



**UNIVERSITI PUTRA MALAYSIA**

**DEVELOPMENT OF A DIAGNOSTIC TOOL TO BENCHMARK BEST  
MANUFACTURING PRACTICES IN MALAYSIAN SMEs**

**MARIAM BINTI ABDUL AZIZ**

**FK 2007 57**



**DEVELOPMENT OF A DIAGNOSTIC TOOL TO  
BENCHMARK BEST MANUFACTURING  
PRACTICES IN MALAYSIAN SMEs**

**MARIAM BINTI ABDUL AZIZ**

**MASTER OF SCIENCE  
UNIVERSITI PUTRA MALYSIA**

**2007**



**DEVELOPMENT OF A DIAGNOSTIC TOOL TO BENCHMARK BEST  
MANUFACTURING PRACTICES IN MALAYSIAN SMEs**

**By**

**MARIAM BINTI ABDUL AZIZ**

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in  
Fulfilment of the Requirements for the Degree of Master of Science**

**June 2007**



Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

**DEVELOPMENT OF A DIAGNOSTIC TOOL TO BENCHMARK BEST  
MANUFACTURING PRACTICES IN MALAYSIAN SMEs**

By

**MARIAM BINTI ABDUL AZIZ**

**June 2007**

**Chairman: Associate Professor Rosnah Mohd Yusuff, PhD**

**Faculty: Engineering**

In developing countries such as Malaysia, the small and medium scale enterprises (SMEs) play an important role in increasing the country's economy. For the SMEs to remain competitive and to ensure their survival in the globalize era, the SMEs must continuously improve their manufacturing practices. The development of self assessment tool can facilitate the SMEs to benchmark their manufacturing practices and will help them in becoming more competitive.

Based on literature review, eight areas of manufacturing practices have been proposed for benchmarking and the areas have been validated by selected companies. The areas of manufacturing practices included in this tool are management practice, human resource, marketing strategy, quality, production process, customer focus, supply chain management, technology and product innovation.



The development of this web-based tool used the Hypertext Preprocessor (Php), Structured Query Languages (SQL) scripting languages and Internet as a platform. The participating SMEs can log into the system and choose a particular area to be benchmarked. Based on the indicators that have been developed, summary of their performance and how they fare with others will be generated in the form of a graph. The graph clearly indicates the gaps in their practices. The SMEs can then make appropriate decisions on which areas to be improved, with those results.

The benchmarking tool system has been tested and validated by seven SMEs. From the companies' feedback, some improvements and modifications have been made on the system such as questionnaires, output results and company registration form. The system was developed in dual language (Malay and English) to facilitate SMEs benchmark in the company. It is hoped that the SMEs using this tool will become more aware of the importance of certain practices, facilitate SMEs to be more competitive and able to develop a culture of continuous improvement.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

**PEMBANGUNAN SATU SISTEM PENGUKURAN AMALAN TERBAIK  
SEKTOR PEMBUATAN DALAM PERUSAHAAN KECIL DAN SEDERHANA  
DI MALAYSIA**

Oleh

**MARIAM BINTI ABDUL AZIZ**

**Jun 2007**

**Pengerusi: Profesor Madya Rosnah Mohd Yusuff, PhD**

**Fakulti: Kejuruteraan**

Bagi negara yang sedang membangun seperti Malaysia, Perusahaan Kecil dan Sederhana (PKS) memainkan peranan yang penting di dalam meningkatkan ekonomi negara. Untuk PKS kekal dalam persaingan dan bagi memastikan ia dapat bertahan dalam dunia globalisasi, PKS mestilah secara berterusan membaiki amalan pembuatan mereka. Pembangunan satu alat pengukur penilaian yang menolong PKS untuk melaksanakan aktiviti penilaian akan membantu mereka menjadi lebih berdaya saing.

Berdasarkan kajian literatur, terdapat lapan bidang amalan pembuatan yang telah dicadangkan untuk penilaian dan kesemuanya telah pun disahkan oleh syarikat-syarikat yang terpilih. Lapan bidang tersebut adalah amalan pengurusan, sumber manusia, strategi pemasaran, kualiti, proses pengeluaran, fokus pelanggan, pengurusan rangkaian sumber, teknologi dan inovasi. Pembangunan sistem berlandaskan laman web ini, menggunakan program php, mysql dan Internet sebagai landasan untuk pelancaran

sistem. PKS yang berdaftar boleh memasuki sistem ini, memilih bidang untuk dinilai dan berdasarkan penanda aras yang telah dibina, satu rumusan berkaitan pencapaian mereka dan perbandingan dengan syarikat lain akan diperolehi dalam bentuk graf. Graf tersebut akan dengan jelas menunjukkan kekurangan dalam amalan mereka. Dengan keputusan tersebut, PKS boleh membuat keputusan bidang mana yang perlu dibaiki.

