

# Readiness of Manufacturing Small and Medium Enterprises (SME) to Adopt Problem Solving Tools: A Preliminary Study

Low Rong Quan<sup>a\*</sup>, Ahmad Suhaimi Baharudin<sup>a</sup>

<sup>a</sup>*School of Computer Sciences, Universiti Sains Malaysia, Penang, Malaysia*

\*Corresponding author: lowrongquan@gmail.com

## Article history

Received :4 April 2013  
Received in revised form :  
25 July 2013  
Accepted :15 October 2013

## Abstract

Problem Solving Tools are tools that help companies such as Small and Medium Enterprises (SMEs) engaged in manufacturing to identify the root cause of the problems and rectify the problems effectively. However, the level of utilization of the Tools has been poor. The factors that influence the level of utilization of the Problem Solving Tools by these Small and Medium Enterprises were identified through preliminary interviews conducted in the course of this research. The preliminary interviews also reveal the actual circumstances of Small and Medium Enterprises in the manufacturing sector of Malaysia and the problems that they face with regards to the use of Problem Solving Tools.

*Keywords:* Problem solving tools; problem; small and medium enterprises; manufacturing; quality

© 2013 Penerbit UTM Press. All rights reserved.

## 1.0 INTRODUCTION

Companies operate in a fiercely competitive environment full of challenges which bring implications for their market position and even their very survival. Quality is one of the issues that concern many companies in Malaysia as it is important to maintaining their competitiveness. This is especially so for Small and Medium Enterprises (SMEs) in the manufacturing sector. 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). SMEs contribute 32% of the Gross Domestic Product (GDP), account for 59% of the employed and 19% of the 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).

SMEs may be categorized into many types; one of which is the manufacturing sector. Manufacturing SMEs are companies that have no more than 150 full time workers and with an annual sales turnover not exceeding RM 25 million (SMECORP Malaysia 2012a; SMECORP Malaysia 2012b). In Malaysia, there are currently 37,861 manufacturing SMEs (SMECORP Malaysia 2012a). The manufacturing sector is the second largest sectors in the SMEs category where they play a very important role in helping to promote Malaysia worldwide through its manufactures. In the year 2011, the manufacturing sector contributed 7.9% of the GDP (SMECORP Malaysia 2012a).

In order to stay competitive in the market, the most important operations that manufacturing SMEs should have are balancing the Triple Constraints of quality, delivery time and cost. 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 (Jamian *et al.* 2012).



**Figure 1** The triple constraints. *Source:* Reed, 2010

In a manufacturing company, quality plays an important role as the products or goods produced represent the company's reputation and status. "Quality" has the meaning of the standard of something when another similar thing is compared with it (Hornby *et al.* 2005) while Ning, Chen and Liu said that quality is a set of requirements of the products and services that are required by the customers (Ning *et al.* 2010). Many companies

including Small and Medium Enterprises realize the importance of maintaining quality so they have adopted quality assurance processes.

However, daily problems such as defective products, machine failures and system failures will decrease the quality of the processes. The method of solving problems by the Small and Medium Enterprises 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. 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. The companies do 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 them. Besides that, it will decrease the efficiency of their daily processes. In Malaysia, many Small and Medium Enterprises cannot cope with their daily problems effectively as shown by the recurrence of the problems with more costs being incurred to solve them and in the end even leading them to bankruptcy. 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%.

One of the useful resources 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.

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, 8 Discipline Report (8D), 5 Why Analysis, Plan Do Check Act (PDCA) and the Theory of Inventive Problem Solving (TRIZ). However, according to the preliminary study, the use of Problem Solving Tools is very low in the manufacturing sector of Small and Medium Enterprises. This paper reports the preliminary study conducted in a few SMEs and identifies the factors influencing the level of use of Problem Solving Tools.

