

**ADOPTION OF PROBLEM SOLVING TOOLS IN  
MANUFACTURING SECTOR OF MALAYSIA  
SMALL AND MEDIUM ENTERPRISES**

by

**LOW RONG QUAN**

**Thesis submitted in fulfillment of the requirements  
for the degree of  
Masters in Science**

**NOVEMBER 2015**

## **ACKNOWLEDGEMENTS**

I wish to firstly thank the help and guidance provided by my supervisor, Dr Ahmad Suhaimi Baharuddin. His guidance throughout the whole research period is supportive and knowledgeable. The knowledge given by Dr will always be remembered by me in my entire life.

Next I would like to thank my family for the moral support, patience and understanding provided to me during my whole Masters period.

I would like to thank my fellow colleagues and friends in the research group which give me guidance when I needed them throughout the research period.

Last but not least, I would like to thank the Universiti Sains Malaysia for funding me in this research from both the Research University Grant (RUI) [Account Number: 1001/PKOMP/811251], and from the Short Term Research Grant [Account Number: 304/PKOMP/6312103]

# TABLE OF CONTENTS

	<b>Page</b>
<b>Acknowledgement</b> .....	ii
<b>Table of Contents</b> .....	iii
<b>List of Tables</b> .....	viii
<b>List of Figures</b> .....	xi
<b>Abstrak</b> .....	xii
<b>Abstract</b> .....	xiv
<b>CHAPTER 1 – INTRODUCTION</b>	
1.1 Background of the research.....	1
1.2 Problem Statement.....	10
1.3 Research Questions.....	11
1.4 Research Aim.....	12
1.5 Research Objectives.....	12
1.6 Scope of Research.....	13
1.7 Contribution.....	13
1.8 Definitions of the Variables	
1.8.1 Adoption of Problem Solving Tools.....	15
1.8.2 Complexity.....	15
1.8.3 Compatibility.....	16
1.8.4 Cost.....	16
1.8.5 Relative Advantage.....	16

1.8.6	Comfort Level of Current Problem Solving Process.....	17
1.8.7	Organizational Resources.....	17
1.8.8	External Support.....	17
1.8.9	External Pressure.....	18
1.8.10	Government’s Support.....	18

**CHAPTER 2 – LITERATURE REVIEW**

2.1	Small and Medium Enterprises (SME).....	19
2.2	Small and Medium Enterprises in Malaysia.....	21
2.3	Manufacturing Sector of Small and Medium Enterprises.....	26
2.4	Quality.....	28
2.5	Problem Solving Processes.....	30
2.6	Problem Solving Tools.....	34
2.7	Technology, Organization and External Environmental Framework.....	39

**CHAPTER 3 – THEORETICAL FRAMEWORK**

3.1	Dependent Variable.....	43
3.1.1	Adoption Level of Problem Solving Tools.....	43
3.2	Independent Variable.....	45
3.2.1	Technological Context.....	45
3.2.1.1	Complexity.....	45
3.2.1.2	Compatibility.....	51
3.2.1.3	Cost of Adoption.....	57
3.2.1.4	Relative Advantage of Problem Solving Tools.....	64
3.2.2	Organizational Context.....	71
3.2.2.1	Comfort Level of Current Problem Solving Process.....	71

3.2.2.2 Organizational Resources.....	73
3.2.3 External Context.....	79
3.2.3.1 External Support.....	79
3.2.3.2 External Pressure.....	83
3.2.3.3 Government’s Support.....	87
3.3 Proposed Model.....	92

**CHAPTER 4 – RESEARCH METHODOLOGY**

4.1 Preliminary Study.....	93
4.2 Design of Questionnaires.....	93
4.3 Variables and Measurements.....	95
4.4 Face Validity .....	102
4.5 Population of the Research.....	103
4.6 Sampling Design.....	103
4.7 Data Collection.....	104
4.8 Data Analysis.....	106

**CHAPTER 5 – RESULT AND ANALYSIS**

5.1 Descriptive Analysis.....	107
5.2 Exploratory Factor Analysis.....	109
5.2.1 Technological Factors.....	110
5.2.2 Organizational Factors.....	112
5.2.3 External Environmental Factors.....	113
5.3 Reliability Analysis.....	114
5.4 Discriminant Analysis.....	116

5.4.1 Group Statistics.....	118
5.4.2 Wilks' Lambda.....	119
5.4.3 Standardized Canonical Discriminant Function Coefficients.....	120
5.4.4 Structure Matrix.....	121
5.4.5 Canonical Discriminant Function Coefficients Table.....	122
5.4.6 Group Centroids Table.....	123
5.4.7 Classification Table.....	123

**CHAPTER 6 – DISCUSSION AND CONCLUSION**

6.1 Summary of Research Findings.....	126
6.2 Technological Context.....	127
6.2.1 Complexity is positively influencing the Adoption level of Problem Solving Tools .....	127
6.2.2 Compatibility is positively influencing the Adoption level of Problem Solving Tools .....	128
6.2.3 Cost of Adoption is negatively influencing the Adoption level of Problem Solving Tools .....	129
6.2.4 Relative Advantage of Problem Solving Tools is positively influencing the Adoption level of Problem Solving Tools .....	131
6.3 Organizational Context.....	132
6.3.1 Comfort Level of Current Problem Solving Process is negatively influencing the Adoption level of Problem Solving Tools .....	132
6.3.2 Organizational Resources is positively influencing the Adoption level of Problem Solving Tools .....	133
6.4 External Environmental Context.....	134