Sistem penanda aras tersebut telah diuji dan disahkan oleh tujuh syarikat PKS. Dengan maklum balas daripada syarikat-syarikat tersebut, beberapa perubahan dan pembaikan telah dilakukan terhadap sistem tersebut yang merangkumi soalan soal selidik, keputusan akhir dan ruangan pendaftaran syarikat. Sistem tersebut dibina dalam dwi bahasa (Melayu dan Inggeris) untuk memudahkan PKS menanda aras syarikat mereka. Adalah diharapkan PKS yang menggunakan sistem ini akan menjadi lebih perihatin terhadap kepentingan amalan terbaik, membantu PKS menjadi lebih berdaya saing dan boleh membentuk budaya pembaikan secara berterusan.

## **ACKNOWLEDGEMENTS**

First and foremost, I would like to express my sincere thanks to my supervisors, Associate Professor Dr. Rosnah Mohd Yusuff, Ir. Mohd Rasid Osman and Associate Professor Dr. Megat Mohamad Hamdan Megat Ahmad for their invaluable guidance and advice to complete this project. Also, special thanks to my beloved husband Azrulnizam Zul and my family for being the pillar of strength throughout the process of the project.

Last but not least, I wish to thank my friends, the SMEs companies, NPC and KMP staff for their co-operation during this project. May Allah bless all of you.





I certify that an Examination Committee met on 26 June 2007 to conduct the final examination of Mariam Binti Abdul Aziz on his Master of Science thesis entitled “Development of diagnostic tool to benchmark best manufacturing practices in Malaysian SMEs” in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

**Chairman, Ph.D.**

Assoc. Professor Ir. Dr. Md Yusuf Ismail  
Department of Mechanical Engineering and Manufacturing  
Faculty of Engineering  
University of Putra Malaysia  
(Chairman)

**Examiner 1, Ph.D.**

Dr. Tang Sai Hong  
Department of Mechanical Engineering and Manufacturing  
Faculty of Engineering  
University of Putra Malaysia  
(Member)

**Examiner 2, Ph.D.**

Dr. Norzima Zulkifli  
Department of Mechanical Engineering and Manufacturing  
Faculty of Engineering  
University of Putra Malaysia  
(Member)

**Independent Examiner, Ph.D.**

Assoc. Professor Dr. Noordin Mohd Yusof  
Department of Engineering Manufacturing and Industry  
Faculty of Mechanical Engineering  
University of Technology Malaysia  
(Independent Examiner)

---

**HASSAN MOHD GHAZALI, Ph.D.**

Professor/Deputy Dean  
School of Graduate Studies  
University of Putra Malaysia

Date :

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

**Rosnah Mohd Yusuff, PhD**

Associate Professor  
Faculty of Engineering  
Universiti Putra Malaysia  
(Chairman)

**Ir. Mohd Rasid Osman, PhD, M.Sc**

Lecturer  
Faculty of Engineering  
Universiti Putra Malaysia  
(Member)

**Megat Mohamad Hamdan Megat Ahmad, PhD**

Associate Professor  
Faculty of Engineering  
Universiti Putra Malaysia  
(Member)

---

**AINI IDERIS, PhD**

Professor and Dean  
School of Graduate Studies  
Universiti Putra Malaysia

Date :13 December 2007



## **DECLARATION**

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

---

**MARIAM BINTI ABDUL AZIZ**

Date: 11 October 2007

## TABLE OF CONTENTS

	<b>Page</b>
<b>DEDICATION</b>	ii
<b>ABSTRACT</b>	iii
<b>ABSTRAK</b>	v
<b>ACKNOWLEDGEMENTS</b>	vii
<b>APPROVAL</b>	ix
<b>DECLARATION</b>	x
<b>LIST OF TABLES</b>	xvi
<b>LIST OF FIGURES</b>	xvii
<b>GLOSSARY OF TERMS</b>	xix
<b>CHAPTER</b>	
<b>1 INTRODUCTION</b>	<b>1</b>
Problem Statement	2
Project Objectives	5
Significance of Project	5
Limitation of the study	5
<b>2 LITERATURE REVIEW</b>	
2.0 Introduction	6
2.1 Small and Medium Scale Enterprises	
2.1.1 Definition	6
2.1.2 Category of Malaysian SMEs	7
2.1.3 The Nature of SMEs in Malaysia	9
2.2 Benchmarking	10
2.2.1 Definition	10
2.2.2 Type of Benchmarking	11
2.2.3 Benchmarking Process	13
2.2.4 Advantages of Benchmarking	15
2.3 Best Practices	17
2.3.1 Definition of Best Practices	17
2.3.2 Manufacturing Best Practices	19
2.4 Benchmarking of Manufacturing Practices	25
2.4.1 Management Practices	26
2.4.2 Human Resource Development Practices	26
2.4.3 Marketing Strategy Practices	27
2.4.4 Quality Practices	28
2.4.5 Customer Focus Practices	29
2.4.6 Technology and Innovation Practices	29
2.4.7 Supply Chain Practices	30
2.4.8 Production Process Practice	31
2.5 Benchmarking of Manufacturing Performance	34
2.6 World Class Manufacturing	35
2.7 Self Assessment Tool for Benchmarking Process	38

