Chapter 2

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The importance of the automotive industry to the Indonesian economy has heightened in recent years. The role of foreign investors in the development of the industry, as well as in the industry's level of technology, is unavoidable. This paper attempts to identify the strengths and weaknesses of the technological capability of Indonesia's automotive firms by interviewing ten companies in the industry. The results show that they seem to focus on short-term gains in their business as they excel in meeting demands with QCD criteria, managing the assigned projects well, and often learning from the experience. However, they seem not to have a long-term technology strategy, as most of them have not started research and development and do not place technological learning as a priority when selecting technology or other activities.

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1. Introduction

The relationship between global-local linkage and innovation has been studied by many authors. Aswicahyono and Kartika (2010) find the significance of Japanese investors in the development of Indonesia's automotive industry and in the technological learning of Indonesian engineers. Although considerable research has been done on this area, much less is known about the depth of technological capability of Indonesia's automotive firms. The purpose of this research is to gain knowledge on the strengths and weaknesses of the technological capability of Indonesia's automotive companies. The results suggest that the core competencies of Indonesia's automotive firms are good management skill in implementing the technology-based projects, meeting customers' demand in QCD (quality, cost, and delivery) terms, and drawing lessons from past technology-based projects. Nevertheless, the limitation of the Indonesian automotive companies is the fact that they do not invest in research and development nor make attempts in building their own technology for the benefit of their future technological competence. Furthermore, some manufacturing firms which are heavily foreign-owned and have a sole customer/supplier, i.e. their own principals, usually have relatively low technological capability, since their technology is provided by their principals and they have neither responsibility nor incentive to upgrade their technology. Despite the limitations of the technological capability of Indonesian automotive manufacturing firms, the importance of the industry to the country's economy is increasing recently, and the labor productivity of the industry also shows upward movement.

This paper is structured as follows. Section 2 gives the development of the

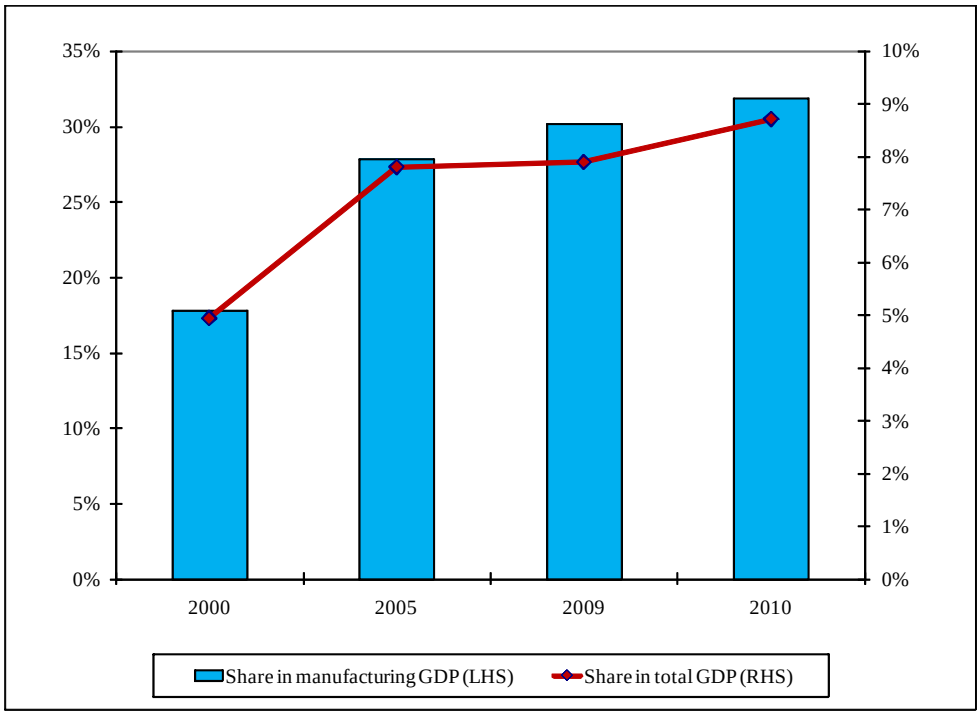
industry, utilizing secondary data of the GDP (gross domestic product), exports, domestic sales, number of laborers, and labor productivity. Section 3 describes the excerpts from interviews with 10 automotive firms, preceded by the theoretical framework of the interviews. After presenting the stylized findings from the interviews, the last section attempts to draw policy implications.

2. Structure of Indonesia's Automotive Industry

The significance of the automotive industry to the nation's economy has heightened during the past decade. This is reflected in its rising share of the country's GDP, the larger value added the industry produces, the rapid growth of local automotive sales, and the increasing productivity of laborers in that industry.

The contribution of the transport equipment industry to total GDP has increased recently. It was 5% in 2000 and enlarged to almost 9% in 2010. Likewise, the portion of value added created by the transport equipment industry in the total value created by all manufacturing industries expanded from 18% in 2000 to almost 32% in 2010. These indicate the heightened significance of the industry to the economy.

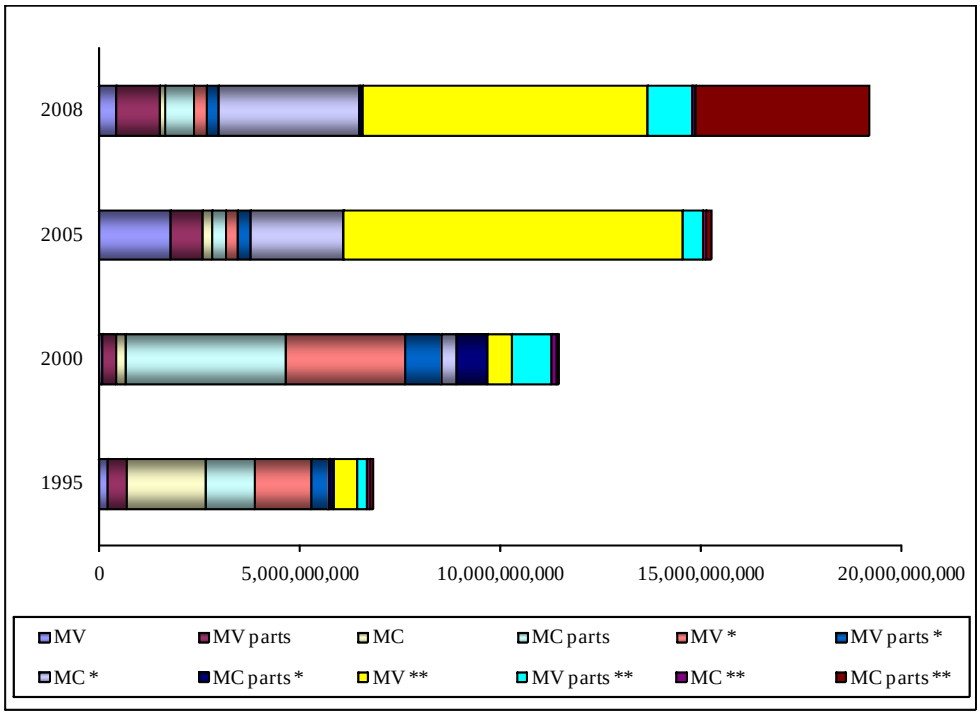
Figure 1: Share of Value Added of Transport Equipment Industry in GDP



Source: Calculated by authors, CEIC Database.

