Competitiveness Analysis: An Ahp Approach for the Automotive Components Industry in Thailand

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This paper addresses the multi-faceted nature of an industrial competitiveness problem by using a multi-criteria decision analysis technique, namely the analytic hierarchy process (AHP). An AHP model is developed and applied to evaluate trade-offs among the varying degrees of importance of competitiveness indicators and the different effects of competitiveness drivers. The automotive components manufacturing industry in Thailand was selected as an illustrative case that represents a situation where firms in developing countries compete in the global market. Since industrial competitiveness underlies the economic growth of nations, the results obtained can be useful for both automotive parts makers and policy makers in guiding their decisions to competitiveness improvement.

1. Introduction

Competitiveness is not a readily measurable concept. The Organization for Economic Co-operation and Development (OECD) suggests that the meaning of competitiveness entails fair competition, trade performance and sustainable economic growth. Given this point of view, the output of business activities contributes to the competitiveness of industries and the economic welfare of many nations. For example, the manufacturing sector is regarded as an important economic engine because manufacturing firms produce goods and compete in the global international market. An analysis of the competitive performance among firms can, therefore, be useful for a competitiveness study of a particular industry.

This study considers how the competitiveness of many firms can determine the competitiveness of an overall industry. It proposes

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an analytical model that applies theories in strategic management and operations management to examining a complex relationship between variables affecting an industrial competitiveness position and indicators of competitiveness. Two key variables are identified in the literature: the indicators and the drivers of competitiveness. The strategic management school tends to assess competitiveness mainly from the financial aspect, by looking at either the industrial organization (IO), theory or the resource-based view of the firm (RBV). On the other hand, operations management (OM) suggests that choices of competitiveness should encompass various indicators of organizational performance, and it considers manufacturing functions as are competitiveness drivers.

Today, manufacturing firms in developing economies are increasingly faced with various induces changes in business practices. The competition in the world market challenges in the wake of trade and investment liberalization. Globalization has had a particularly significant impact particularly on the automotive industry. In Thailand, this sector generated more than 10% of all manufacturing exports in 2005 (Ministry of Commerce, 2006). Because of its economic significance, this paper therefore, presents a competitiveness analysis model for this sector. The model helps to identify the degree to which a specific performance indicator is important to defining competitiveness of automotive parts makers operating in Thailand. In addition, it also helps to evaluate the extent to which each driver affects the indicators. The analytic hierarchy process (AHP) was adopted to analyze the complex relationship between these variables of competitiveness analysis.

2. Literature Review: Approaches to Industrial Competitiveness Studies

Researchers study competitiveness either from the perspectives of a nation or an individual firm. As a result, studies of competitiveness are found across multiple disciplines including economics,

performance measurement, strategic management, operations management as well as policy research. Over the past decades, the literature on this subject mainly centered on questions of measuring competitiveness usingusing various indicators and identifying sources of competitive advantage or so-called competitiveness drivers. Attempts to answer these questions have produced extensive research, especially in the strategic management and operations management fields of study.

2.1 The Strategic Management Perspective

The strategic management approach assesses competitiveness according to financial performance, and identifies competitiveness drivers as competitive conditions of markets and resources of firms. To explain why firms achieve different profit rates, the literature provides two important but contrasting theories: the industrial organization (IO) and the resource-based view of the firm (RBV) (Hoskisson, Hitt, Wan & Yiu, 1999).

- Industrial Organization Theory

The IO theory explains why firms operating in some industries are more profitable than others (Ghemawat, 2002). It asserts that firm profitability is function of the industrial environment or market conditions, since the the nature of an anindustry directs behaviors of firms (Hoskisson et al., 1999). Porter (1998, reprinted 1998) explains that the profit potential of firms in a particular industry depends on trade-offs among the following five forces of market competition: bargaining powers of buyers, bargaining powers of suppliers, threats of new entrants, threats of substitute products, and the intensity of rivalry among competitors. This framework for industry analysis has been widely used for competitiveness analysis of industries (Fairbanks & Lindsay, 1997). In order to maximize the profitability of their respective firms, managers should seek to manipulate the underlying factors of the

five forces (such as customer switching costs and government policy) to their favor (Porter, 1998).

- Resource-Based View

anthe RBV theorists believe the firm's resources are the most important factors affecting profitability (Barney, 2001; Wernerfelt, 1984; Wernerfelt, 1995). The term "resources" refers to bundles of tangible and intangible assets as well as skills, which are valuable, rare, imperfectly imitable and not substitutable (Barney, Wright & Ketchen, 2001). Thus, resources encompass various assets and capabilities of firms (Hall, 1993; Challis & Samson, 1996; Barney, 2001; Fahy, 2002). According to Barney (1991), resources refer to "all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc controlled by a firm, that enable a firm to develop and implement strategies that improve its efficiency and effectiveness (quoted in Michalisin et al., 1997)." In brief, resources are tangible and intangible assets that a firm uses to choose and implement its strategies (Barney, 2001). For example, resources include employee expertise and knowledgecompany reputation, product reputation, as well as the company's organizational culture (Hall, 1992, 1993). Tis school of thought The aprocess of deploying those resource within firms thus, yield different levels of performance. Thus By developing and exploiting firm resources, managers can change the "rules of the game"– competitive conditions, and establish a competitive advantage that addresses customer values (Stoelhorst & van Raaij, 2004).

