

# Empirical Investigation of the Impact of Internal and External Barriers towards Technology Innovation for Small and Medium Enterprises (SMEs): A Second Order Structural Equation Modeling

Fatin Izzati Khairushalimi<sup>1</sup>, Nurul Hafizah Azizan<sup>2</sup>, Sabri Ahmad<sup>3</sup>, Nazleen Nur Ain Zulkurnain<sup>4</sup>

School of Informatics and Applied Mathematics  
Universiti Malaysia Terengganu

**Abstract**— Innovation is the implementation of a new or significantly improved product or process, a new marketing, or organizational method in business practices. A case study has been carried out to identify the obstacles of technological innovation of SMEs faced by entrepreneurs in Kelantan. The study was conducted in three month (11 weeks), which was on 9th September 2013 to 9th December 2013. The main objectives of this study were to investigate whether internal and external barriers significantly influence technological innovation in SMEs industry level. The internal barriers of technological innovation were classified lack of skill personnel and lack of finance while external barriers of technological innovation were classified as high cost of innovation and lack of technological and market information. This study used MANOVA to examine whether lack of personnel skill, lack of finance, lack of technological and market information, high cost of innovation and technological innovation are significantly differ between small and medium business scales. The results revealed that high cost of innovation, lack of finance and technological innovation were found to be statistically significant difference between small and medium business scales. Apart from that, the data for this study was also analyzed by using structural equation modeling (SEM) to achieve the main hypotheses of this study. All the findings in this study were supported. As overall, most entrepreneurs faced the obstacles of innovation in order to raise up their business.

**Index Terms**— Structural Equation Modeling (SEM), MANOVA, internal barrier, external barrier, technological innovation

## 1 INTRODUCTION

GENERALLY there is no accepted worldwide definition of SMEs. However, in Malaysia, the definition of SMEs is mainly based on annual sales turnover and total number of full time employees. SMEs in Malaysia can be segregated into three main sectors such as general business, manufacturing and agriculture. In Malaysia, according to Small and Medium Enterprises Corporation Malaysia (SMECORP), enterprises that employ between 50-150 full time employees are considered as medium while those that employ between 5-50 are called small and less than 5 are considered as micro enterprises.

In a rapidly changing world, the imperative for innovation increases. Innovation is common to all organizations' technology development and management, no matter how large a company is. "Innovation is the implementation of a new or significantly improved product or process, a new marketing, or organizational method in business practices" [4]. Innovation is widely regarded as the most important competitive advantage that enables a firm to thrive in today's dynamic business environment. With increasing global competition and quickly spreading of knowledge, the future of many businesses depends upon their ability to innovate.

The aim of the research on barriers is initially to find out about the factors of barriers to innovation for SME. It attempts then to identify their most obstacles to innovation and the im-

pact in the innovation process. Barriers can be classified in various ways, a usual one differentiates between external to the firm or exogenous [1] and internal or endogenous [5]. External can be further subdivided into supply, demand and environment related. Internal barriers can be further subdivided into resource related, technical expertise or management time, culture and systems related [7], and human nature related. Thus, this study focused on generating relevant information to understand barriers for technological innovation of SMEs.

### 1.1 Problem Statement

As cited in [9] "many failure stories of SMEs in technology innovation reveal that there are various factors hindering their innovation process". Although the phenomenon on innovation factors of SMEs has captured the interest of many scholars, less study focuses on the issue from the developing countries especially in Malaysia. Even though, in developing countries like Malaysia, SMEs are important for number of reasons, their engagement on innovation is lower when compared to other developing countries. Based on [8], 31% of the respondents revealed that, their main focus of innovation activities is enhancement of quality of the products and services, whereas 12% or 116 respondents indicated that innovation activities are not important to them. 29% of the respondents indicated that financial difficulties is the main obstacle while carrying out

innovation activities, followed by the usage of technologies (27%) and uncertainty in market direction (26%). For companies in operation less than 3 years, their main obstacles for innovation activities are financial difficulties (50%) while only 27% of the companies in operation for 10 years and above facing the same problem. Therefore, the lower focus initiates to conduct further investigation to describe factors obstacle SMEs engagement on technological innovation.

