecycle. Software product quality can be evaluated by measuring internalattributes (typically static measures of intermediate products), or by measuring external attributes(typically by measuring the behaviour of the code when executed), or by measuring quality in useattributes. The objective is for the product to have the required effect in a particular context of useimproving product quality, and product quality

ISSN 2301-6590

contributes to improving quality in use(3).

The full table of Characteristics and Subcharacteristics for the ISO 9126-1 Quality Model is:-

Characteristics	Subcharacteristics	Definitions
Functionality	Suitability	This is the essential Functionality characteristic and refers to the appropriateness (to specification) of the functions of the software.
	Accurateness	This refers to the correctness of the functions, an ATM may provide a cash dispensing function but is the amount correct?
	Interoperability	A given software component or system does not typically function in isolation. This subcharacteristic concerns the ability of a software component to interact with other components or systems.
	Compliance	Where appropriate certain industry (or government) laws and guidelines need to be complied with, i.e. SOX. This subcharacteristic addresses the compliant capability of software.
	Security	This subcharacteristic relates to unauthoriz

Characteristics	**Subcharacteristics**	**Definitions**
		ed access to the software functions.
Reliability	Maturity	This subcharacteristic concerns frequency of failure of the software.
	Fault tolerance	The ability of software to withstand (and recover) from component, or environmental, failure.
	Recoverability	Ability to bring back a failed system to full operation, including data and network connections.
	Understandability	Determines the ease of which the

Characteristics	**Subcharacteristics**	**Definitions**
Usability		systems functions can be understood, relates to user mental models in Human Computer Interaction methods.
	Learnability	Learning effort for different users, i.e. novice, expert, casual etc.
	Operability	Ability of the software to be easily operated by a given user in a given environment.
Efficiency	Time behavior	Characterizes response times for a given thru put, i.e. transaction rate.
	Resource behavior	Characterizes resources

 ISSN 2301-6590

Characteristics	**Subcharacteristics**	**Definitions**
		used, i.e. memory, cpu, disk and network usage.
Maintainability	Analyzability	Characterizes the ability to identify the root cause of a failure within the software.
	Changeability	Characterizes the amount of effort to change a system.
	Stability	Characterizes the sensitivity to change of a given system that is the negative impact that may be caused by system changes.
	Testability	Characterizes the effort needed to verify (test)

Characteristics	**Subcharacteristics**	**Definitions**
		a system change.
Portability	Adaptability	Characterizes the ability of the system to change to new specifications or operating environments.
	Installability	Characterizes the effort required to install the software.
	Conformance	Similar to compliance for functionality, but this characteristic relates to portability. One example would be Open SQL conformance which relates to portability of database used.
	Replaceabili	Characteriz

 ISSN 2301-6590

Characteristics	**Subcharacteristics**	**Definitions**
	ty	es the *plug and play* aspect of software components, that is how easy is it to exchange a given software component within a specified environment.

MODEL SOFTWARE LIFE CYCLE

The concepts can be mapped on to other models of software life cycles if the user so wishes as

- **STEP #1 QUALITY REQUIREMENTS IDENTIFICATION**

For each of the Quality characteristics and sub-characteristics defined in the Quality modeldetermine the Quality in Use, External and Internal Quality Assigning relative weights willallow the evaluators to focus their efforts on the most important sub characteristics.

- **Step #2 Specification of the evaluation**

This step is applied during every development process activity, For each of the Quality sub-characteristics defined in the Quality model identify the metrics to be applied and the required levels to achieve the User Needs set in Step 1

- **Step #3 Design of the evaluation**

This step is applied during every development process activity.Develop a measurement plan (similar to example in Table 2) containing the deliverables thatare used as input to the measurement process and the metrics to be applied.

- **Step #4 Execution of the evaluation**

This step is applied during every development process activity.Execute the evaluation plan and complete the column.process for evaluations may be used as a guidance for planning andexecuting the measurement process.

- **Step #5 Feedback to the organization**

This step is applied during every development process activity.Once all measurements have been completed map the results and documentconclusions in the form of a report. Also identify specific areas where quality improvements arerequired for the product to meet the user needs.

ISO 9126-4 QUALITY IN USE METRICS

Effectiveness metrics assess the tasks performed by users achieve specified goals with accuracy and completeness in a specified context of use.

