

Technological Factors that Differentiate the Adoption Levels of Problem Solving Tools in Manufacturing Sector of SMEs in Malaysia

Rong Quan Low, Ahmad Suhaimi Baharudin and Seng Chee Lim
School of Computer Science, Universiti Sains Malaysia, Penang, Malaysia

Abstract: The fight for survival continues in the business world and becoming harder especially for the small and medium enterprises. They are limited to resources such as human resources and financial resources and the number of SMEs are decreasing in a rapid speed especially in Malaysia context. One of the reason is because they are unable to solve daily problems effectively and the problem recurs. Hence, problem solving tools are introduced to the companies but the adoption rate is low. This research will use the technological factors (complexity, cost of adoption and relative advantage) from the TOE model to differentiate the adoption level of problem solving tools. The questionnaires are sent to 1000 companies and 141 are useable for the final analysis which the response rate is 14.1%. The discriminant analysis is used and the result shows that all the factors are having significant values. The managers could use the result to higher the adoption level of problem solving tools such as sending the employees for trainings and choose the tools which are easy to use and adopt in the companies' processes.

Key words: SME, relative advantage, costs, complexity, manufacturing

INTRODUCTION

In the challenging market of today, survival rate of companies is very crucial as many companies are going bankruptcy and the number is increasing daily. Hence, Small and Medium Enterprises (SMEs) especially requires double the effort than large companies when coming to the issue of maintaining the survival rate as they are companies who either just start their business or companies who are smaller in size with limited resources. However, SMEs played an important role in most of the countries for example in Malaysia. In Malaysia, 97.3% of the businesses established are made up from SMEs. Even though, SMEs played an important role, their bankruptcy level is very concerning as it keep on increasing.

One of the main reasons why SMEs bankruptcy level is high is because they cannot cope with their daily problems faced such as production problems, defective products and reoccurrence of the problems. These problems will lead to lower quality products. SMEs are not having enough human resources and financial resources hence they tend to solve only the surface of the problem and not rectifying the roots where this scenario is defined by Repenning (2001) as "fire-fighting" process. In order to rectify the problems completely from the root, problem solving tools are introduced to the SMEs. Problem solving tools such as Six Sigma, TRIZ, Plan Do Check Act (PDCA) and 5 Whys are tools developed to help companies to solve and rectify daily problems effectively.

They produce a series of guidelines and procedures for the companies to follow and solve the problems from the root cause. The tools are useful and effective to solving problems however the adoption level is still reported to be low in manufacturing sectors of SMEs in Malaysia (Hashim and Osman, 2003; Mohd Yusof, 2003; Sahran *et al.*, 2010). Hence, this research study will focused on the technological factors (complexity, costs and relative advantage) of the Technological, Organizational and Environmental (TOE) model which could differentiate the level of adoption of the problem solving tools in manufacturing sector of SMEs in Malaysia. The TOE model is a very popular framework to explain about the adoption of a new innovations and technologies in the context of organizations.

Literature review

Adoption level of problem solving tools: The dependent variable of this research study is the adoption level of problem solving tools which in this context is the low and high level. The high level of adoption is referring to companies which adopt the tools in most of the departments where low level is referring to the companies which adopt the tools only in certain departments.

Technological factors

Complexity: Complexity in this research is the level of adversity when adopting and adapting the tools into the

daily production processes (Marimuthu *et al.*, 2011; Thong, 1999). In many past researches, complexity is reported to be an important factor as many companies are unwilling to adopt new innovations as they are difficult to learn and adopt (Antony *et al.*, 2005; Beatty *et al.*, 2001; Marimuthu *et al.*, 2011; Sultan and Chan, 2000).

This applies to the problem solving tools adoption in SMEs as they are small companies and have insufficient experts and resources to adopt the tools in every departments. The companies are reluctant to adopt tools that are complicated such as TRIZ and developed their own tools by tailor-made the tools which is a combination of other tools. Hence, complexity of the tools is good predictor of adoption level of problem solving tools in Manufacturing Sector of SMEs.

- H₁: Complexity of the tools is good predictor of adoption level of problem solving tools in manufacturing sector of SMEs

Cost of adoption: Cost of adoption in this research refers to the money and human power needed to adopt the tools in the company (Chau and Tam, 2000). The costs need are cost of trainings, changes of old to new tools and costs of hiring experts (Kuan and Chau, 2001; Thia *et al.*, 2005; Zhu *et al.*, 2006).

The costs will be a burden for the SMEs as they are restricted to the limited funds and resources they had. They normally have little amount of experts to help them solve problems using the tools and will increase the cost of the operations if they could not solve the problems correctly using the tools. They also need to seek outside trainers and help to train the employees to use the tools. Hence the cost is a good predictor to predict the level of adoption of problem solving tools.

- H₂: Cost of Adoption is good predictor of adoption level of problem solving tools in manufacturing sector of SMEs relative advantage

One of the most important factors reported by many researches previously is the relative advantage (Sultan and Chan, 2000; Ungan, 2004; Zhu *et al.*, 2006). In this research, the advantage is referring to the benefits that the company received after adopting the tools such as increase in quality, increase profitability, reduction in cycle time and better competitive level (Antony *et al.*, 2005; Kuan and Chau, 2001; Ungan, 2004).

