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A Structural Equation Model of Factors that Affect the ASEAN Competitive Advantage of the Thai Automotive Parts Industry

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ABSTRACT

Thailand is considered the heart of Asia and a gateway to the most densely-populated countries in the world included China and India. Thailand is also part of the 600 million people ASEAN Economic Community which is considered the ninth largest global economy representing $2 trillion USD. Under this community's free trade framework with a projected average output increase of 10% annually, Thailand's 'Detroit of Asia' is a crucial component of any future growth. As such, the researchers have therefore developed a structural equation model of influences on research and development (R and D) and technological capabilities affecting the competitive advantage of the Thai automotive parts industry. This sector in 2013 was the 3rd largest part of the economy contributing 12% of GDP. This study clearly shows that in developing countries technology plays a key role in competitive advantage and even more so to Thailand which faces intense competition from both regional and other global players. Therefore, it is crucial that organizations focus on innovative research and development capabilities which need to collaborate, support, fund and incentivize players, both domestic and foreign, to upgrade Thailand's innovative capacity and fill in gaps in its cluster environment going forward. Thailand's recognized success as a global automotive hub is a classic case of a well-executed industrial plan but it must not rest on its laurels and continue moving forward with innovation combined with R and D capability.

Key words: Competitive advantage, research and development, technology capability, auto parts, Thailand

INTRODUCTION

According to the Thai Commerce Ministry, auto manufacturing in Thailand will reach 2.5 million units in 2014 and possibly increase to three million units in 2016. The Thai International Trade Promotion Department has stated that the Thai auto industry has generated US$30 billion or Bt900 billion in the past year, $18 billion USD from automobiles and $12 billion USD from auto parts. Thailand ranks ninth among top auto manufacturers worldwide and it should step up to the fifth position in the next two years. The Thai Auto-parts Manufacturers Association (TAPMA) said Thailand imported $2 billion worth of auto parts in 2012-2013 (TAPMA, 2014) but the weakened baht has resulted in added exports producing Bt600 billion worth of auto parts annually.

Business operations within the Thai auto parts industry must work under an extremely competitive environment due to the increasing volatility and uncertainty as Thailand moves closer

to its entry point within the ASEAN free trade area in 2015. Flexibility and adaptability will be the key as the AEC (ASEAN Economic Community) creates even greater competition requiring better marketing and production techniques.

Porter (1985) proposed a theory that emphasized productivity growth as the focus of national strategies. It was further stated that competitive advantage rests on the notion that cheap labor is ubiquitous and natural resources are not necessary for a good economy, therefore it is important to meet the needs of the global economy (Han and Xi, 2008) both in terms of quality and costs. Other factors include using the company's resources to create strategies which are important for the company to develop a sustainable competitive advantage as well as helping to manage resources and information (Progoulaki and Theotokas, 2010).

Thailand's auto parts industry is a major industry that currently has and will continue to have a significant economic impact on the country's economic development in terms of both employment and added value.

The Thailand automotive institute has indicated in its third master plan for the Thai automobile sector that Thailand should focus on five key development areas. These include:

- Technology, research and development
- Skilled labor
- Human-resource development which strengthens the competitiveness of manufacturers
- Good environment policies from the basic infrastructure upward
- Setting up of a policy-steering committee for the auto and auto-parts industry (Chaowachuen, 2012)

The Thai industrial and automotive parts sectors include three main groups. These are steel parts which include the engine, car body parts or electronics and other parts including rubber, plastic, glass, etc. Fig. 1.

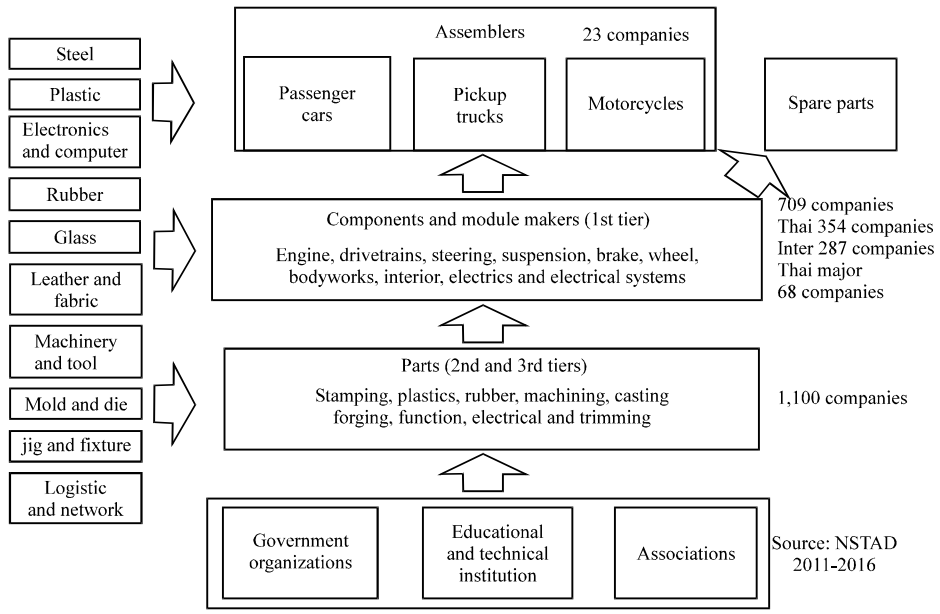

Fig. 1: Thailand's main stream automotive industry map (NSTDA, 2011)

