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The Effect of Technological Capability on the Performance of SMEs in Thailand

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Abstract

Technological capability (TC) is widely known as a strategic source of growth and wealth at the national and the firm levels. Empirical studies highlight the role of imported technologies acquired by developing countries as a crucial element in their ability to catch up. These studies emphasized on the industry and country phenomena, whereas the distinctive TC at firm-level phenomena has not been much stressed. In particular, the analysis of the relationship between firm-level TC and export performance of emerging market countries small and medium-sized enterprises (SMEs) would be very helpful in understanding their growth. This study contributes to the literature by yielding further insights into the impact of TC of SMEs on their export performance. The results show that entrepreneurial orientation (EO) and absorptive capability (AC) have significant impact on TC at the level of technological operating and technological upgrading. Only AC is related to TC at technological acquiring level. In addition, different levels of TC are significantly related to export intensity and export growth. These findings suggest that innovative processes and product innovation could entail the success of SMEs in international markets. Thus, SMEs in developing countries need to accumulate technological knowledge acquired from internal and external sources and to develop distinctive level of technologies in order to improve their performance in the global economy.

Keywords: *Technological capability, Entrepreneurial orientation, export performance, SMEs, Plastic Industry, Thailand*

1. Introduction

Technological capability (TC) is widely known as a strategic source of growth and wealth at the national and the firm levels (Monopoloulos et al, 2009). The employment of technology demands considerable effort, devoted to learning the new technology and developing the capability, for efficient development of industry. In this context, since the 1980s, TC has become the main focus of conceptualizing technology study (Rosenberg, 1976; Bell and Pavitt, 1993). It is the decisive factor in developing competitive positions, competitive strengths, and sustained growths (Ngoc Ca, 1999). The firm level TC has been regarded as an important strategic

resource, enabling firms to achieve competitive advantage within their industry. Those firms with superior TC can secure greater efficiency gains by pioneering process innovations and can achieve higher differentiation by innovating products in response to the changing market environment (Tsai, 2004).

The development of TC by small and medium-sized enterprises (SMEs) is crucial for them to overcome the fast-changing and fiercely competitive global markets. However, only a small numbers of SMEs in emerging economies are well equipped to develop necessary TCs (Caniels and Romijn, 2003) and the understanding of TC development is still inadequate (Archibugi and Coco, 2004). Several studies e.g. Rosenberg (1976); Kim (1997) pay attention to the development of TC in emerging economies, nevertheless, most of those studies accentuated the industry and country phenomena, where the firm-level phenomena have not been much emphasized (Caniels and Romijn, 2003). Additionally, in spite of the fact that empirical studies e.g. Lall (1992), and Bell and Pavitt (1993) identified distinct levels of technological capability, they are not yet empirically tested on site. Moreover, Guifu and Hongjia (2009) concerned with the improvement of the firms' performances on the basis of accumulative technological capability proposed that a broader scope in different industries and in different countries is required. Lastly, researches on the relationship between TC of emerging market countries SMEs and their export performance are required to generate better understanding (Tsai, 2004).

Thailand is ranked the 6th developing country exporter by World Bank. As much as 99% of the enterprises in Thailand are SMEs (OSMEP 2010). SMEs in Thailand provide three fourth of the available countrywide labor force and generate 40% of total GDP. They are dominant players in some of Thailand's major export sectors namely Apparel, Agricultural, Jewelry, Plastic among others. Plastic industry is the only technological intensive sector in which SMEs are responsible for nearly 50% of export turnover. There are three main reasons that plastic industry is in the focus of this study. Firstly, it has kept consistently expanding in the past four years. Secondly, it is listed in the top 15 exporting industries in Thailand since 1993. Lastly, only the firms in technology-intensive industry are more likely to have a chance to improve their TC and performance (Dunphy and Stace, 1988). Therefore, this study attempts to examine: the impact of TC on export performance of SMEs in Thailand using the Plastic Industry as the main subject.

2. Literature and Hypotheses

2.1 Entrepreneurial Orientation, absorptive capability and Technological Capability

Entrepreneurial orientation (EO), in this study, is based on Miller (1983) which is most widely accepted from the firm-level perspective because it has been used and tested in many studies. He characterized EO as consisting of three elements: innovation, proactiveness, and risk taking. Innovation supports creativity and experimentation in new product development and in technology adoption which lead to the technological capability development (Lumpkin and Dess, 1996). Proactiveness refers to an organizational process aimed at pursuing entrepreneurial opportunities. Proactiveness needs high level of TC in order to continuously develop and to first introduce new products and services to the market (Stevenson and Jarillo, 1990). Risk taking pursuits the firm to commit an extent of its resources to the new projects (Miller, 1983), and then supports the firm itself to develop better level of TC. Baker and Sinkula (2009) insisted that firms

with strong EO presumably develop utterly new product concepts in responding to latent customer needs.