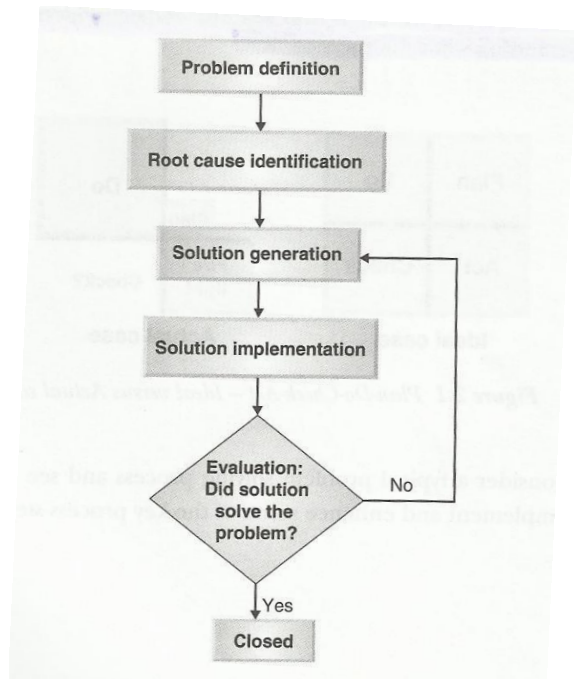
## 2.0 PROBLEM SOLVING & PROBLEM SOLVING TOOLS

### 2.1 Problem Solving

Problems can occur at any phase of the manufacturing process. According to (Shirwaiker & Okudan 2006), the problem areas could be narrowed down to three main categories:

- I. Design for manufacturing
- II. Manufacturing Processes
- III. Manufacturing Systems

According to (T S Yeoh *et al.* 2009), the same problems were always occurring across industries. The typical problem solving process could be divided into 6 steps which are: problem definition, root cause identification, solution generation, solution implementation, and evaluation of solution and refinement of the solution if its initial implementation fails.



**Figure 2** Typical problem solving process. *Source:* T S Yeoh *et al.* 2009)

In the first step, the problems are identified. The next step identifies the root causes of the problems. After this a series of investigations are conducted to generate solutions which are then implemented to solve the problems. After implementation of the solutions, the problem areas are monitored to ensure that the solutions are not defective and the problems have been truly solved. If the problems still persist, the process of solution generation will be repeated (T S Yeoh *et al.* 2009).

However, managers of the departments in the manufacturing sector of Small and Medium Enterprises tend to find shortcuts or adopt the “firefighting” solution to temporarily solve the problems instead of using a proper and problem solving process (Repenning 2001; T S Yeoh *et al.* 2009). Hence, the Problem Solving Tools have been created to help the managers to follow proper steps and resolve the problems completely.

### 2.2 Problem Solving Tools (PST)

Problem Solving Tools assist their users to solve the problems that they face daily in the workplace. A range of Problem Solving Tools are available in the market each of which has been created to suit the different contexts in which problems present themselves. Some of these tools are: Six Sigma, 8 Discipline Report (8D), 5 Why Analysis, Plan Do Check Act (PDCA), House of Quality (HOQ) and Theory of Inventive Problem Solving (TRIZ). Different tools have different ways of tackling different types of problems for example, HOQ tool helps the organizations to plan solutions according to the customer’s requirement and achieve a satisfactory standard of quality between the customers.

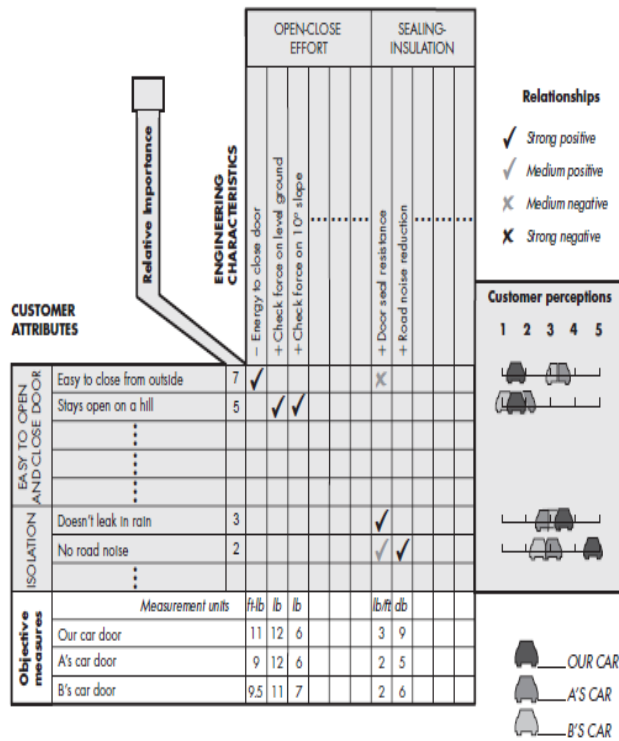


Figure 3 House of quality. Source: Hauser & Clausing, 1988)

