

THE RELATIONSHIP BETWEEN EXTERNAL KNOWLEDGE AND PRODUCT INNOVATION OF MANUFACTURING FIRMS IN THAILAND

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ในอุตสาหกรรมการผลิตในประเทศไทย

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Abstract

An external source of new technologies and information is an important factor for developing existing product to create added value and a new product development. This paper examines the relationship between the external source of new technologies and information (i.e. local customers (LC), local suppliers (LS), multinational companies (MNCs), and joint ventures (JVs), and universities) and product innovation. Data collection through questionnaire surveys during 2011-2015. A total of 1,516 valid datasets from manufacturing firms. The collected data were analyzed using logistic regression. The results show that manufacturing firms are more likely to introduce a new product by packaging redesign and appearance redesign of exiting products when they use new technologies and information from LC and customers from MNCs/JVs located in Thailand. Moreover, they are more likely to develop a new product by using new technologies and information from LC, LS, customers from MNCs/JVs located in Thailand, and MNCs/JVs supplier located in a foreign country.

Keywords: External knowledge, Product innovation, Supply chain collaboration

บทคัดย่อ

ความรู้ภายนอกองค์กรเกี่ยวกับเทคโนโลยีและข้อมูลใหม่เป็นปัจจัยสำคัญต่อการพัฒนาผลิตภัณฑ์เดิมและสร้างมูลค่าเพิ่มในการพัฒนาผลิตภัณฑ์ใหม่ บทความวิจัยฉบับนี้ศึกษาความสัมพันธ์ระหว่างความรู้จากภายนอกองค์กรเกี่ยวกับเทคโนโลยีและข้อมูลใหม่ (จากลูกค้าและซัพพลายเออร์ทั้งในประเทศ และจากบริษัทข้ามชาติที่อยู่ในหรือต่างประเทศ และสถาบันการศึกษา) และนวัตกรรมผลิตภัณฑ์ในอุตสาหกรรมไทย งานวิจัยใช้ข้อมูลจากการจัดเก็บแบบสอบถามระหว่างปี 2554-2558 ซึ่งมีจำนวนข้อมูลทั้งหมด 1,516 ชุด ข้อมูลถูกวิเคราะห์โดยใช้เทคนิคการวิเคราะห์การถดถอยโลจิสติกส์ (Logistic Regression) ผลการวิเคราะห์พบว่า บริษัทมีแนวโน้มอย่างสูงในการแนะนำสินค้าใหม่โดยการปรับเปลี่ยนบรรจุภัณฑ์ หรือการปรับเปลี่ยนการออกแบบรูปแบบสินค้าที่มีอยู่ เมื่อใช้ความรู้เกี่ยวกับเทคโนโลยีและข้อมูลใหม่จากลูกค้าในประเทศและลูกค้าจากบริษัทข้ามชาติหรือบริษัทร่วมกับต่างชาติที่ตั้งอยู่ในประเทศไทย นอกจากนี้งานวิจัยยังพบว่า บริษัทมีแนวโน้มอย่างสูงที่จะสามารถผลิตสินค้าใหม่ เมื่อใช้ความรู้ภายนอกองค์กรจากลูกค้าและซัพพลายเออร์ในประเทศ ลูกค้าจากบริษัทข้ามชาติหรือบริษัทร่วมกับต่างชาติที่ตั้งอยู่ในประเทศไทย และซัพพลายเออร์จากบริษัทข้ามชาติหรือบริษัทร่วมกับต่างชาติที่ตั้งอยู่ต่างประเทศ

คำสำคัญ: ความรู้จากภายนอกองค์กร นวัตกรรมผลิตภัณฑ์ ความร่วมมือในห่วงโซ่อุปทาน

Introduction

In globalization era, organizations need to be responsive and adaptive to internal and external change. It requires several factors and skills in order to enhance its competitive advantages and organizational performances and lead to sustainable growth. As the innovation paradigm has changed from being discovery-based to being centrally learning-based (Lundvall, et al., 2002), firms have to adapt and emerge the way in which knowledge processes within firms and between partners. Innovation has played an important role as a critical factor that enhances organizational performances and is one of a business's key enabler of long-term success and improve business competitiveness (Ahuja, Lampert & Tandon, 2008; Baker & Sinkula, 2002; Balkin, Markman & Gomez-Mejia, 2000). In term of business, innovation includes the introduction of new technological products and

new organizational processes (Mol & Birkinshaw, 2009).