6.4.1 External Support is positively influencing the Adoption level of Problem Solving Tools .....	134
6.4.2 External Pressure is positively influencing the Adoption level of Problem Solving Tools .....	135
6.4.3 Government’s Support is positively influencing the Adoption level of Problem Solving Tools .....	136
6.5 Theoretical Contributions of the Research.....	137
6.6 Practical Contributions of the Research.....	139
6.7 Future Research Suggestions.....	141
6.8 Conclusion.....	142
<b>References.....</b>	<b>145</b>
<b>List of Publication.....</b>	<b>165</b>
<b>Appendix A.....</b>	<b>166</b>
<b>Appendix B.....</b>	<b>171</b>
<b>Appendix C.....</b>	<b>184</b>

## LIST OF TABLES

		<b>Page</b>
Table 1.1	The Number of Manufacturing SMEs in year 2005 and year 2011	4
Table 1.2	Development Programs of Malaysian Government Agencies	8
Table 2.1	Definition of SMEs in Malaysia	20
Table 2.2	Number of SMEs by Sector	22
Table 2.3	Total Employment of SME and Large Firms (2009-2011)	25
Table 2.4	Quality Definitions According to Different Quality Gurus	29
Table 2.5	Problem Solving Tools and Definitions	34
Table 3.1	Literature regarding Complexity of Innovations and Technologies	46
Table 3.2	Literature regarding Complexity of Innovations and Technologies	48
Table 3.3	Literature regarding Compatibility	52
Table 3.4	Literature regarding Compatibility	55
Table 3.5	Literature of Costs of Adoption	59
Table 3.6	Literature of Costs of Adoption	62
Table 3.7	Literature of Relative Advantage	65
Table 3.8	Literature of Relative Advantage	69
Table 3.9	Literature of Comfort Level of Current Technologies and Innovations	71
Table 3.10	Literature of Comfort Level of Current Technologies and Innovations	72
Table 3.11	Literature of Organizational Resources	74
Table 3.12	Literature of Organizational Resources	77



Table 3.13	Literature of External Support	80
Table 3.14	Literature of External Support	81
Table 3.15	Literature of External Pressure	84
Table 3.16	Literature of External Pressure	85
Table 3.17	Literature of Government Support	87
Table 3.18	Literature of Government Support	90
Table 4.1	Source of the items	96
Table 5.1	Response Rate Table	108
Table 5.2	KMO Statistics and Interpretations	110
Table 5.3	KMO and Bartlett's Test of Technological factors	110
Table 5.4	Rotated Component Matrix	111
Table 5.5	KMO and Bartlett's Test of Organizational Factors	112
Table 5.6	Rotated Component Matrix of Organizational Factors	112
Table 5.7	KMO and Bartlett's Test of External Environmental Factors	113
Table 5.8	Rotated Component Matrix of External Environmental Factors	114
Table 5.9	Reliability Analysis Table	115
Table 5.10	Group Statistics Table	118
Table 5.11	Wilks' Lambda Table	119
Table 5.12	Standardized Canonical Discriminant Function Coefficients Table	120
Table 5.13	Structure Matrix Table	121
Table 5.14	Canonical Discriminant Function Coefficients Table	122
Table 5.15	Group Centroids Table	123
Table 5.16	Prior Probabilities for Groups Table	124



## LIST OF FIGURES

	<b>Page</b>
Figure 1.1 The Triple Constraints	2
Figure 1.2 The Flowchart of the Product Inspection in Semi-Conductor Factory	6
Figure 2.1 GDP Growth of Different Countries of Year 2011-2013	23
Figure 2.2 Overall GDP Growth and SME Growth in Malaysia	24
Figure 2.3 Role of SMEs in Malaysia	24
Figure 2.4 Typical Problem Solving Process	32
Figure 2.5 The Context of TOE Model	39
Figure 3.1 The Theoretical Framework for Problem Solving Tools Adoption	92

# **PENGGUNAAN PERALATAN PENYELESAIAN MASALAH DI KALANGAN PERUSAHAAN KECIL DAN SEDERHANA DALAM SEKTOR PEMBUATAN DI SEMENANJUNG MALAYSIA**

## **ABSTRAK**

Dalam pasaran yang berdaya saing ini, tahap berdaya saing sesebuah syarikat telah memainkan peranan yang sangat penting untuk terus tinggal dalam pasaran terutamanya syarikat kecil dan medium (SME) yang mempunyai sumber yang terhad. SME telah juga memainkan watak yang penting sebagai pemaju ekonomi di kebanyakan negara seperti Malaysia. Di Malaysia, Kadar sektor pembuatan SME adalah 5.9% daripada seluruh SME negara. Walaubagaimanapun, kadar bankrapsi sektor pembuatan SME di Malaysia adalah tinggi. Antara punca-punca yang menyebabkan kadar bankrapsi tinggi adalah kerana SME tidak dapat menyelesaikan masalah-masalah yang timbul di proses yang dilaksanakan harian dan ini telah menjejaskan kualiti produk yang dibuat oleh mereka. Jadi Alat Penyelesaian Masalah telah diperkenalkan kepada SME tetapi tahap penggunaan adalah rendah. Kajian ini telah mencari faktor-faktor yang telah membezakan tahap penggunaan Alat Penyelesaian Masalah di sektor pembuatan syarikat-syarikat kecil dan sederhana di Semenanjung Malaysia. 1000 set kertas soal selidik telah dihantar kepada syarikat-syarikat dan 141 set telah digunakan untuk analisis terakhir. Dengan menggunakan perisian SPSS, data yang dikumpul telah dianalisis dengan menggunakan teknik Analisis Diskriminan. Hasil daripada analisis telah menyatakan bahawa Kerumitan, Kos, Kelebihan Relatif, Tahap Kesselesaian Proses Penyelesaian Masalah Semasa, Sumber Organisasi, Tekanan Luar dan Sokongan Daripada Kerajaan merupakan faktor-faktor

penting yang membezakan tahap penggunaan Alat Penyelesaian Masalah. Analisis juga menyatakan bahawa Keserasian dan Sokongan Luar tidak membawa hasil dalam perbezaan tahap penggunaan Alat Penyelesaian Masalah.