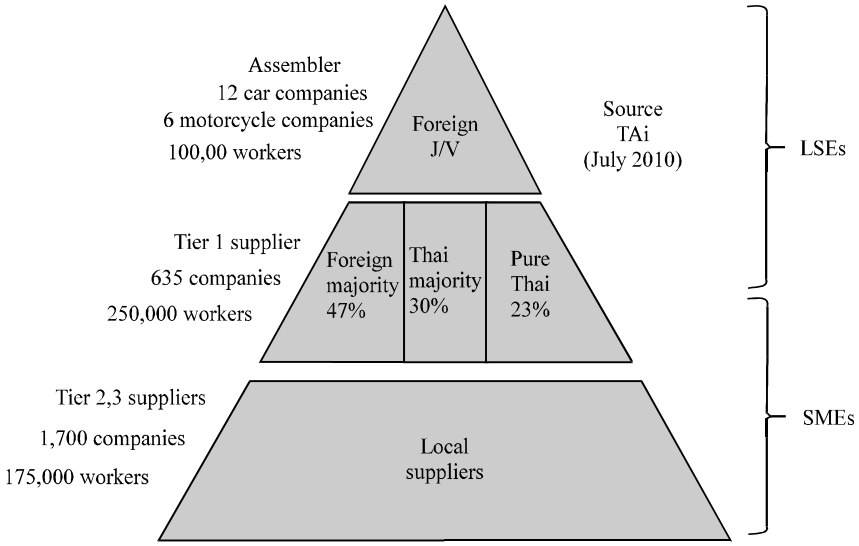

Fig. 2: Thailand automotive tiered assembler and supplier environment, Source: TAI (2010), LSEs: Large scale enterprises 4, SMEs: Small and medium enterprises

Typically, major automotive manufacturers produce few automotive parts themselves but instead outsource this process to others. The industry therefore refers to this process as a 'tiered' environment consisting of the following manufactures and distribution of replacement parts (Fig. 2).

Additionally, for over 40 years Thai vehicle production and auto parts supply industries have worked closely together. Vehicle production and part supply can be categorized in the following two ways: Tier 1 suppliers are the Original Equipment Manufacturers (OEM). The OEM suppliers usually provide components to auto assembly operations which include such things as cushions, doors, tires, safety belts and other assembly components for new cars. Tier 2 is the second category of suppliers which sell parts and materials to the Tier 1 suppliers. This includes the manufacturing and distribution of replacement parts and auto assembly parts for broken, defective and r eplacement parts (Ministry of Industry, 2010).

Thailand's auto parts industry is faced with more intense competition due to lower wages from regional competitors and Thailand's 2015 entry into the AEC (ASEAN Economic Community) which will force it to compete for market share, both domestically and in foreign markets. The ASEAN's large combined market however, provides it with the size necessary to manufacture components cost effectively. This is particularly important for the auto parts industry which relies on production volume to lower costs and to supply auto assembly plants from a small number of focused production facilities (USITC, 2010).

Thailand unfortunately may lag behind its' competitors. This is due to the industry's inability or unwillingness to make the required adjustments which creates a better competitive advantage. One such adjustment is to provide research and development which not only requires a large investment of time and funds but also the commitment of the organization to research and development (Lee, 2008) resulting in the creation of innovative and value-added products or services.

Organizations must strive continuously to improve their own technological capabilities in research and development as a way to build a strong organization and achieve high performance

and profitability. Technology, technical skill and R and D capability influence profitability significantly, both partially and simultaneously which meets the needs of the market in an increasingly competitive environment (Lee, 2009).

Researchers were therefore very interested in studying the problems, reasons and other variables via., the use of a structural equation model of the research and development competencies that affects the organizational competitiveness of the Thai automotive parts industry. Review of the literature indicates that organizations need to be committed to new processes in product research and development as well as the management of R and D to help organizations build innovative and cutting-edge technology. This includes such things as design, production and management, as well as providing safe, convenient, fast, accurate, reliable and efficient operations. Organizations must also be able to determine the vision, mission, policies and strategic planning which helps in giving an organization competitive advantage.

The objectives of the study were:

- To study the direct and indirect influences of variables that affects the Thai auto parts enterprise competitive advantage
- To develop structural equation modeling of variables that affects the Thai auto parts enterprise competitive advantage

COMPETITIVE ADVANTAGE

Porter (2001) identified two basic types of competitive advantages consisting of cost advantage and differentiation advantage. A competitive advantage exists when the firm is able to deliver the same benefits as competitors but at a lower cost (cost advantage) or deliver benefits that exceed those of competing products (differentiation advantage). Thus, a competitive advantage enables the firm to create superior value for its customers and superior profits for itself. Cost and differentiation advantages are known as positional advantages since they describe the firm's position in the industry as a leader in either cost or differentiation.

Leonidou *et al.* (2013) said creating a long-term strategy that makes a difference uses low costs in order to generate revenue and profits. The organization should benefit from increased customer satisfaction and the building of customer retention. This also includes the use of innovative processes and products to take advantage of the cost and the difference in the market (Wong, 2012). The ability to compete is defined in the operation of the manufacturer to give leadership on quality, delivery, flexibility and low cost (Kristal *et al.*, 2010). The productivity frontier is the sum of all existing best practices at any given time or the maximum value that a company can create at a given cost using the best available technologies, skills, management techniques and purchased inputs. Thus, when a company improves its operational effectiveness, it moves toward the frontier. The frontier is constantly shifting outward as new technologies and management approaches are developed and as new inputs become available (Porter, 1996).