## 1.2 Research Objective

The objectives of this study are:

1. To examine whether lack of personal skill, lack of finance, lack of technological and market information, high cost of innovation and technological innovation are significantly differ between small and medium business scales.
2. To determine whether internal barriers significantly influence technological innovation.
3. To examine whether external barriers significantly influence technological innovation.

## 1.3 Research Question

The research questions for this study are:

1. Does lack of personal skill, lack of finance, lack of technological and market information, high cost of innovation and technological innovation are significantly differ between small and medium business scales?
2. Does internal barriers significantly influence technological innovation for SMEs enterprise level?
3. Does external barriers significantly influence technological innovation for SMEs enterprise level?

## 1.4 Theoretical Framework

Fig. 1 below shows the theoretical framework with two main hypothesis need to be tested from this study. Firstly this study crucial to assess whether internal barriers significantly influence technological innovation. Secondly, this study also want to examine whether external barriers significantly influence technological innovation.

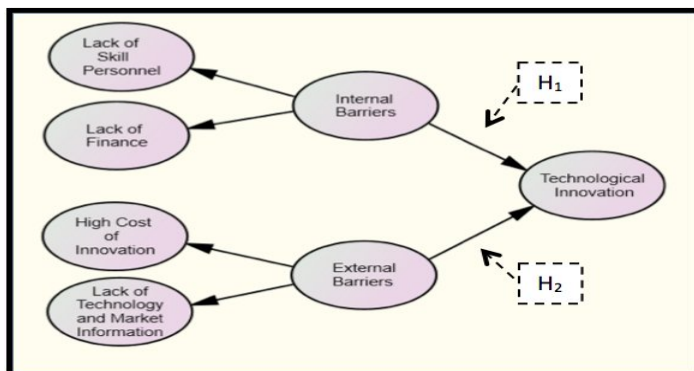


Fig. 1. Theoretical Framework

## 1.5 Research Hypothesis

The hypotheses for this study are:

1. H1: Lack of personal skill, lack of finance, lack of technological and market information, high cost of innovation and technological innovation are significantly differ

between small and medium business scales.

2. H1: Internal barriers has a significant and direct effect on the low technological innovativeness of SMEs.
3. H1: External barriers has a significant and direct effect on the low technological innovativeness of SMEs.

## 2 LITERATURE REVIEW

An enterprises can make many types of changes in its methods of work, its use of factors of production and the types of output that improve its productivity or commercial performance. There are four types of innovations are distinguished according [4]; [2]: product innovations, process innovations, marketing innovations and organizational innovations.

Barriers to innovation can be classified in different ways and different typologies. A useful classification of barriers is made by [5]; he classifies company's internal and external barriers. [1] admits that external barriers have their origin in the surrounding environment and cannot be influenced. However, a company can influence internal ones. Government policies and regulations, is a frequent source of barriers to innovation [6]. He views barriers as a component of a national innovation climate in the country. Bureaucratic procedures, lack of properly settled national strategy, problems in policy communication and execution may cause abnormal external barriers for innovation process.

Regarding internal barriers [3] has classified five barriers existing on "individual" or "organizational" level: ability barriers; knowledge barriers; functional barriers; intentional barriers and affective barriers. He pointed internal barriers have to be perceived to be more important than the external ones. They are easier to identify and deal with.

## 3 METHODOLOGY

This study employed descriptive research design to describe the characteristics of relevant groups such as entrepreneurs for this study, to estimate the percentage of units in a specified populations exhibiting a certain behavior and to make specific predictions about something. The target population of this study are owners and/or managers of Small and Medium Enterprises (SMEs) in Kelantan.

Survey method used to collect information from managers or owners of SMEs in Kelantan. This study used primary data to gather the information by using self-administered questionnaire. There are consists of 3 sections in the questionnaire which are Section A is Demographic Background (7 items), Section B is Barriers of Innovation (24 items), and Section C is Open Ended Questions (5 items).

This study applied simple random sampling because already have the list of registered enterprises under MITI Kelantan and there are homogeneous in term of characteristics of interest for the study. The sample size of this study are 100 SME's in Kelantan. The sampling frame was the list of registered enterprises obtain from MITI Kelantan.