2.2 The Operations Management Perspective

From the operations management perspective, competitiveness is measured against multiple criteria. Among others, the performance indicators include sales growth, market share, customer satisfaction, productivity, and profitability (Ahmed, Montagno & Firenze, 1996; Morita & Flynn, 1997; Li, 2000; Gordon & Sohal,

2001; Ross, 2002).

Resources and capabilities related to operations functions such as advanced manufacturing technologies (Tracey, Vonderembse & Lim, 1999; Gordon & Sohal, 2001; Sharma & Fisher, 1997), quality management practices (Anderson & Sohal, 1999; Gordon & Sohal, 2001; Sharma & Fisher, 1997), product design and development capability (Sharma & Fisher, 1997; Li, 2000; Gordon & Sohal, 2001) contribute to the competitiveness of firms. Manufacturing firms can achieve competitiveness through improvement of operational capabilities (Wheelwright & Hayes, 1985). In fact, Skinner (1969) was the first to suggest the importance of operations functions. functions and the ofthe manufacturing,;&, Such had a positive effect on firm performance the ss

2.3 Understanding Industrial Competitiveness: A Synthesis View

Globalization makes the relationship between competitive resources and the positions of firms more complex and therefore more difficult to explain using a single theoretical viewpoint (Hoskisson et al., 1999). On the one hand, the strategic management literature considers competitiveness mainly in terms of financial performance, and factors affecting competitiveness are market forces otherwise firm resources. On the other hand, operations management studies show that competitiveness is measured by multiple indicators and the roles of manufacturing functions are emphasized as competitiveness drivers. Since both approaches share the common objective of identifying sources of superior competitive performance, a number of factors relevant to competitiveness analysis emerge from the empirical evidence in both fields. The findings in these studies point to two sets of variables: the indicators and the drivers of competitiveness.

- Indicators of Competitiveness

Although profitability indicators such as return on investment and return on assets are traditional proxies of competitiveness, one should not confuse competitiveness with profitability. The literature in operations management shows that non-financial performance indicators are also important competitiveness indicators, especially in the manufacturing sector. Aside from profitability indices, the following indicators were also mentioned: sales volume (Li, 2000; Anderson & Sohal, 1999); sales growth (Lau, 2002; Sharma & Fisher, 1997); market share (Li, 2000; Anderson & Sohal, 1999; Sharma & Fisher, 1997); market share growth (Tracey et al., 1999); perceptions on overall customer satisfaction (Tracey et al., 1999; Sharma & Fisher, 1997); overall competitiveness (Lau, 2002; Anderson & Sohal, 1999); overall plant success (Gordon & Sohal, 2001); and productivity (Ross, 2002; Sharma & Fisher, 1997).

The use of both financial and non-financial performance indicators reveals an integrated view of a business and guides business decisions (Neely et al., 2001; McAdam & Bailie, 2002; Nilsson & Kald, 2002). It also facilitates the business improvement process (Kaplan & Norton, 1992). An integrated performance measurement system is a useful strategic tool to improve competitiveness for manufacturing firms (De Toni, Nassimbeni & Tonchia, 1997; Chenhall, 2005). Therefore, using both types of indicators can be useful for competitiveness analysis.

- Drivers of Competitiveness

The IO-based studies show how market forces and the role of government impinged on profitability (Fairbanks & Lindsay, 1997). RBV-based studies, on the other hand, suggest particular capabilities that influence competitive performance (Hall, 1992; Hall, 1993). The operations management literature adds to an understanding of how firms achieve competitiveness through resources generated by operations functions (Amundson, 1998). Therefore, observations from the operational management point of view complement the

RBV theory (Amundson, 1998; Dangayach & Deshmukh, 2001; Coates & McDermott, 2002).

This paper considers the relevant theories and classifies competitiveness drivers into two groups. The first group consists of market forces and governmental roles described by the IO theory, reflecting firm-external drivers. Since characteristics of the operations function complement the RBV theory, the second group thus includes resources and capabilities of firms as suggested by the RBV theory and the OM perspectives, representing firm-internal drivers. By combining these theories in this way, a more comprehensive picture emerges that includes both the "outside-in" and "inside-out" perspectives (Spanos & Lioukas, 2001; Stoelhorst & van Raaij, 2004).

2.4 A Theoretical Framework of Competitiveness Analysis

Before an effective competitiveness improvement strategy can be devised, it is vital to know how each competitiveness driver affects the indicators. The literature review discussed above, suggests a series of linkages between the indicators and the drivers of competitiveness. The three theories reveal the multidimensional nature of competitiveness and when combined, they make a more comprehensive analysis possible (Hoskisson et al., 1999; Coates & McDermott, 2002). By integrating these theories, this study proposes a theoretical framework for competitiveness analysis featuring a hypothetical relationship for such linkages, presented in Figure 1.