External knowledge is important for firms to create innovation and improve the production system. Firms' innovation model comes from the coordination and cooperation among their external business partners such as suppliers and customers (Boudreau & Lakhani, 2009). A degree of diversity of external networks affects the innovation and performance of a firm (Laursen & Salter, 2006). Knowledge is a crucial asset for both individual and organizations. Therefore, firms need to assess existing knowledge and integrate with external knowledge in order to create new ideas and opportunities. External knowledge sources are widely available such as customer, suppliers, business partner even competitors. If firms have the ability to target, capture, absorb and utilize the external knowledge efficiently, they can improve product quality,

create product innovation, and gain competitive advantages.

This paper aims to investigate the relationship between the different type of external knowledge source (LC, LS, MNCs/JVs, and university) and product innovation using the logistic regression analysis.

Literature Review

Many organizations use innovation as a key strategy to enhance business performances and to achieve competitive advantages over rivals. Innovation allows firms to discover new opportunities for both product development and process improvement which lead to market opportunities. Research on innovation has become more popular. Adler & Shenhar (1990) defined innovation as: (1) the ability to develop products to meet the needs of market, (2) the ability to use existing technology to develop products, (3) the ability to develop new products or update existing products to meet the needs of markets, and (4) the ability to acquire new technology to create new opportunities. Product innovation involves improvement in existing products or introduction of new features/products/services to meet customer needs (Damanpour, Walker & Avellaneda, 2009). The improvement or addition of new features to products requires technical knowledge that is tangible and discrete (Mol & Birkinshaw, 2009). Moreover, product innovation changes what a firm can offer to its customers and the outside world (Forés & Camisón, 2016). The introduction of new products have an immediate impact

on market sales, and hence the potential to change the distribution of market share among competing companies (Damanpour, Walker & Avellaneda, 2009).

Knowledge is derived and absorbed from both internal and external sources. For internal knowledge sources, it includes the experience and knowledge that already possessed by an organization. External knowledge source refers to acquisitions, licensing, purchases, collaboration, cooperation, employment, adoption, an inter-organizational relationship such as research and development and joint venture, and so on (Tseng, 2012). External knowledge relations are important and can be complement with internal knowledge (Teirlinck & Spithoven, 2008). The organization needs to continue improving utilizing internal knowledge and acquiring external knowledge to gain competitive advantages and enhance organizational performance. A firm can develop knowledge by itself or develop together with external sources (Leonard-Barton, 1995). Cockburn & Henderson (1998) state that firms must develop the ability to identify the value of external knowledge, absorb and transform it into their knowledge according to employee's experience, value, and cultures.

Knowledge can be created from the interaction among customers, suppliers, and company (Nonaka & Toyama, 2003). Previous studies have focused on the impact of different sources of knowledge on innovation (e.g. Machikita et al., 2010; Tseng, 2009). Tseng (2009) developed a conceptual framework to explore how an enterprise obtains three different types of

external knowledge, which are customer, supplier and competitor knowledge. The findings show that enterprises apply internal knowledge chain activities to gain customer, supplier, and competitor knowledge, then transform this to enhance enterprise competitiveness. Machikita et al. (2010) examine the effect of internal and external sources of knowledge on the introduction of new products based on new technologies or information using binary probit model. The results show that local firms achieved new product innovation by using a local source of knowledge, however, foreign-owned firms rely mainly on internal R&D and cooperate with local universities. Laursen & Salter (2006) argue that suppliers and customers are the most important external sources of knowledge inputs for innovations. Brettel & Cleven (2011) indicate that the use of external knowledge in the new product development process can enhance firm's competitiveness through innovation performance. Granero & Vega-Jurado (2012) concluded that suppliers are considered as the main driver of the development of new or improved products. In contrast, universities and research institutes do not have a direct effect on innovation. Since there are conflicting research results of the relationship of different types of external sources on product innovation, therefore this paper investigates the relationship between the external source of new technologies and information (local customers (LC), local suppliers (LS), multinational companies (MNCs), and joint ventures (JVs), and universities) and product

innovation of manufacturing firms in Thailand.