It was found that suppliers' flexibility, engineering and modularization capabilities positively influence collaboration in new car development which in turn positively affects the competitive advantage of carmakers (Oh and Rhee, 2010). Suppliers must enhance flexibility, modularization and engineering capabilities in order to vitalize collaboration with carmakers in new car development. As technological uncertainty increases, carmakers should address in-house problems caused by technological uncertainty or delegate related jobs only to suppliers with significant capabilities for quality improvement and modularization.

Hayes and Wheelwright (1984) suggested that companies compete in the marketplace by virtue of one or more of the following competitive priorities:

- Quality
- Lead-time
- Cost
- Flexibility

After a review of the research and literature of competitive advantage, three dimensions were concluded:

- **Cost:** Management has to perform operational, financial and marketing processes to both save money for the organization and improve their operations to achieve productivity increases (Patil *et al*., 2012; Wingwon and Piriyakul, 2010; Oh and Rhee, 2010; Kristal *et al*., 2010)
- **Quality products:** These are consumer goods that meet the requirements of customers, are reliable, have long service lives and make the customer satisficed leading to repeat purchases and word of mouth sales (Patil *et al*., 2012; Chang, 2011; Oh and Rhee, 2010; Kristal *et al*., 2010)
- **Flexibility:** The ability to alter or modify operations to cater to the rapidly changing customers' needs or requirements (Patil *et al*., 2012; Kristal *et al*., 2010; Oh and Rhee, 2010; Boon-itt and Paul, 2006)

RESEARCH AND DEVELOPMENT

With intensified competition, another idea to create competitive advantage is to develop an organization focused on the future with organizational strategies that implement new vision and innovation. Research and development is regarded as one of the organizational change processes that have this ability (Magrab *et al*., 2009) which consists of:

- It must satisfy the needs of its customers by combining ideas and new technologies into products
- Creative products that meet the expectations of customers
- Adapt to different business environments
- Create new ideas and combine existing components to create valuable new resources

Trott (2012) noted the past 10 years have witnessed enormous changes in the way that companies manage their technological resources and in particular research and development. Within industrial R and D, the effect is a shift in emphasis from an internal to an external focus. Contract R and D, R and D consortia and strategic alliances and joint ventures now form a large part of R and D management activities. The need to provide scientific freedom and still achieve an effective return from any R and D investment, however, remains one of the most fundamental areas of R and D management.

Lee (2009) investigated the long-debated relationship between market competition and firm Research and Development (R and D) by investigating the effect of competitive market pressure on firms' incentives to invest in R and D. The study showed that a firm's R and D response to competitive market pressure depends primarily on its level of technological competence or R and D productivity; firms with high levels of technological competence tend to respond aggressively

(i.e., exhibit a higher level of R and D efforts) to intensifying competitive market pressure, while firms with low levels of technological competence tend to respond submissively (i.e., exhibit a lower level of R and D efforts).

Organizations must strive to continuously improve their own technical abilities with technology innovation and use research and development as a way to build a strong organization to a gain sustainable, competitive advantage (Chaowachuen, 2012). In research conducted with US technology firms, it was that the strategic role of knowledge and external leveraging strategies that played important roles in competitive advantage. It was also found that technology firms with weak knowledge depth should focus on internal R and D to accumulate knowledge in core technology areas, while those with strong knowledge depth should lower internal R and D intensity and shift their strategic resources to inter-firm alliances and acquisitions (Lin and Wu, 2010).

Huang and Yu (2011) studied whether a firm can improve its innovation either by its internal research and development (R and D) efforts or by forming external collaborative R and D alliances. By examining the data of 165 Taiwanese firms in the information and communication technology industry, the research found that: (1) Non-competitive R and D collaborations with universities have a positive and direct impact on firm's innovation performance and (2) Both non-competitive and competitive R and D collaborations have a positively moderating effect on the relationship between a firm's internal R and D efforts and firm innovation and the positive moderating effect is higher for non-competitive R and D collaborations than that of competitive R and D collaborations. These findings suggest that R and D collaborations, either non-competitive or competitive, exhibit the nature of a win-win situation.

The study reviewed research and literature of capabilities in research and development and determined that there are three dimensions to Research and Development:

- **Research and product development:** To create and bring new and improved products to the market quicker than the competition. This can take the form of either improving or upgrading older products in both quality and performance as well as the creation of new products (Gunasekaran and Spalanzani, 2012; Lang *et al*., 2012; Ellis *et al*., 2011; Oh and Rhee, 2010)
- **Research and development process:** This use to improve process efficiency or to develop processes which reduce the cost of operations or reduce production costs with increased flexibility in production (Gunasekaran and Spalanzani, 2012; Lang *et al*., 2012; Lee *et al*., 2011; Oh and Rhee, 2010)
- **Research and development management:** This process project management as well as the coordination with other agencies and the pursuit of research both within and outside the organization in order to continue to develop new products (Lee *et al*., 2011; Prajogo and Sohal, 2006)

Technology capability: Huang and Yu (2011) examined the data of 165 Taiwanese firms in the information and communication technology industry and found that: (1) Non-competitive R and D collaborations with universities have a positive and direct impact on form's innovation performance and (2) Both non-competitive and competitive R and D collaborations have a positively moderating effect on the relationship between a firm's internal R and D efforts and firm innovation and the positive moderating effect is higher for non-competitive R and D collaborations than that of competitive R and D collaborations. This results in the improvement of manufacturing processes to become more effective and efficient (Wang and Zhang, 2010) and

to support the value chain activities (Hemmatfar *et al*., 2010) in the automotive parts industry. This concentration of investments in technology helps to improve the capacity of the organization and adaptation (Gowen and Tallon, 2005) resulting in the technology's potential which is important for innovation (Baker *et al*., 2009).