This study used MANOVA to examine whether lack of personal skill, lack of finance, lack of technological and market

information, high cost of innovation and technological innovation are significantly differ between small and medium business scales. Apart from that, this study employed path analysis in structural equation modeling or popularly known as SEM, firstly, to examine whether internal barriers significantly influence technological innovation and secondly, to determine whether external barriers significantly influence technological innovation.

## 4 ANALYSIS AND FINDING

The results for the reliability analysis, normality assessment, MANOVA and path analysis in structural equation modeling for each hypotheses in this study are shown below.

### 4.1 Reliability Analysis

Reliability analysis based on Cronbach's alpha value is used to examine the internal consistency of the questionnaire. Cronbach's alpha value with equal or more than 0.7 is acceptable. Based on TABLE 1, all the Cronbach's alpha values in this study have exceeded 0.7. Thus, it shows all the items in the data used in the study considered reliable.

TABLE 1  
SUMMARY OF RELIABILITY ANALYSIS RESULTS

Section	Number of Items	Cronbach's Alpha
Internal Barriers	10	0.949
External Barriers	14	0.929
Technological Innovativeness	5	0.791

### 4.2 Assessment of Normality

TABLE 2 illustrates the descriptive statistics of the variables internal barriers, external barriers, and technological innovation. Since all measures for the skewness are within the range between -1.0 to 1.0, the study concludes that the distribution of data is almost symmetry or bell-shaped. The bell-shaped distribution indicates the data is normally distributed.

TABLE 2  
DESCRIPTIVE STATISTICS

Items of Internal Barriers	Skewness
(LSP1)	.586
(LSP2)	.425
(LSP3)	.595
(LSP4)	.225
(LSP5)	.546
(LF1)	.532
(LF2)	.149
(LF3)	.557
(LF4)	.525
(LF5)	.509
Items of External Barriers	
(LTM11)	.425
(LTM12)	.759
(LTM13)	.376
(LTM14)	.991
(LTM15)	.364
(LTM16)	.736
(LTM17)	.185
(HCI2)	.752
(HCI3)	-.319
(HCI4)	.398
(HCI5)	.328
(HCI6)	.344
(HCI7)	.431
(HCI8)	.531
Items of Technological innovation	
(IT1)	.073
(IT2)	.382
(IT3)	-.700
(IT4)	.860
(IT5)	.977

## 4.3 MANOVA Results

### 4.3.1 Box's M Test – Assessment of Homogeneity of Covariance across the Groups

The result of Box's M (26.117) as shown in TABLE 3 was not significant (p-value=0.075), indicated that the assumption of homogeneity of covariance across the groups was satisfied

TABLE 3  
BOX'S M STATISTIC

Box's M	F-Statistic	p-value
26.117	1.565	0.075

### 4.3.2 Wilk's Lambda – To examine whether there is Significant Difference in EF, SF, LAF and BP among Three Business Sectors

As shown in TABLE 4, it revealed that there are significant differences between small and medium business scales for at least one of these five factors (lack of personal skill:LSP, lack of finance:LF, lack of technological and market information:LTM, high cost of innovation:HCI and technological innovation:IT).

TABLE 4  
WILK'S LAMBDA STATISTIC

Wilk's Lambda	F-Statistic	p-value
0.960	2.783	0.044

### 4.3.3 Univariate ANOVA – To Examine whether Each of Dependent Variables (LSP, LF, LTM, HCI and IT) Significantly Differ among Three Business Sectors

The univariate ANOVA results shown below implied that there were statistically significant difference in lack of finance (F-statistic=8.830, p-value=0.010), high cost of innovation (F-statistic=5.954, p-value=0.002), and technological innovation (F-statistic=6.487, p-value=0.029) between small and medium business scales.

TABLE 5  
UNIVARIATE ANOVA RESULT

Dependent Variable	F-Statistic	p-value
LSP	2.976	0.342
LF	8.830	0.010
LTM	2.432	0.193
HCI	5.954	0.048
IT	6.487	0.029

Factor: Business Scales (1: Small, 2: Medium)

## 4.4 Measurement Model: Confirmatory Factor Analysis (CFA)

With Confirmatory Factor Analysis (CFA), any item that does not fit into its measurement model should be removed from the model. The assessment for each element is done as follows:

### 4.4.1 Assessment of Unidimensionality

Refer Fig.2, the requirement has been achieved either through the item-deletion process or through setting the “free parameter estimate”. All the factor loading in this study above 0.6.

