

## A Software Testing Process Methodology using DMAIC Model

Oythip Onsu<sup>1</sup>, Pongpisit Wuttidittachotti<sup>2</sup>, Somchai Prakanchroen<sup>3</sup>, Sakda Arj-ong Vallipakorn<sup>4</sup>

<sup>1,2,3</sup>Faculty of Information Technology

King Mongkut's University of Technology North Bangkok

Bangkok, Thailand 10800

e-mail: <sup>1</sup>oythip.onsuk.99@gmail.com, <sup>2</sup>pongpisitw@kmutnb.ac.th, <sup>3</sup>spk@kmutnb.ac.th

<sup>4</sup>Section for Clinical Epidemiology and Biostatistics, Faculty of Medicine

Ramathibodi Hospital, Mahidol University

Bangkok, Thailand 10400

e-mail: <sup>4</sup>dr.sakda@gmail.com

*Abstract*—This research proposes to resolve the software testing process from the original test process comes as the six sigma. The application of Six Sigma quality management principles under DMAIC technique. The study of historical data, the number of defects found is that the Run-Time Error, Logical Error and Syntax Error respectively due to an operational error. Respectively, due to an operational error. A lack of knowledge of the test and to increase customer 3.833%, 2.833 % and 5.500% defects all respectively. The process consists of five steps, operations research principles DMIC. Starting from the process of identifying the problem, study the problem to find the cause of the problem in a number of defects and then do an analysis quickly, using maps, charts, tree and Fishbone to know why has created real cause analysis assumptions. Where do the update using design of experiments techniques. The last step is controlled by software testing standards made the process so that the problem does not occur again. This process can reduce defects.

**Keywords- Software Testing; CMMI; Six sigma; DMAIC**

### I. INTRODUCTION

At present, global business is expanding rapidly. Almost every business category has already been introduced into the information technology have a role as a supporting unit to make businesses grow. Compete with other businesses and in the business of manufacturing software. On the part of the trial process, the software by using the technical know-how to be able to identify or locate the error of the software emerged that can identify its approach to a problem with the assumption of error that may occur [1]. The software testing process has brought a case study on a software company, one of the software houses to reduce process errors, based on the concept of managing remodel to the six sigma.

#### A. Objective

- To develop a model of software testing process

with DMAIC increasing efficiency in software testing.

To the process to reduce DMAIC the risk of losing the reliability of the software testing process.

#### B. Scope of Research

Processes DMAIC applied in software testing project have been designed by the system.

- Define the process of defining the problem or choose a project to make improvements or designer. The needs of their customers the projects selected, it is critical to make it worthwhile. This issue does not waste time.
- Measure is the measure phase. Measure the ability of the process. Measuring the effectiveness of measures to bring the various variable analyses.
- Analyze the process of analysis of the measured data to find or prove to be the most important variables in the process (Key process variable) is the cause of the problem is defined.
- Improve the process of updating after catching a lot of variables that affect or have therefore embarked on a major change or improve. To eliminate the causes of analysis the design phase is to design processes and products. To eliminate or control the variables analyzed.
- Control is the process of controlling the process to slide by under control on a regular basis, keep track of the results of the report to work.

### II. THEORY AND RELATED RESEARCH

#### A. Theory of Six Sigma.

Six Sigma Management philosophies are to plan for improvement. Indeed, a central role for the administration has been developed and tested for the first time in years 1979 by Mister at Sandarai (Mr. Art Sundry) executives of Motorola Company. With that comes from Dr. Demming's management philosophy (Dr. Deming) and Dr. Churan (Dr. Juran), which discusses the statistical strategy implementation (Statistical techniques) and subsequently in 1981 Motorola Company hotel. Improves product

quality by making the project six sigma projects 10-Mar 5-year period by the control of Mister Kawin Roboet (Mr. Robert Galvin), which is the CEO of Motorola hotel. While the Motorola company Terra was awarded. There are 3 major goals best improve satisfaction to customers, reducing cycle time to reduce the defects caused by the split process six sigma Reduction defects are caused by the process into 3 elements. six sigma process without the involvement of the administration.

#### B. *The work of the Six Sigma in DMAIC*

- D-Define are the first step of the six sigma Determine the topic and scope of the project is to define the topic and scope of the project. This project works to improve or change the subject. Begin searching for the true customer of the process that made the update. Find customer needs something that makes the customer satisfied, or what the competitors are in the same business [2] [3].

- M-Measure is collecting information about the output. The services out of the process, starting from a defined storage plans. Format How to store data to suit your needs and processes. After that. Data for the performance of the process compared to the target set is closest or is different from the target the target is what customers want.