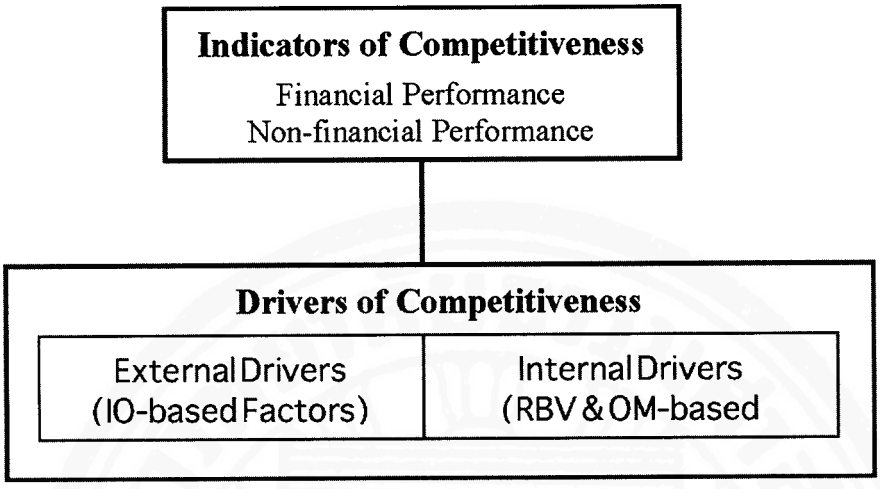

Figure 1: Framework for Industrial Competitiveness Analysis: A Multi-Theory Approach

This framework explicitly addresses the influence of competitiveness drivers on competitiveness indicators, as discussed in the above-mentioned theories. A methodology that considers the multidimensional characteristics of competitiveness analysis can quantify the degrees of such effects.

3. Methodology: The Analytic Hierarchy Process

Competitiveness indicators can evolve from conflicting business objectives, and various competitiveness drivers have emerged from competing theoretical points of view. This reflects a complex relationship between the indicators and drivers. To systematically analyze the relationship among these variables, an appropriate methodology is necessary. AHP is an appropriate tool for this task because it can effectively evaluate trade-offs among the multi-faceted and competing factors in a single model, and can incorporate both qualitative and quantitative data simultaneously (Saaty, 1990). AHP has been applied to competitiveness analysis in studies that identify key success factors for certain objectives. For example, Partovi (1994) developed an AHP model to prioritize

and select production processes that were crucial for process benchmarking. The model was based on a strategic benchmarking procedure. Rangone (1996) analyzed manufacturing performance by constructing an AHP model that assessed overall performance of factories. Chin et al. (2002) used AHP to evaluate factors affecting the adoption and implementation of total quality management systems. Hafeez, Zhang & Malak (2002) explored competence-based competition by using AHP to prioritize key capabilities vital for improving a firm's performance. Therefore, AHP has proved to be a useful tool to analyze competitiveness, by prioritizing competitiveness indicators and exploring the degrees of influence of the competitiveness drivers.

Using AHP involves three main steps (Partovi, 1994). The first step is to decompose a complex problem into several elements and then re-organize them in a hierarchical structure. The construction of the hierarchical structure is the most creative part of the process and has the most critical effect on the outcome (Saaty, 1996). The first level of the hierarchy represents an overall goal of a problem or a desired situation. Other elements of the problem are organized into levels so that comparison of preference across elements in each level must be possible with respect to some or all elements in the above level. When an AHP model is well developed, the next step is to identify the relative degrees of importance for elements in the model. This can be done through the pairwise comparison method, which compares elements at each hierarchical level and assigns an AHP score to each of them. The c sindicatesthe element's when with its corresponding, with respect to a particular criterion shown as an element at the above level. The values of pairwise comparison scores are based on the 1-9 AHP scale (Saaty, 1990). The final step is to synthesize these scores in order to derive the weighted degrees of importance for all elements in the model. Computer software for AHP can be helpful at this stage.

4. The Application: Competitiveness Analysis of the Automotive Components Industry in Thailand

4.1 The Automotive Components Market in Thailand

The automotive components industry is a growing sector in Thailand. According to the Thailand Automotive Institute (TAI), this industry includes more than 1600 companies (TAI, 2002). About two thirds of these are local companies and some joint ventures making intermediate products such as sheet metal stamping, forging, and plastic parts. Their customers are parts makers in the group of another one third, who produce and supply particular automotive parts to carmakers. Thus, the former group consists ofof parts makers is considered indirect suppliers, while the latter consists ofis the direct one. Direct suppliers include subsidiaries of leading global parts makers such as Delphi, Denso, Robert Bosch, TRW, and Visteon. Many Thai-Japanese joint ventures and few local companies also compete in this latter market. Parts manufactured in the country include engines, suspension controls and springs, axles, hubs, propeller shafts, brakes, clutches, steering systems, body parts, electronic parts, air conditioning systems, tires, wheels, internal and external trim components and glass (OIE, 2004).