Absorptive capability is defined as the ability to assimilate, use, adapt and change existing technologies, as well as the ability to create new technologies, and to develop new products and processes in response to a changing economic environment (Kim, 1995). It enables firms to gain and to sustain a competitive advantage, and has become one of the most significant constructs in the last twenty years. AC allows a firm to use knowledge from the external sources through four sequential elements: acquisition, assimilation, transformation, and application capabilities (Camisón and Forés, 2010). *Acquisition capability* is referred as the recognition and understanding of new potentially valuable external knowledge through exploratory learning (Zahra and George, 2002). *Assimilation capability* is defined as the processes and routines that assimilate new knowledge through transformative learning (Camisón and Forés, 2010). *Transformation capability* is a firm's capability to create new knowledge and commercial outputs through exploitative learning (Kogut and Zander, 1992). *Application capability* enables firms to incorporate transformative knowledge into their operations and routines and to create leverage for new operations, competences, routines, goods and organizational forms (Zahra and George, 2002; Camisón and Forés, 2010). Thus:

Hypothesis 1: SMEs need to develop entrepreneurial orientation and absorptive capability in order to gain technological capability.

2.2 Technological Capability and Export Performance

In this study, TC is the ability to make effective use of technological knowledge in order to assimilate, use, adapt and change existing technologies as well as the ability to create new technologies and to develop new products and processes in response to the changing economic environment to the advantage of the SMEs in question (Kim, 1997). It is one of the critical success factors for firms in emerging economies. It allows firms to reduce cost, to increase efficiency, to develop new knowledge and technology rapidly, to reconfigure foster firm international structure, and to upgrade its products and processes (Caniels and Romijn, 2003).

Guifu and Hongfu (2009) have classified firm-level TC into three distinctive levels: TAC – technological acquiring capability, TOC – technological operating capability, and TUC – technological upgrading capability. TAC ascribes to capabilities to acquire new knowledge through formal, informal, internal and external channels. In general, they form their own TC by gradually absorbing, digesting and improving this knowledge. TOC refers to capabilities to operate, use and sustain production equipments and facilities. Accompanying with the TC promotion, firms shorten the gaps with other leading companies when they continuously introduce more advanced product and process innovation. TUC concerns capabilities which improve greatly on products and processes depending on firm's own strength and on changing market demands. The upgrading results will allow the firms to reach higher TC level.

This paper hypothesizes the relationship between each level of TC and three export performance measures: export Intensity; export Growth; and export Diversity. *Export Intensity* has been suggested as an effective measure for export performance in many of the past studies (Aaby and Slater, 1989; Iyer, 2010). Several scholars confirmed the positive relationship between TC and

export intensity, however, most of them are emphasized on large firms or SMEs in developed countries. The relationship between TC and export intensity is still in doubt. *Export growth* is one of the most commonly used dimensions to measure export performance and is viewed as an important dynamic measure of export performance (Aaby and Slater, 1989). Kongmanila and Takahashi (2009) have suggested that innovative firms tend to have higher export growth. *Export diversity* is measured by the number of export markets. It has been observed that small firms with higher TC are most likely to accelerate their international expansion (Karadeniz and Göçer, 2007). As a result:

Hypothesis 2: Each level of technological capability is positively related to export performance of SMEs

3. Methodology

3.1 Operational Definition

Entrepreneurial Orientation**,** in this study, is adapted from that developed by Covin and Slevin (1989) and Ripollés-Meliá et al (2007). This scale has been used by several researchers in various research settings which presented high levels of reliability and validity in the results. The seven-Likert scale is used for the interviewees to evaluate their own firms to the extent do the measure items apply to the firms regarding to the abilities of the competitors from "totally disagree" (1) to "totally agree" (7).

Absorptive Capability is measured by self-evaluation seven-Likert scale, which reflects managers' perception of the strength of their firm's capabilities. This scale has precedents in the distinctive competencies literature (e.g. Camisón, 2005; Camisón and Forés, 2010). The scale ranges from (1) which is "totally disagree" to (7) which is "totally agree".