# **ADOPTION OF PROBLEM SOLVING TOOLS IN MANUFACTURING SECTOR OF MALAYSIA SMALL AND MEDIUM ENTERPRISES**

## **ABSTRACT**

In the competitive world, the competitive level of the company played a very essential role especially to the SMEs where they are having limited resources. The Manufacturing Sector of SMEs played an important role in the economy growth of many countries such as Malaysia as 5.9% of businesses of the total were from Manufacturing Sector. However, the bankruptcy level increased in the period of five years in Malaysia which the main root cause is because manufacturing sector of SMEs did not solve daily problems and their product's quality were lowered. Hence Problem Solving Tools are recommended to the SMEs. However, the adoption level was only at low level. This research was conducted to find out the factors that influence the high level and low level of adoption of the tools in Manufacturing Sector of SMEs in West Malaysia. 1000 sets of questionnaires were sent to the Manufacturing Sectors of SMEs and 141 data sets were accepted for the final data analysis. The SPSS software was used for analysis and the data of the results were analyzed with the help of the Discriminant Analysis technique. As a result, Complexity, Cost, Relative Advantage, Current Comfort Level of the Problem Solving Process, Organizational Resources, External Pressure and Government Support were found out to be significant predictors that influence adoption level of Problem Solving Tools whereas Compatibility and External Support were found not significant.

# **Chapter 1**

## **Background of the Research**

In Chapter 1, the background of the research is discussed. The Chapter will then discuss about the problem statement, research aim, research objectives, research scope and the contribution of the study. Next, the definitions of the variables are provided at the end of the chapter.

### **1.1 Background of the research**

Companies are competing among each other to survive in the market and it is a challenge for them as fierce competition took place every day and everywhere in the world (Marimuthu, Omar, Ramayah, & Mohamad, 2011; Mohd Yusof, 2003). The company's competitive level is very critical for the company's survival especially to the Small and Medium Enterprises (SME). SMEs are companies that are medium or small in sized and are still growing or just began their business (Sahran, Zeinalnezhad, & Mukhtar, 2010).

In order to stay competitive in the market, the most important operation that companies especially SMEs should have is balancing the Triple Constraints of-quality, delivery time and cost which is shown in Figure 1.1 (Mohd Yusof, 2003). Many successful multinational companies in the world such as Intel and Motorola became successful because they were adept at managing the Triple Constraints of their operations.

A successful company will reduce the costs incurred in their daily processes; reduce the cycle time of each process while increasing the quality of their products and services (Enterprise PM, 2013; Reed, 2010).



Figure 1.1: The Triple Constraints (Reed, 2010)

For SMEs today, quality plays an important role as the products or goods produced represent the company's reputation and status and keep the company competitive. According to Senator Nnenadi Usman Crusoe Osagie of Nigeria, high quality goods and services are essential to the growth of SMEs. Low-cost products that does not have quality and does not last long will only give negative results to the SMEs and country (This Daily Live, 2013). The companies are aware that quality is an important strategy for them to stay competitive in the market (Mohd Yusof, 2003; Ross & Perry, 1999).



However, daily problems such as defective products, machine failures and system failures will decrease the overall performance of the SMEs as the quality of the processes and the quality of the products are already facing a failure (Educational Business Articles, 2013). Problems happened every day in the whole processes of the companies but what makes the companies stand out in the competitive world is the way they counter the problems and preventing it from happening again (Giroux, 2009; Educational Business Articles, 2013). Lin (1998) said that problem-solving orientation is one of the key factor for SME's success because SMEs are lacking of resources and experts as compared to the large companies or multi-national companies which have large amount of resources and experts to help them in their problem solving processes (Borhan, 2012; Hashim & Osman, 2003; Kumar, Antony, & Douglas, 2009).

The method of solving problems by the companies could be likened to "firefighting" as they temporarily put off dealing with the problems, or deal with the problems superficially rather than addressing the root cause of the problems (Repenning, 2001). This "firefighting" approach will not help and could possibly create more problems in the future. Irrespective of whether the problems are major or minor, if the problems are not countered correctly, the problems may result in serious consequences for the company (Repenning, 2001; Yeoh, Yeoh, & Song, 2009). The companies did not realize that these attempts at solutions will not bring them the results intended but instead increase their problems with a consequent increase in the costs of handling the problems and the quality of the products which end up affecting the ability of the companies to generate profits where will lead the companies to bankruptcy (Jafri & Chan, 2001; Educational Business Articles, 2013). According to (Franco & Haase, 2009; Giroux, 2009; Timmons & Spinelli,

1994), 20% of the new businesses failed within one year and 66% failed in six years in many countries such as Canada and Australia. In the context of Malaysia, according to the SME Master Plan 2012-2020, 42% of the enterprises that existed in the year 2000 closed down by the year 2005 which means there was a survival rate of only 58% (SMECORP Malaysia, 2012c). The bankruptcy level is obvious towards the second largest sub-sector of SMEs which is the Manufacturing Sector as mentioned in the annual report of SMECORP 2014 (SMECORP Malaysia, 2014). From Table 1.1, the number of Manufacturing SMEs decreased by 1512 from 39,373 in the year 2005 to 37,861 in year 2011 (Department Of Statistics, 2006, 2012; SMECORP Malaysia, 2012a, 2014).