4.2 Identifying Competitiveness Indicators

Parts makers are expected to meet rigorous customer requirements in terms of cost, quality and delivery targets. These manufacturing performance are primary criteria for selection and evaluation of suppliers (TAI, 2002). In addition to satisfying their customers, parts makers also need to sustain financial health and business growth (Fahy, 2002). Financial health can be assessed by profitability ratios and cash flows. Indicators of business growth are more complicated since growth can also result from either expanded breadth of product line, or customer base. Simpson, Siguaw, & White

(2002) further point out intangible qualities such as trust and the relationship between suppliers and customers is considered an important source of growth for automotive parts makers.

The above studies reveal five dimensions of ofparts makers' performance that can be considered as competitivenessappropriate indicators. These performance indicators are namely, manufacturing excellence, value-added of products, market expansion, financial returns and intangible values.

4.3 Identifying Competitiveness Drivers

The firm-external drivers are essentially the five market forces proposed by Porter (1998). However, research in the automotive sector reveals that carmakers have considerable influences over parts makers, particularly through their procurement strategies (Corrêa & de Miranda, 1998; Humphrey & Memedovic, 2003; Noble 2001). For this study, procurement strategies of the carmparent companies of vehicle makers should be taken into account as an important force, since such influences are beyond power of their affiliates which are direct buyers in Thailand. In addition, Kawahara (1997) and OIE (2004) show how government policies play an important role in developing the automotive industry in many countries. For example, the Japanese and the US governments were involved in trade disputes in the automotive sector. For developing countries, host governments play a crucial role by attracting foreign investment from carmakers and global suppliers. In Thailand, several measures concerning tax incentives, infrastructure and local workforce improvement have been introduced to encourage investment in this sector (OIE, 2004; Siroros, 1997). It can be said that firm-external drivers of competitiveness can be categorized into two groups, i.e., industrial competitive conditions and governmental roles.

Regarding the firm-internal drivers, implementation of quality management systems and lean production helps firms achieve better competitive performance (Lewis, 2000; Liker & Wu,

2000; Johnson, 2002; Kojima & Kaplinsky, 2004). Effective shop-floor management enables front-line operators to effectively pursue problem solving and continuous improvement activities in terms of product development, quality management and cost reduction (Delbridge & Barton, 2002). Further, engineering expertise embedded in firms is important to competitive positions of parts makers. A highly trained workforce and up-to-date technology can therefore be considered as competitiveness drivers. For example, new manufacturing technology helps parts makers significantly improve performance in terms of quality of conformance, production efficiency and company image (Laosirihongthong, Paul & Speece, 2003). In addition, research in product design may result in new product technology that adds more value to automotive parts such as Commonrail technology in diesel combustion engines. Therefore, firm-internal drivers should include technologicalcapabilities of parts makers in both managerial and engineering aspects.

4.4 The AHP Model of Competitiveness Analysis

The above discussion presents the requisite preliminary information to construct a tentative model of competitiveness analysis for the automotive components industry. Because a model represents a simplification of reality, it is subjected to a validation process to establish creditability and to improve its relevance and acceptability (Qureshi, Harrison & Wegener, 1999). To ensure that the model is duly developed, the following four types of model validation need to be considered: conceptual, logical, aptness and data validation (Oral & Kettani, 1993). *Conceptual validation* verifies the appropriateness of the method used to obtain and apply experiential-based data, to develop a conceptual model. *Logical validation* concerns itself with the transforming process from the conceptual model into a formal model, so that no essential element or relationship established in the conceptual model is lost. *Aptness*

validation refers to the model's ability to address representativeness, usability, and usefulness. The appropriateness of the types of data and related administration processes employed at each step, determines *data validity*.

Relevant competitiveness indicators and drivers can be properly identified, and the final model can be fully developed through the validation process. In this study, the use of primary data obtained from face-to-face interviews with knowledgeable experts helps to validate the tentative model. These individuals included researchers in the automotive industry as well as industrialists from representative groups of the industry's stakeholders. Interview notes were taken during the interview sessions, transcribed and then reported back to interviewees in order to ensure accuracy and improve the conceptual, logical and data validity of the model. The aptness validation was then carried out through in-depth interviews and pilot projects using the AHP pairwise comparison method. It should be noted that the process of model development and validation concerns revolving activities, and a total of 48 experts participated at this stage. After a few revisions of the first tentative model, all elements were finally designated for the final model, shown in Figure 2.