Although the share of the industry's value added to total GDP rose, the growth of the industry's value added declined slightly. However, the figures still indicate strong growth over time: 68% during 1995-2000; 33% during 2000-05; 26% during 2005-08. Furthermore, there seems to be a shift of the largest contributor of value added from domestic firms to foreign firms. As for the years 1995 and 2000, the largest value added creators were, in order, domestic motorcycle parts and components firms, domestic motorcycle parts firms, and motor vehicle firms with >10-50% foreign ownership. Nevertheless, in 2005 and 2008, the main contributors of the industry's value added were, by rank, majority foreign-owned motor vehicle firms, majority foreign-owned motorcycle parts and components firms, and minority foreign-owned motorcycle firms.

Figure 2: Value Added of Automotive Industry, by Ownership (in Thousand Rupiah)



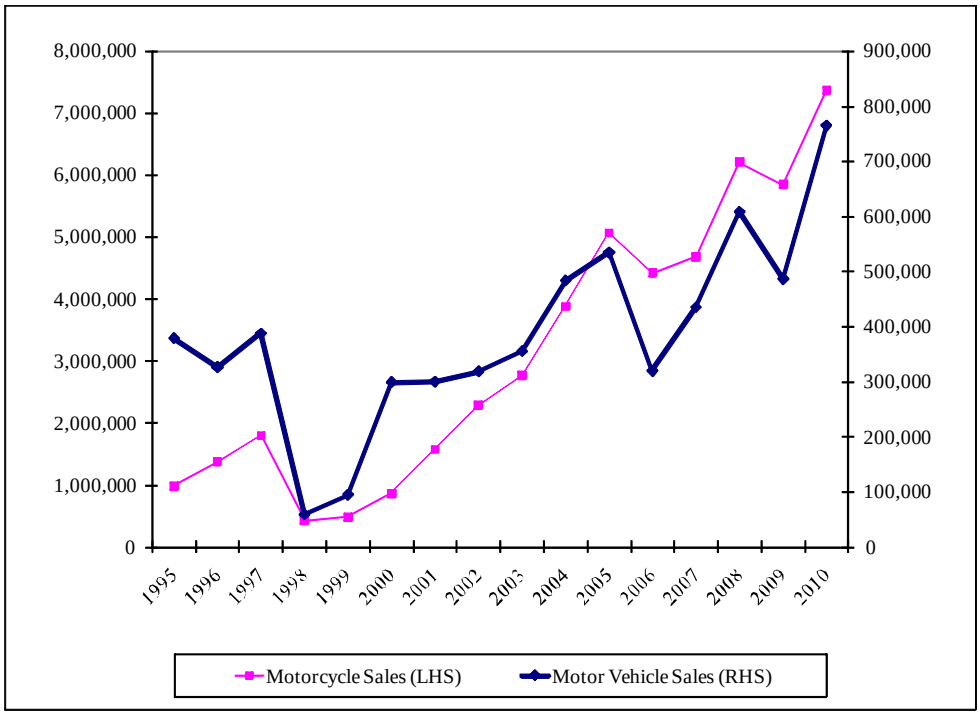
Source: Calculated by authors, Central Bureau of Statistics.

Notes: MV = Motor vehicle firms with <=10% foreign ownership
MV* = Motor vehicle firms with >10 – 50% foreign ownership
MV** = Motor vehicle firms with >50% foreign ownership
MV parts = Motor vehicle's parts & components firms with <=10% foreign ownership
MV parts* = Motor vehicle's parts & components firms with >10 – 50% foreign ownership
MV parts ** = Motor vehicle's parts & components firms with >50% foreign ownership
MC = Motorcycle firms with <=10% foreign ownership
MC* = Motorcycle firms with >10 – 50% foreign ownership
MC** = Motorcycle firms with >50% foreign ownership
MC parts = Motorcycle's parts & components firms with <=10% foreign ownership
MV parts* = Motorcycle's parts & components firms with >10 – 50% foreign ownership
MV parts ** = Motorcycle's parts & components firms with >50% foreign ownership.

Motorcycle and car domestic sales have increased greatly since 1998. After being hit by the 1998 economic crisis, sales in 2001 were back to a level similar to that before the crisis. Afterwards, the motorcycle sales quadrupled to around 7.4 million units sold in 2010. Similarly, the car domestic sales grew by 2.5 times to approximately 760,000 units in 2010. This reflects the booming of the Indonesian economy in the 2000s. There were decreases in both types of vehicles in 2006, perhaps due to the rise in domestic fuel prices in 2005. There were also slight

decreases in 2009, probably because of the 2008 global financial crisis.

Figure 3: Local Sales of Motorcycles and Motor Vehicles (unit)



Source: Central Bureau of Statistics.

Indonesian exports of automotive products surged after the economy recovered from the crisis in 2002. Exports of cars increased by about 600% and 400% during the periods of 2002-05 and 2005-08. This is in line with the policy development at that time, when in 2006 the government abolished the import duty on parts of cars for the export market. As for auto parts exports, they also experienced strong growth in the periods under observation (Table 1).

Table 1: Export Growth of Automotive Industry

	MV	MV parts	MC	MC parts
1996-99	94.50%	152.47%	17.22%	-2.83%
1999-2002	-47.62%	89.86%	-10.60%	6.56%
2002-05	599.47%	153.64%	-5.50%	62.63%
2005-08	407.04%	43.79%	140.33%	11.57%

Source: Calculated by authors, WITS World Bank.
Notes: MV = Motor vehicle
MV parts = Motor vehicle's parts & components
MC = Motorcycle
MC parts = Motorcycle's parts & components.

For the four years under observation (1995, 2000, 2005, and 2008), domestic auto parts and components firms (i.e. MV parts and MC parts) were the firms which absorbed the most laborers (Figure 4). In contrast, labor absorption in the domestic motor vehicle and motorcycle firms as finished goods producers was not much. This might indicate a large amount of local SMEs (small and medium enterprises) in the auto parts and components industry in Indonesia. However, despite the large number of laborers, the labor productivity of the local motor vehicle parts and components companies was relatively low (Figure 5).

Moreover, there was a substantial increase in the number of laborers for majority foreign-owned motor vehicle firms in 2005 and majority foreign-owned motorcycle parts and components firms in 2008. This may be due to the opening of Indonesia's automotive industry in 1999. Around that time, as part of Indonesia's commitments with IMF, the sector started to be liberalized. Local content requirements and non-tariff barriers were removed. Import tariffs on CKD (completely knocked down) and CBU (completely built up) parts were slashed. Furthermore, many domestic shares of automotive companies were acquired by foreign investors after the 1998 Asian economic crisis (Aswicahyono and Kartika, 2010). Thereby, foreign-ownership

became larger in the automotive firms. This is shown in Figure 5, which depicts that in 1995 and 2000 domestic firms absorbed more laborers than foreign firms did, whereas in 2005 and 2008 foreign firms employed more laborers than domestic firms did.