2.7.1	Methodology for Developing Self Assessment Tool	39
2.7.2	Benchmarking Online Using the Internet	40
2.7.3	Present Online Benchmarking Tool	42
2.7.4	Advantages of Online Benchmarking	45
2.8	Development of Online Benchmarking System	45
2.8.1	Programming Language	46
2.8.2	Database	47
2.9	Summary	48
<b>3</b>	<b>METHODOLOGY</b>	
3.1	Introduction	52
3.2	Identification of Areas and Indicators of Manufacturing Best Practices	53
3.3	Identifying Selected Companies to validate the Areas and Indicators	54
3.4	Determining Requirements of Benchmarking Tool for SMEs	54
3.4.1	Identifying Functional Requirements of the Tool	55
3.4.2	Identifying Technical Requirements of the Tool Development	55
3.5	Drafting Benchmarking Questionnaire	56
3.6	Development of Online Benchmarking Tool	56
3.7	Testing and Validity of the Tool	59
3.8	Final Tool	60
<b>4</b>	<b>RESULT AND DISCUSSION</b>	
4.1	Identification of Areas and Indicators of Manufacturing Best Practices	61
4.2	Validated Areas and Indicators of Manufacturing Best Practices	63
4.3	Determining Functional Requirements of the Benchmarking Tool	69
4.4	Determining the Technical Requirements	69
4.5	Drafting Benchmarking Questionnaire	70
4.6	Development of Online Benchmarking Manufacturing Practices System	70
4.6.1	User Interface	72
4.6.2	Administration Interface	74
4.7	Content of Benchmarking system	76
4.7.1	Questionnaire	77
4.7.2	Analysis of Result	79
4.7.3	Overall Result	82
4.8	Content of Administration Interface	84
4.8.1	Edit Questionnaire	85
4.8.2	Companies' Information	86
4.9	Trial Run	87
4.10	Modifying the Tool	89
4.11	Final Tool	90
4.12	Results of Benchmarking for Tangkas Technology Sdn Bhd	90

<b>5</b>	<b>CONCLUSION AND RECOMMENDATION</b>	
	5.1 Conclusion	93
	5.2 Recommendation	95

**REFERENCES**

**APPENDICES**

**BIODATA OF THE AUTHOR**



## LIST OF TABLES

<b>Table</b>	<b>Page</b>
Table 2.1 : Category of Malaysian SMEs	7
Table 2.2 : Type of benchmarking	12
Table 2.3 : Summary of benchmarking advantages	16
Table 2.4 : Manufacturing best practice	19
Table 2.5 : Summary of benchmarking manufacturing practice	32
Table 2.6 : The steps of developing self-assessment tool	39
Table 2.7 : Online benchmarking tool	43
Table 2.8 : The difference of PHP and ASP	46
Table 4.1 : Areas and indicators of manufacturing best practices	62
Table 4.2 : Mean average value for each area	67
Table 4.3 : Analysis for indicators of best manufacturing practices	68
Table 4.4 : Flow of questionnaire design	77
Table 4.5 : Analysis from evaluation form	89

## LIST OF FIGURES

<b>Figure</b>	<b>Page</b>
Figure 2.1: SMEs distributor by sector	8
Figure 2.2 : SMEs in manufacturing sector	9
Figure 2.3 : Six area of manufacturing best practice	18
Figure 2.4 : Overview of benchmarking model	35
Figure 2.5 : Category of company position	36
Figure 2.6 : Flow of online benchmarking	41
Figure 3.1 : Flow chart of the overall methodology adopted in the study	52
Figure 3.2 : Flow of tool design	59
Figure 4.1 : Analysis for area of best manufacturing practices	64
Figure 4.2 : Main page	70
Figure 4.3 : Log-in page	71
Figure 4.4 : Flow diagram of log-in menu	72
Figure 4.5 : Registration page	73
Figure 4.6: Flow diagram of user interface	74
Figure 4.7 : Flow of administration interface	75
Figure 4.8 : Main menu	76
Figure 4.9 : Practice measurement	78
Figure 4.10 : Performance measurement	79
Figure 4.11 : Result of quality practice	80
Figure 4.12: Graph of practices score for each area of focus	81