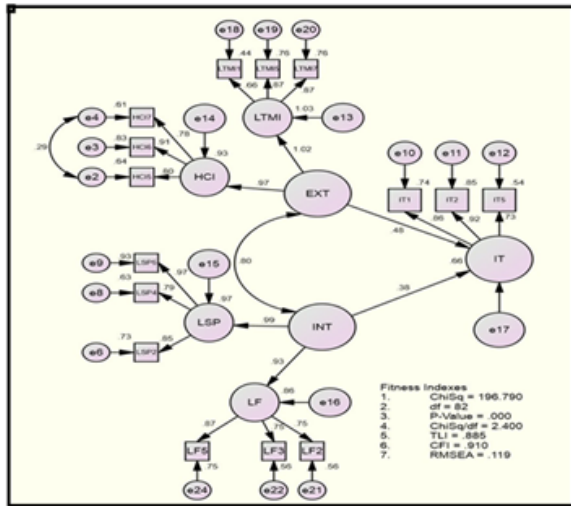


Fig. 2. The Factor Loading for All Items of the Respective Construct

#### 4.4.2 Assessment of Validity

The requirement of validity was achieved through three following processes which are (1) construct validity, refer TABLE 6 shows that all fitness indexes for the models meet the required level; (2) convergent validity, the value of AVE > 0.50 as shown in TABLE 6; and (3) discriminant validity as shown in Fig.2 shows that the redundant items are either deleted or constrained as “free parameter”.

TABLE 6  
THE ASSESSMENT OF FITNESS FOR THE MEASUREMENT MODEL

Name of category	Name of index	Index value	Comments
1. Absolute fit	RMSEA	0.119	The required level is accepted
2. Incremental fit	CFI	0.910	The required level is achieved
3. Parsimonious fit	ChiSq/df	2.400	The required level is achieved

#### 4.4.3 Assessment of Reliability

Refer TABLE 7, the requirement of reliability was achieved through all following processes which are (1) internal reliability shows that cronbach’s alpha greater than 0.7 for all variables; (2) the values of construct reliability (CR) are greater than 0.6 for each construct; and (3) average variance extracted (AVE) also greater than 0.5 for all constructs.

TABLE 7  
THE SUGGESTED CFA RESULTS REPORTING FOR THE MEAS-

UREMENT MODEL

Construct	Item	Factor Loading	Cronbach Alpha	Construct Reliability	Average Variance Extracted
			(Above 0.7)	(Above 0.6)	(Above 0.5)
INT	LSP2	0.85	0.919	0.931	0.695
	LSP4	0.79			
	LSP5	0.97			
	LF2	0.75			
	LF3	0.75			
	LF5	0.87			
EXT	LTM11	0.66	0.922	0.924	0.671
	LTM15	0.87			
	LTM17	0.87			
	HCI5	0.80			
	HCI6	0.91			
	HCI7	0.78			
IT	IT1	0.86	0.864	0.877	0.706
	IT2	0.92			
	IT5	0.73			

#### 4.4.4 Squared Multiple Correlation

Based on TABLE 8, the value of  $R^2$  is 0.66, which indicate the contribution of construct internal barriers (INT) and construct external barriers (EXT) in estimating technological innovation (IT) is 66%.

TABLE 8  
THE SQUARED MULTIPLE CORRELATIONS

Variable	Estimate ( $R^2$ )
IT	.660

#### 4.5 Structural Equation Modeling (SEM)

Based on TABLE 9, the actual beta explained when external barriers (EXT) goes up by 1, technological innovativeness (IT) goes up by 0.865. Since the P-value is lower than 0.05, the above research is supported. The study concludes that external barriers has a significant and direct effect on the low technological innovativeness of SMEs ( $z = 3.097$ ,  $p$ -value = 0.002). Then, actual beta explained when internal barriers (INT) goes up by 1, technological innovativeness (IT) goes up by 0.282. The result revealed that internal barriers has a significant and direct effect on the low technological innovativeness of SMEs ( $z = 2.483$ ,  $p$ -value = 0.013).