Technological Capability, in this study, follows the suggestion of Guifu and Hongfu (2009) classifying TC into three distinctive levels: TAC, TOC, and TUC. Indicators have been designed to capture the firm's position comparing to its competitors' over last five years. Seven-Likert scale is applied to evaluate all measure items ranging from "totally disagree" (1) to "totally agree" (7).

Export Performance has been measured by export intensity, export growth, and export diversity. Export intensity is the ratio of export sales to total sales (Iyer, 2010). Export growth is the percent change of growth rate (Cooper and Kleinschmidt, 1985). Export diversity is measured by the number of international markets (Tihanyi et al, 2009).

3.2 Sample

Personal and telephone interview survey was conducted in order to obtain information from the sampling group using questionnaire as the tool. The questionnaire was prepared in English and then translated into Thai following the back-translation process for accuracy. The measures used in the model mostly derived from previous empirical study and adopted for this study. The interviews were conducted in Thailand, mainly in Bangkok and its outskirt, during August 2010 - February 2011. The targets were selected from the list of company in Plastic Industry in Thailand providing by the Petroleum Institution of Thailand. Only the companies with labor force less than

200 people and fixed assets capital less than 200 million baht are the target. The respondents were contacted for their willingness to participate in either personal or telephone interview. Only 105 companies were selected for participation.

A total of 105 SMEs in plastic industry in Thailand, who export, have been interviewed for this research. Most of the samples are located in Bangkok and its surrounded areas. The respondents are mainly the CEOs or the owners whereas the rest are the managers in related functions who were assigned by the CEOs. Out of the sample, 43 of the sample are small firms while 62 are medium sized. The average capital is 21.38 million Baht. The average number of employees is 83.65, among this; the average number of engineers is only 2.36. From the 105 SMEs, 89 firms export their products to their neighboring countries, whereas there are 34 firms exporting to Japan, 33 to China, 23 to India, 20 to USA, and 17 to Europe. Only 44 from the 105 SMEs could identify their R&D expenditure from their total expense. The average percentage of R&D to total sales is 5.42%.

3.3 Analysis

Descriptive analysis such as mean, mode, standard deviation, and cross tab is applied to describe the sample group and for better understanding of the variables. Multiple regressions are used to examine the relationship between EO and AC to TC. Bootstrapping technique is applied into multiple regression in order to create more accuracy for datasets which do not meet basic assumption of multiple regression (Hesterberg et al, 2003). Later, multivariate multiple regression analysis is being used to investigate the relationship between different levels of TC and export performance with PAST version 2.17 (Hammer et al, 2001).

4. Results

Cronbach's alpha, mean and standard deviation for EO, AC, TC and export performance are shown in Table 1. On average, the SMEs in Plastic Industry agreed that they have higher level of EO than their competitors in terms of innovation and proactiveness. However, they did not view themselves as risk takers. They also somewhat agreed that they have higher level of AC and TC than their competitors. The Cronbach's alpha coefficient for EO, AC, TAC, TOC and TUC are 0.862, 0.945, 0.902, 0.873, and 0.903 respectively, suggesting that the measure items for each variable have relatively high internal consistency. From 2005-2009, the average export intensity is 28.68%, average export growth is 7.62% and average export diversity is 5 countries per SME.

Hypothesis 1: table 2 presents the results of multiple regression analysis with bootstrapping technique between EO, AC and all three levels of TC. The statistical data shows that EO and AC have significant relationship with TC at the firm level. However, EO is not significantly related to TAC and its relationship with TOC and TUC has significant level only at 0.10.

The results of multiple regression analyses between EO + AC and TC presents F-value = 104.65 and sig. = 0.00 which means that there is significant relationships between EO + AC and TC at the 95% confidential level. As shown in table 2, the R^2 value is 0.66 referring that EO and AC together has the power to explain firm-level TC at 66%. In addition, the multiple regression analysis between EO and TAC exhibit F-value = 124.59 and sig. = 0.00 with R^2 = 0.70. That result of EO and TOC present F-value = 47.07 and sig. = 0.00 with R^2 = 0.47 and that of EO and TUC illustrate F-value = 55.26 and sig. = 0.00 with the highest R^2 at 0.51. The F-value suggests

that the model is reliable and the relationship is significant. This finding confirms that EO and AC are critical factors for SMEs to develop TC at firm level.

Hypothesis 2: the result of multivariate multiple regression analysis presented in table 3 with overall F-value = 10.09 and sig. = 0.000 which means that each level of TC and each measurement of export performance are correlated. Next, the tests on independent variables show that TAC and TUC significantly affect export performance at the 90% and 95% confidential level respectively, whereas TOC is not significantly related to any of export performance measures.