According to (Antony *et al.*, 2005) companies perceive that the tools are giving benefits to their

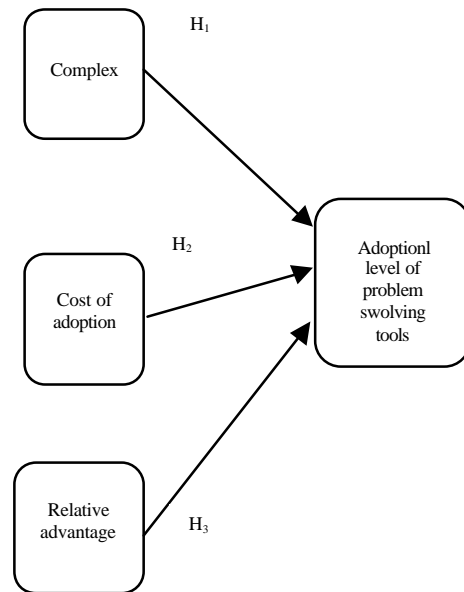


Fig. 1: Research framework

companies and mentioned that when a company completed the PDCA cycle. The relative advantage hence is a good predictor of the adoptions of the tools.

- H₃: Relative advantage of the tools is good predictor of adoption level of problem solving tools in manufacturing sector of SMEs

MATERIALS AND METHODS

The respondents of the research were identified through random sampling technique and questionnaires were send out by using post service. The list of manufacturing small and medium enterprises were retrieved from the help of SMECORP and SMEINFO portal.

The data collection period was carried out between February to June 2014 where 1000 questionnaires are sent out. In the end of the data collection period, a number of 281 respondents returned their questionnaires which is having the response rate of 28.1% however, only 141 are valid which is having response rate of 14.1%. The sample size of 141 is accepted as according to Hair *et al.* (2013), the ratio should be 10 to one variable which in this research only requires 30 respondents as there are only three variables. The questionnaires then were analyzed with the SPSS Software using the discriminant analysis technique.

RESULTS AND DISCUSSION

Discriminant analysis: Table 1 below shows the group statistics table. In this Table 1, the mean value are observed to be different between the two groups. This shows that the research is suitable to use the discriminant analysis. In this research, ‘1’ represents the low level of adoption of problem solving tools and ‘2’ represents the high level of adoption of problem solving tools.

Table 1 also shows that companies with lower level of adoption of the tools found that the tools that they are using is lesser complex, requires lesser costs and also having lesser benefits compare to the companies with higher level of adoption of the tools. This is because companies with higher level of adoption of the problem solving tools requires more cost to train their employees as they use them in the problem solving process of most of their departments and also they feel that the tools are more complex when use as the experts or problem solvers of the companies require more skills compare to handle different kinds of tools and when to use the tools. Hence solving problems more effectively which in the end they perceived more benefits from the tools compare to the companies who only adopt the tools in low level.

Tests of equality of group means: Table 2 shows the significance level of the predictors to differentiate the dependent variable. The results shows that all variables are <0.05. Hence, all variables are mentioned to be significant and it is having the same results as many previous researches (Beatty *et al.*, 2001; Marimuthu *et al.*, 2011; Sultan and Chan, 2000; Ungan, 2004; Zhu *et al.*, 2006).

Classification table: In this research, there is two groups of dependent variable which is low level and high level of adoption of problem solving tools hence the percentage of having a perfect prediction of the case is 50% each (Burns and Burns, 2009). In many past researches as mentioned that the acceptable hit-ratio is >25% when compare with the ratio by chance (Burns and Burns, 2009; Hair *et al.*, 2013). Hence, the equation is as follows:

$$0.5^2+0.5^2 = 0.5$$

The result should be 25% more from total accuracy Hence, 1.25 the ratio by chance = 1.25×0.5 = 0.625×100 = 62.5%. In the classification Table, the cross-validated grouped cases are reported to be 72.3% Hence, it shows in Table 3 that the research is correctly classified as it is higher than the ratio by chance of 62.5%.

Table 1: Group statistics table

New (d)	Mean	SD	Group statistics	
			Valid N (listwise)	
			Unweighted	Weighted
1.00 M_COMP	3.9538	1.17283	100	100
M_COST	3.2525	1.29758	100	100
M_RA	4.5789	1.01667	100	100
2.00 M_COMP	4.7530	1.07365	41	41
M_COST	4.1951	1.36875	41	41
M_RA	5.3794	0.95192	41	41
Total M_COMP	4.1862	1.19780	141	141
M_COST	3.5266	1.38219	141	141
M_RA	4.8117	1.05968	141	141

Table 2: Tests of equality of group means

New (d)	Tests of equality of group means				
	Wilks' Lambda	F	df1	df2	Sig.
M_COMP	0.908	14.166	1	139	0.000
M_COST	0.903	14.863	1	139	0.000
M_RA	0.881	18.691	1	139	0.000

Table 3: Classification results^{b,c} table

Group ratio value (%)	New (d) values	Predicted group membership		
		1	2	Total
Original count	1.00	93.0	7.0	100
	2.00	31.0	10.0	41
	1.00	93.0	7.0	100
	2.00	75.6	24.4	100
Cross-validated ^a count	1.00	92.0	8.0	100
	2.00	31.0	10.0	41
	1.00	92.0	8.0	100
	2.00	75.6	24.4	100

^aCross validation is done only for those cases in the analysis. In cross validation, each case is classified by the functions derived from all cases other than that case: ^b73.0% of original grouped cases correctly classified, ^c72.3% of cross-validated grouped cases correctly classified

CONCLUSION

The research concluded that the technological factors which is complexity, cost of adoption and relative advantage are significant predictors to the adoption level of problem solving tools in manufacturing sector of SME in Malaysia. The managers could use the results to improve their adoption level which is by having extra resources for hiring experts and send employees for trainings to lower the complexity level of the tools. When the tools are easier to use, the adoption level will automatically increase. The future researches who wish to further this research could further using the different factors from the TOE model such as external support.

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