- **Task effectiveness,** purpose of the metrixwhether proportion of the goals of the task is achieved correctly, measurement formula :

M1 = |1-∑Ai|1

 ISSN 2301-6590

A :proporsional value of each missing or incorrect component in the task output

- **Task Completion**, whether proportion of the tasks are completed, measurement formula :
  X =A / B

  A: Number of tasks completed

  B: total number of task attempted

- **Error Frequency**, wheter the frequency of error.measurement formula :

  X =A / T

  A: Number of error made by user

  T: time or number of tasks

Productivity metrics assess that users consume in relation to the effectiveness achieved in a specified context of the time to complete the task, although other relevant resources could include the user's effort, materials or the financial cost of usage.

- **Task time,** to measure how long does it take to complete a task, Formula :
  X=Ta
  Ta : Task Time
- **Task Efficiency,** to measure efficiency are the users
  X= M1/T

  M1 = task effectiveness
  T = task time
- **Economic productivity,** to measure costeffective is the user
  X= M1/C

  M1 = task effectiveness
  C = total cost of the task
- **Productivity proportion,** to measure costeffective is the user
  X= Ta/Tb

  Ta = productivity time=task-help me

  Tb = task time

- **Relative user efficiency,** to measure efficient is a user compared to an expert
  Relative user efficiency : X = A/B

  A: ordinary user's task efficiency
  B: expert user's task efficiency

Safety metrics assess the level of risk of harm to people, business, software property or the environment in a specified context of use .it include the health and safety to the both the user and those affected by use, as well as unintended physical .

- **User health and safety**, to measure the incidence of health problems among users of the product.
  X = 1-A/B
  A: number of user's reporting RSI
  B: total number of user's

- **Safety of people affected by use of the system**, to measure

 ISSN 2301-6590

the incidence of hazard to people affected by use of the system .
X = 1-A/B
A: number of people put a hazard
B: total number of people potentially affected by the system

- **Economic damage,** to measure the incidence of economic damag**e.**
X = 1-A/B
A: number of occurrences of economic damage
B: total number of usage situations

- **Software damage,** to measure the incidence of software corruption.
X = 1-A/B
A: number of occurrences of software corruption
B: total number of usage situations

Satisfaction metrics assess user's attitudes towards the use of products in a specified context of use. Satisfaction is influenced by the user's perception of properties of the software product (such as those measured by the external metrics) and by the user's perception of the efficiency, productivity, and the safety in use.

- **Satisfaction scale,** to measure the satisfied of the user's
X = A/B
A: questionnaire producing psychometric scales
B: population average

- **Satisfaction questionnaire,** to measured the satisfied of the user's with specific software features
$X = \Sigma(A_i) / n$
A): response to a question
n: number of responses

- **Discretionary questionnaire,** to measured the proportion of potential user's choose to use the system.
X= A/B
A: number of times that specific software functions/application/systems are used
B: number of times they are intended to be used

MODEL OF ISO 9001:2008

ISO 9001:2008 is a necessary requirement forquality management system. It is a part of ISO 9000family that consist of ISO 9000 (fundamentals andvocabulary), ISO 9001 (requirements), ISO 9004 (guidelines for performance improvements) and ISO19011 (guidelines for quality and environmentalmanagement systems auditing). ISO 9001:2008 is anabstract and sparse document that can be applied toany category of business. ISO 9001 could be interpreted by ISO 9000-3[2] or TickIT[3] whenapplied to organizations in the software industry. Forevery requirement in ISO 9001, an organization canchoose to have two status, 'satisfied' or 'not satisfied'.If every requirement is satisfied, then ISO registrations achieved. Compared with ISO 9001:2008 ISO 9001:2008 and ISO 9004:2000 are both similar in terms of structure and terminology used to allow easyconversion from one to the other.

 ISSN 2301-6590

.Table.1 Method for integration classified according to the correspondence types

Types of correspondence	Methods to integrate models
When ISO 9001:2008 shall-statements (requirements) fully satisfy CMMI practices	ISO 9001:2008 shall-statements are kept and the relationships between CMMI and the integrated model are recorded.
When ISO 9001:2008 shall-statements can or can not satisfy CMMI practices by interpretation	ISO shall-statements are modified - ISO requirements' focus are calibrated by using square brackets ([ ]). Relationships between CMMI and the integrated model are recorded.
When ISO 9001:2008 shall-statements partially satisfy CMMI practices	Relationships between ISO 9001:2008 shall-statements and CMMI are recorded.