Figure 4: Number of Workers in the Automotive Industry

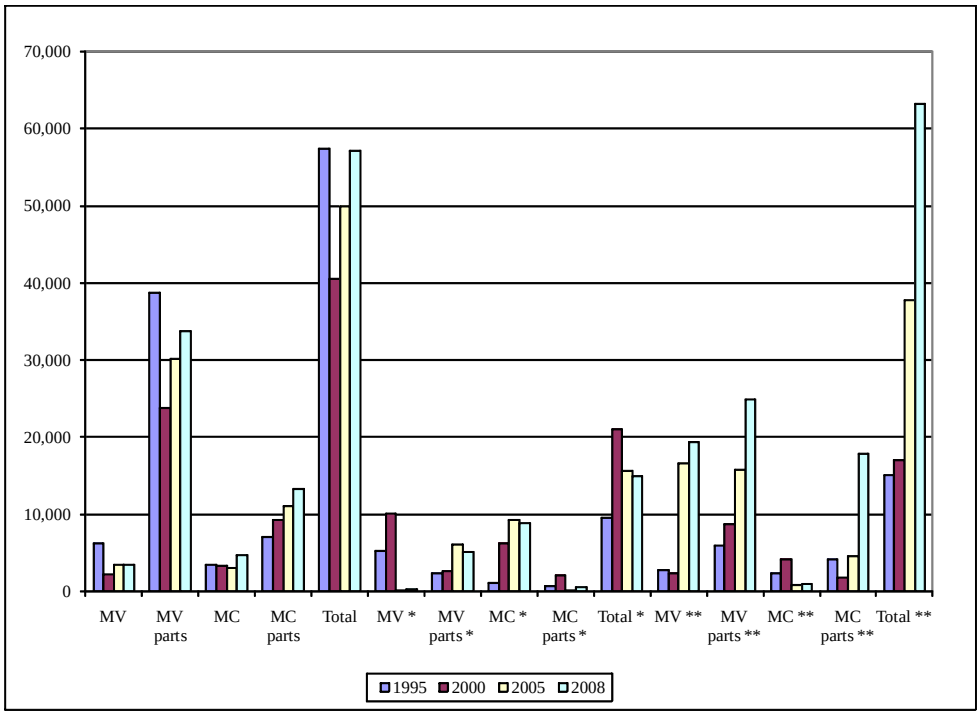


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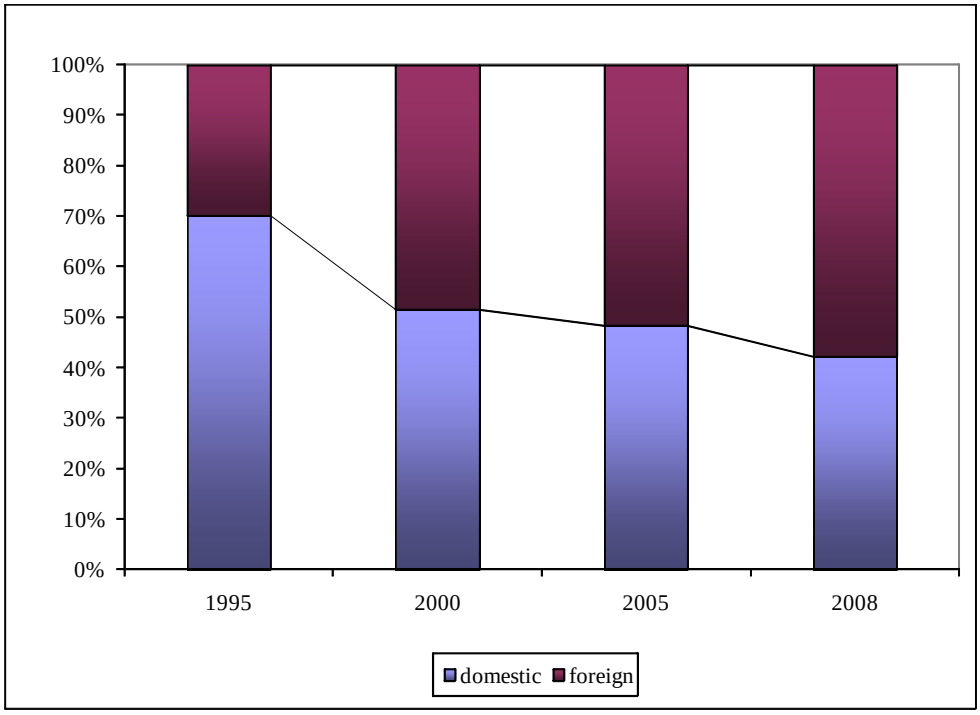
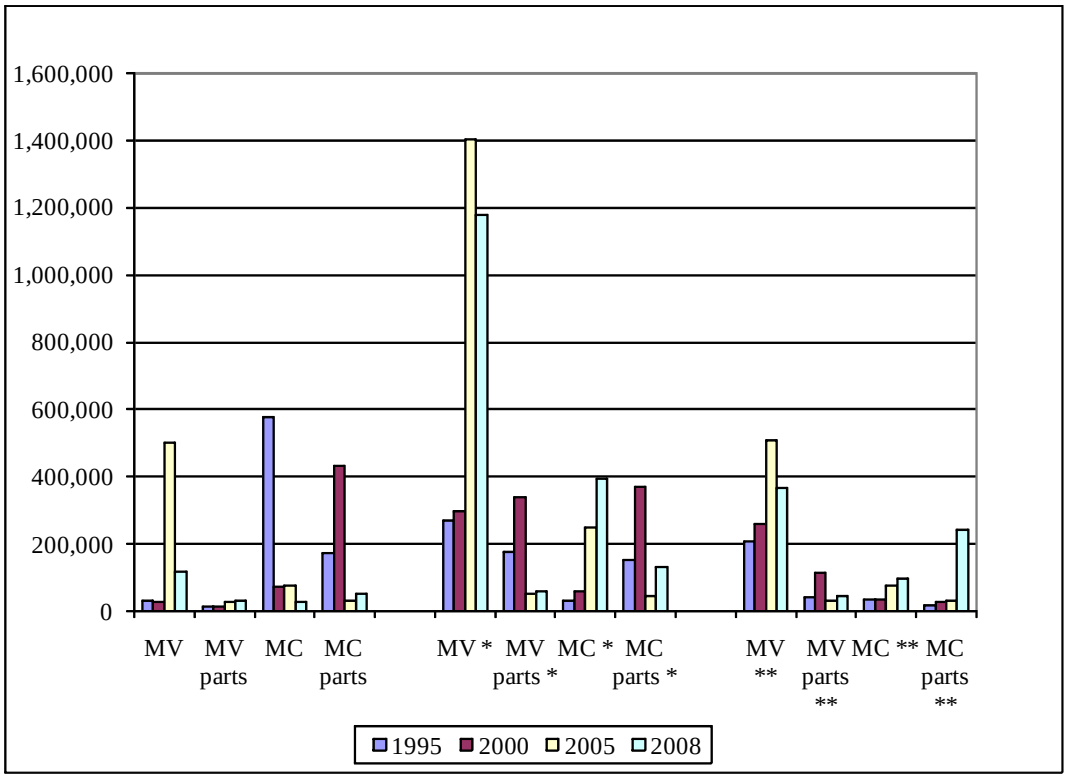
Figure 5: Labor Absorption in Domestic Firms and Foreign Firms in the Automotive Industry



Source: Central Bureau of Statistics.

Regarding productivity, the highest labor productivity is in the foreign-owned motor vehicle firms, i.e. MV* and MV** (Figure 6). The figure also demonstrates that domestic firms seemed to experience a decrease in labor productivity from 1995 to 2008, except for the domestic motor vehicle firms. Nevertheless, many foreign firms seemed to experience an increase in labor productivity in 2005 and 2008, compared to their levels of labor productivity in 1995 and 2000. This phenomenon is more obvious in the minority foreign-owned motor vehicle and motorcycle firms, majority foreign-owned motor vehicle firms, and majority foreign-owned motorcycle parts and components firms (i.e. MV*, MC*, MV** and MC parts** firms).