Table 1.1: The Number of Establishments of Manufacturing SMEs in year 2005 and year 2011

Year	Micro	Small	Medium	Total SMEs
2005	21,516	15,796	2,061	39,373
2011	21,619	13,934	2,308	37,861

Source: (SMECORP Malaysia, 2014)

Manufacturing SMEs in Malaysia play very important role as the key growth driver towards the economy of Malaysia. Manufacturing SMEs are acting as the suppliers for many large organizations and multi - national companies as the product that produced by SMEs are at a cheaper price if compared with the price of the in-house production by the multi-national companies themselves (Fard, Mansor, & Mohamed, 2011; Hashim & Osman, 2003; Sahran et al., 2010). Hence the quality of the products is very important. However, traditional approach of 100% inspection is still used in most of the companies. For example in Figure 1.2 shows an inspection process of a SME which manufactures semi-conductor in Penang. The products inspection process will begin with notification or labeling of the products then the products will began the inspection process. The employees manually check the products and reject the defective products. The defective products will return to the production line after the rescreens are issued. Then the whole inspection process will begin again. However, the inspection process is only 70% efficient and there will still be defected items passed onto the hand of the customers Educational Business Articles, 2013). This is because the real problem and the root cause of the problems are not found and tackled (Hagemeyer, Gershenson, & Johnson, 2006; Educational Business Article, 2013; Yeoh et al., 2009).

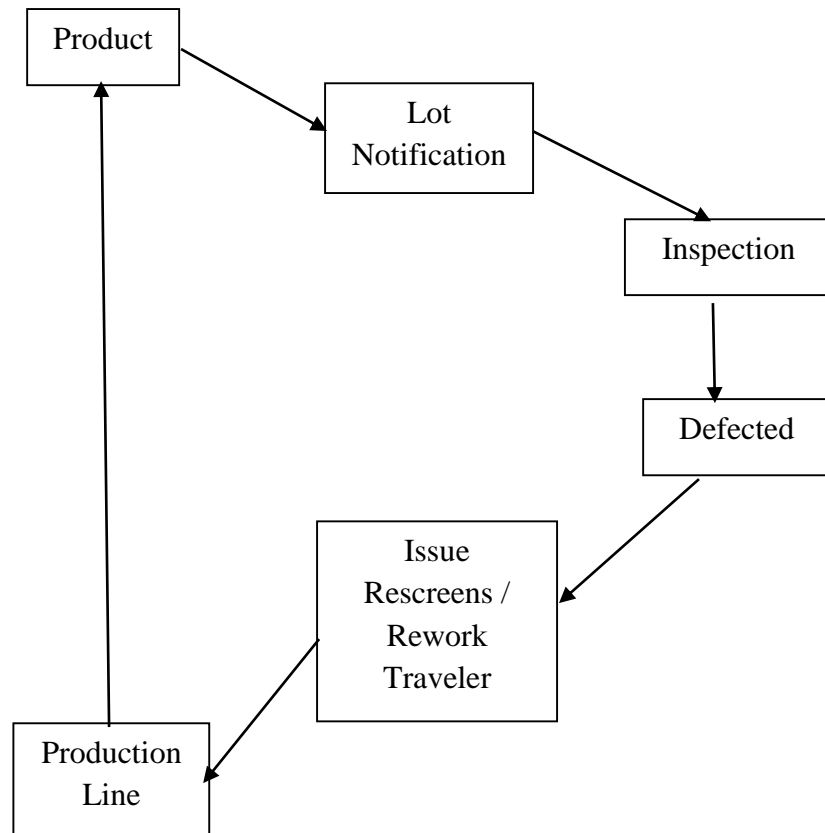


Figure 1.2: The Flowchart of the Product Inspection in a Semi-Conductor Factory.

One of the useful resources and tools that manufacturing companies could use to identify the problems and overcome them is by using the Problem Solving Tools. Problem Solving Tools enable industries to effectively manage the problems they encounter as the method used is a systematic one whereby the users will first identify the root cause of the problems and then, the Tools will guide them step-by-step to an effective solution (Hagemeyer et al., 2006; Yeoh et al., 2009). For example, a root cause of the problem could be found by using the 5 Whys where “Why” questions are being asked repeatedly ( Educational Business Articles, 2013, Mind Tools, 2013). Then after the root cause is identified, the solutions are generated and solutions are analyzed using the Failure Mode

and Effect Analysis (FMEA) to analyze whether the solutions will bring benefits or will it fail ( Educational Business Articles, 2013, 2013; Hagemeyer et al., 2006; Tay & Lim, 2006).

In the market, there is a choice of many Problem Solving Tools that have different capabilities to effectively manage the particular problems faced. Examples of Problem Solving Tools that have been available in the market for a few decades now are: Six Sigma Tools, 8 Discipline Report (8D), Box Plot, Check Sheets, Histogram, Control Plan, SPC Control Charts, 5 Why Analysis, Plan Do Check Act (PDCA), TQM Tools and the Theory of Inventive Problem Solving (TRIZ).

However, due to the smaller in size and lack of resources, the adoption level of Problem Solving Tools and Quality Management is very low and slow in SMEs and not every implementation of the tools is successful (Hashim & Osman, 2003; Mohd Yusof, 2003; Ross & Perry, 1999; Sahran et al., 2010). Table 1.2 shows some of the development programs provided by the Malaysian Government Agencies. Even though, Malaysian government has provide many help and support in development of the SMEs such as SIRIM provide short course of Problem Solving Tools for SMEs and SMECORP, the government agency that is introduced to the SMEs to help in the development of SMEs also provides many courses and trainings on Quality Improvements (SIRIM, 2012; SMECORP Malaysia, 2012b, 2012c). These courses will help the SMEs to develop skills of using the tools and hence increase the adoption level of the tools in the companies.