Tsai *et al*. (2011) used a sample from 105 high-technology firms over a six-year period and found that external technology acquisition has a positive impact on product innovativeness. Second, R and D investment increases the effect of external technology acquisition on product innovativeness. Finally, firm size exhibits a negative effect on the contribution of external technology acquisition to product innovativeness. However, firm age positively impacts the relationship between external technology acquisition and product innovativeness. In addition, the study revealed a positive effect of product innovativeness on firm growth.

Bolivar-Ramos *et al*. (2012), suggested that: (1) Top management support positively influences the generation of technological skills, technological distinctive competencies and organizational learning and (2) Technological distinctive competencies and organizational learning positively affect organizational performance, directly and indirectly through organizational innovation.

Another recent study showed that technology can play a significant role in the company's innovation and competitiveness and the ability of technology is related to the competitive environment that affect the company's innovation (Huang and Yu, 2011). With the right Information Technology (IT) adoption, Asian growth will provide a great advantage in improving the potential of the growth of companies. Further findings revealed that there were nine IT applications that moderate the collaborating capability which included; E-Mail, content management, decision support systems, knowledge base/repository, document management, search engines, website content, intranet and internet access (Ling *et al*., 2013). Organization Orientation of enterprises is to be able to utilize and manage the technological capabilities of each organization to be more effective (Wang *et al*., 2006).

From the continuing review of research and literature in the ability of innovation, it was discovered there are three dimensions:

- **Design technology:** This is used to design, build, improve and develop technology to produce the final product and to make sure process works correctly and meets customer specifications (Lee and Wong, 2011; Wang *et al*., 2006; Song *et al*., 2010; Wang and Zhang, 2010)
- **Production technology:** This technology uses engineering skills for design, tool manufacturing and design processes (Huang and Yu, 2011; Almannai *et al*., 2008)
- **Process technology:** This is the use of technology in the production process and the performance of the operating system (Bolivar-Ramos *et al*., 2012; Lee and Wong, 2011; Wang *et al*., 2006)

MATERIALS AND METHODS

The format of the survey population or unit of analysis is the industrial and automotive parts manufacturers in Thailand.

Data collection: Schumacker and Lomax (2010) stated that Structural Equation Modeling (SEM) uses a variety of models to show the relationships between observed variables with the same basic goal of providing a quantitative test of a theoretical model hypothesized by a researcher. The models developed using SEM can be tested to show how sets of variables define concepts and how

they are related. The goal of SEM is to determine the extent to which the model is supported by the data that is gathered during research (Schumacker and Lomax, 2010) and since, SEM is capable of statistically modeling and testing complex phenomena, it has therefore become the preferred method for confirming (or not) theoretical models, quantitatively. Another very important consideration is the intended sample size with most authors recommending a sample size of at least 100 to generate good results (Cunningham, 2008; Schumacker and Lomax, 2010; Weston and Gore, 2006; Wang *et al*., 2006), so therefore, a sample size smaller than 100 should not be used as it is unreliable and consequently SEM should not be used (Meldrum, 2010).

As such, this study drew upon the base of Thai auto part industry managers and selected those entities with some form of manufacturing capability. From the sample size determined by Schumacker and Lomax (2010), the researchers used the 10-20 sample size suggested for each variable. As the research consisted of 9 variables, a minimum of 90 samples were deemed as acceptable of which 180 were obtained (Hair *et al*., 2006) which is significantly higher than the minimum required.

The questionnaires were designed to be used as a measurement tool according to the conceptual framework and operational definitions. The survey used the 7-Point Likert Scale (Likert, 1972) and field definitions were constructed with its use. Quality has been assured by using Cronbach's a-coefficient for calculation of average of correlation coefficient gained. Resultant data below 0.50 has been eliminated from the measurements.

Questionnaire design: For this study, the measurement instrument or questionnaires utilized was prepared from the literature. This questionnaire was used to investigate how and which variables affected the Enterprise Competitive Advantage in the Thai Automotive Parts Industry. The 7-Point Likert Scale (Likert, 1972) was used for a post-study survey. The draft questionnaire was created with items which were later checked for their content validity by five experts in their respective fields based on the Item-Objective Congruence (IOC) Index as shown in Table 1 below. The items with IOC index higher than 0.5 were acceptable. In order to test the proper reliability of the questionnaire, the questionnaire was piloted with 30 Thai auto sector individuals and calculated for proper reliability value by determining the internal consistency measured by coefficient alpha (a-coefficient) of Akron BAC (Cronbach) to calculate the average value of the correlation coefficient.