From a review of the literature, this paper focuses on two perspectives of product innovation, which are the introduction of a new product by packaging redesign and appearance redesign of exiting products and the new product development. The external source is classified into nine sources namely, local customers, local suppliers, MNCs/JVs customers located in Thailand, MNCs/JVs suppliers located in Thailand, MNCs/JVs customers located in a foreign country, MNCs/JVs suppliers located in a foreign country, universities, and local business. We propose the following hypotheses.

Hypothesis 1: The introduction of a new product by packaging redesign and appearance redesign of exiting products is more likely to occur if a firm uses technology and information from external knowledge sources (local customers, local suppliers, MNCs/JVs customers located in Thailand, MNCs/JVs suppliers located in Thailand, MNCs/JVs customers located in a foreign country, MNCs/JVs suppliers located in a foreign country, universities).

Hypothesis 2: The new product development is more likely to occur if a firm uses technology and information from external knowledge sources (local customers, local suppliers, MNCs/JVs customers located in Thailand, MNCs/JVs suppliers located in Thailand, MNCs/JVs customers located in a foreign country, MNCs/JVs suppliers located in a foreign country, universities).

Methodology

1. Sample and Data Collection

The questionnaire surveys were constructed and distributed to Thai manufacturing firms located in Thailand by mail, email, direct interview, and phone interview during 2011-2015. The questionnaire survey contained 5 parts. First part was the question about the firm characteristics and organizational performance. Second part included questions relating to the achievements in product innovation. Third part was the questions relating to the result of the internal knowledge sharing and organizational learning. Forth part was the results of the external sources of information sharing. Last part was the business linkage with main customer and supplier.

A representative sample of 3,000 companies was sent the questionnaire. There are 1,516 valid questionnaires, representing a response of 50.5 percent. The dataset were analyzed by descriptive statistical and logistics regression analysis.

A summary of firm characteristics is shown in Table 1. It shows the basic information of responding firms. For example, approximately 82.3% are local firms, 8.2% are MNCs, and 9.5% are JVs. For the establishment, most of the respondents are factory (84.1%) and headquarters (36.6%). Most firms have less than 50 employees (42.6%).

Table 1 Descriptive statistics of the respondents.

Variable	Freq.	%
Capital structure		
100% Locally-owned	1,247	82.3
100% Foreign-owned (MNCs)	125	8.2
Joint-Venture (JVs)	144	9.5
Total	1,516	100.0
Type of establishment		
Headquarters/Main office	555	36.6
Regional Headquarters	49	3.2
Factory/Plant	729	48.1
Branch Office/Sales Office	166	10.9
No response	17	1.1
Total	1,516	100.0
Number of full-time employees (Persons)		
< 50	646	42.6
50 - 200	405	26.7
> 2000	435	28.7
No response	30	2.0
Total	1,516	100.0
Type of Manufacturing		
Food	152	10.0
Textiles, Apparel, footwear	133	8.8
Wood products	97	6.4
Paper products	65	4.3
Chemicals products	33	2.2
Plastic, rubber products	74	4.9
Non-metallic products	23	1.5
Iron, steel	63	4.2
Non-ferrous metals	20	1.3
Metal products	79	5.2

Table 1 Descriptive statistics of the respondents.
(cont.)

Variable	Freq.	%
Machinery, equipment	84	5.5
Computers	35	2.3
Electronics	105	6.9
Automobile, auto parts	156	10.3
Transportation equipment	21	1.4
Other	356	23.5
No response	17	1.1
Total	1,516	100.0

2. Measurement Scale

The dependent variables are two types of product innovation, the introduction of a new product by packaging redesign of existing products (hereafter NPR) and the new product development (hereafter NPD). The dichotomous questions are used to measure the achievement of product innovation (0 = Not achieved and 1= Achieved). The independent variables are the seven types of external source, which are local customers (LC), local suppliers (LS), MNCs/JVs customers located in Thailand (CMJT), MNCs/JVs suppliers located in Thailand (SMJT), MNCs/JVs customers located in a foreign country (CMJF), MNCs/JVs suppliers located in a foreign country (SMJF), and universities (UNI).

Results and Discussions

The summary statistic of dependent variables is shown in Table 2. It shows two main product innovations: (1) introduction of a new product by packaging redesign and appearance redesign

of exiting products and (2) new product development. An approximately 61% of the sample firms are able to introduce a new product by packaging redesign and appearance redesign of exiting products and about 71% of the firms developed a new product.