Source :Chanwoo Y*et.al.*

Table Structure of the integrated model

Integrated model's contents	CMMI
4. Quality management system	
4.1 General requirements	GP 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.8, 2.9, 2.10, 3.1, 3.2
4.2 Documentation Requirements	
4.2.1 General	OPD
4.2.2 Quality manual	OPD
4.2.2.1 Organization's set of standard process	OPD, GP 3.1
4.2.2.2 Organization's set of standard process tailoring criteria and guidelines	OPD, GP 3.1
4.2.3 Control of documents	IPM, GP 3.2
4.2.4 Control of records	
4.2.5 Process assets management	OPD, IPM, GP 3.2
4.2.6 Measurement management	OPD
14.3 Decision analysis and resolution	DAR
5. Management responsibility	
5.1 Management commitment	GP 2.10, OEI
5.2 Customer focus	
5.3 Quality policy	GP 2.1
5.4 Planning	
□ 5.4.1 Quality objectives	OPF
5.4.2 Quality management system planning	
5.5 Responsibility, authority and communication	
5.5.1 Respon sibility and authority	GP 2.4
5.5.2 Management representative	
5.5.3 Internal communication	
5.6 Management review	
5.6.1 General	GP 2.10
5.6.2 Review input	GP 2.10
5.6.3 Review output	GP 2.10
6. Resource management	
6.1 Provision of resources	GP 2.3
6.2 Human resources	

 ISSN 2301-6590

Integrated model's contents	CMMI
6.2.1 General	GP 2.5
6.2.2 Competence, awareness and training	OT, OEI, GP 2.5
6.3 Infrastructure	GP 2.3
6.4 Work environment	OEI
7. Product realization	
7.1 Planning of product realization	GP 2.2
7.2 Customer-related processes	
7.2.1 Determination of requirements related to the product	RD
7.2.2 Review of requirements to the product	RD, REQM
7.2.3 Customer communication	GP 2.7
7.3 Design and development	
7.3.1 Design and development planning	GG 2, PP, VAL, VER, PMC, GP 2.4, OEI
7.3.1.1 Establishing design and development plan	GP 3.1, PP, IPM
7.3.1.2 Team composition and operation	IPM, IT, OEI
7.3.1.3 Risk management	RSKM
7.3.2 Design and development inputs	
7.3.A Design and development process	
7.3.A.1 Design and development process management	IPM, REQM
7.3.A2 Technical solution	TS
7.3.A3 Product integration	PI
7.3.4 Design and development review	PMC, IPM, RSKM
7.3.5 Design and development verification	VER
7.3.6 Design and development validation	VAL

Integrated model's contents	CMMI
7.3.7 Control of design and development changes	CM
7.4 Purchasing	
7.4.1 Purchasing process	SAM, ISM
7.4.2 Purchasing information	
7.4.3 Verification of purchased product	SAM, ISM
7.5 Production and service provision	
7.5.1 Control of production and service provision	
7.5.2 Validation of processes for production the service provision	
7.5.3 Identification and traceability	CM, GP 2.6
7.5.4 Customer property	
7.5.5 Preservation and delivery of product	PI
7.6 Control of monitoring and measuring devices	
8. Measurement, analysis and Improvement	
8.1 General	
8.2 Monitoring and measurement	MA
8.2.1 Customer satisfaction	
8.2.2 Internal audit	OPF, GP 2.9, PPQA
8.2.3 Quantitative project management	QPM
8.2.3.1 Monitoring and measurement of processes	MA, GP 2.8, QPM

Integrated model's contents	CMMI
8.2.3.2 Monitoring and measurement of product	MA, QPM
8.2.4 Monitoring and measurement of product	MA
8.3 Control of nonconforming product	
8.4 Analysis of data	MA, OPP
8.4A Measurement management	OPF, MA
8.5 Improvement	
8.5.1 Continual improvement	OPF
8.5.1.1 Selecting improvements	OID
8.5.1.2 Deploying improvements	OID
8.5.2 Casual Analysis and Resolution	CAR
8.5.2.1 Corrective action	OPF, CAR
8.5.2.2 Preventive action	CAR

Source :Chanwoo Y*et.al.*

CMMI PROCESS MODEL

CMMI (Capability Maturity Model Integration) is an integrated model of many CMMs intended to achieve process improvement. CMM is a model that contains the essential elements of effective processes for one or more disciplines and describes an evolutionary improvement path from ad hoc, immature processes to disciplined, mature processes with improved quality and effectiveness.