Table 1: Research measurement development

Variables	Manifest variables	Research questions development
External latent variables		
Research and development ability		
	Research and development product	(Yam *et al*., 2011; Prajogo and Sohal, 2006;
	Research and development process	Oh and Rhee, 2010; Lang *et al*., 2012)
	Research and development management	
Intermediate variables		
Technological capabilities	Technology design	(Prajogo and Sohal, 2006; Lucia-Palacios *et al*., 2014;
	Production technology	Bicen *et al*., 2014; Wang *et al*., 2006)
	Technology process	
Latent variables		
Competitive advantage	Cost	(Chiou *et al*., 2011; Ar, 2012; Oh and Rhee, 2010;
	High quality	Antonio *et al*., 2009)
	Flexibility	

RESULTS

Partial Least Squares has been applied for analysis of quantitative data by the researcher. It is data analysis for Confirmatory Factor Analysis (CFA) relating to the determination of manifest variable and latent variable and testing of research hypothesis exhibiting in structural model analyzed by using the applications of PLS-Graph (Chin, 2001). According to the analysis result of scale validity and reliability, scale investigation was conducted using internal consistency measurement coefficient alpha (α-coefficient) of Akron BAC (Cronbach) to calculate the average value of the correlation coefficients which ranged from 0.794-0.955 which is considered to have high reliability.

In case of measure variables with reflective analysis, convergent validity has been conducted. Loading is used as consideration criteria and must be positive quantity and indicator loading has been more than 0.707 and all values have been statistically significant ($|t| \geq 1.96$) representing convergent validity of scales (Lauro and Vinzi, 2004; Henseler *et al*., 2009; Wingwon and Piriyakul, 2010) and analysis results as shown in Table 2 below.

Research and development (research): Factors underlying the external variables influencing Product research (re_product), Research Process (re_process) and Research Management (re_manage) have values of 0.8791, 0.8812 and 0.9118, respectively and a significance level of confidence of 95% (t-stat>1.96) which considers such factors highly reliable. Research and development (Research) has a positive and direct influence on Technology Capabilities (Technology) (Fig. 3).

Technology capabilities (technology): Factors underlying the external variables influencing Technology Design (tec_des), Production Technology (tec_prod) and Technology Process (tec_proc) have values of 0.9391, 0.9549 and 0.8969, respectively and a significant level of confidence level of 95% (t-stat>1.96) which considers such factors highly reliable. Technology Capabilities (technology) has a positive and direct influence on Competitive Advantage (Fig. 3).

Competitive advantage (compet_adv): Factors underlying the external variables influencing Cost (cost), quality (quality) and Flexibility (flexibility) with values of 0.8622, 0.8758 and 0.7943, respectively and a significant level of confidence level of 95% (t-stat>1.96) which considers such factors highly reliable.

Table 2: Statistic values presenting convergent validity of reflective scales of latent variables

Construct/item	Loading	AVE	t-test
Research and development (research)			
Product research (re_product)	0.8791	0.794	42.0504
Research process (re_process)	0.8812		34.4450
Research management (re_manage)	0.9118		86.2798
Technology capabilities (technology)			
Technology design (tec_des)	0.9391	0.866	109.4011
Production technology (tec_prod)	0.9549		121.4132
Technology process (tec_proc)	0.8969		50.8108
Competitive advantage (compet_adv)			
Cost (cost)	0.8622	0.714	37.0403
Quality (quality)	0.8758		50.5471
Flexibility (flexibility)	0.7943		20.0706

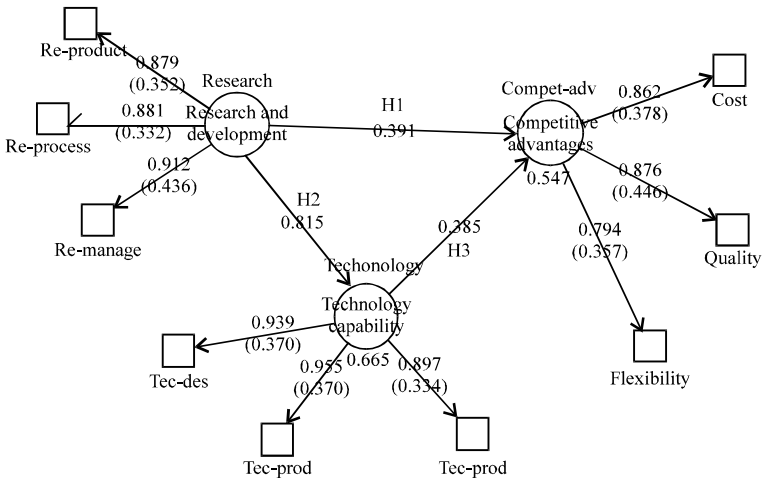

Fig. 3: Final model-analysis of factors that affect competitive advantage within the auto parts industry

Table 3: Results of Confirmatory Factor Analysis (CFA) for measurement model

				Cross construct correlation		
Construct	CR	R^2	AVE	Research and development	Technology capabilities	Competitive advantage
Research and development	0.920		0.794	0.891		
Technology capabilities	0.951	0.665	0.866	0.815	0.931	
Competitive advantage	0.882	0.547	0.714	0.705	0.704	0.845

CR: Composite reliability, R^2: Square of the correlation, AVE: Average variance extracted, statistical significance level is at 0.01 and diagonal figures mean $\sqrt{AVE}$