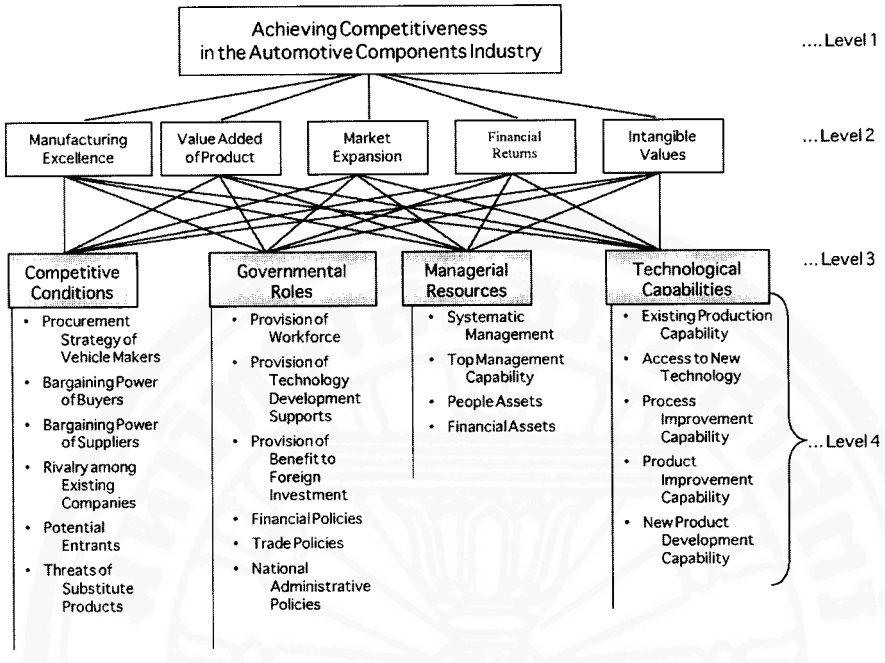

Figure 2: AHP Model of Automotive Components Industry Competitiveness

The first level expresses the overall goal of the model, which is to attain a desired competitive position in the market. This goal can be better achieved if one understands the defining criteria for competitiveness and the effects of the drivers towards overall competitiveness. Therefore, the second level presents the criteria of competitiveness assessment for this market, based on the five aspects of parts makers' performance. The third level shows four categories of competitiveness drivers. The driver attributes are located at the lowest level, and form their respective groups. The operational definitions of all elements are shown in Table 1.

Table 1: Model Description

Competitiveness Indicators	**Operational Definitions**
Manufacturing Excellence	Parts makers can consistently produce and deliver goods according to customers' requirements in terms of quality of conformance and punctual delivery, at competitive costs (QCD).
Value-Added of Product	Parts makers succeed in offering products with higher value-added to customers. The added value can result from improvement of existing products or introduction of new products.
Market Expansion	Parts makers succeed in expanding their customer base by tapping on new customers.
Financial Returns	Parts makers achieve satisfactory financial returns such as generation of cash inflows, profit margin, and profit amount from the existing business.
Intangible Values	Parts makers benefit from continuing business with customers in terms of intangible values. Such values are, for example, a better business opportunity in the future, a prospect of penetrating new markets/customers, an increased volume of order, an opportunity to utilize existing facilities, etc.
Competitiveness Drivers	**Operational Definitions**
Firm-External Drivers	
(1) Industrial Competitive Conditions	
Procurement Strategies of Vehicle Makers	Vehicle maker procurement strategies refer to the policies and regulations for procurement of automotive parts. For example, the strategies include supplier selection, allocation of supply quota and global purchasing plan.
Bargaining Power of Buyers	Bargaining power of buyers is the degree of influence parts makers perceive the buyers to have on their business.

Table 1: Model Description

Bargaining Power of Suppliers	Bargaining power of sellers is the degree of influence parts makers perceive the suppliers to have on their business.
Existing Competitors	The extent of rivalry among existing parts makers depends on various factors e.g., overall growth of the industry, different characteristics of parts makers in terms of size, production capability, products, and competitive strategies, influence of parent companies, significance of loss if parts makers lose customers, market share or the entire business, etc.
Potential Entrants	Threats of potential entrants include effects of having new competitors in the market no matter how they compete, i.e., setting up manufacturing plants in Thailand or imports from other countries.
Substitute Products	Substitutes refer to all goods that can be used as alternatives to the current type of automotive components. Such substitutes can result from technological advancement or a better price/performance ratio of the substitute product, as well as preference of buyer toward the substitutes.
(2) Governmental Roles	
Provision of Workforce	Development of relationships between the industry, educational institutes and other governmental agencies in order to produce a workforce with suitable qualifications for the industry.
Provision of Technology Development Support	Development of relationships between the industry, educational institutes and other governmental agencies to support joint technology development projects. The support includes access to locally developed technology and funding.
Provision of Benefits for Foreign Investment	Investment incentives that the government provides for foreign investment in the automotive components industry.