CMMI has two representations. One is the stagedrepresentation. The other is the continuous representation. In the staged representation maturity level of an organization ranges from level 1 to 5. In the continuous representation each process capability level ranges from 0 to 5. The staged representation is most suitable for an organization that does not know which processes need to be improved first because the staged representation offers process areas applicable to

each maturity level. The continuous representation provides flexibility for selecting processes fit for achieving business goal of the organization. CMMI provides 25 process areas (Process areameans a cluster of related practices in an area that,when implemented collectively, satisfies a set of goals considered important for making significant improvement in that area. Goals are classified as generic goals and specificgoals. A generic goal describes the characteristics thatmust be present to institutionalize the processes thatimplement a process area. A specific goal describesthe unique characteristics that must be present to

satisfy the process area. Practices are expected components for satisfying goals. Practices are classified as generic practices andspecific practices. A generic practice is the descriptionof an activity that is considered important in achievingthe associated generic goal. A specific practice is thedescription of an activity that is considered important

in achieving the associated specific goal.

CMMI Process model

The Capability Maturity Model Integration [5] describes the characteristics of effectiveprocesses. It is a process improvement approach that provides organizations with the essentialelements of effective process. CMMI best practices enable organizations to do thefollowing:

- link management and engineering activities to their business objectives,
- expand the scope of and visibility into the product lifecycle and engineering activities to ensure that the product or service meets customer expectations,
- implement more robust high-maturity practices,
- incorporate lessons learned from additional areas of best practices,

 ISSN 2301-6590

- more fully comply with relevant ISO standards,
- address additional organizational functions critical to their products and services.

This model can be used in such a way as to define the Maturity Level (ML) of the organization, taking into account its software process, as to guide an improvement process work.

There are five MLs and each of this level acts as a foundation for the following level and indicates the capability of the organization software process.

In ML 1 – Initial, the succes of the organization depends on the efforts of the people.

In ML 2 – Repeatable, organization already possesses a plan for new projects based on its specifications and experiences of similar projects.

For ML 3 – Defined, there is existence of a standard software process for all the organization.

In ML 4 – Managed, the organization keeps a quantitative control of the software process quality and of the software products quality.

At ML 5 – Optimizing, organization provides a continuous improvement of its software processes in an organizational way.

The latest version of CMMI ver 1.2 was released in August 2006. There are 3constellations of CMMI in the new version: CMMI Development, CMMI Services and CMMI Acquisition.

CMMI for Development Ver 1.2 consists of 22 process areas with capability or maturity levels.

CMMI should be adapted to each individual company, therefore companies are not "certified." A company is appraised (e.g. with an appraisal method like SCAMPI) at a certain level of CMMI.

The CMMI provides a framework for process improvement that consists of Process Areas (PAs), to be influential in various aspects of the development process and resultant software quality.

The processes are devided into four categories namely:

a) Process Management,
b) Project Management,
c) Support and
d) Engineering.

Each ML focuses on different processes with these four categories.

The PAs contain goals and best practices, specific and generic, and subpractices that the employees must control to reach the goals [9].

METHOD OF INTEGRATION OF ISO 9126 AND CMMI

The integration of a process model and a standard for software product quality propose practical alternative for software producing organizations. A method is to analyze examples of a software process model that has potential for the use of ISO 9126 standard.

The activities that encompasses PAs describe how to establish the software process capability. Implementing the norm ISO 9126 in the PAs of the activities define what must be done to establish the software process capability.

 ISSN 2301-6590

In other words, the CMMI based process improvement can result in better project

performance and higher quality products if the measures of performance and some

related practices are used in conjunction with the ISO 9126 norm.

There are a lot of chances of CMMI application points of ISO 9126 concepts use.

Using the ISO 9126 norm in examples of the CMMI must be simple and easy to

implement, some examples are described:

Requirements Management (RM) – a Process Area for ML 2: Repeatable

The purpose of RM is to manage the requirements of the project's products

and product components and to identify inconsistencies between those

requirements and the project's plans and work products.