According to the preliminary study, PDCA is among the most widely used tools by SMEs.

Plan Do Check Act (PDCA) which is also called the Deming Cycle was created by Dr. W. Edwards Deming and it consists of 4 phases which are: plan, do, check and act (Ning *et al.* 2010; Zhichun & Yuejun, X. *et al.* 2011). According to (Ning *et al.* 2010), a minor defect in the product could cause a huge loss lost to the customers. PDCA is applicable as a problem solving tool for all stages of the manufacturing process. PDCA is a tool that is applied in a circular motion as each of the phases is inter-linked.

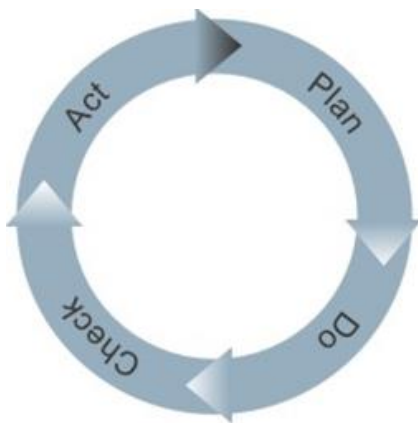


Figure 4 Plan, Do, Check, Act (PDCA). Source: Podmoroff n.d.

PDCA not only solves problems but also improves the quality of the product at the same time. When all the 4 phases of the PDCA have been completed, the quality level of the product

will increase by one level (Ning *et al.* 2010; Zhichun & Yuejun, X. *et al.* 2011).

Besides PDCA, many companies have also shown an interest in the Theory of Inventive Problem Solving (TRIZ) Tool. The Theory of Inventive Problem Solving (TRIZ) or to give it its original name, “Teoriya Resheniya Izobreatatelskikh Zadatch”, was developed by a Russian patent engineer Genrich Altshuller in 1946 (T S Yeoh *et al.* 2009; Jiang 2010; Nihong Najjie, L., & Huiling, Y *et al.* 2010).

TRIZ is a methodology which analyzes problems and tries to provide a range of strategies and tools to arrive at inventive solutions. As problems repeat themselves across the industries, so the solutions to the problems are also applied accordingly (Tay Jin Yeoh & Teong San Yeoh 2008). Hence, the solutions have been collected and collated as the ‘40 Inventive Principles’ (T S Yeoh *et al.* 2009).

Wang, Li and Yu discussed in their research that many enterprises have applied TRIZ in their problem solving process and have gained economic benefits as a result (Nihong Najjie, L., & Huiling, Y *et al.* 2010). However, TRIZ is a rather complicated tool to master. Researchers (Shirwaiker & Okudan 2006) have said that TRIZ is only applicable to the manufacturing industrial sector but this statement is not really true as others (Jiang 2010) have used TRIZ in Innovation Education. Besides, TRIZ is still in the process of being tested by Intel in the area of Facilities, Management and Technology Development (Tay Jin Yeoh & Teong San Yeoh 2008). Therefore, it is premature to dismiss its possible wider application.

### 3.0 RESEARCH METHODOLOGY

This research which is of an exploratory study was conducted among Small and Medium Enterprises Manufacturing companies in Malaysia. The respondents are chosen randomly from the list provided by the SME Info Portal (SMECORP Malaysia 2011).

The exploratory study will investigate the problems that are faced by Manufacturing Small and Medium Enterprises, and also the Problem Solving Tools that are currently adopted as well as the problems which present themselves when using the Tools.