TABLE 9  
THE REGRESSION WEIGHTS FOR INT AND EXT IN PREDICTING IT

Variable	Path	Variable	The actual beta values	Standard Error	Critical Ratio	P-value
IT	<---	EXT	.860	.279	3.097	.002
IT	<---	INT	.280	.114	2.483	.013



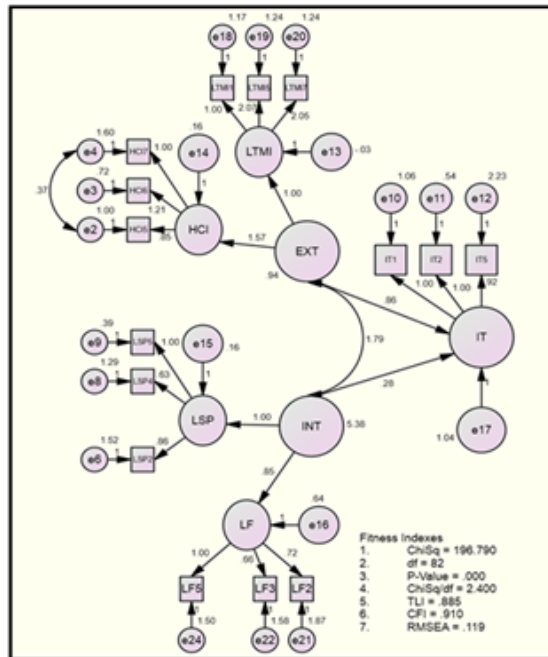


Fig. 3. The Unstandardized Regression Weight (Measures of Beta Estimate in its Actual Unit)

## 5 DISCUSSION

The summary of the findings for this study are shown in TABLE 10. As mentioned earlier the main purpose of this study is to investigate the factors obstacle SMEs engagement on technological innovation for enterprises in terms of internal and external barriers which are lack of skill personnel and lack of finance are variables under internal barriers while high cost of innovation and lack of technology and market information variables under external barriers. In order to achieve this purpose, there are two main hypotheses being proposed in this study. Then, path analysis in structural equation modeling was carried out to test all the hypotheses in this study. The results revealed that, both hypotheses were supported. Since both hypotheses are statistically significant, it implied that there were internal and external barriers on technological innovation faced by SMEs in Kelantan.

TABLE 10  
SUMMARY FINDINGS IN THE STUDY

The Main Hypothesis Statement in the Study	Result
H <sub>1</sub> : Internal barriers has a significant and direct effect on the low technological innovativeness of SMEs.	Supported
H <sub>2</sub> : External barriers has a significant and direct effect on the low technological innovativeness of SMEs.	Supported

## 6 CONCLUSION AND RECOMMENDATION

According to the findings of this research, the first hypothesis is whether the internal barriers has a significant and direct effect on the low technological innovativeness of SMEs or not is supported. Meaning that, lack of skill personnel and lack of

finance are the most obstacles commonly faced by enterprises along their innovative activities. Next, for the second hypothesis is whether the external barriers has a significant and direct effect on the low technological innovativeness of SMEs or not is also supported. Therefore, lack of technological and market innovation and high cost of innovation influenced the entrepreneurs to practice or operate the innovative activities for their enterprises in order to produce good and high quality products to attract many customers.

As the conclusion above, it is important to solve the obstacles that faced by the entrepreneurs to practice the innovative activities for their enterprises. Firstly, government should help and support the entrepreneurs by using Ministry of International Trade and Industry (MITI) as a mediator to communicate with entrepreneurs personally. Besides, MITI also have seven agencies that will able to monitor the entrepreneurs to operate their enterprises from the first stage until international level. Agencies under MITI provide more services likes funds to invest in business, advisory services, business workshops, grant and so on.

Other than that, there are many other agencies that could provide information and exposure about the latest innovations such as Majlis Amanah Rakyat (MARA), Malaysian Agricultural Research and Development Institute (MARDI), Dewan Usahawan Industri Desa Malaysia (DUID) and others.

Lastly, as already informed, there are several universities and institutes do the research and design of highly innovative range of equipment equivalent with the international level of achievement. Therefore, the entrepreneurs must seize this opportunity to enhance the enterprise to collaborate with students.

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