In order to add value to this purpose the incorporation of ISO 9126 into software process is to establish mutual agreement between the requirements provider and requirements receiver so that commitment to the requirements is obtained from the

project participants.

Organizational Process Focus (OPF) – PA for ML 3: Defined

The purpose of OPF is to plan and implement organizational process

improvement based on a through understanding of the current strengths and

weaknesses of the organization's processes and process assets.

The improvements of the organizational processes with the incorporation of ISO

9126 may be obtained from various resources including product evaluation activities

that will improve organization's overall software process and product capability.

Causal Analysis and Resolution (CAR) – PA for ML 5: Optimizing

The purpose of CAR is to identify causes of defects and other problems and take

action to prevent them from occurring in the future.

The incorporation of ISO 9126 into process is the identification of problems in

reaching goals related to the product characteristics [9].

Method to make the integrated model CMMI and ISO 9001:2008

With applied the concise N-N mapping for the

integrated model while the concise N-N mapping was

derived by using a N-N mapping some changes

need to be made to the mapping table. First, many

practices have dependencies among one another, and

the N-N mapping table does not preserve these

dependencies. Therefore, we need to place dependent

practices in an adequate place together. Second, the

concise N-N mapping may possibly make the relationship between CMMI practices and ISO

9001:2008 requirements too simple. Thus, in order to

resolve this, some additional explanations on the

relationships between CMMI practices and ISO

9001:2008 requirements should be added to the

integrated model. Third, granularity of the integrated

model is another issue. CMMI assesses that a process

area is satisfied only when all the goals in the process

area are satisfied. In other words, each goal in the

process area is a primitive unit to be assessed.

However, if the goals in CMMI are selected for the

target of the integrated model, then the relationship

between ISO 9001:2008 and CMMI can become "All

Match". Therefore, practices in each process area are

selected as the CMMI-side target of the integrated

model.

After developing a concise N-N mapping, CMMI

practices were merged with ISO 9001:2008

requirements using the method [15].

CONCLUSIONS

we proposed an integrated model by inserting CMMI practices into ISO 9001:2008 requirements. And ISO 9126 We expect that this model will be helpful to implementation of Quality Managorganizations ament Sysytem based in ISO, it will allow existing ISO assets to be re-used without redundant efforts. In addition, the model will help organizations to perform gap analysis and maintain their quality manual without any difficulty when adopting CMMI. And, even if an organization does not have ISO registration but plans to adopt CMMI only, the organization will be able to implement ISO 9001:2008 and CMMI simultaneously by this integrated model for the software's product. In future research, we plan to conduct experiments to confirm how effective this model will be real application..

REFERENCES

1] Gordon G.S, McManus I James.Handbook of Software Quality Assurance. Norwood, MA : Artech House, 2008.

[2]Guidelines for quality and/or environmental management systems auditing. ISO/IEC. Genewa, Switzerland : ISO/IEC, 2002. 19011:2002.

[3]Pressman, Roger S.Software engineering: a practitioner's approach. New York : McGraw-Hill series in computer science, 2001.

[4]Software Engineering - Product quality - Part 1. ISO/IEC.

ISSN 2301-6590

Genewa,Switzerland : ISO, 2000. ISO 9126.

[5] ISO. www.iso.org. www.iso.org/aboutiso. [Online] Tuesday june 2012. [Cited: Tuesday June 2012.] www.iso.org.

[6]ISO/IEC.Software Engineering-Product Quality-Part 2 : External Metrics. Genewa, Switzerland : ISO, 2003. ISO 9126-2 :2003,.

[7] —. Software Engineering-Product Quality Part-3; Internal Metrics. Genewa,Switzerland : ISO/IEC, 2003. ISO/IEC 9126-3:2003.

[8] Hoyle D, ISO 9000 Quality Systems Handbook, Butterworth-Heinemann is an imprint of Elsevier, Fifth Edition. 2006

[9] Slavek, N.; Jovic, F. & Blaževic, D. toward software process and software product quality integration. advanced engineering

2(2008)1, issn 1846-5900

[10]Application For a Wizard Based Software Quality Measurement Standard Iso 9126. Sukoco, A. Bandar Lampung : Explore, 2011, Vol. 1.

[11] Computer Based Assessment Systems Evaluation via the ISO9126 Quality Model. Salvatore Valenti, Alessandro Cucchiarelli, and Maurizio Panti. Istituto di Informatica, Università di Ancona, Italy : Journal of Information Technology Education, 2002, Vols. Volume 1 No. 3, 2002.