Table 1.2: Development Programs of Malaysian Government Agencies

Development Programs	Government Agencies
<p>PRORGAM LATIHAN 1 MALAYSIA</p> <ul style="list-style-type: none"> <li>- 7 New QC tools for quality practitioners</li> <li>- Failure Mode and Effect Analysis (FMEA)</li> <li>- Lean Supply Chain Management for Managers (LEAN SCM)</li> <li>- Six Sigma Improvement methodology and tools</li> <li>- TQM for organizational excellence</li> </ul>	<p>Pembangunan Sumber Manusia Berhad (PSMB)</p>
Enrichment & Enhancement Program	SMECORP
Skills Upgrading Program	SMECORP
SIRIM-MRRD Skill Development / Enhancement Program	SMECORP
Course and Technical Training Program	SMECORP
Integrated Technology and Quality Based Program for SME Development	SMECORP
Quality improvement practices (QIP) program	SIRIM Berhad
Standards & Quality and Technical Services	SIRIM Berhad

In this research, the researcher wishes to research on the factors that differentiate SMEs with high level of adoption of Problem Solving Tools from the SMEs with low level of adoption of Problem Solving Tools in order to identify the factors that could enhance the adoption level of adoption of Problem Solving Tools in manufacturing sector of SMEs in Malaysia which is currently having low level of adoption (Hashim & Osman, 2003; Mohd Yusof, 2003; Sahran et al., 2010). In order to identify the factors, the Technology, Organization and External Environmental (TOE) Framework were used. TOE framework is a commonly used framework in the organization researches and the Technological, Organizational and External Environmental factors are suitable in the context of influence innovation adoption (Hameed, 2012). The Technological Factors are relative advantage of the tools, complexity of the tools, compatibility of the tools and cost of implementing the tools. On the other hand, the Organizational Factors are Satisfaction with current Problem Solving Process, Resources of the Manufacturing SMEs. Lastly, the External Factors are the External Support, External Pressure and the Government's Support. The TOE framework has being proven to have an important impact on the research of innovations and context in the organizational model (Dwivedi, Wade, & L.Schneberger, 2012; Hameed, 2012). The analysis of the research's data was conducted using the Discriminant Analysis technique and SPSS analysis software. Discriminant Analysis was widely used for categorical data set where in this research the main two categories are low level of adoption and high level of adoption (Burns & Burns, 2009; Hair, Black, Babin, & Anderson, 2013). The result of the research will benefit to the top managements of the SMEs, supplier of the Problem Solving Tools, vendor and the government.

## 1.2 Problem Statement

In Malaysia, due to restricted resources such as Financial and Human Resources, many SMEs still solving their daily problems at the surface only which was called as ‘fire-fighting’ (Repenning, 2001). The SMEs could not find the root cause of the problems that is affecting their daily processes so in order to save human power and cost of solving the problems, the SMEs just solve the problems which they could discover.

The solutions found to solve problems on the surface could only solve the problems temporarily (Repenning, 2001). The problems normally will reoccur and it will bring more problems. The problems will normally become more serious and requires more time, cost and human resources to solve again. However, without the proper guidance, guidelines and tools, the SMEs are only will solve the surface of the problem again.

Hence Problem Solving Tools are introduced to the SMEs. Yeoh et al (2009) mentioned that problem solving tools not only provide solutions for the problem and solve the problem by searching the root cause but after the problem solving process, the quality of the process will be upgraded by one level. This situation not only will solve problem but will bring a lot benefits to the SMEs.



However, the adoption of Problem Solving Tools is reported to be in low level (Hashim & Osman, 2003; Mohd Yusof, 2003; Ross & Perry, 1999; Sahran et al., 2010). The low level of the adoption of the Problem Solving Tools could be caused by a few factors such as the low resources and complexity of the tools.

Hence this research will examine the high level and low level of adoption of Problem Solving Tools in manufacturing sector of SMEs in West Malaysia and identified the factors that influence the adoption levels of the tools.

### **1.3 Research Questions**

Therefore in order to find out the solution to the low adoption of Problem Solving Tools, two research questions are developed:

1. What are the factors influencing the adoption level of the Problem Solving Tools in Manufacturing SMEs in Malaysia?
2. Do Technology, Organizational and External Environmental factors have influence on the Adoption Level of Problem Solving Tools among Manufacturing Sector of SMEs in Malaysia?

## **1.4 Research Aim**

The final aim of the research was to study the factors that differentiate the low level and high level of adoption of Problem Solving Tools in manufacturing sectors of SMEs in Malaysia.

## **1.5 Research Objectives**

In order to achieve the final aim of the research, the following objectives are developed:

1. To identify the factors that influence the adoption level of Problem Solving Tools in Manufacturing Sectors of the SMEs in Malaysia.
2. To investigate the influence of the Technological, Organizational and External Environmental Factors on Adoption Level of Problem Solving Tools in Manufacturing Sectors of the SMEs in Malaysia.

## **1.6 Scope of Research**

The scope of this research is the adoption level of Problem Solving Tools in Manufacturing SMEs in West Malaysia. The main units of analysis are the users for the problem solving tools and the person who solve the problems when encountered such as the top management team or the skilled workers which includes the Manager of the department, Engineers, Director of the Company, Technology Officers and etc. These problem solvers of the company are the users of Problem Solving Tools. The data collection will be carry out in the Manufacturing Sector of the SMEs in West Malaysia.

## **1.7 Contribution**

This research will provides a few contributions to the body of knowledge and the top authorities of the SMEs such as managers, engineers, top management who involved in problem solving process and also planning to adopt Problem Solving Tools. This section will discuss briefly about the contributions of the research towards the theory and practice.