The exploratory study was conducted by using the preliminary study method. The results of the preliminary study were used to determine the problem statements and also to find the potential independent variables that are influencing the adoption level of Problem Solving Tools

### 4.0 PROBLEM SOLVING TOOLS IN THE INDUSTRY

In order to understand how Problem Solving Tools are used in the industries, a preliminary study was done by conducting the interviews in the organizations that are currently adopting Problem Solving Tools and also in companies that are not currently adopting Problem Solving Tools.

Interviews were conducted in five Small and Medium Enterprises (SME) which are randomly selected from the SME Info Portal (SMECORP Malaysia 2011). The objective in conducting the interviews was to understand the real problems that are occurring in these enterprises when adopting Problem Solving Tools. The interviews were held with a semi-structured questionnaire. The outcome of the interviews has been transcribed and reported in the sub-chapters that follow.

#### 4.1 Interview with Organization “A”

Organization “A” was the first organization where the researcher conducted his interviews. Organization “A” which was established in 1989 is located in Selangor. It is an organization that provides trading and logistics services to Japanese multi-national companies that are based in Malaysia. It also supports local and international manufacturers in the audio-visual industrial sector.

The researcher interviewed the Quality & Business Development Manager of Organization “A” about the Problem Solving Tools that the Organization had adopted. The Manager has knowledge of Problem Solving Tools and has in fact adopted them for the Organization’s daily problem solving processes.

This Manager expressed great satisfaction with the Problem Solving Tools which he said were both easy to understand and to use. The workers are given proper training on how to use the Tools before implementation. Recurrence of problems has been prevented while cooperation and team work of the Department’s employees showed an improvement with the use of the Tools.

However, using the Tools is quite time consuming for the Manager as step-by step procedures have to be followed in order to get to the root cause of the problem. There are no shortcuts. Hence, this also increases their workload.

#### 4.2 Interview with Organization “B”

Organization “B” is a Small and Medium Enterprise which mainly focuses on the production of parts for automotive, power tools, electronic, audio, video and office industries. The Organization is a joint venture organization between Malaysia and Japan. The Organization which is situated in Prai, was established in October 1990.

The interview was conducted with the Sales Manager of Organization “B”. The Sales Manager has some knowledge of the Problem Solving Tools. The Organization with the help of the Manager also adopted the Tools with which he was familiar. The Manager is very satisfied with the current Problem Solving Tools as they help the Organization to ascertain the root cause of the problems and solve them effectively. The Manager also stated that besides being easy to use, costs in terms of implementing counter measures have been reduced as the problems have not recurred.

However, the Manager thinks that Problem Solving Tools still have some weaknesses. Firstly, Problem Solving Tools are time consuming and it required a certain number of steps to use the Tools. The second weakness is the increase in workload as they need to attend workshops and classes regarding the correct way to implement the tools.

#### 4.3 Interview with Organization “C”

Organization “C” is a manufacturing Small and Medium Enterprise (SME) that is situated in Seberang Prai, Penang. The Organization was established in December 1998 and it is a contract manufacturer. The Organization produces Chip on Flex/Board (COB).

The interview was conducted with the QA Manager of the Organization. When the researcher talked to the Manager about Problem Solving Tools, he showed some knowledge about them. However, when asked if the Organization was currently using Problem Solving Tools, he answered in the negative giving the reason that they as yet only used analysis tools as requested by their customers.

On being questioned further by the researcher on why his Organization did not adopt Problem Solving Tools to help in managing problems, he responded that the Organization lacked guidance and knowledge to adopt and use the Tools. He also pointed out the high cost of adopting the Tools and training workers to use them which would in turn increase the Organization’s expenses.

Furthermore, adopting Problem Solving Tools will increase the workload of the workers besides being time consuming. He also noted that the workshops for learning the Tools would incur high costs for the Organization and that only a few workers would be sent to the workshops.

#### 4.4 Interview with Organization “D”

Organization “D” is a floppy disc and compact disc manufacturer. It was founded in Tokyo, Japan in 1953.