Figure 4.13: Results for all benchmarking practices	82
Figure 4.14 : Show company position towards achieving World-class manufacturing	84
Figure 4.15 : Administration page menu	85
Figure 4.16 : Edit questionnaire	86
Figure 4.17 : Companies' information database	87
Figure 4.18 : Position of the company towards world class manufacturing	91
Figure 4.19 : Gap of company practices	91

## GLOSSARY OF TERMS

ASP	Active Server Page
CAD	Computer Aided Design
CAM	Computer Aided Manufacturing
CIM	Computer Integrated Manufacturing
ERP	Enterprise Resource Planning
FMS	Flexible Manufacturing System
HTML	Hypertext Markup Language
JIT	Just in Time
KPIs	Key Performance Indicators
MRP	Material Resource Planning
NPC	National Productivity Corporation
PHP	Hypertext Preprocessor
R&D	Research and Development
SCM	Supply Chain Management
SMEs	Small Medium Enterprises
SQL	Structured Query Language
XML	Extensible Markup Language

## CHAPTER 1

### INTRODUCTION

SMEs in the manufacturing sector represent an important part in Malaysian economy. In 2003, the Malaysian economy recorded growth in gross domestic product (GDP) of 5.2 percent compared with 4.2 per cent in 2002. Most of the contribution was from manufacturing sector (SMIDEC, 2004).

However, from SMEs performance report in 2003, SMEs still lack the capability to meet industry standard. In global competitiveness market, SMEs need to adopt or achieve 'best practice' or 'World-class' performance. There are many ways to improve Malaysian SMEs and one such tool is benchmarking. Benchmarking is an activity adopted by many companies to improve their performance and it is an interesting strategy for organizational learning and improvement (St-Pierre and Raymond, 2004). Camp (1989) also defined benchmarking as the searching of best practices that will lead to superior performance.

#### 1.1 Problem statement

Malaysian Small and Medium Enterprises (SMEs) are facing competitive pressures from globalization and high quality requirements of customers. In order to survive, SMEs must increase their productivity and their competitiveness. The ability of Malaysian SMEs to survive and compete in today's competitive markets is a concern for the

government, since Malaysian SMEs are often faced with lack of skill workers and knowledge of managerial practices (Baharun *et al*, 2004).

Continuous improvement of Malaysian SMEs through benchmarking activity helps SMEs in trying to cope with today's challenging markets. Benchmarking is a system of continuous process of searching, learning, adapting and implementing the best practices from within an organization or from other organizations towards attaining superior performance (NPC Malaysia, 2003). By comparing itself with its competitors through an appropriate benchmarking activity, SMEs are able to identify areas of their weakness and find solutions for the improvement.(Bhutta and Huq, 1999). Benchmarking will thus lead SMEs to search for and adopt new manufacturing practices in order to achieve world-class manufacturing (St-Perre and Raymond, 2004).

However, SMEs on their own face difficulties in implementing benchmarking because SMEs generally have insufficient human and financial resources to allocate for benchmarking activity. Furthermore the expected benefits of this activity are not immediate (Badrinath (1998) cited in St-Pierre and Raymond, 2004). Therefore, a self-assessment tool can facilitate SMEs in benchmarking activity. SMEs also can share and assess performance of their business operations, functions and process against the best performers in specific areas of interest. Using internet as a platform, this assessment tool can be accessed easily.

Other researchers have also developed self assessment tool for benchmarking such as Voss (1994) developed a score card to identify best practice of technology management

in organizations. Thiagarajan and Zairi (1998) also developed Critical Card Index to assess quality practice in companies. However, with fast growth of internet and information technology, development of online benchmarking tool is more accessible and eases to collect other companies' database compared to traditional system.