Table 4: Research hypotheses test results

Hypotheses	Coef.	t-test	Results
H1: Research and development has a positive and direct influence on competitive advantage	0.391	3.6686	supported
H2: Research and development has a positive and direct influence on technology capability	0.815	27.7571	supported
H3: Technology capability has a positive and direct influence on competitive advantage	0.385	4.1005	supported

The above reflective model in Table 2 shows the discriminant validity of the internal latent variables and the correlation of variables. It also depicts the scale reliability which has been analyzed from Composite Reliability (CR) as well as the Average Variance Extracted (AVE) and R^2. The CR value should not go below 0.60 and the AVE values should also drop below 0.50 and R^2 values should not be under 0.20 (Lauro and Vinzi, 2004; Henseler *et al.*, 2009; Wingwon and Piriyakul, 2010). In Table 3 below the Confirmatory Factor Analysis (CFA) of the independent variables of Research and Development and technology capabilities on the dependent variable of competitive advantage is shown. The results of research hypothesis are shown in Table 4.

DISCUSSION

The results of the research concerning the influencing variables of research and Development and Technology Capability on Competitive Advantage in this study 'A Structural Equation Model of factors that affect the ASEAN Competitive Advantage of the Thai Automotive Parts Industry'

opened the door to an even larger discussion concerning the regional competitiveness issues associate with the upcoming 2015 ASEAN (Association of Southeast Asian Nations) integration.

Technology capability has been addressed numerous times by many researchers and there is a constant thread back to how well an educational system prepares a country's students to meet the technological challenges of a modern, industrial world which was supported by research from the Huang and Yu (2011) study which examined the data of 165 Taiwanese firms in the information and communication technology industry and found that non-competitive R and D collaborations with universities have a positive and direct impact on form's innovation performance.

It was also found that suppliers' flexibility, engineering and modularization capabilities positively influence collaboration in new car development which in turn positively affects the competitive advantage of carmakers (Oh and Rhee, 2010) and that suppliers' quality improvement and modularization capabilities directly contribute to the competitive advantage of carmakers.

In research from China, Xie and Li (2013) established that vehicle manufacturers and parts supply companies must learn from countries with high automobile industry developmental levels and take full advantage of modular convenience and technological advantages which continuously promote the strength of automobile companies and parts enterprises and strive to enhance the technological innovation level which helps ensure a strong parts supply base throughout the country.

Trott (2012) noted the past ten years have witnessed enormous changes in the way that the companies manage their technological resources and in particular research and development. Within industrial R and D the effect is a shift in emphasis from an internal to an external focus. Contract R and D, R and D consortia and strategic alliances and joint ventures now form a large part of R and D management activities. The need to provide scientific freedom and still achieve an effective return from any R and D investment, however, remains one of the most fundamental areas of R and D management.

Organizations must strive to continuously improve their own technical abilities with technology innovation and use research and development as a way to build a strong organization to a gain sustainable, competitive advantage (Chumaidiyah, 2012).

CONCLUSION

Auto manufacturing in Thailand will reach 2.5 million units in 2014 and possibly increase to three million units in 2016, according to the Thai Commerce Ministry. The Thai International Trade Promotion Department has stated that the Thai auto industry has generated US$30 billion or Bt900 billion in the past year, $18 billion USD from automobiles and $12 billion USD from auto parts. The industry plans to manufacture and export more of its current production per year to markets around the world, especially in Asia. The keys to the success of Thai automotive industry are its focus on top quality with highly motivated workers with the training of employees in world-class production techniques. Thailand currently ranks ninth among top auto manufacturers worldwide and it hoped that it will step up to the fifth position in the next two years.

It is expected that in 2015 when AEC opens, Thailand will have three million cars in its production line. However, if the parts and assembly in Thailand are not done here, there would not be any increase in value to the Thai economy. Therefore, it is necessary to have strong local auto parts manufacturers as a root of sustainability and to increase the capacity for competition. However, in the competitive global market, the Thai auto parts manufacturers must use manage its costs which have been increasing continuously. In addition, technology development, the

economy, society and environment also are important for manufacturers in the AEC. Meanwhile, the ASEAN market is forecast to be the 6th biggest in world in 2018.

A key to this is R and D capability as Thailand grows closer to its entry into the AEC in 2015 with a common market and production base. The history of automobile manufacturing in the United States suggest that Thailand needs to make a commitment to research and development technology and innovation by improving and developing new concepts in the design, production, process, equipment, corporate management and marketing. This in turn will result in an advantage in competitive advantage to the Thai auto sector, both in terms of low cost products and process quality. There needs to be flexibility to produce both quantity and variety, the ability for 'on-time delivery increasing customer satisfaction. As the industry continues to mature, it must be a leader setting the direction, vision, mission, policies and strategy of the automotive parts industry.

REFERENCES

Almannai, B., R. Greenough and J. Kay, 2008. A decision support tool based on QFD and FMEA for the selection of manufacturing automation technologies. Robotics Comput. Integr. Manuf., 24: 501-507.

Antonio, K.W.L., C.M.Y. Richard and E. Tang, 2009. The complementarity of internal integration and product modularity: An empirical study of their interaction effect on competitive capabilities. J. Eng. Technol. Manage., 26: 305-326.

Ar, I.M., 2012. The impact of green product innovation on firm performance and competitive capability: The moderating role of managerial environmental concern. Proc. Soc. Behav. Sci., 62: 854-864.