During the interview with the Senior Manager of the Quality Assurance Department, the researcher realized that the Manager was very knowledgeable in Problem Solving Tools as he understood them well and had implemented them competently in the Organization. He was of the view, that Problem Solving Tools could prevent problems from recurring and at the same time reduce the costs of implementing counter measures. The Manager also said that the Tools actually act as guidance, so the person who uses them should understand how to apply them and how to arrive at the solutions. As such, the Tools do not of themselves solve the problem. If the person who uses the Tools does not understand how to use them, the Tools are worthless.

The Manager continued that small enterprises which wish to adopt all the Tools may not be as successful as big organizations have been because the latter have better educated employees and can also properly train them to apply the Tools to the problems. Even if the small enterprises wish to send their employees for workshops or classes, they do not have the funds to do so as the courses may be expensive and it will be an extra cost for their organizations.

The Manager thinks that the company and its employees must consider in depth whether it is viable for them in terms of both experience and costs to adopt the Tools; if it is not, it would be futile for them to do so.

#### 4.5 Interview with Organization “E”

Organization “E” is situated in Johor Bahru at the southern part of Peninsular Malaysia. The company is a Small and Medium Enterprise that produces intelligent or smart electric and electronic devices.

The Managing Director of Organization “E”, who has 17 years of working experience in the manufacturing sector, was helpful in deepening understanding of the subject matter of the preliminary study.

The Director had deepened his understanding of Problem Solving Tools through his experiences. When he established the Organization, he used his practical knowledge of the Tools to solve the problems encountered daily especially in the Production Department. The Director is currently quite satisfied with the performance of the Tools.

The Tools helped the Organization to be more organized and at the same time the teamwork in the Production Department became closer. The Tools also prevented the problems from recurring. However, the Director did note some weaknesses of the Tools, the first one being that the Tools are time consuming to apply. At the same time, the cost of counter measures also increases when using them.

4.6 Summary of the Preliminary Study

Table 1 Summary of preliminary study

Organization	Adopt Problem Solving Tools	Benefits	Weaknesses
A	Yes	-Easy to use and Understand, -Recurrence Problems are Prevented, -Team Work Improved	-Time Consuming, -Increase Workload
B	Yes	-Find out root cause of the problem and Solve the problems, -Easy to use, -Reduces the price of implementing counter measures	-Time Consuming, -Increase Workload,
C	No	-	-No Knowledge, -Increase Cost, -Increase Workload, -Time Consuming
D	Yes	-Prevent Recurrence, -Reduce Cost of implementing Counter Measures, -Act as Guidance	-Increase Cost, -No Knowledge
E	Yes	-Organization become more organized, -Teamwork closer, -Prevent recurrence from happening	-Time Consuming, -Increase Cost

From the table, we could derive that Prevent Recurrence is the main benefits of the Problem Solving Tools. According to Jafri, Rohani and Chan, after using the tools such as Pareto Chart and Fish Bone Diagram, the defective rate of the products and daily processes has improved from 13.49% to 7.4% (Jafri & Chan 2001). The second recurring benefits that the organizations mentioned are Reduce Costs, Ease of Use, and Improve Teamwork. A simple and cheap Problem Solving Tools could also bring big changes and benefits to the organizations (Jafri & Chan 2001; Jamian *et al.* 2012).

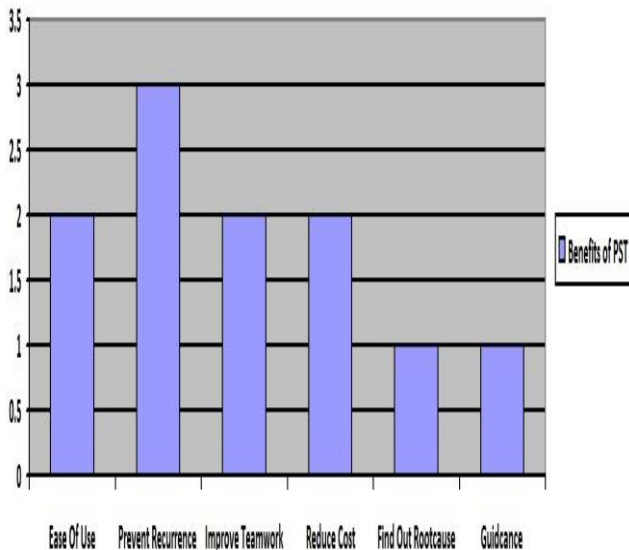


Figure 5 Benefits of problem solving tools

Whereas the biggest weakness that most of the organizations stated is Time Consuming. Workers have to go through courses and trainings about how to use the tools which took a lot of their time where manufacturing SMEs are said to have constraints in time (Jafri & Chan 2001; Jamian *et al.* 2012).