The last part of Table 3 exhibits the regression coefficients and statistics. The result shows that TAC and TOC together have influenced on export intensity at the 95% of confidential level. TUC alone is significantly related to export growth. There is no significant relationship among each level of TC and export diversity. Thus, this finding confirms that SMEs in plastic industry in Thailand need different level of TC as critical factors to export success in terms of export intensity and export growth.

Table 1 Descriptive Statistics

Variables	Items Value		Aggregated Value		
	Mean	S.D.	Mean	S.D.	Cronbach
Entrepreneurial Orientation (EO)[1]			**34.34**	**8.62**	**0.862**
Innovation					
- Emphasis on R&D, technology leadership, and innovation.	4.99	1.39			
- Entered new businesses / marketed new products in the past 5 years.	4.86	1.45			
- Make significant changes in lines of products or services.	4.61	1.40			
Proactiveness					
- Initiate actions in the sector rather than responds to competitors.	4.88	1.36			
- Be the first to introduce new products or services, administrative techniques, operating technologies, etc.	4.69	1.45			
Risk Taking					
- Eager to explore into new market.	3.30	1.69			
- Prefer high-risk projects with chances of very high returns.	3.44	1.65			
- Make an aggressive posture decision to exploit opportunities.	3.60	1.63			
Absorptive Capability (AC)			**67.61**	**13.69**	**0.945**
Acquisition					
- Collect information from customers to learn their needs.	4.78	1.06			
- Have a strong tendency for high-risk projects for high returns.	4.41	1.21			
- Cooperate with research institutions to develop technologies.	4.31	1.41			
- Have strong ties with the technology suppliers in the market.	4.70	1.34			
Assimilation					
- Utilize employees' level of knowledge, competencies, and experience to assimilate and interpret new knowledge.	4.95	1.20			
- Assimilate the basic, key business knowledge and technologies from the best practice in the same industry.	4.74	1.34			
- Develop knowledge management programs, guarantee capacity for understanding, and analyze knowledge and technology from others.	4.75	1.25			
- Support employees for training, trade fairs, and meetings.	5.12	1.31			
Transmission					
- Stimulate the search for alternative innovations and their adaptation to eliminate obsolete internal knowledge.	5.10	1.34			
- Encourage employees voluntarily transmitting useful scientific and technological information acquired to each other.	4.90	1.41			
- Coordinate, transmit and integrate technological information and R&D processes between engineering, production and marketing.	4.79	1.31			
Application					
- Use and exploit new knowledge in the workplace to respond quickly to competitive pressured and environment changes.	4.88	1.28			
- Be strategically at the technological edge in the business by applying our knowledge and experience in the field.	4.96	1.27			
- Put technological knowledge into product and process development.	5.20	1.15			
Technological Capability (TC)[1]			**46.39**	**10.33**	**0.948**
TAC: Technological acquiring capability			**13.65**	**3.74**	**0.902**
- Cooperate with scientific research institutions to develop technologies.	4.31	1.41			
- Cooperate with others (suppliers/customer) to develop technologies.	4.64	1.35			
- Tie with the technology suppliers in the market.	4.70	1.34			
TOC: Technological operating capability			**13.60**	**3.46**	**0.873**
- Manufacture with advanced technologies.	4.76	1.21			
- Have more skilful technical workers and operational workers.	4.37	1.29			
- Have less operation discontinuity.	4.47	1.38			
TUC: Technological upgrading capability			**19.14**	**4.07**	**0.930**
- Frequently modify production process.	4.81	1.17			
- Strongly modify products according to market demand.	4.96	1.08			
- Improve greatly on production process based on our own ideas.	4.67	1.12			
- Develop and test new product design generated from our own.	4.70	1.10			
Export Performance[2]			**-**	**-**	**-**
Export Intensity	**28.68**	**25.17**			
Export Growth	**7.62**	**6.62**			
Export Diversity	**4.77**	**4.27**			

Remark 1 Items are measured by 7-point Likert Scale ranging from "totally disagree" (1) to "totally agree" (7)
2 Export performance were measured by objective measurements.