- A-Analyze Quantitation of cause the output of the process does not meet the defined which is the cause of the Defect (Xs): the mathematical equations  $Y = f(Xs)$  as the targets are not met in six sigma is a Defect (Y), so at this stage to analyze what factors affect Birth Defect and are arranged in order of precedence to determine the cause. Secondary causes (X1, X2, X3 ...) the need to collect data and statistics for commercial processing. Working every step must be verifiable and clearly. Do not use the beliefs or feelings on the decision. This is. There are a variety of statistical tools [4].

- I-Improve after making an analysis of the main causes for the poor causes (X1) Birth Defect that causes this step to determine a plan to improve the workplace by focusing on eliminating or reducing what their main cause problems in six sigma. Can also evaluate each X is able to deliver results to improve as many of Y values is especially useful in the effective costs [5].

- C-Control is the final stage of the Six Sigma project. As an important step, especially after an update or make changes to improve procedures to work, it is necessary to place the control system so that the changes remain forever. Adjustment process back to the original format due to a familiar worker. To control it requires both Create an accepted or esteem of the process. Evaluation is continuous from time to time [6].

### III. CONDUCT RESEARCH

#### A. *The process of defining the problem*

- The software testing process in an overview of the testing process. Case study in software companies the study of the educational process, the system being tested. Personnel Assignment The equipment used for testing Test data preparation Test case and preparing documents for a basic knowledge of research to understand before analyzing defects and implement improvements.

- The sample in the study used to select a group (Cluster Sampling) which will be divided into 3 groups of 12 systems based on the relationship of each group. And a system of three systems, which will be studied is the Security Module System Dispute Manager Module System and Interchange Module System after a neat collect classify defects on test data for the past 3 system by conducting. The process begins by considering all the defects that occurred in the past.

- Identified in a study by the sort of information available to most defects minimal down the order to analyze a problem, most of such defects. The data of each problem to determine the percentage of defects and cumulative percentage for selection problem significantly.

- Team preparation related to the problem of Security is a system of systems, System 3 Module system, link Manager, and system Module Card Interchange Dispute Module, divided into 3 groups of works by testing the old system and to test the Six Sigma. The test team used the same series.

#### B. *The measurement procedure*

- The measurement procedure measurement procedure as an error value as an introduction to improve starting from creating a flow chart (Mapping Process) of the test system in the production of software to be aware of the factors and the relation of each process, and then. Leading factors associated with the problem of education create a flow chart (Mapping Process) and to create a chart, tree chart, and chevrons, respectively. To use the analysis of the problems and questions why it crashes (Why-Why-Tree) In order to show cause and effect related to the problems resulting from this process is the cause of the problem.

- The planning process flow diagram of the process (Process Mapping) to study the layout of the software testing process. Consists of a multi-step workflows. The first step of the study and improvement of production will make it possible to determine the factors and their relationship to each stage of the process. Teams must have an understanding of the duty to provide details of their responsibility in the process. To be able to identify the problem this could be the cause bugs [7][8].

C. The analysis phase

- A new method for the experiment to find out what proportion of job imperfections with the experiment to find out what the reason was confirmed. If the reason was not able to confirm the reliability of the tests need to be made to accept an alternative choice to choose because there are not enough reasons to reject. (Fail to Reject) by selecting it in the contrary if that reason can do to confirm the belief of those tests can be accepted [9][10].

- To compare the performance reliability of the software testing process with a traditional Six Sigma process under good memory makers. As a whole must be greater than or equal to 95% of the index monitoring rejection must be less than or equal to 5% and the index monitoring acceptable error must be less than or equal to 2% to be in good compromise.

D. Process improvement

- The Traditional software testing see Figure 1.