Baker, E., H. Chon and J. Keisler, 2009. Advanced solar R and D: Combining economic analysis with expert elicitations to inform climate policy. Energy Econ., 31: S37-S49.

Bicen, P., S. Kamarudin and W.H. Johnson, 2014. Validating new product creativity in the eastern context of Malaysia. J. Bus. Res., 67: 2877-2883.

Bolivar-Ramos, M.T., V.J. Garcia-Morales and E. Garcia-Sanchez, 2012. Technological distinctive competencies and organizational learning: Effects on organizational innovation to improve firm performance. J. Eng. Technol. Manage., 29: 331-357.

Boon-itt, S. and H. Paul, 2006. A study of supply chain integration in Thai automotive industry: A theoretical framework and measurement. Manage. Res. News, 29: 194-205.

Chang, C.H., 2011. The influence of corporate environmental ethics on competitive advantage: The mediation role of green innovation. J. Bus. Ethics, 104: 361-370.

Chaowachuen, T., 2012. 5-yr auto plan aims for top-10 ranking. The Nation, Bangkok, Thailand, December 14, 2012. http://tinyurl.com/pull5x4.

Chin, W.W., 2001. PLS-Graph User's Guide. Version 3.0, Soft Modeling Inc., Houston, TX., USA.

Chiou, T.Y., H.K. Chan, F. Lettice and S.H. Chung, 2011. The influence of greening the suppliers and green innovation on environmental performance and competitive advantage in Taiwan. Transp. Res. E.: Logist. Transp. Rev., 47: 822-836.

Chumaidiyah, E., 2012. The technology, technical skill and R and D capability in increasing profitability on indonesia telecommunication services companies. Proc. Econ. Finance, 4: 110-119.

Cunningham, E., 2008. A Practical Guide to Structural Equation Modelling Using AMOS. Statsline Publisher, Melbourne.

Ellis, P.D., H. Davies and A.H.K. Wong, 2011. Export intensity and marketing in transition economies: Evidence from China. Ind. Market. Manage., 40: 593-602.

Gowen, C.R. and W.J. Tallon, 2005. Effect of technological intensity on the relationships among Six Sigma design, electronic-business and competitive advantage: A dynamic capabilities model study. J. High Technol. Manage. Res., 16: 59-87.

Gunasekaran, A. and A. Spalanzani, 2012. Sustainability of manufacturing and services: Investigations for research and applications. Int. J. Prod. Econ., 140: 35-47.

Hair, J.F., W.C. Black, B.J. Babin, R.E. Anderson and R.L. Tatham, 2006. Multivariate Data Analysis. 6th Edn., Prentice-Hall Inc., New Jersey, USA., ISBN-13: 9780130329295, Pages: 899.

Han, F. and Q. Xi, 2008. Building competitive advantage of locations for automobile industry: Changchun as the example. Int. J. Bus. Manage., 3: 107-112.

Hayes, R.H. and S.C. Wheelwright, 1984. Restoring Our Competitive Edge: Competing Through Manufacturing. John Wiley and Sons, New York, USA.

Hemmatfar, M., M. Salehi and M. Bayat, 2010. Competitive advantages and strategic information systems. Int. J. Bus. Manage., 5: 158-169.

Henseler, J., C.M. Ringle and R.R. Sinkovics, 2009. The Used of Partial Least Squares Path Modeling in International Marketing. In: Advances in International Marketing: New Challenges to International Marketing, Sinkovics, R.R. and P.N. Ghauri (Eds.). Emerald, Bingley, UK., pp: 277-319.

Huang, K.F. and C.M.J. Yu, 2011. The effect of competitive and non-competitive R and D collaboration on firm innovation. J. Technol. Transfer, 36: 383-403.

Kristal, M.M., X. Huang and A.V. Roth, 2010. The effect of an ambidextrous supply chain strategy on combinative competitive capabilities and business performance. J. Oper. Manage., 28: 415-429.

Lang, T.M., S.H. Lin and T.N.T. Vy, 2012. Mediate effect of technology innovation capabilities investment capability and firm performance in Vietnam. Proc. Soc. Behav. Sci., 40: 817-829.

Lauro, C. and V.E. Vinzi, 2004. Some contributions to PLS Path Modeling and a system for the European customer satisfaction. The European Commission Grant ESIS, European Satisfaction Index System 2001-2004.

Lee, J., 2008. Effects of leadership and leader-member exchange on innovativeness. J. Manage. Psychol., 23: 670-687.

Lee, C.Y., 2009. Competition favors the prepared firm: Firms' R and D responses to competitive market pressure. Res. Policy, 38: 861-870.

Lee, K.B. and V. Wong, 2011. Identifying the moderating influences of external environments on new product development process. Technovation, 31: 598-612.

Lee, Y., S. Kim and H. Lee, 2011. The impact of service R and D on the performance of Korean information communication technology small and medium enterprises. J. Eng. Technol. Manage., 28: 77-92.

Leonidou, L.C., C.N. Leonidou, T.A. Fotiadis and A. Zeriti, 2013. Resources and capabilities as drivers of hotel environmental marketing strategy: Implications for competitive advantage and performance. Tourism Manage., 35: 94-110.