Figure 6: Labor Productivity in the Automotive Industry (in Thousand Rupiah)



Source: Calculated by authors, Central Bureau of Statistics.

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3. Innovation

3.1. Theoretical Framework

Jong and Brouwer (1999) defined innovation as development and success of the application of a product, service, technology, work process or new market condition, or

the upgrading of those things mentioned in order to achieve the goal of competitive superiority. This is similar to the innovation definition by Cozijnsen and Vrakking in Jong *et al*. (2001), as well, who stated that innovation is related to some objectives, for a new product, new market, new technology, or new work process, etc.

Innovation itself is a chain of activities built and implemented in a continuous process and involving several stages. Buijs in Jong *et al.* (2001) constructed a simple model which illustrates how the process of innovation happens. Buijs divided the innovation process into two stages, which are the Search Stage and the Implementation Stage. Through the two-stage model, Buijs explained the relation between innovation and the innovation capability in a company or organization. In the Search Stage, the component of the human resources of an organization does the searching and building of the ideas, and also the determining of the objective of the performed development. In this stage, the capability to perform innovation becomes the key concept. The innovation capability becomes the most crucial factor for an organization. If the company is weak in innovation capability, then it will also be weak in performing the innovation project and in its resultant product. In the Implementation Stage, the idea or the concept is developed into the actual innovation, in form of a product innovation such as a new product, or as a process innovation such as a new technology that makes the production process shorter and more efficient. From those two stages explained above, it is clear that innovation capability is a very important factor.

Romijn and Albaladejo (2000) define the capability of innovation as the capability to make modification and major upgrading to the existing technology, and to create the new technology. Innovation capability applies to process technology, product technology, and also the way to organize and arrange the production. Meanwhile, the

World Bank defines innovation capability as activities which enable a firm to choose and use technology to create strategic competitive advantage. In other words, technological capability is what firms need to be able to use technology for strategic competitive advantage. The better a firm's technological capability, the greater its gain of competitive capability. There are nine indicators of the extent to which a firm has developed capability in this area, including:

1. **Awareness** – this refers to the ability of a company to recognize the role of technology in competitiveness and the dangers of 'standing still' in today's highly competitive environment.
2. **Searching** – the ability of the company to scan or monitor external technology events and trends which might affect the company or provide opportunities for growth or competitiveness. Large advanced companies often have a group of individuals permanently working on this task.
3. **Building core technological competence** – this category refers to the success of a company in defining its individual technological strengths and building up a unique advantage in specific areas. A company with strong technological competence will understand how its distinctive technological strengths differ from its competitors and how to further develop its skills and knowledge to remain competitive.
4. **Technology strategy** – formulating a technology strategy is a key part of the overall business strategy of any leading firm. This is the process by which visions, objectives, and priorities are set and communicated within the company.
5. **Assessing and selecting technology** – leading companies are able to gather information on the range of technological options available, choose quickly among

competing solutions (e.g. different machines, approaches or suppliers) and identify the most appropriate source which fits with their needs. A leading firm is able to make a comparison between (or 'benchmark') the various options available and can reliably select the most appropriate option, based upon this comparison.

6. **Technology acquisition** – once a new technology option is decided upon, a firm needs to deploy the resources to exploit it (e.g. by creating technology via in-house R&D, or by acquiring it through a joint venture or technology licensing). In some cases, this may be a simple matter of buying off-the-shelf, or it may involve exploiting the results of research already carried out. In other cases, it might require extensive search and research to acquire the technology.
7. **Implementing and absorbing technology** – having acquired technology, a firm needs to implement the technology within the organization, which may involve various stages of further development to final launch, as in the case of a new product or service in the external market place, or a new manufacturing process or method within the organization.
8. **Learning** – an important part of building technological competence involves reflecting upon and reviewing technology projects and processes within the firm, in order to learn from both successes and failures. In order to learn how to manage the technology processes better, a firm needs to systematically capture relevant knowledge from its own (and other firms') experience and act on this knowledge.
9. **Exploiting external linkages** – in each of the eight key technology activities above, firms can and, in some cases, should make use of external suppliers of technology and related services. These next questions concern the different kinds

of organizations which might supply the firm with services (e.g. consultancy companies, government research institutes, or universities).

Based on those nine factors, the innovation capability of the automotive companies in Indonesia is identified. The identification of innovation capability is carried out by doing in-depth interviews with 10 automotive companies in Indonesia. The level of innovation capability is identified by scoring from 1 to 4 for each factor determining the innovation capability. One indicates a low capability while four indicates a high capability. The in-depth interviews and scores are carried out based on the interview guide developed by the World Bank.

3.2. Innovation Capability of Automotive Industry: Case Studies of 10 Firms

3.2.1. PT. AGI

AGI is a joint venture between Japanese and Indonesian investors, with its shares for Asano Gear Co. Ltd at 73.77% and for PT. Inti Ganda Perdana at 26.23%. The main product of the company, which was established in 2006, is the differential gear for automobiles, along with parts machining. Sales of the product are all for PT. Astra Daihatsu Motor (including exports through PT. TMMIN). The production process of the company is supported by 73 workers.

Awareness

AGI's score for the factor of awareness is 3. AGI has realized the importance of technology for its competitiveness. Although AGI tends to have no competitor, it is possible that this company's customers will find another supplier outside of Indonesia if AGI is not capable of creating the product at a lower price. Customers also require QCD which needs to be fulfilled by their supplier. In order to maintain its

competitiveness and to meet the customer requirements (QCD), AGI performs a variety of improvements (the production process, safety, and cost) that are gradual and continuous (the concept of Kaizen) and are leap-frogging. By using the machines or new manufacturing processes resulting from the improvements, AGI can produce higher-quality products faster and cheaper. This will definitely have a positive impact on the competitiveness of products.

Searching

In the factor of technology searching, AGI's score is 2. AGI has an understanding of how the company should compete. The company also knows what factors are affecting the competitiveness of enterprises. AGI recognizes that the key factor that determines its competitiveness is its ability to meet the QCD requirements of customers. Therefore, AGI does various improvements to meet these customer requirements. The improvements by AGI include the manufacturing process, safety, and cost. Of these three types, the company is more focused on doing a lot of improvement in cost, which is aimed at efficiency improvement that can reduce production costs. In order to make continuous improvements, AGI always tries to follow the technological developments in the field of the differential carrier for automobiles and parts machining. In this case, AGI has been actively searching technology from various sources, such as by training and by searching the Internet.

Building Core Competence

AGI's score for the factor of building core competence is 3. AGI recognizes that the advantages of the company compared to its competitors are its ability to provide products with better quality and efficiency in the production process, its clean factory

environment, and its good working control. In order to maintain its core competence, AGI tries to be consistent in making improvements, especially in producing higher quality and cheaper products. Unfortunately, AGI does not have a clear mechanism to protect and develop its competence. The company has no R&D units that can be used to create particular knowledge.