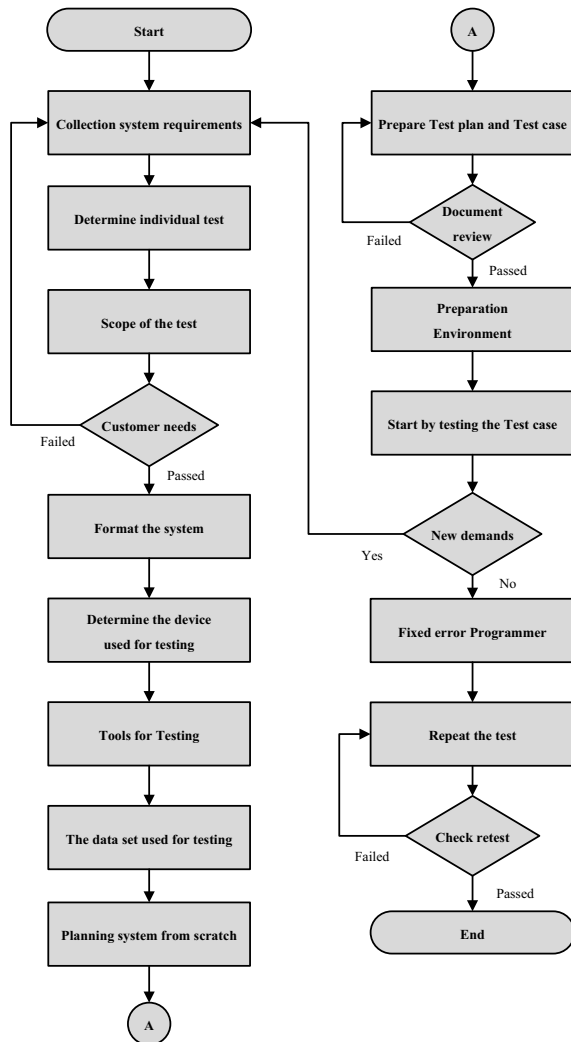


Figure 1. Traditional software testing process

- The Six Sigma software testing see Figure 2.

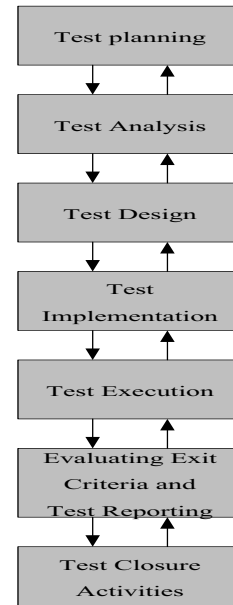


Figure 2. The process of software testing in Six sigma

E. Process control

- The procedure is monitored. And evaluation of the performance by comparing the performance before the performance. And the performance is much different. If the results come out as planned then to establish standards for the performance the next time.

IV. OPERATING RESULTS

A. The Define results

- Storage in proportion to the problem of software testing. From data to action from April to May period 2014(2014) 6 weeks the number of cases testing the 900 cases tested by 150 per week divided into test cases in phase 1 (Phase 1) has found a fault problem seen in Figure 3.

Appearance defects	Test case (Security Module )															
	April						May									
	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Average	SD	Week 1	Week 2	Week 3	Week 4				
Run-time Error	9.00	7.00	5.00	1.00	1.00	0.00	3.8333	3.7103	8.00	7.00	4.00	1.00	0.00	1.00	3.5000	3.3912
Logical Error	8.00	7.00	4.00	1.00	0.00	1.00	3.5000	3.3912	2.00	2.00	2.00	0.00	1.00	2.00	1.5000	0.8367
Syntax Error	2.00	2.00	2.00	0.00	1.00	2.00	1.5000	0.8367								
Appearance defects	Test case (Interchange Module )															
	April						May									
	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Average	SD	Week 1	Week 2	Week 3	Week 4				
Run-time Error	5.00	5.00	4.00	2.00	1.00	0.00	2.8333	2.1370	3.00	2.00	2.00	0.00	1.00	2.00	1.6667	1.0328
Logical Error	3.00	2.00	2.00	0.00	1.00	2.00	1.6667	1.0328	2.00	1.00	0.00	1.00	1.00	1.0000	0.6325	
Syntax Error	2.00	1.00	0.00	1.00	1.00	1.00	1.0000	0.6325								
Appearance defects	Test case (Card link Dispute Manager Module )															
	April						May									
	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Average	SD	Week 1	Week 2	Week 3	Week 4				
Run-time Error	10.00	10.00	5.00	3.00	3.00	2.00	5.5000	3.6194	10.00	8.00	5.00	1.00	0.00	1.00	4.1667	4.1673
Logical Error	10.00	8.00	5.00	1.00	0.00	1.00	4.1667	4.1673	1.00	1.00	0.00	0.00	0.00	2.00	0.6667	0.8165
Syntax Error	1.00	1.00	0.00	0.00	0.00	0.00	0.6667	0.8165								

Figure 3. The number of flaws of each system

**B. The Measurement results**

- To discover why impact study which problems cause 3, which contains a Run-Time Error, Logical Error and Syntax Error analysis using Logical were 3 reasons why performance is a program crash due to lack of customer knowledge test user requirement.