The theoretical contribution of the research is the development of the TOE framework used in the context of Problem Solving Tools and in the Manufacturing Sector of the SMEs in Malaysia. Previous research is focusing more on the intention to adopt new technologies whereas this research focus on the companies that adopted the technologies which is Problem Solving Tools.

The practical contribution to the research will help the top management to recognize which factors will need their extra focus and also which is suitable to use in the context of SMEs and by then help the company to adopt Problem Solving Tools. The top management could use the result of the research and plan for a better environment such as increase more resources for the adoption of Problem Solving Tools, hire more expertise and choosing the suitable and user friendly Problem Solving Tools for the workers to adopt the tools. The problem solver could use the result of the research to analyze which factors that differentiate the low and high level of the adoption of the tools and which are relevant to their companies' operations. In addition, the Malaysian manufacturing companies could also use this framework to help them adopt the tools that could them solve problems.

The government sectors could also benefit from this research as they could promote to the SMEs more about the workshops, trainings and incentives that are available for the SMEs in order to help them adopt Problem Solving Tools. This is because SMEs are still not knowing about the kinds of trainings and incentives provided to them by the government (The Associated Chinese Chambers of Commerce & Industry of Malaysia, 2012).

## **1.8 Definitions of the Variables**

The definitions of each of the variables including the dependent and independent variables are discussed in this section.

### **1.8.1 Adoption of Problem Solving Tools**

Level of adoption Problem Solving Tools in the problem solving processes. It is divided into two groups which are High Level and Low Level of Adoption of Problem Solving Tools in the company.

*High Level of Adoption of Problem Solving Tools* is referring to SMEs which adopted Problem Solving Tools in most of the departments in the company.

*Low Level of Adoption of Problem Solving Tools* is referring to the SMEs which adopted Problem Solving Tools in just a few of the departments in the company.

### **1.8.2 Complexity**

*Complexity* is the degree of how complex and difficult the Problem Solving Tools are when adopted into the problem solving processes (Marimuthu et al., 2011; Oliveira & Martins, 2011; Rogers, 2003).

### **1.8.3 Compatibility**

*Compatibility* is the degree of how well the Problem Solving Tools could adapt to the current problem solving processes and also examine that whether the tools are actually working in the adopting companies (Beatty, Shim, & Jones, 2001; Hoppe, Newman, & Muger, 2001; Rogers, 2003).

### **1.8.4 Cost**

*Cost* is the cost of adopting the Problem Solving Tools. In this research, cost refer to the money used to send employees to training on how to use the new tools and hiring professionals and experts that could use the tools effectively (Alam, 2009; Bogan & English, 1994; Ungan, 2004)

### **1.8.5 Relative Advantage**

*Relative Advantage* is the degree of how the Problem Solving Tools is giving benefit or advantage to the problem solving processes (Marimuthu et al., 2011; Rogers, 2003; Zhu, Dong, Xu, & Hally, 2006).

### **1.8.6 Comfort Level of Current Problem Solving Process**

*Comfort Level of Current Problem Solving Process* refers to the current issues and problems of the current Problem Solving Process in company. The level of dissatisfaction of the current problem solving process will affect the level of adoption (Bogan & English, 1994; Chau & Tam, 2000; Urgan, 2004).

### **1.8.7 Organizational Resources**

*Organizational Resources* is the resources that are available by the Manufacturing SMEs to adopt Problem Solving Tools such as human resources and financial resources (Chau & Tam, 2000; Franco & Haase, 2009).

### **1.8.8 External Support**

*External Support* refers to the external help or support received from the outside support for example suppliers, partner companies and knowledge providers to help adopting the Problem Solving Tools (Marimuthu et al., 2011; Tornatzky & Fleischer, 1990; Urgan, 2004).

### **1.8.9 External Pressure**

*External Pressure* is the pressure given by the external forces such as competitors and customers to the Manufacturing SMEs (Marimuthu et al., 2011; Urgan, 2004).

### **1.8.10 Government's Support**

*Government's Support* refers to the financial and trainings that the government gives to the Manufacturing SMEs in helping them to adopt the Problem Solving Tools (Iacovou, Benbasat, & Dexter, 1995; Marimuthu et al., 2011).



## **Chapter 2**

### **Literature Review**

Chapter 2 will discuss about the literature review of the past research. This chapter will give an overview of the meaning and current situation of the SMEs, Manufacturing Sector of the SMEs, Quality, Problem Solving Process and Problem Solving Tools. This chapter will also discuss about the framework that is used to explain the research which is the Technology, Organization and External Framework.

#### **2.1 Small and Medium Enterprises (SME)**

SMEs have many definitions in different countries and are normally derived in the context of number of employees and annual sales turnover. For example, National Bureau of Statistics of China defined their SMEs as companies that have employees of having employees of less than 2000 and with annual turnover of less than RMB 300 million (National Bureau of Statistics of China, 2013; Wang, 2009). On the other hand, European Union derived their SMEs as companies that have less than 250 employees and annual turnover of less than 50 million euros (European Commission, 2012) and in Australia, SMEs are defined as companies with employees between 1 – 200 (Australia Custom, 2013) . In Malaysia, SMEs as defined by the SMECORP are companies that have employees with lesser than 150 employees or annual turnover of lesser than RM 25 million (SMECORP Malaysia, 2011) but in year 2013, the government announced the new

guidelines for the SMEs in Malaysia. The new guidelines are companies that have employees that are lesser than 200 or annual turnover of lesser than RM 50 million. The definitions are shown in Table 2.1.