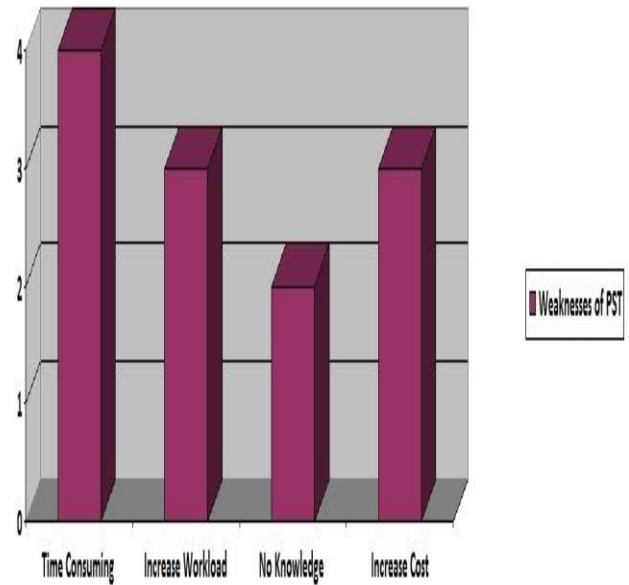


Figure 6 Weaknesses of problem solving tools

5.0 CONCLUSION

Quality played an important role as a key driver of success in SMEs especially Manufacturing SMEs in order to stay competitive in the global market (Jafri & Chan 2001; NA Ismail *et al.* 2012)

The preliminary study conducted by the researcher has shown that ease of use, the prevention of recurrent problems and closer teamwork are the benefits of the Tools. The main weaknesses are that the Tools are time consuming, result in an increase of workload, incur increased costs and their use is hampered by a lack of knowledge. One of the problems that are recurring themes is about the cost. Manufacturing SMEs are sensitive with issues regarding cost as they normally have constraints with their financial resources (Jamian *et al.* 2012; NA Ismail *et al.* 2012).

From the preliminary study also, the researcher found out one critical factor that why organizations did not adopt Problem Solving Tools is because they could not perceived any benefits of using the tools.

The preliminary study has reflected the real and current situation that the SMEs face when they adopt Problem Solving Tools.

Acknowledgement

The authors wish to express their appreciation to the Small and Medium Enterprises which extended their assistance in making this preliminary study a success.