Table 2 Statistics of Product Innovation

Product innovation	Mean	S.D.	Min	Max
New product by packaging redesign (NPR)	0.61	0.49	0	1
New product development (NPD)	0.74	0.44	0	1

Table 3 shows the summary statistics of external sources of new technologies and information. Based on the mean of each external sources, the respondents agree that external sources are important for product innovation.

Table 3 Statistics of External Sources

External sources	Mean	S.D.	Min	Max
LC	3.92	1.06	0	1
LS	3.74	1.03	0	1
CMJT	3.35	1.30	0	1
SMJT	3.29	1.25	0	1
CMJF	3.31	1.27	0	1
SMJF	3.27	1.22	0	1
UNI	3.01	1.18	0	1

3. Hypothesis 1 Testing

A logistic regression was performed to ascertain the effects of each type of external source on the likelihood that the respondents achieve the introduction of a new product by packaging redesign and appearance redesign of exiting products. Table 4 shows that the model mostly predicts “achieved” because more respondents achieved this type of product innovation (1,118 compared to 385 according to the achieved column). The overall percentage in classification table indicates that this approach to prediction is 74.3 percent of the time.

Table 4 Classification Table of NPR

Observed	Predicted		
	NPR		Percentage Correct
	Not achieved	Achieved	
Not achieved	8	385	2.0
Achieved	5	1118	99.6
Overall Percentage			74.3

Table 5 shows the variables in the equation that indicates the contribution of each external source to the model and its statistical significance. The fitted model is:

$$\text{Probability (Achieved NPR=1)} = 0.947 + 0.322\text{LC} - 0.142\text{LS} - 0.313\text{CMJT} + 0.045\text{SMJT} + 0.076\text{CMJF} + 0.096\text{SMJF} - 0.087\text{UNI}. \quad (1)$$

The findings show that local customers (LC, $p = .000$) and MNCs/JVs customers located in Thailand (CMJT, $p = .000$) added significantly to the introduction of a new product by packaging redesign and appearance redesign of exiting products. The results indicate that the probability of successfully introducing a new product by packaging redesign and appearance redesign of exiting products (“achieved” category) is 1.380 times greater for using technology and information from local customers as opposed to not using it. Moreover, the probability of successfully introducing a new product by packaging redesign and appearance redesign of exiting products (“achieved” category) is 0.731 times greater for using technology and information from MNCs/JVs customers located in Thailand as opposed to not using it. However, the others external sources do not add significantly to the model.

Table 5 Logistic Regression of Hypothesis 1 with NPR as Dependent Variable

Hypothesis 1	β	S.E.	Wald	df	P value	Exp (β)
LC	0.322 ^{***}	0.070	21.418	1	0.000	1.380
LS	-0.142	0.076	3.459	1	0.063	0.868
CMJT	0.313 ^{***}	0.088	12.588	1	0.000	0.731
SMJT	0.045	0.096	0.221	1	0.638	1.046
CMJF	0.076	0.098	0.608	1	0.436	1.079
SMJF	0.096	0.095	1.034	1	0.309	1.101
UNI	-0.087	0.061	2.031	1	0.154	0.917
Constant	0.947 ^{***}	0.265	12.751	1	0.000	2.577

Note: ^{***} $p < 0.001$, ^{**} $p < 0.01$, ^{*} $p < 0.005$

4. Hypothesis 2 Testing

For the external source on the likelihood that the respondents achieve the new product development, Table 6 shows that the model always predicts “achieved” because most of the respondents achieved this type of product innovation (874 compared to 506 according to the achieved column).

The overall percentage in classification table indicates that this approach to prediction is 62.9 percent of the time.

Table 6 Classification Table of NPD

Observed	Predicted		
	NPD		Percentage Correct
	Not achieved	Achieved	
Not achieved	79	506	13.5
Achieved	57	874	93.9
Overall Percentage			62.9

Table 7 shows the variables in the equation that indicates the contribution of each external source to the model and its statistical significance. The fitted model is:

$$\text{Probability (Achieved NPD=1)} = 0.177 + 0.274\text{LC} + 0.158\text{LS} + 0.293\text{CMJT} + 0.123\text{SMJT} + 0.006\text{CMJF} + 0.219\text{SMJF} + 0.004\text{UNI}. \quad (2)$$

The findings show that local customers (LC, $p = .000$), local suppliers (LS, $p = .020$) and MNCs/JVs customers located in Thailand (CMJT, $p = .000$), and MNCs/JVs suppliers located in a foreign country (SMJF, $p = .010$) added significantly to the new product development. The results indicate that the probability of achieved new product development (“achieved” category) is 1.315 times greater for using technology and information from local customers as opposed to not using it. The probability of achieved new product development is 0.854 times for using technology and information from local suppliers as opposed to not using it. The probability of achieved new product development is 0.746 times

for using technology and information from MNCs/JVs customers located in Thailand as opposed to not using it. Moreover, the probability of achieved new product development is 1.245 times greater for using technology and

information from MNCs/JVs suppliers located in a foreign country as opposed to not using it. However, the others external sources do not add significantly to the model.