The development of this online benchmarking tool also can help SMEs to benchmark their company practices because the areas and indicators were developed based on SMEs best manufacturing practices such as production and process, supply chain management, technology and innovation, quality and human resource management. Comparing to other tools such as from NPC and IndustryWeek, the indicators were developed based on large scale industry and service type of industry. For example Benchmarking On-line Networking Database (BOND) from NPC was developed based on the eight excellent criteria of the organizational excellence framework of service and manufacturing sector such as leadership, quality data and information, human resource management, customer focus, process management, process improvement, business performance and corporate responsibilities (NPC, 2005). Furthermore, the tool from NPC is not user-friendly for Small and Medium scale industries compared to this new system. This new system was developed as an online survey with 5-Likert style in order to assist SMEs benchmark their company faster. This system also was developed with an interactive webpage in order to attract SMEs to participate in this benchmarking activity. Besides that, function of current online benchmarking tools is very limited. Users only can benchmark their company practice and performance between the competitors but their performance towards achieving World Class Manufacturing cannot be identified. Therefore, ability of this benchmarking tool has been upgraded where SMEs position

towards achieving World Class Manufacturing can be justified in a scatter graph. This benchmarking tool also can help the SMEs in comparing their companies' practices against the best from all industry groups or from the same industry group. Database of other companies' practices are available in the tool and quick benchmarking analysis can be carried out.

Besides low cost of benchmarking system, the development of this assessment tool can help the SMEs to make quick assessment of their manufacturing practices and enable them to identify the important practices to increase their competitiveness. It is hoped that the development of the tool will encourage the SMEs to improve their business.

## **1.2 Project Objectives**

The objectives of the project are:

1. To identify the areas and the indicators of best manufacturing practices.
2. To develop a web-based diagnostic tool to measure best manufacturing practices in Malaysia SMEs.

## **1.3 Significance of the Project**

Identification of the areas and indicators of best manufacturing practices provides the SMEs with better knowledge on the practices towards achieving World-class Manufacturing. Besides that, development of a web-based diagnostic tool for Malaysian SMEs assists them to benchmark their company's practices and performances against the best. The areas that have to be improved can be identified faster and helped them to

continuously improve. It is hoped that, using the tool, SMEs can increase their business performance and productivity.

#### **1.4 Limitations of the Study**

The scope of the study is to develop a self-assessment tool to benchmark SMEs manufacturing practices and performance. In order to develop the tool, areas and indicators of manufacturing best practices for Malaysian SMEs have been identified. The benchmarking areas and indicators were selected from literature review and have been validated by SMEs award winners. Only eight areas have been used for the benchmarking purpose such as management, human resource development, marketing strategy, quality, production process, technology and innovation, supply chain and customer focus.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.0 Introduction

Small and Medium Enterprises (SMEs) play an important role in developing the Malaysian economic growth. SMEs in the manufacturing sector consist of 90% of the total 51,606 manufacturing industry (SMIDEC, 2004). In the globalization era, SMEs should be more competitive to achieve world class manufacturing. To achieve the status, SMEs have to improve their practices and performances. Development of a tool to measure best manufacturing practices for Malaysian SMEs will assist them to benchmark their company faster. It is hoped that the development of the tool will encourage SMEs to continuously improve their business.

#### 2.1.0 Small and Medium Scale Enterprise

##### 2.1.1 Definition

In practice, both quantitative and qualitative criteria are used to define SMEs. In Malaysia, the definition is only based on fixed quantitative criteria such as the number of employees, amount of capital, amount of assets and sales turnover (Hashim and Abdullah, 2000). Malaysian Small and Medium Industries Development Corporation (SMIDEC) defined SMEs as:

- i. Small-scale firm with sales turnover between RM 250,000 to less than RM 10 million and the number of full-time employees between 5-50.



- ii. Medium-scale firm with sales turnover between RM 10 million to RM 25 million and the number of full-time employees between 51-150.

(SMIDEC, 2004).

### 2.1.2 Category of Malaysian SMEs

In determining the contribution of small and medium enterprise to Malaysian economy, Hashim (1999a) categorized the SMEs firm into three sub-sectors as shown in table 2.1. The manufacturing sector continued to provide the strongest contribution of economic growth in 2003, followed by agriculture sector and general business sector such as services, constructions and mining (Ministry of Finance Malaysia, 2003).

**Table 2.1: Category of Malaysian SMEs (Hashim, 1999a)**

General Business sector	Manufacturing sector	Agriculture sector
Construction, wholesale and retail trade, transport and storage, business services and activities, and providing services such as hotel and restaurant businesses.	Processing and production of raw materials such as food, textile, wood, chemicals, petroleum, rubber, plastic, metallic and nonmetallic materials, transport equipment, and electronics appliances and components.	Natural product such as of rubber, padi, oil palm, coconuts, cocoa, pepper, tobacco, livestock timber, fish, fruits and vegetables.

According to Figure 2.1, SMEs in the manufacturing sector consist of 7% of the total SMEs in Malaysia. Although the percentage is low, SMEs in the manufacturing sector forms about 90% of the total 51,606 manufacturing industries in Malaysia (SMIDEC, 2004).