Technology Strategy

For the technology strategy factor, AGI's score is 4. The firm has developed a strategic framework to guide change, and has deployed its business strategy to specific frameworks for product and process (manufacturing) improvement. To increase its competitiveness, AGI always makes improvements that are intended to produce better quality and cheaper products. In this regard, efforts to increase competitiveness by improvement are based on the 4C concept (Clean, Compact, Challenge, and Creative). The Clean concept means that the company has to be clean. Clean in this way involves two things. First, it means a clean working environment. The second meaning is to be clean in the production process. All production processes running at AGI must follow the SOP (standard operating procedure) which had been predetermined. The Compact concept implies that in working out production processes, it should not be done in vain. All of its business activities, starting from production costs to product delivery, should be as efficient as possible. The third "C" is Challenge. It means that every person in the company must dare to fight and accept the challenges. The last "C" is Creative, which means that AGI should always be able to make improvements, aligned with the concept of Kaizen improvement. To that end, the company routinely conducts a program review system to discuss ideas and QCD to be achieved. The company has a special program to improve its ability significantly in terms of QCD.

Assessing and Selecting

For the assessment and selection of technology factor, AGI's score is 2. AGI has established a special mechanism in conducting assessment and technology selection. However, the process still depends on the Japanese side. In terms of assessment and technology selection, AGI involves Asano Gear Co. of Japan as the largest shareholder. Improvement in the use of machinery depends on the decision of the Japanese side. The quality team in Indonesia only has the responsibility to collect claims data of the market, to analyze it, and to propose the improvement. Then, further analysis is conducted by the R&D unit in Japan. Thus, the improvements which would be done depend on the Japanese side's decision. It is similar when AGI carries out projects that require a new machine. The process of setting up the use of new machines to run the project is mostly done through a series of compromises with the Japanese side.

Acquiring Technology

For acquiring technology factor, AGI's score is 2. The company has used various mechanisms in the acquisition of technology. However, most of the technology that the company acquired has been through the purchase of new machines. There are no machines independently developed by AGI because the company does not have its own R&D unit to conduct research to develop its own machines. AGI's R&D unit is still affiliated with the R&D unit in Asano Gear Japan. The technological capability of AGI is still at the stage of making improvements to the efficiency of the process and cost of production. AGI also makes efforts to enhance its technological capability through searching technology information from external sources such as the Internet, attending training both locally and abroad, and inviting lecturers from universities (ITB) to provide training.

Implementing

For the implementing of technology factor, AGI's score is 4. AGI has sufficient expertise in technology-based project management and risk management. AGI has a fairly good mechanism for managing the project. When there are new projects, especially those using new machines, AGI will prepare its employees in advance. Before implementing the new machine, the company sends its employees to suppliers of machinery (such as in Taiwan and Japan) to learn about how the machine works. AGI also has good risk management, conducted by the company throughout the routine every day from 8 until 9 o'clock or 9:30.

Learning

For the factor of learning technology, AGI's score is 3. AGI has a fairly good mechanism for learning, which is conducted through benchmarking and internal learning. Although the company has not conducted learning through benchmarking against competitors yet, it has done so to parties who are deemed to have a higher technological capability. To obtain the technological learning, AGI also actively engages its employees in training activities conducted by both internal and external parties. In addition, the company has made efforts to control the progress of a project regularly, benefiting from lessons on what to do in the future to obtain better results.

Exploiting External Linkages

In the factor of exploiting external linkages, AGI's score is 3. The company has known external sources that can support technological capability. This is proven by the company's efforts to access them. AGI actively seeks parties that can provide training for its employees. This company is no longer reluctant to actively explore technology both locally and abroad, such as with the Dana Bhakti Astra Foundation

(YDBA), Astra Polytechnic, ITB, and the suppliers of machinery from Japan and Taiwan. In addition, the company has established cooperation with the government. Unfortunately, AGI is limited to the use of new testing facilities owned by government agencies.

3.2.2. PT. NKP

This business was established in 1985, starting as CV. Hadi Karya. In 1996, along with its development, the company changed the name to PT. NKP as a specialist in the manufacturing of metal stamping parts and dies. This company has 780 workers with one Japanese foreigner. NKP's products are all supplied to the domestic market. NKP has been a subcontractor of PT. Astra Honda Motor (AHM) since 1997. Therefore, almost all of NKP's products (95%) are supplied to its main customer, AHM, while the rest (5%) goes to other customers.

Awareness

For the awareness of technology factor, NKP's score is 2. NKP is aware of the need for change and improvement in mastering technology. Therefore, the company implements the Kaizen system which applies continuous improvement in all divisions. Even until now, there is no major improvement in the company, but small improvements continue to occur in every department. Unfortunately, the awareness of this company is oriented only to its internal matters. NKP does not give great attention to its external environment, especially its competitors. Related to that, NKP has a paradigm that owning sophisticated technology is not its priority. The most important thing for the company is the resultant product with particular specification, without owning sophisticated technology. The technology development in this company is

only based on its need to make products with particular specifications and not on 'fighting' its competitors.

Searching

For the factor of searching, NKP's score is 1. NKP has a good understanding of factors required by its customers to be their subcontractor. The company knows that in the automotive parts industry, customers require quality, cost, delivery, productivity, safety, and morale (QCDPSM). To obtain and keep its customers, NKP has the principle to always preserve these QCDPSM requirements. Besides implementing the Kaizen system, NKP also created a business plan with specific targets that must be achieved by each department, and which are reviewed every month. The business plan also defines the next improvement. Even so, in preserving customers' requirements, NKP is not oriented on competitors. The company is not concerned with what its competitors have done. The most important thing for this company is to focus on conducting internal improvement which then may result in appropriate products with particular specifications, even if it only uses available technology which is not as sophisticated as that of its competitors.

Building Core Technological Competence

For the factor of building core technology competence, NKP's score is 3. The company does not pay much attention to its position in the market compared with its competitors. Lack of information on its competitors' positions makes the company unaware of its competence compared with them. To maintain its customers, this company only attempts to fulfill its customer requirements. In order to satisfy QCDPSM, NKP emphasizes activities to increase human resources quality and always

makes improvements in all lines of the company's business. Development of human resources is conducted by the company through a training scheme both domestically and overseas. Improvement is oriented on achievement of production efficiency with the target of workforce replenishment. Efficiency is achieved through its activities to continue improving and to achieve perfection through Kaizen.

Technology Strategy

For the factor of technology strategy, NKP's score is 2. NKP has no particular strategy to develop its technology. Technology development occurs incrementally through the improvement process. The key strategy chosen by NKP to increase its business performance involves increasing the quality of its human resources, which is conducted through various training and activity schemes. The training program is conducted either through sending the workers abroad or through in-house training. This human resource competence is regularly controlled by the company every six months. From the quality system, NKP has the target to obtain ISO TS, which is an ISO certification for automotive companies. Therefore, this company always improves all of its production line in order to achieve the target. Even so, improvements in this company are not major ones, as incremental improvements occur continuously in all divisions.

Assessing and Selecting Technology

For the assessing and selecting of technology factor, NKP's score is 2. NKP already has a clear mechanism, although it is still oriented on needs and the availability of resources. The company has not yet had orientation to anticipate long-term conditions and competitiveness by technology. As explained earlier, the technological

development of NKP is only oriented on the needs toward fulfilling customer requirements. This is conducted through a technology evaluation process by the engineering department. Then, based on the results of these evaluations, the decision to change the use of the machinery is made on the management level after coordinating with many divisions of the company. Even when replacing a machine, it still does not buy the most sophisticated one, basing the purchase on the needs of the company. The most important thing for the company is not mastering and owning the most sophisticated technology but making products that fulfill customers' requirements with technology that is appropriate to the mechanical, electrical, and human resources capability of the company.