Table 7 Logistic Regression of Hypothesis 2 with NPD as Dependent Variable

Hypothesis 2	β	S.E.	Wald	df	P value	Exp (β)
LC	0.274 ^{***}	0.063	18.829	1	0.000	1.315
LS	0.158 [*]	0.068	5.404	1	0.020	.854
CMJT	0.293 ^{***}	0.081	13.032	1	0.000	.746
SMJT	0.123	0.087	1.989	1	0.158	1.131
CMJF	0.006	0.087	0.004	1	0.949	1.006
SMJF	0.219 ^{**}	0.085	6.667	1	0.010	1.245
UNI	0.004	0.054	0.007	1	0.935	1.004
Constant	0.177	0.240	0.547	1	0.460	.838

Note: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.005$

The results from Hypothesis 1 and 2 are compared in Table 8. The findings show that local customers and customers from a multinational companies or joint ventures (MNCs/JVs) located in Thailand have contribute to both types of product innovation; the achievement of the introduction of a new product by packaging redesign and appearance redesign of exiting products. Since, customers play important role in product design improvement because they can provide feedback about what needed to be redesigned or improve to attract more

customers.

For new product development, firms who use information and technology from local suppliers and suppliers from a MNCs/JVs located in foreign countries are more like to achieve the new product development. It shows that suppliers also play key role of a new product development because they facilitate or provide new machine or technology of the firms. They provide the ideas of new design and coordinate in the process of production.

Table 8 The comparison of NPR and NPD with logistic regression.

External Source	NPR	NPD
LC	0.322 ^{***} (0.070)	0.274 ^{***} (0.063)
LS	-0.142 (0.076)	0.158 [*] (0.068)
CMJT	0.313 ^{***} (0.088)	0.293 ^{***} (0.081)
SMJT	0.045 (0.096)	0.123 (0.087)
CMJF	0.076 (0.098)	0.006 (0.087)
SMJF	0.096 (0.095)	0.219 ^{**} (0.085)
UNI	-0.087 (0.061)	0.004 (0.054)

Note: ^{***} $p < 0.001$, ^{**} $p < 0.01$, ^{*} $p < 0.005$

Conclusion

This paper examined the relationship between external sources of new technology and information in Thai manufacturing firms with 1,516 sample. The results of logistics regression showed that firms using a new source of technologies and information from local customers and from customers from a MNCs/JVs located in Thailand are more likely to introduce a new product by packaging redesign and appearance redesign of exiting products. The findings indicated that new technology and information from local and MNCs/JVs customers

in Thailand are useful and help firms to improve the design and appearance of their product. They provide feedback and valuable information of the application of product after they used it. They can detect defect or pitfalls of the product and notify firms to improve it.

For new product development, firms are more likely to develop a new product by using new source of technologies and information from local customers, local suppliers, customers from MNCs/JVs located in Thailand, and MNCs/JVs supplier located in a foreign country. The findings show that using new technologies and information from universities do not add probability in achieving the introduction of a new product nor a new product development.

Moreover, the findings also indicated that besides new technologies and information from local and MNCs/JVs customers in Thailand, local suppliers and MNCs/JVs suppliers in a foreign country also contribute to the probability of a new product development. Suppliers provide insight about how to improve production process with new technologies that they have. They can provide high quality and a new specification of input that allow firms to successfully develop a new product. Foreign suppliers also transfer technical knowledge and high technology to firms for further development.

This paper contributes to the literature by providing strong evidence to support an important of knowledge from customers and suppliers. Firms who build a strong collaboration with customers and suppliers can exploit in-depth technological capabilities, knowledge, feedback,

and valuable information from them. New technologies and information from both local and foreign customers and suppliers provide new ideas and insight for firms to improve an existing product, which can lead to a new product development.

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