[12]Applying ISO/IEC 9126-1 Quality Model to Quality Requirements Engineering on Critical Software. AZUMA, Motoei. Waseda : s.n., 2005.

[13]ISO/IEC.Requirements - Quality Mangement System. Genewa,Switzerland : ISO, 2008. 9001:2008.

[14]—. Vocabulary - Quality Management System . Genewa. Switzerland : ISO , 2009. 9000:2009.

[15]Chanwoo Y., Junho Y., Byungjeong Lee. An Integrated Model of ISO 9001:2000 and CMMI for ISO Registered Organizations. Proceedings of the 11th Asia-Pacific Software Engineering Conference (APSEC'04) 1530-1362/04.

[16] —. Software Engineering-Product Quality-Part 4; Quality in Use. Genewa, Switzerland : ISO/IEC, 2004. ISO/IEC 9126-4:2004.

[17]. Applying the ISO 9126 Quality Model to Test Specifications Exemplified for TTCN-3 Test Specifications. Benjamin Zeiss, Diana Vega. s.l. : Proceedings of CONQUEST, 2012.

[18]Sukoco A. Concept of Quality Measurement System SoftwareBased on Standard ISO 9126 and ISO 19011 .IEEE.2012.

[19]The Method Of Quality management software. Aleksandr Kharchenko, Iryna Galay, and Vasiliy Yatcyshyn. Polyana-Svalyava (Zakarpattya), UKRAINE : MEMSTECH'2011, 11-14 May 2011.

[20] Sukoco A. Concept of Quality Measurement System Software based on Standard ISO 9126 and 19011.published by IEEE.

[21] CMMI Product Team, Capability Maturity Model® Integration (CMMISM),Version 1.1, CMMIsm for Software Engineering (CMMI-SW, V1.1), Carnegie Mellon Software Engineering Institute, Pittsburg. Diakses25 Juli 2009, dari Software Engineering Institute, http://www.sei.cmu.edu/pub/documents/02.reports/pdf/02tr029.pdf

[22] Ho-Won Jung and Seung-Gweon Kim, Measuring Software Product Quality: A Surveyof ISO/IEC 9126. IEEE SOFTWARE Published by the IEEE Computer Society.. 0740-7459/04/

[23]Dominique St-Louis, Witold Suryn. Enhancing ISO/lEe 25021 Quality MeasureElements for wider application within ISO 25000 series. 978-1-4673-2421-2/12

[24]Gartner Analyst, IT Persepective: Balancing Six Sigma and the Capability Maturity Model (CMM/CMMI),

[25] efner, Rick., Using Six Sigma to Accelerate CMMI Adoption (and Vice Versa), Presented at the Softeare Engineering Process Group Conference, Seattle, WA, March 7-10, 2005., Diakses 25 Juli 2009, dari Sofware Engineering Institute http://www.sei.cmu.edu/sema/presentations/hefner.pdf

[26]Janiszewski, Steve, Introducing Six Sigma to Software Development. PS&J Software Six Sigma, New Jersey. Diakses 25 Juli 2009, dari Software Six Sigma,http://www.softwaresixsigma.com/PDFs/0403%20NycPmi.pdf

[27]Janiszewski, Steve and Ellen George, Six Sigma & Software Process Improvement. PS&J Software Six Sigma, New Jersey. Diakses7 Agustus 2009, dari Software Six Sigma,

[28]Persse, James R., Process Improvement Essentials, O'Reilly Media, Inc., Sebastopol, CA 95471, 2006

[29]Raghav, Nandyal S., CMMI A Framework for Building World Class Software and System Enterprise, Tata McGraw Hill Publishing Company Limited, New Delhi, 2004

[30] Inoue K., Watanabe A, IIda H, Torii K. Modelling method for management Process and Its Application to CMM and ISO 9000-3.IEEE.1994.

[31] Chanwoo Y, Junho Yoon, An Integrated Model of ISO 9001:2000 and CMMI for ISO Registered Organizations.

universitas
bandar lampung

Jl. Z.A. Pagar Alam No.26 Labuhan Ratu
Bandar Lampung 35142 Phone: +62 721 701463
www.ubl.ac.id
Lampung - Indonesia