Table 2.1: Definition of SMEs in Malaysia

Type	Micro Enterprise	Small Enterprise	Medium Enterprise
Manufacturing, Manufacturing-Related Services and Agro-based industries	Annual sales turnover of less than RM250,000(USD83,300) OR full time employees less than 5	Annual sales turnover from RM300,000 (USD89,672) to less than RM15 mil (USD4.5 mil) OR full time employees from 5 to less than 75	Annual sales turnover from RM15 mil (USD4.5 mil) to less than RM50 mil (USD14.9 mil) OR full time employees between 75 and 200
Services, Primary Agriculture and Information & Communication Technology (ICT)	Sales turnover of less than RM200,000 (USD62,500) OR full time employees less than 5	Sales turnover from RM300,000 (USD89,672) to less than RM3 mil (USD896,727) OR full time employees between 5 and 30	Sales turnover from RM3 mil (USD896,727) to less than RM20 mil (USD5.98 mil) OR full time employees between 30 and 75

Source: (SMECORP Malaysia, 2013)

## **2.2 Small and Medium Enterprises in Malaysia**

SMEs played an important role as the backbone in the economy of many countries which include the developed and developing countries (Borhan, 2012; Franco & Haase, 2009; Sahran et al., 2010). Even though SMEs are small and developing companies but 98% -99% of the total business enterprises are comprise of SMEs (Borhan, 2012; Franco & Haase, 2009). For example the European Union (EU) stated that more than 99% of the total businesses established are SME and as in Malaysia, 97.3% of the total firms established are SMEs (Department Of Statistics, 2012; Franco & Haase, 2009; SMECORP Malaysia, 2012a, 2014). According to the Economic Census of 2011, SMEs comprise 97.3% of total businesses established in Malaysia, amounting to a total of 645,136 companies (Department Of Statistics, 2012; SMECORP Malaysia, 2014). The SMEs then are divided into sub-sectors which are Manufacturing, Services, Agriculture, Construction, Mining and Quarrying where the biggest sector is from the Services sector and follow up by the Manufacturing sector (Department Of Statistics, 2012; SMECORP Malaysia, 2012a). The numbers of the SMEs according to the sub-sectors are shown in Table 2.2.

Table 2.2: Number of Establishments of SMEs by Sector

Sector	Micro	Small	Medium	Total SMEs	Percentage of Shares (%)
Manufacturing	21,619	13,934	2,308	37,861	5.9
Services	462,420	106,061	12,504	580,985	90.1
Agriculture	3,775	1,941	992	6,708	1.0
Construction	8,587	6,725	3,971	19,283	3.0
Mining & Quarrying	57	126	116	299	0.05
Total SMEs	496,458	128,787	19,891	645,136	100.0

Source: (Department Of Statistics, 2012; SMECORP Malaysia, 2012a, 2014)

As what Azrvain Borhan (2012) described, SMEs are like ‘cili padi’ or ‘small chili’ because they might be small in the size but the potential and benefits that SMEs brought is very powerful. SMEs contribute a lot to the Gross Domestic Product growth of the countries (Fard et al., 2011; Hashim & Osman, 2003; Hashim, 1999; Marimuthu et al., 2011; Steven, 2013; Sultan, 2007). Besides growth in GDP, SMEs also opened up a lot of opportunity for employment opportunities, enhancement of products and services and increase the economy of country by increasing exports and trades (Fard et al., 2011; Franco & Haase, 2009; Hashim & Osman, 2003; Sahran et al., 2010; SMECORP Malaysia, 2012c). This has shown that SMEs are important for economy of most countries especially to the developing countries (Fathian, Akhavan, & Hoorali, 2008; Gadenne & Sharma, 2009; Sahran et al., 2010). Figure 2.1 shows the GDP Growth in

Different Countries. The main differences between large companies and SMEs are the experience, the business concepts and the hierarchical layers of the management (Mohd Yusof, 2003; Raimona Zadry & Mohd Yusof, 2006).

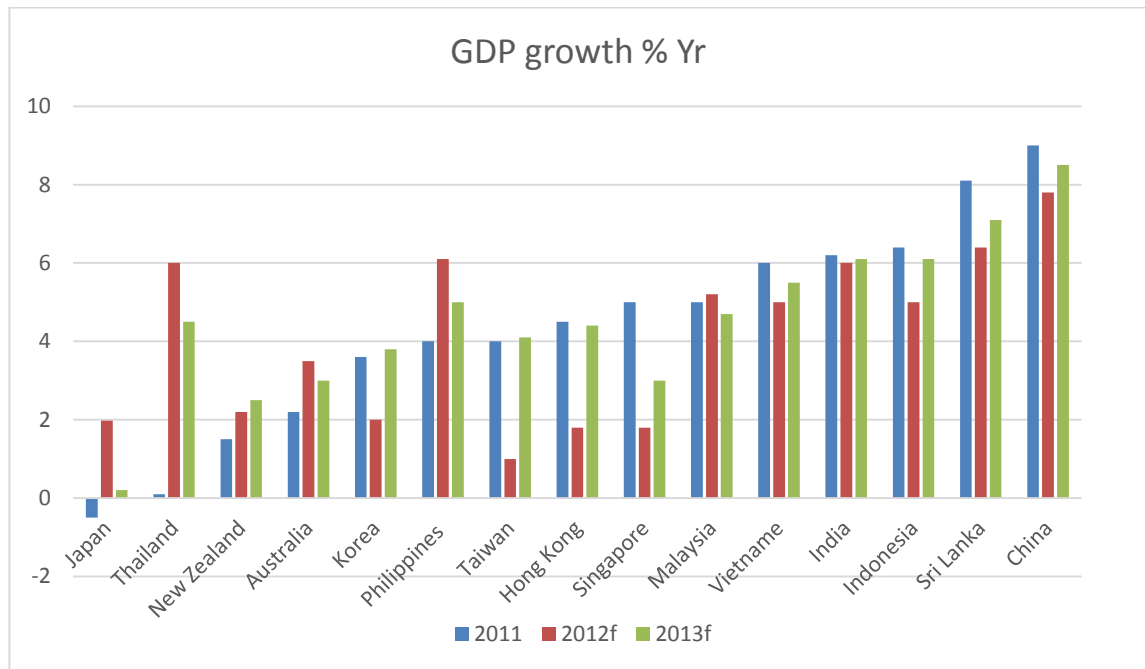


Figure 2.1: GDP Growth of Different Countries of Year 2011 – 2013 (Steven, 2013)