Table 1: Model Description

Financial Policies	Financial policies that affect interest rates and foreign exchange rates to encourage industrial growth.
Trade Policies	Trade policies such as those related to the development of AFTA and other FTA regulations as well as adjustment of tariff structure and non-tariff barriers.
Administrative Policies	General administration policies on the tax system, energy, political stability, infrastructure as well as laws and regulations for businesses located in Thailand.
Firm-Internal Drivers	
(1) Managerial Resources	
Systematic Management	Implementation of systematic management systems such as ISO9000, QS9000, ISO/TS16949, as well as decision-aid information technology, effective shop-floor management, production management system, and JIT system.
Top Management Capability	Knowledge about the nature of the industry, the global competitive environment, the strategies of vehicle makers, and the importance of business networking.
People Asset	Availability of employees who possess sufficient working skills and a cooperative working attitude.
Financial Asset	Availability of or access to sufficient capital for additional investment and are able to manage associated risks.
(2) Technology Capabilities	
Existing Production Technology Access to New Technology	Production technology refers to the knowledge of the manufacturing processes as well as production capability. Access to new technology refers to the ability to acquire and use new technology through technical assistance agreements or licenses, and development of joint ventures or joint technological development projects.
Process Improvement Capability	Process improvement capability refers to the ability to improve the current manufacturing technology to satisfy customer requirements.

Table 1: Model Description

Product Improvement Capability	Product improvement capability refers to the ability to improve the existing products in their functional characteristics, performance or appearance, to better satisfy customers.
New Product Development Capability	Ability to design and develop new products to satisfy customers, either by itself or with other companies.

This model facilitates a comprehensive analysis of industrial competitiveness. The evaluation process begins by asking knowledgeable experts to make pairwise comparisons of the five indicators with respect to their relevance to industrial competitiveness. The driver categories are compared according to their impact on competitiveness improvement in terms of each indicator. Next, the drivers in the fourth level are compared with members within each group to determine their influence on the respective categories. When expert opinion has been fully solicited, the priority weights of all elements in the model can then be derived by using AHP software such as the Expert Choice®.

5. Results and Discussion

5.1 Uses of AHP

The development and implementation of AHP models often encounter certain challenges in the data collection process. The quality of these works relies substantially on the quality of experts and their judgments. For this study, the process of model development can be safeguarded by the involvement of individuals representing various industrial stakeholders. Once the model is fully developed, the pairwise comparison process is used as the tool for the final phase of data collection. Although AHP methodology

enables a systematic use of expert opinions, collecting them using the pairwise comparison process should consider the following three subjects: the sequence of pairwise comparison questions, the consistency of the individual's judgments, and the aggregation of group judgments.

First, if the strength of elements at a lower level could affect others above them, the pairwise comparison process should start first for elements at the lowest level of the hierarchy. In this study, the current performance of competitiveness drivers may influence judgments made on the pairwise comparisons for the importance of the driver categories with respect to the competitiveness indicators. Thus, the pairwise comparison questions were arranged in a sequence that started from elements in the lowest level of the model.

Second, it is important that the decision-making process is reliable so that experts can make consistent assessments. AHP does not require the judgment to be perfectly consistent. Generally, a consistency level ($CI \leq 10\%$) needs to be tolerated for each set of an individual's judgments. However, achieving a low CI ratio should not become the goal of data collection process. A higher level of inconsistency can be accepted as long as the judgments are accurate (Forman & Selly, 2001). According to Saaty (1990), the quality of expert opinion is more reliable when all elements in the model are well defined. In this study, the introduction part of the pairwise comparison questionnaire served this purpose. It provided operational definitions of terms used in the model so that an understanding of the model could be better aligned among the experts. Further, Expert Choice® provides a tool to identify judgments that lead to a high consistency level (EC, 2004). For experts whose judgments were considerably inconsistent, this tool was applied. When such a judgment was noted, the expert was asked if that particular pairwise comparison needed to be re-assessed. If not, the tool was implemented again to locate the next possible adjustment. In these cases, the EC program was run concurrently during the interview session. By the end of the data collection process, it was found that only few sets of

judgments had CI ratios slightly larger than 0.1. Most of the judgments were consistent within the tolerance limit of 10% CI.

Finally, the judgments of each expert need to be properly combined with others' in order to obtain a group judgment. Opinions of several respondents can be incorporated into group judgment either by means of achieving consensus or the use of a geometric mean, given that individual judgments are consistent (Saaty, 1990; 1996). In this study, experts made their judgments independently. The group judgments were then automatically derived by geometric means when judgments from all experts were solicited and combined using the software. In this study it was found that experts from the same group of stakeholder had different opinions in some cases, but in other cases opinions of experts from different groups were also more or less similar. Therefore, combining their opinions using the geometric mean should result in a reliable group decision without having lengthy debates.

5.2 Findings

The AHP results provide two sets of priority weights for the competitiveness indicators and drivers. Regarding the indicators, Manufacturing Excellence and Value Added of Product are two prominent aspects that define the competitive status of parts makers. As shown in Figure 3, the weights of these two indicators are significantly higher than others. Research participants explained this finding by pointing out that unless parts makers could supply their products according to the customer requirement in terms of cost, quality and delivery, an opportunity to supply new products with higher value-added will be limited; their financial and marketing performance could also be vulnerable, and a growth opportunity would be less foreseen. The suppliers are required to meet rigorous requirements on cost, quality and delivery targets. These targets are major criteria for supplier selection and evaluation processes (TAI, 2002). In fact, carmakers further emphasize this aspect of

performance improvement by imposing increasingly stringent annual targets.