Technology Acquisition

For the technology acquisition factor, NKP's score is 2. NKP's technology acquisition is conducted by buying new machines. This company does not attempt to develop its own technology through R&D activities. Meanwhile, other technology development is in the form of simple improvement in the production process to achieve higher efficiency. In building innovation capability, the company also needs to have a mechanism to obtain external sources of knowledge. Related to this, NKP has one foreign worker from Japan. To obtain external knowledge, this company also joins many seminars and sends its workers for training outside of the company, even abroad. Although there are many schemes for obtaining external knowledge or technology, the technology development of NKP is still oriented to the needs and still based on the targets of workforce replenishment. Technology development is not yet directed to place the company in a higher position compared with its competitors.

Implementing and Absorbing Technology

For the factor of implementing and absorbing technology, NKP's score is 3. The company has clear methods in conducting its projects. As explained earlier, the company has a business plan as guidance for all divisions in conducting activities. To obtain good cooperation and coordination among divisions, this company has particular methods. Every morning, this company has an Asakai or a meeting for coordination, conducted to synergize tasks and targets which must be achieved that day. Every day, each division in the company has a P5M or "Pertemuan 5 Menit" (5-minute meeting) before work is started. After that, at 9.00 a.m., all of the department heads have a coordination meeting as well. This meeting is also conducted as one of the activities required for implementation of ISO related to risk management. In implementing ISO, risks such as lateness and accidents have been anticipated because this audits what affects risks. Project management of the company is also accommodated through an activity plan containing a plan for work which will be conducted. Every month, this activity plan is reviewed to see the activities done and targets achieved. This plan also becomes a type of risk management for the company because it is created to avoid potential problems.

Learning

For the factor of learning, NKP's score is 2. In technological learning, NKP does not learn much through its competitors. This is due to the lack of attention to competitors' conditions. Learning activities conducted by NKP are still oriented to internal problem solving. One example is giving training to the workers to increase their capability in mastering technology. Training is conducted by sending workers to learn about a technology and obtain a certificate. After that, the workers undergo

internal training in order to train other workers. Learning at NKP also occurs through the company's participation in seminars, either domestically or abroad. Technological learning in NKP also occurs in the review mechanism of its activity plan. Review on activities which have already been conducted or are target achievements provides indirect learning for the company. Through the review, the company may know weaknesses and barriers in its business activities. As the result, the company must try to make improvements so that the barriers no longer occur.

Exploiting External Linkages

In this factor, NKP's score is 1. NKP's networking with external parties is particularly directed to develop its weak technology. The company convinces that at present it does not use technology either from a university or an R&D institution. NKP's relationship with other companies also occurs when there are visits by consultants from Japan. The company convinces that it is often the object of research by foreign consultants. Generally, they analyze the company to identify what it still needs to improve. Unfortunately, NKP said that the analysis is not deep enough and has not yet provided real solutions for the company.

3.2.3. PT. GKD

GKD is a private domestic investment company and at the moment it occupies 45,353 m2 of land within the IGP Group area, employing 572 people. GKD's mainstay products are the frame chassis category II (medium-sized truck) and category III (heavy-duty truck). To maintain product quality, GKD has been technically supported by its main customers, including PT Krama Yudha Berlian Motor – Mitsubishi; PT Toyota Motor Manufacturing Indonesia – Toyota; and PT Astra Nissan Diesel

Indonesia – Nissan UD. GKD is committed to consistently improving the quality of the company and its products. This is reflected by the acquirement of ISO 14001, OHSAS 18001 and ISO/TS 16949 certification.

Awareness

For the factor of awareness, GKD's score is 2. GKD realizes the importance of technology for the company's competitiveness. Even so, awareness of the importance of technology is restricted to the local issues and is reactive based on customers' demands. GKD always tries to fulfill the requirement of technological change from its customers. GKD is aware of this and knows that if it cannot follow technological change demanded by its customers, then the company will lose orders. GKD also has a strong commitment to striving to satisfy customers by increasing competence in designing, developing, and maintaining dies and by increasing capability in the production process.

Searching

For the technology searching factor, GKD's score is 2. GKD knows how to maintain its competitiveness. Even so, the understanding is still limited because the company has cost reduction as a key factor in maintaining competitiveness. GKD believes that the company's growth and competitiveness depend on its ability to fulfill customers' demands, including QCDS (quality, cost, delivery, and safety), and continuous improvement. These principles are always maintained by this company in performing its business activities. Nevertheless, GKD convinces that a key factor in winning orders from customers is to produce products with low prices. Other factors at GKD such as quality, delivery, and safety are not much different or are even the

same as at its competitors, including those in Korea. Even so, GKD is able to produce products at lower price levels. Therefore, GKD has to focus more on making cost reductions, which may be conducted by improvement in the production process.

Building Core Competence

In the factor of building core competence, GKD's score is 3. This means GKD knows its core competence. Therefore, this company knows how it can compete. Even though this company has not tried to scan new ways to strengthen core competence, GKD always tries to make improvements, especially in the production process, to keep its advantage as a single player in ASEAN. At present, GKD plans to have improvement in the concept of its production process. For the long term, GKD intends to make low-cost cars by changing its driving system from back-wheel drive to front-wheel drive. With that, fuel consumption can be more efficient.

Technology Strategy

For technology strategy, GKD's score is 2. The company has not yet had a real strategy or idea on how it must develop technology to increase competitiveness. This is shown by the absence of a company vision on developing its technology, so there is no clear target on technology that it wants to achieve. As a result, this company also has no main priority in developing technology. From the four technologies used in the production process (stamping, welding, drilling, and painting), the company cannot define which one should be prioritized for development. To survive in the market, this company only focuses on doing minor improvements (and these are not improvements to the main technology) aimed at fulfilling the requirements of product quality and cost efficiency.

Assessing and Selecting

For the assessing and selecting factor, GKD's score is 2. The company already has a framework for assessing and selecting new technology. Nevertheless, the selection of technology is still based on economic factors such as the financial ability of the company to implement new technology. The use of new technology by GKD generally is driven by customer requirements. Support to use new technology also comes from competitors. In addition, GKD tries to find out what technology is being used by its competitors. If competitors are using different technology, then this company will find information about the advantages and disadvantages of the technology compared with its own technology. After learning about the requirements of new technology, either from customers or competitors, the next step is to find information about the technology, such as specifications, advantages, disadvantages, and prices. Then, GKD makes a decision on whether it will use the new technology. The criteria used in deciding about the technology are the requirements from customers, prices, and sustainability of the order and model.

Acquiring Technology

For the acquiring technology factor, GKD's score is 2. GKD has a mechanism for obtaining external technology. Nevertheless, the mechanism is still dependent on the tried-and-true approach such as buying machinery. The main technologies at GKD are all obtained through buying machines from the foreign market. Until now, this company is not yet capable of developing that kind of machine because it does not have its own R&D unit to conduct research. Development or improvement capable of being conducted by this company is only in the production process. Even so, to define

what technology and how to obtain it, GKD has a clear mechanism. As explained earlier, choosing new technology that is going to be implemented and the source from which to obtain it is based on the information and requirements of customers and competitors.