SMEs in Malaysia contribute a total of 32% of the Gross Domestic Product (GDP), 59% of the employment and 19% of the total exports (SMECORP Malaysia, 2012c). This shows that SMEs play an important role in Malaysia as they act as a spur towards the economic growth. According to the SMEs Master Plan Report 2012-2020, they also act as a stabilizer for the economy, as for example, during the 1997 Asian Economic Crisis (SMECORP Malaysia, 2012c). Figure 2.2 shows the overall GDP growth of Malaysia and the growth of SMEs while in Figure 2.3 show the role of SMEs in Malaysia.

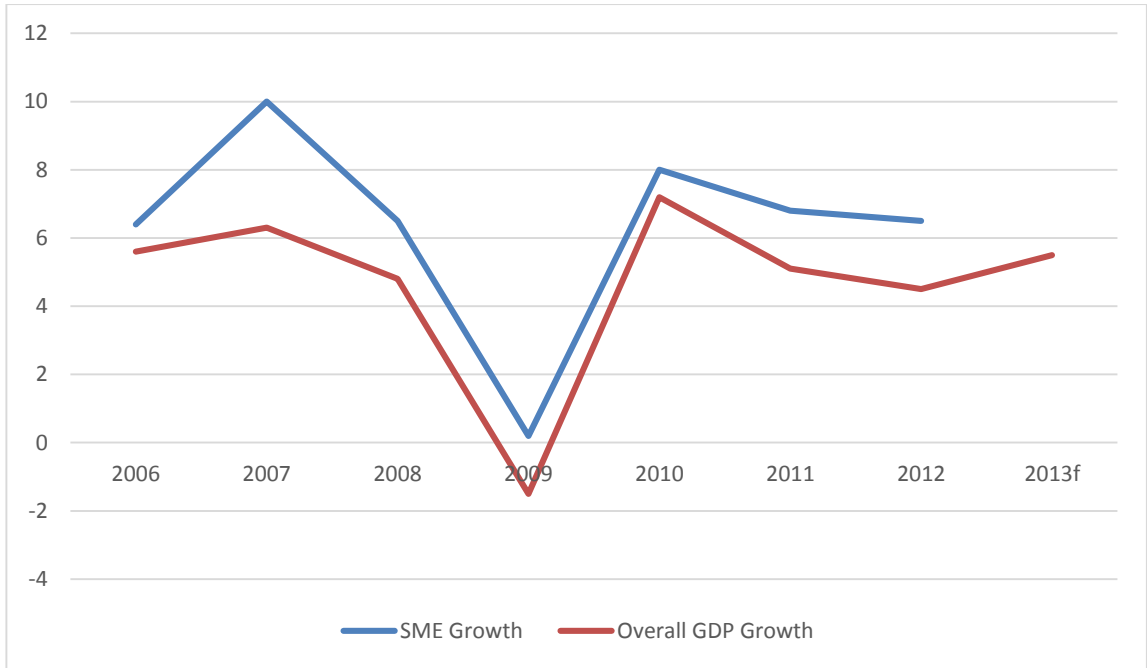


Figure 2.2: Overall GDP Growth and SME Growth in Malaysia (SMECORP Malaysia, 2012c)

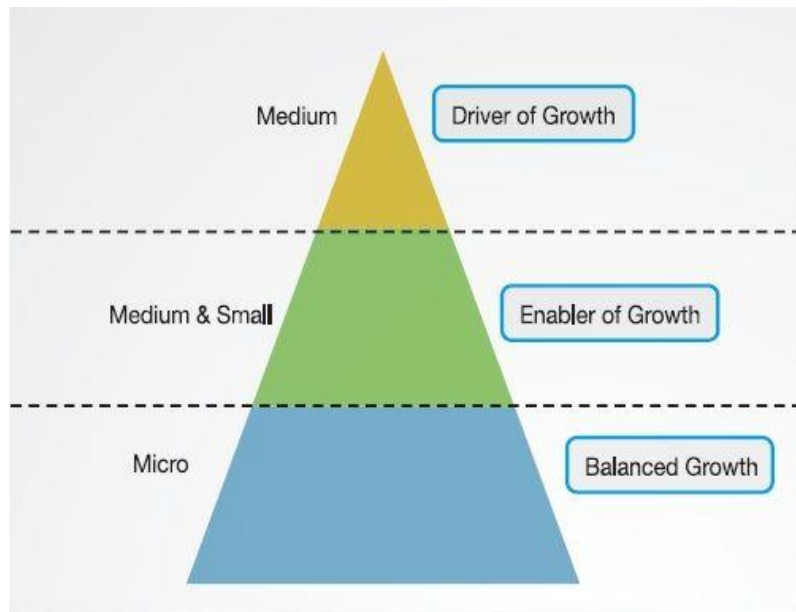


Figure 2.3: Role of SMEs in Malaysia (SMECORP Malaysia, 2012c)