Likert, R., 1972. Likert Technique for Attitude Measurement. In: Social Psychology: Experimentation, Theory, Research, Sahakian, W.S. (Ed.). Intext Educational Publishers, Scranton, USA., ISBN-13: 9780700223879, pp: 101-119.

Lin, B.W. and C.H. Wu, 2010. How does knowledge depth moderate the performance of internal and external knowledge sourcing strategies? Technovation, 30: 582-589.

Ling, L.S., O.P. Tee and U.C. Eze, 2013. The effects of information technology applications on collaborating capability in achieving organisational competitive advantages in Malaysia. Int. J. Bus. Manage., 8: 1-14.

Lucia-Palacios, L., V. Bordonaba-Juste, Y. Polo-Redondo and M. Grunhagen, 2014. Technological opportunism effects on IT adoption, intra-firm diffusion and performance: Evidence from the U.S. and Spain. J. Bus. Res., 67: 1178-1188.

Magrab, E.B., S.K. Gupta, F.P. McCluskey and P.A. Sandaborn, 2009. Integrated Product and Process Design and Development: The Product Realization Process. 2nd Edn., CRC Press Inc., New York, ISBN-13: 9781420070606, Pages: 333.

Meldrum, K., 2010. Structural equation modeling: Tips for getting started with your research. Contemporary Approaches to Research in Mathematics, Science, Health and Environmental Education 2010. https://www.deakin.edu.au/arts-ed/efi/conferences/car-2010/papers/meldrum.pdf.

Ministry of Industry, 2010. FTA and Thai industry advancing to AEC and world market. Ministry of Industry Publics Newsletter, The Office of Industrial Economics, Ministry of Industry, Thailand.

NSTDA, 2011. NSTDA's strategic plan 2011-2016. Strategic Planning Alliance II (SPAII), National Science and Technology Development Agency (NSTDA), Thailand.

Oh, J. and S.K. Rhee, 2010. Influences of supplier capabilities and collaboration in new car development on competitive advantage of carmakers. Manage. Decis., 48: 756-774.

Patil, P.P., B.E. Narkhede and M.M. Akarte, 2012. An exploratory study of manufacturing strategy of packaging product-manufacturing companies in India. Int. J. Qual. Res., 6: 233-249.

Porter, M.E., 1985. Competitive Advantage Creating and Sustaining Superior Performance. The Free Press, New York.

Porter, M.E., 1996. What is a strategy? Harvard Business Review (November-December) pp: 61-78.

Porter, M.E., 2001. Strategy and the internet. Harvard Business Review, pp: 1-21.

Prajogo, D.I. and A.S. Sohal, 2006. The integration of TQM and technology/R and D management in determining quality and innovation performance. Omega, 34: 296-312.

Progoulaki, M. and I. Theotokas, 2010. Human resource management and competitive advantage: An application of resource-based view in the shipping industry. Mar. Policy, 34: 575-582.

Schumacker, R.E. and R.G. Lomax, 2010. A Beginners Guide to Structural Equation Modeling. Routledge, New York, ISBN-13: 9781841698915, Pages: 536.

Song, L.Z., C.A. Di Benedetto and M. Song, 2010. Competitive advantages in the first product of new ventures. IEEE Trans. Eng. Manage., 57: 88-102.

TAI, 2010. Thailand automotive cluster. Thailand Automotive Institute (TAI), Bangkok, Thailand. http://tinyurl.com/oh8oghw.

TAPMA, 2014. Thai auto parts exports to surge 10% this year. Thai Auto-Parts Manufacturers Association (TAPMA), Thailand.

Trott, P., 2012. Innovation Management and New Product Development. Prentice Hall, New York.

Tsai, K.H., M.H. Hsieh and E.J. Hultink, 2011. External technology acquisition and product innovativeness: The moderating roles of R and D investment and configurational context. J. Eng. Technol. Manage., 28: 184-200.

USITC, 2010. ASEAN: Regional trends in economic integration, export competitiveness and inbound investment for selected industries. Investigation No. 332-511, USITC Publication 4176, United States International Trade Commission, USA., August 2010.

Wang, Y., H.P. Lo, Q. Zhang and Y. Xue, 2006. How technological capability influences business performance: An integrated framework based on the contingency approach. J. Technol. Manage. China, 1: 27-52.

Wang, H. and H. Zhang, 2010. A distributed and interactive system to integrated design and simulation for collaborative product development. Robot. Comput. Integr. Manuf., 26: 778-789.

Weston, R. and P.A. Jr. Gore, 2006. A brief guide to structural equation modeling. Counsel. Psychol., 34: 719-751.

Wingwon, B. and M. Piriyakul, 2010. Antecedents of PLS path model for competitive advantage and financial performance of SMEs in Thailand. Afr. J. Market. Manage., 2: 123-135.

Wong, S.K.S., 2012. The influence of green product competitiveness on the success of green product innovation: Empirical evidence from the Chinese electrical and electronics industry. Eur. J. Innov. Manage., 15: 468-490.

Xie, P. and L. Li, 2013. Research about Jiangxi's auto enterprises co-opetition relationship and industrial upgrading based on the modular production perspective. Adv. Inform. Sci. Serv. Sci., 5: 254-262.

Yam, R.C.M., W. Lo, E.P.Y. Tang and A.K.W. Lau, 2011. Analysis of sources of innovation, technological innovation capabilities and performance: An empirical study of Hong Kong manufacturing industries. Res. Policy, 40: 391-402.