Table 2 Results Summary of Multiple Regression Analysis

Dependent Variable	Independent Variables	Adjusted R^2	ANOVA		Coefficient[#]		
			F	Sig.	β	t	Sig. (2-tailed)
TC		0.666	104.651	0.000*			
	Constant				4.662	1.577	0.163
	EO				0.243	2.304	0.047*
	AC				0.494	7.429	0.000*
TAC	EO	0.704	124.594	0.000*			
	Constant				-1.964	-1.947	0.105
	EO				0.041	1.138	0.352
	AC				0.210	9.262	0.001*
TOC		0.470	47.070	0.000*			
	Constant				1.831	1.467	0.154
	EO				0.085	1.917	0.100**
	AC				0.131	4.655	0.001*
TUC		0.511	55.255	0.000*			
	Constant				4.795	3.401	0.003
	EO				0.117	2.319	0.054**
	AC				0.153	4.825	0.001*

Remark [#] Bootstrap result based on 1,000 bootstrap samples
* significant at the 0.05
** significant at the 0.10

Table 3 Results Summary of Multivariate Multiple Regression Analysis

	Wilks' lambda	R^2	F	Sig.	Coefficient	t	Sig.
Overall MANOVA	0.4594	-	10.09	0.000*	-	-	-
Independent variables							
- TAC	0.9299	-	2.488	0.064**	-	-	-
- TOC	0.9503	-	1.724	0.167	-	-	-
- TUC	0.9085	-	3.324	0.023*	-	-	-
Regression							
EI	TAC	0.3620	-	-	1.7633	2.193	0.030*
	TOC	0.3893	-	-	2.2301	2.232	0.027*
	TUC	0.3399	-	-	0.9203	1.145	0.255
EG	TAC	0.2185	-	-	0.3533	1.484	0.141
	TOC	0.1933	-	-	-0.0935	-0.316	0.753
	TUC	0.2790	-	-	0.6942	2.916	0.004*
ED	TAC	0.0010	-	-	-0.1722	-0.956	0.342
	TOC	0.0004	-	-	0.0081	0.036	0.971
	TUC	0.0030	-	-	0.1665	0.924	0.358

Remark * significant at the 0.05
** significant at the 0.10

5. Conclusion

5.1 Discussion

The positive relationship between TC and export intensity at the firm level is supported by the study of Karadeniz and Göçer (2007) in Turkey and that of Kongmanila and Takahashi (2009) in Lao Republic. This finding indicates that SMEs require curtain levels of TC in order to engage themselves into international market. The more they adopt technological knowledge that they have acquired and absorbed into their processes and product development, the more likely they are able to penetrate into existing foreign market. However, this does not guarantee their international success if they are lack of competitive advantages (López-Rodríguez and García-Rodríguez, 2005). Only when they have started to export and accumulated experience, the export process as a result of technological spillovers within the industry allow it to improve its TC at the firm level and hence its competitiveness. This positively affects its export intensity.

The positive relationship between TUC and export growth at the firm level was supported by Macpherson (1994). He studied the influence of innovation on SMEs in USA. The result presented the positive relationship between product innovation and export growth and the strong relationship between process innovation and export growth as well. Flor and Oltar (2005) found out the same phenomenon in their study on 88 Spanish exporting ceramics tile firms.

5.2 Implication

This study provides several theoretical and practical implications for researchers and managers who are concerned with TC development in SMEs in emerging countries. The findings of this research suggest that the improvements of manufacturing processes and of product design are critical for SMEs to successfully compete in international markets. These improvements are based on accumulative technological knowledge acquired from both internal and external sources.

Practical implications of this work are considerable. Firstly, SMEs' owners and managers should recognize the importance of TC to the international competitiveness of their firm, and hence of the need to invest more in technology to improve it. At the higher level of firm-level TC, SMEs could achieve the better result SMEs perform in the international market. Moreover, they should take initiatives to empower TC within their firm to continuously improve their processes and products, to boost up sales volume in foreign markets, and consequently, to reduce their cost in order to maintain the existing export market as well as to develop new products and services. Secondly, researchers can study the export performance for SMEs in emerging economies from the concept of organizational capabilities. The studies of the impact of other capabilities on SMEs export performance are needed to further the understanding of this phenomenon. Third, the policy makers should promote and stimulate the investment in TC developing at specific level for SMEs. However, they should separate campaigns for SMEs that engage intensively in international markets.

These findings contribute to the understanding of how SMEs in emerging market countries use the available technologies to improve firm performance and integrate them into the global economy. However, from the results, firm-level TC alone is not enough for SMEs to sustain their

existing international customer and to spread themselves into new foreign markets. Thus other relevant capabilities need to be included in further study. Furthermore, this study concentrated only on plastic industry in Thailand. The studies of the impact of firm-level TC on export performance in different industries and countries are in required.

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