**C. The Analysis results**

- Study on work flow processes (Mapping Process), which studies the process and procedure. The extensive process makes it possible to show the process of running a test case was born in Run-time's range of Error is an error that occurs while the worker is not a Syntax error but may also have a Logical error or errors that occur while the program is operated by either due to unexpected conditions or a the unexpected seen in Figure-4.

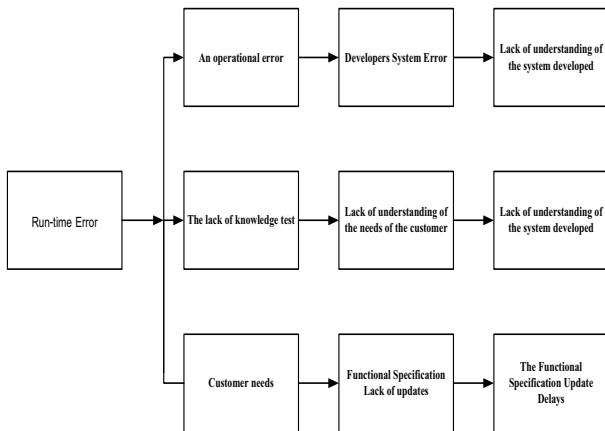


Figure 4. Factors that affect the occurrence of problems

**D. The Improved results**

- Experimental analysis of testing the Mapping Process to refine the factors. The cause was found to cause defects as factor to adjust the 3 main factors. By the proposed ways to improve the scaling procedure standard six sigma was made from the original test process and monitor the process of adjusting the settings and start the planning and execution process bat work seen in Figure 5.

**E. The Control results**

- To compare trust information

Statistical hypothesis  $H_0 : \mu_1 - \mu_2 = 0$  (1)

$H_1 : \mu_1 - \mu_2 > 0$

Significance level 0.05

Run-time Error	CS	IM	CDM	Mean	Std. Deviation	Std. Error Mean	Correlation	Sig.
The original system	3.8333	2.8333	5.5000	4.0553	1.3473	0.7779	0.9835	0.1160
The Six Sigma System	2.6667	1.3333	3.8333	2.6110	1.2509	0.7222		

Run-time Error	Mean	S.D.	Std. Error Mean	95% Confidence Interval		t	df	Sig. (2-tailed)
				Lower	Upper			
4.553 -2.6110	1.4443	0.2551	0.1473	0.8106	2.0780	9.8067	2.0000	0.0102

Figure 5. Calculate the reliability of the data

Critical values . . Denied  $H_0$  Accept  $H_1$

Concluded that  $t_{0.05(3)} = 4.306$  after using management Six Sigma resulted in reduction of fault has a significant 42% at 0.05 level.

**F. The Observation results annulled after a control fault**

Comparing data set from defects prior to working on the problem in the operations to improve the problem, which can reduce defects defined goals seen in Figure 6.

Appearance defects	Test case (Security Module)							
	October				November			
	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Average	SD
Run-time Error	7.00	5.00	3.00	1.00	0.00	0.00	2.6667	2.8752
Logical Error	6.00	6.00	3.00	0.00	0.00	1.00	2.6667	2.8048
Syntax Error	1.00	1.00	0.00	0.00	0.00	0.00	0.3333	0.5164

Appearance defects	Test case (Interchange Module)							
	October				November			
	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Average	SD
Run-time Error	3.00	3.00	1.00	1.00	0.00	0.00	1.3333	1.3663
Logical Error	2.00	2.00	1.00	0.00	0.00	0.00	0.8333	0.9832
Syntax Error	3.00	1.00	0.00	0.00	0.00	1.00	0.8333	1.1690

Appearance defects	Test case (Card Link Dispute Manager Module)							
	October				November			
	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Average	SD
Run-time Error	8.00	8.00	5.00	1.00	0.00	1.00	3.8333	3.6560
Logical Error	7.00	5.00	3.00	0.00	0.00	0.00	2.5000	3.0166
Syntax Error	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.0000

Figure 6. The defects of each system after improvement

**V. Conclude**

This study is a study in order to solve the problem of the software testing process, for example, A software manufacturing company by doing a study on the problem and Run-Time Error, Logical Error and Syntax Error consisting of a system of work to be followed is. One of the codes using the DMAIC process birds, mostly of the Sigma approach performance are as follows: the factors that affect the problem Error Run-time Error and Logical Syntax, by this research also illustrates the principle of DMAIC can be used as a tool in reducing the problem of fault Error Run-time Error and Logical Syntax, Error that occurs in the process of testing the software properly.

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