Implementing and Absorbing Technology

For the factor of implementing and absorbing technology, GKD's score is 2. The company has a quite good mechanism for project management. To meet customer requirements in the form of a project or new technology, GKD has various routine meetings. In the meetings, all departments join to discuss the projects and new technologies which will be implemented, look at customer requirements which need further discussion to be fulfilled, review orders and prices, and identify problems and best solutions. Each department in the company also does a regular meeting each week. Every morning at 9.00 o'clock, each department also has an Asakai to identify critical points from yesterday's problems and what must be done today. Although there is a quite good coordination mechanism on projects, GKD is still weak in risk management. This company has not yet created a special division for risk management. Last year, the company just built a team for focusing on financial risk management, consisting of four persons.

Learning

For the factor of learning, GKD's score is 3. Technological learning at GKD is often done through IGP group coordination. The IGP group builds its competence in product development through many learning activities for its workers. Through cooperation with a design house in Europe, the IGP group sends its engineers

(including engineers from GKD) to learn product design at the design house. The IGP group has also constructed a Learning Center institution which is used to develop human resources intensively by in-house training. Technology learning also takes place through a coordination mechanism when implementing a project or new technology, like what has been explained earlier. Coordination among departments also becomes a media for evaluating ongoing projects and finding solutions when problems occur. Through this media, the company may learn many things related to what can be done better by the company in the future.

Linking to External Sources

For the linking to external sources factor, GKD's score is 3. GKD is aware of external sources which can be used to drive the company's development. The external sources include the government and universities. Nevertheless, the two sources have not been maximized by this company to develop its technology. Cooperation with government institutions is only at a testing facility for analyzing product performance as required by customers. As for the universities, the IGP group invites lecturers from universities (ITB) to provide training for GKD's employers.

3.2.4. PT. NL

NL is a local investment company established in 2004 to fulfill the demand of components of motorcycle spare parts. The company, which has 35 employers, occupies a building of 1,000 m2 and land of 3,400 m2 in Jababeka Industrial Park. The main customers of NL are PT. Astra Otopart Tbk, PT. Dynaplast Tbk, PT. Yasunli Abadi Utama Plastik, PT. Citra Plastindo, and PT. Indospray.

Awareness

For the factor of awareness, NL's score is 3. NL really has awareness of the importance of technology for the company's competitiveness. From that awareness, the company tries to develop technology and innovation so it can survive in the market. NL really understands that technology and innovation can increase efficiency, in the production process as well as the use of resources such as laborers. This condition will surely have positive implications on production costs so that the product price will become cheaper. NL is also aware that technology and innovation play important roles in achieving the QCD assigned by the customer.

NL's awareness of the importance of technology to competitiveness is implemented by the company through efforts to develop technology and innovation by itself. The financial limitations of the company for buying some high-tech machinery forces it to innovate in developing its own machinery. NL also always observes the technology position of competitors. The company actively finds out what technology is used by its competitors, and it follows through in buying new machines or developing its own.

Searching

For the technology searching factor, NL's score is 3. In the business area that NL explores, QCD is the key factor that determines the company's competitiveness. That condition is deeply understood by NL. Meanwhile, as explained before, NL always attempts to create innovation and update the technology used. For that objective, NL actively searches the technology related to its business area through following some exhibitions and training abroad, digging out information from competitors, and attending some discussions held by the YDBA, a foundation of the Astra business

group for its automotive companies, or the government. Based on the technology searching, the company then attempts to self-develop the technology. Unfortunately, the search and development of technology has not been included systematically in the company's framework for building competitiveness.

Building Core Competence

For the building core technology competence factor, NL's score is 3. This means that NL knows of its core competence and also has made some effort to maintain and improve it. However, the company has not done the scanning of the new ways for building its competence and developing that into new products and processes. NL admits that its own competencies are the company's consistency in delivering products according to the QCD assigned by customer, and its capability to innovate in self-developing the technology. Therefore, the company always attempts to stay consistent in its capability of delivering products according to customer requirements, as conducted by NL through technology development and improvement of the quality of human resources.

Technology Strategy

For the factor of technology strategy, NL's score is 2. NL has not had a real strategy for developing technology. The company only has a simple strategy in technology searching, but it has not determined the priority of which technology is to be developed by the company in the future. The technology development efforts by the company are encouraged more by the need to fulfill costumers' specification demands. These demands are then combined with the results of the technology search done by the company. In other words, technology development at the company is still

sporadic without any definite, written strategic plan.

Assessing and Selecting Technology

For assessing and selecting technology, NL's score is 2. The company does have a framework for selecting between some technology options which would be adopted or developed. However, the framework is still too simple and excludes the long-term issues. To identify which technologies are required to be developed by NL, the company actively monitors technology development through participation in exhibitions, discussions, technology training, and browsing the Internet, and by finding out the technologies its competitors are using. After doing the technology searching, the company determines which technology is to be bought and which it should self-develop. The consideration used by NL to decide those selections is the matter of the precision of the resultant product. Then, the decision on whether to purchase or develop the technology is taken by the management through some discussion processes. If the management decides to develop the technology required, then the next step is to start finding ideas and attempting to create the design. Because NL does not have an R&D department, the activity is fully conducted by the engineering department.

Acquiring Technology

For the acquiring technology factor, NL's score is 3. The company has used various mechanisms to acquire technology. The technology implemented in the company is not only acquired from external sources but also from efforts to self-develop technology. The sources of NL's technology indirectly stimulate the improvement of the company's technological capability. When the company decides

to self-develop the technology, then it will seek out, study and build the technology on its own from what has been studied. This situation will surely boost technological capability because the company has the new knowledge about the technology that it built.

Implementing and Absorbing Technology

For the factor of implementing and absorbing technology, NL's score is 2. The company has project and risk management but it is still limited. The company does not have a proper framework for risk management nor the continuous review of project progress. The project management that NL has done can be seen from the mechanism for routine coordination and inter-departmental communication. On the employee level, coordination is done every morning with the 5-minute meeting (P5M – Pertemuan 5 menit) that discusses yesterday's work results and what will be done today. For the coordination in the management level, it is done twice a week. Meanwhile, for risk management, the company handles it with the implementation of quality management. And for the risk of work accidents, the government applies the Occupational Health and Safety Training (LK3 – Latihan Keselamatan dan Kesehatan Kerja).

Learning

For the factor of learning, NL's score is 2. The company has carried out a mechanism to obtain technology learning from external and internal sources. However, the learning mechanism is still simple. Technological learning at NL is done by referring to competitors or by doing internal study. If competitors use higher technology, then the company will learn about the technology's strength and

weaknesses compared to its machinery and will consider the possibility of applying that technology in the company. From those activities, the employees' knowledge will indirectly increase, improving the company's overall technological capability. Meanwhile, technological learning conducted by internal study can be obtained through training that the employees participate in. The mechanism of coordination and inter-departmental routine discussions can also be an important learning media for the company. From this media, some issues and problems are usually found, along with the solutions to take in order to solve problems in the future.

Exploiting External Linkages

For the factor of exploiting external linkages, NL's score is 3. This means that NL has an awareness of the existence of the external sources. NL also knows how it can access those technology sources, so that it can encourage the company's technological capability. This is done by some cooperation with external parties such as the YDBA, Balai Besar Logam, and foreign parties. However, the company admits to the minimal role of the government and colleges in supporting the improvement of its technological capability.

3.2.5. PT. SRM

SRM is a local investment company established in 2002. SRM was appointed as an Authorized Distributor of GRACO Fluid Handling Equipment to serve various industries and application in Indonesia. With continuous support from principals, SRM expanded the business into design, installation, and commissioning of the paint circulation system, sealant and adhesive system, lubrication system and others, besides sales and service. The industries served by SRM are automotive manufacturers, auto

parts manufacturers, and motorcycle manufacturers, among others. The main customers of SRM are Astra Daihatsu Motor and Indomobil Suzuki International.