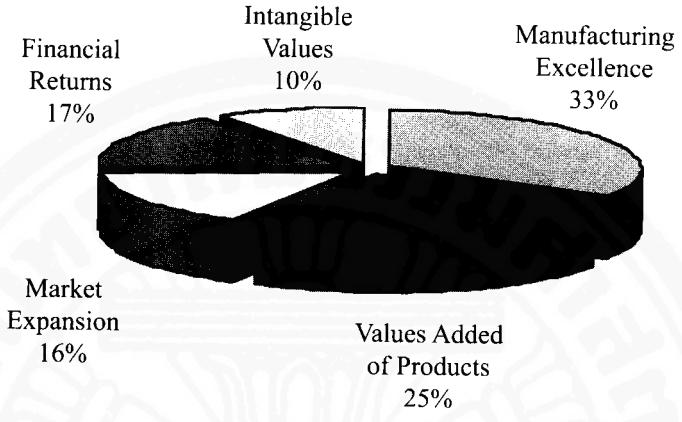

Figure 3: Importance of Competitiveness Indicators

However, given the mandatory requirement carmakers impose for annual cost reduction, manufacturing efficiency alone is not enough to make a business viable. Unless they can supply new products, parts makers may not be able to achieve a sufficient financial return. Higher value added products are necessary as they provide parts makers opportunities to increase profits. In addition, parts makers can penetrate supply chains of new customers if they have attractive products. Thus, the Value Added of Products is perceived as the second most important indicator.

The weights of competitiveness drivers identify the degree to which the drivers have an impact on the overall competitive position of parts makers. According to the results shown in Figure 4, key competitiveness drivers include Top management capability, Procurement strategies of vehicle makers, Process improvement capability, Bargaining power of buyers, New product development capability, Access to new technology, Product improvement capability, Systematic management and People assets.

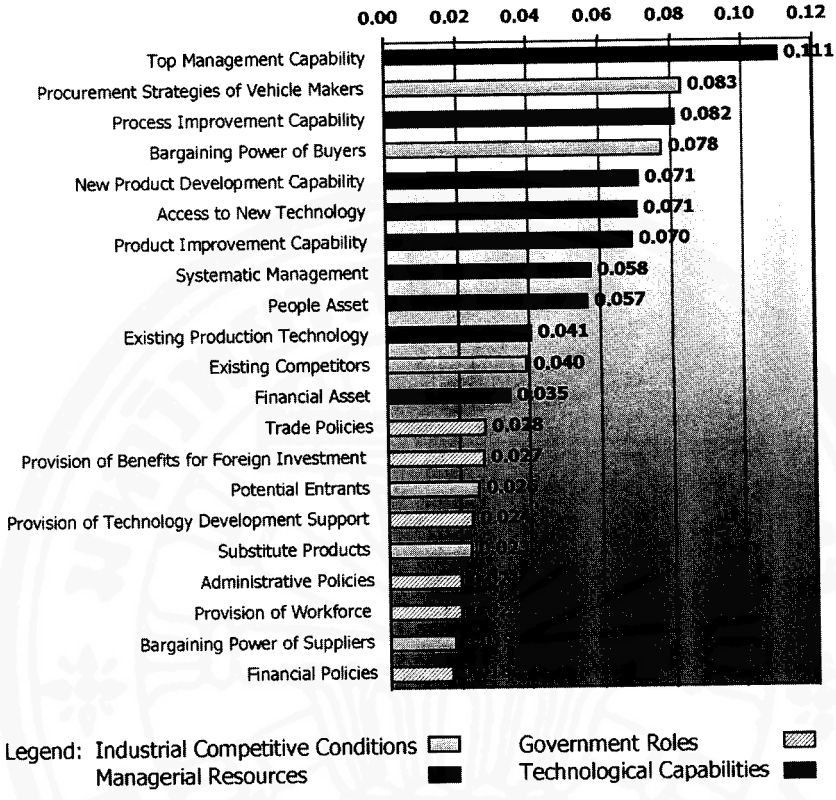

Figure 4: Importance of Competitiveness Drivers

Results shown in the above bar chart illustrate that the importance of four competitiveness driver categories are quite different. The contribution of the Thai government is apparently least significant. Managerial resources are as important as competitive conditions in terms of strengthening parts makers' competitive positions. The most important category of competitiveness drivers is Technological Capabilities.

Further, sensitivity analyses were performed to investigate the trend of changes in priority of these drivers if the importance of the indicators was perceived to be significantly different. These "what-if" analyses can shed light on management decisions when parts makers devise a competitiveness improvement strategy. The results of sensitivity analyses indicate that drivers in each category

are important to each facet of competitiveness in different ways. The relative degrees of importance of the four driver categories with respect to the five competitiveness indicators are shown in Figure 5.