## References

- [1] Department Of Statistics. 2012. *Economic Census 2011- Profile of Small and Medium Enterprise*. Malaysia: Department of Statistic.
- [2] Hauser, J. & Clausing, D. 1988. The House of Quality. Available at: [https://mywebspace.wisc.edu/sbconver/CIOSponsoredCourses/GatheringBusinessRequirements/Readings%26AdditionalResources/Post-course\\_readings-UW\\_Netid\\_required/8-TheHouseOfQuality-HBS.pdf](https://mywebspace.wisc.edu/sbconver/CIOSponsoredCourses/GatheringBusinessRequirements/Readings%26AdditionalResources/Post-course_readings-UW_Netid_required/8-TheHouseOfQuality-HBS.pdf) [Accessed April 8, 2013].
- [3] Hornby, A. S. et al. 2005. *Oxford Advanced Learner's Dictionary of Current English*. Oxford University Press. Available at: <http://books.google.com.my/books?id=5VEkAQAMA AJ>.
- [4] Ismail, N. A., Abdullah, S. & Tayib, M. 2012. Computer-based Accounting Systems: The Case Of Manufacturing-Based Small and Medium Enterprises in the Northern Region of Peninsular Malaysia. *Jurnal Teknologi*. 39: 19–36. Available at: <http://www.jurnalteknologi.utm.my/index.php/jurnalteknologi/article/view/473> [Accessed April 3, 2013].
- [5] Jafri, M. & Chan, K. 2001. Improving Quality with Basic Statistical Process Control (SPC) Tools: A Case Study. *Jurnal Teknologi*. 35: 21–33. Available at: <http://eprints.utm.my/1032/> [Accessed April 3, 2013].
- [6] Jamian, R. et al. 2012. The Use Of 5S As Sustainable Practices In Manufacturing Small And Medium Sized Enterprises. In *Global Conference on Operations And Supply Chain Management (GCOM 2012) Proceeding*. 116–125.
- [7] Jiang, F. 2010. Application idea for TRIZ theory in innovation education. *Computer Science and Education (ICCSE), 2010 5th International Conference*. 1535–1540.
- [8] Nihong Naijie, L., & Huiling, Y., W., Nihong, W. & Naijie, L. 2010. The Design of TRIZ Expert System Inference Engine. *Computer Design and Applications (ICDDA), 2010 International Conference*. 2: V2–487–V2–491.
- [9] Ning, J., Chen, Z. & Liu, G. 2010. PDCA Process Application in the Continuous Improvement of Software Quality. *2010 International Conference on Computer, Mechatronics, Control and Electronic Engineering (CMCE)*. (1): 61–65. Available at: [http://ieeexplore.ieee.org/xpl/freeabs\\_all.jsp?arnumber=5609635](http://ieeexplore.ieee.org/xpl/freeabs_all.jsp?arnumber=5609635).
- [10] Podmoroff, D. 2012. Plan-Do-Check-Act (PDCA) Implementing New Ideas In A Controlled Way. 2012 (2<sup>nd</sup>. Dec). Available at: [http://www.mindtools.com/pages/article/newPPM\\_89.htm](http://www.mindtools.com/pages/article/newPPM_89.htm).
- [11] Reed, A. 2010. Working with Project Managers to Juggle the Triple Constraint. 2012 (2<sup>nd</sup>. Dec). Available at: <http://www.bridging-the-gap.com/working-with-pms-to-juggle-the-triple-constraint/>.
- [12] Repenning, N. P. 2001. Understanding fire fighting in new product development. *Journal of Product Innovation Management*. 18(5): 285–300. Available at: <http://www.sciencedirect.com/science/article/pii/S0737678201000996>.
- [13] Shirwaiker, R. A. & Okudan, G. E. 2006. TRIZ and Axiomatic Design: A Review of Manufacturing Case-Studies & Their Compatibility. In *Technology Management for the Global Future, 2006. PICMET 2006*. Istanbul, Turkey: IEEE. 2510–2520.
- [14] SMECORP Malaysia. 2012a. *SME Annual Report 2011/12*. Malaysia.
- [15] SMECORP Malaysia. 2012b. SME Corporation Official Website. 2012 (7th June 2012). Available at: <http://www.smecorp.gov.my>.
- [16] SMECORP Malaysia. 2011. SME Info Portal. Available at: <http://secure.smeinfo.com.my/directory/sector.php?intSectorID=1> [Accessed April 4, 2013].
- [17] SMECORP Malaysia. 2012c. *SME MASTERPLAN 2012-2020*. 1st ed. Malaysia.
- [18] Yeoh, T. S., Yeoh, T. J. & Song, C. L. 2009. *Theory of Inventive Problem Solving Triz Systematic Innovation in Manufacturing*. Malaysia: Firstfruits Sdn. Bhd.
- [19] Yeoh, Tay Jin & Yeoh, Teong San. 2008. TRIZ: Systematic Innovation Towards Factory Operational Efficiency. In *Electronic Manufacturing Technology Symposium (IEMT), 2008 33rd IEEE/CPMT International*. 1–4.
- [20] Zhichun & Yuejun, X., Q., Qiao, Z. & Xiao, Y. 2011. Quality Improvement of Wall Energy Conservation Project Based On PDCA Cycle. *Electric Technology and Civil Engineering (ICETCE), 2011 International Conference*. 1416–1419.