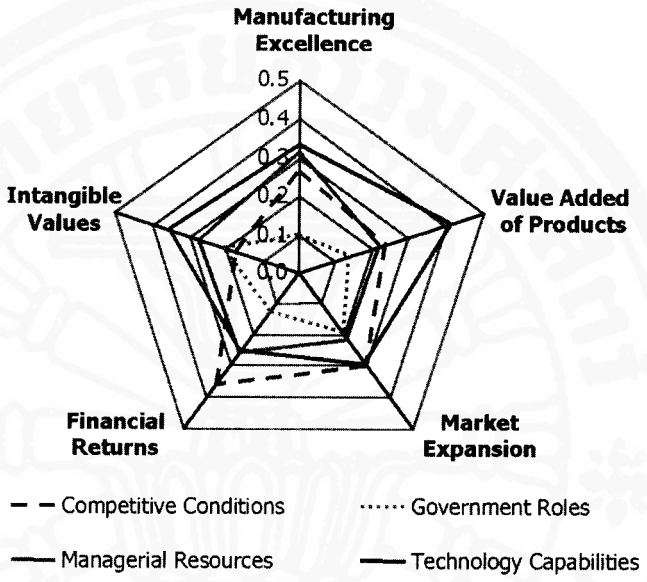

Figure 5: Contributions of the Drivers toward the Indicators

This finding confirms the government's limited influence since drivers pertaining to this category have the least influence on almost every indicator. The competitive conditions of the market have a significant influence on the financial performance of parts makers. On the other hand, drivers related to the managerial resources and the technological capabilities significantly affect all aspects of competitiveness. Since drivers relevant to both the firm-internal and firm-external categories contribute to achieving competitiveness, the results of this study support the application of multiple theories from both the strategic management and operations management literature to study competitiveness. The contributions of the four driver categories are discussed below.

The experts explained that the government's influence is

limited because the Thai government is inclined towards laissez faire policies. The government therefore, is only considered important in terms of its ability to provide a sound investment environment by maintaining open economics policies, providing attractive investment promotion, political stability and a stimulated domestic market. In other words, the government only offered limited support towards improving the performance of firms in a particular industry.

Managerial resources of part makers and competitive conditions of the market are comparatively strong drivers. It can be seen that competitive conditions of the market can significantly affect the performance of parts makers in terms of financial returns and Market expansion. This result corresponds to an explanation provided by Porter (1998), although factors related to the automaker's influence are exceptionally stronger than other market forces. Key reasons for the buyer's significant influence are that automakers are much larger companies compared with their suppliers and they are the only large-volume buyers in this industry. The recent consolidation among automakers makes them even more powerful in this regard. Automakers such as Toyota, GM and Ford have deeply rooted relationships with parts makers related to their groups of companies. They are also able to configure their respective supply chains through the development of a global production network (Sturgeon & Lester, 2004; Doner, Noble & Ravenhill, 2004). These characteristics allow automakers to influence the marketing and financial performance of parts makers.

On the other hand, the effects of managerial resources are stronger than that of the market forces insofar as manufacturing performance and intangible values can define competitiveness. The capability of top management is considered to be significantly more important than others because many business decisions depend on visions of the top management, and the top management can satisfy customers by ensuring day-to-day business effectiveness. The adoption of systematic managerial approaches and the readiness of employees also have a significant impact on manufacturing

performance. The systematic management approaches such as ISO9000, ISO/TS16949, Total Quality Management, Just-in-time and information technology are managerial tools that institute standardized working processes. In addition, parts makers in Thailand benefit from their employees' accumulated production skills, cooperative working attitude and their familiarity with Japanese management styles. Such benefits are the result of being in business in the country for some forty years.

The technological capabilities of parts makers are the most important drivers for all aspects of competitiveness, with the exception of financial performance. Since continuous improvement on product and production process determine competition in this industry, these drivers strongly affect the competitive performance of parts makers especially in terms of manufacturing performance, enhancement of intangible values and product value-added. The emergence of Commonrail technology and newly developed vehicle control instruments as well as the adoption of the Toyota Production System underline the importance of technology-related drivers.

6. Conclusions

Global competition has made the analysis of competitiveness a vital component of strategic planning. This paper applies an AHP model to analyze the competitiveness of the automotive components industry in Thailand. By analyzing the means-end relationship between the drivers and the indicators of competitiveness, this study reveals the degree to which indicators are relevant and the degree to which a driver influences industrial competitiveness. This paper contributes to both the methodological and practical aspects of the analysis on the automotive components manufacturing industry.

From the methodological aspect, the AHP model of competitiveness analysis provides a new method for investigating the contribution of various sources of competitive advantage. The

conventional approach to such an analysis would only apply variance decomposition analysis and a large-scale survey or secondary data. By using the AHP model, however, the relevance of firm-internal and firm-external competitiveness drivers can be determined according to their weights of importance. The findings indicate that the firm-internal drivers are collectively more powerful than the firm-external ones in making parts makers perform better in the automotive parts market. The results support the application of the IO and RBV theories as well as the OM literature to explain competitiveness.

In terms of practical contributions, this study shows how the competitiveness of automotive parts makers can be measured and improved. Results of this study therefore, offer manufacturers of automotive parts and policy makers involving in this industry practical solutions to the problems they face when devising a competitiveness improvement strategy.

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