Awareness

For the technology awareness factor, SRM's score is 2. SRM is not aware of the importance of technology development in improving the competitiveness of enterprises. This is revealed by the latest technological developments in the field of automotive painting. In addition, the main technologies used at SRM are fully supplied by its principal. Thus, the company until now has not been forced to make technological development, especially in the main machines. SRM's awareness of technology importance has been seen only from the improvement efforts undertaken when there is a demand from customers. Technological development undertaken by SRM can be seen in the company's efforts to make improvements to fulfill customers' needs. The company itself is committed to continuous improvement, particularly improvement in system design painting. Ideas for improvement also are usually driven by customers, who likewise want to make improvements in their own painting processes.

Searching

For the factor of technology searching, SRM's score is 2. This means that the company only has a limited understanding of how to compete with price as a determinant of competitiveness. According to SRM, the key factors determining the competitiveness of a company are price and after-sales service. This is well understood and implemented at SRM. The company still searches for new knowledge through its participation in technology exhibitions and visits to other countries such as

Korea. Through these activities, developments in the company's technologies are accomplished. However, because the main technology that is owned by SRM comes from its principal, the searching of technology is not intended for the development of technology in the company. It becomes an effort to increase knowledge that will be needed to make improvements when there is a demand from customers.

Building Core Competence

For the building core competence factor, SRM's score is 2. The company has an understanding of the advantages that it has over competitors. However, the understanding of the company about how to compete is still modest because it is based on the price factor. SRM acknowledges that its technological capability is similar to that of competitors which are Japanese companies. However, SRM has the advantage in price. Meanwhile, a non-price factor that affects competitiveness is considered to be after-sales service. This shows that technology development has not been taken into account as a factor that can increase the competitiveness of the company.

Technology Strategy

For the factor of technology strategy, SRM's score is 2. The company has a strategy for creating competitive advantage. However, the strategy is simple and as yet there is no real idea of how technology can help the company improve its competitiveness. SRM admits that the main strategy of the company for maintaining competitiveness in the future is to continue developing its human resource capabilities through various training programs. Besides that, a strategy undertaken by the company is to implement ISO. SRM has ISO 9001/2008 certification. Implementation of ISO shows that the company has good operational standards in conducting its business activities. Through ISO certification, the company hopes that it can grow its business in countries such as Thailand and Malaysia.

Assessing and Selecting

For assessing and selecting technology, SRM's score is 1. Leading companies are able to gather information on the range of technological options available, choose

quickly among competing solutions (different machines, approaches, or suppliers) and identify the most appropriate source that fits their needs. A leading company is able to make a comparison between (or 'benchmark') the various options available and can reliably select the most appropriate option, based on this comparison. Unfortunately, these conditions do not occur in SRM. The company is not active in conducting the assessment and selection of classified technology. This is caused by the fact that the major technologies of the company are fully supplied by its principal.

Technology Acquisition

For the technology acquisition factor, SRM's score is 2. SRM realizes the importance of sources of knowledge from the outside and utilizes them. The mechanism used by SRM to gain knowledge from outside is to send employees to attend training. The company is active in regularly sending employees for training in Japan. The company also absorbs much knowledge from its principal that is a world-class company. Another mechanism at the company is to use the service advisor from Japan who is an expert in the field of automotive painting.

Implementing and Absorbing Technology

For the implementing and absorbing technology factor, SRM's score is 1. This means that because the company has little experience in project management, it is easy to lose control of a project. SRM was not able to show clearly how the company managed the absorption of technology. The company only makes innovations in the design of the painting system based on its creativity. Communication within the company is accomplished through several routine meetings. The company conducts weekly meetings between departments. In addition, each month the company also

conducts management review. In those meetings, there is cross-functional communication among departments. In the weekly meetings of each department, the problems faced by the department are discussed and solutions are proposed.

Learning

For the learning factor, SRM's score is 2. This means that the company runs some basic reviews of projects in progress, but these tend to be irregular and informal. SRM regularly sends employees for training in Japan. Learning in the company is also accomplished through guidance provided by senior employees to junior employees. Guidance is certainly related to knowledge of the production processes that take place in the company. In addition, the company also learns knowledge from its principal.

Exploiting External Linkages

For the exploiting external linkages factor, SRM's score is 3. This means that the company knows external sources of knowledge but its awareness is limited to a narrower field and is used temporarily. SRM has been using an external source that is derived from the government, rather than the Ministry of Cooperatives, and SMEs in the form of opportunities for benchmarking with other automotive companies. Another external source utilized by the company is the university through an internship program. Students from the university are given an opportunity to intern at the company.

3.2.6. PT. SC

SC was established on April 21, 2010, and is located in Industrial Town Cibitung, Bekasi. The company obtains its capital from its principal, Toyota Auto Body Co., Ltd

Japan. In November 2010, the number of workers at SC was 1,357. SC produces various automobile parts from plastic/resin.

Awareness

For the awareness of technology factor, SC's score is 2. The company argues that there is no radical technological change in automobile technology, so technology is not its main concern. SC's main source of technology is its principal company. Therefore, SC does not develop its own technology whereas the principle does. Procurement of new machines comes under the authority of the principal through the Toyota trading company. SC has already achieved customer loyalty because of its good project references, and this is also a source of its competitiveness.

Searching

For the searching technology factor, SC's score is 2. Safety is customers' main concern in terms of receiving orders. There are two kinds of safety. The first one refers to the safety in production process in factory and the second one refers to the safety in using their product (components of car). SC also considers QCD as a factor affecting customers' decisions on buying products. SC considers that different customers have different requirements, especially on product quality. For example, a customer in Malaysia has a tropical climate requirement on the quality of material while a customer in the Middle East has a desert climate. Desert climates have more extreme weather changes than tropical climates, so the specifications on materials are different.

Building Core Technological Competence

For the factor of building core technological competence, SC's score is 3. Safety,

quality, cost and delivery are factors that affect customers in placing orders. To create future advantage, SC implements continuous improvement based on Kaizen concepts. The improvement is not only on the production process but also on the management process. SC also improves employees' capability through training, such as Asakai time. In choosing and implementing new technologies, SC has full support from its principal company.

Technology Strategy

For the technology strategy factor, SC's score is 2. SC has full support from its principal. The principal company develops technologies in its own R&D unit. SC also has its own R&D unit, although it is still limited in design development and turns out only small improvements to the production process. Improvement in the production process such as development of robotic devices can increase productivity.

Assessing and Selecting Technology

For the assessing and selecting technology factor, SC's score is 2. Its principal plays a great role in assessing the requirement of a new technology in SC. New technology is selected by the principal through several feasibility tests. In this assessment process, the company will inform the principal about the condition and the requirement of the production process. The principal develops the technologies in its R&D unit.

Technology Acquisition

For the technology acquisition factor, SC's score is 2. The proportion of SC's technology from external parties is almost 100% because the company gets its technology from its principal. The R&D unit in SC only develops simple

improvements in the production process and product design. Management of new technology implementation is by training the company's employees to operate the new machine. Technically, the operator for the new machine will be trained by the trainer from the principal company, until the operator acquires the skill to handle the new machine properly.

Implementing and Absorbing Technology

For the implementing and absorbing technology factor, SC's score is 3. The company manages production risk through Asakai. In the Asakai activity, each employee should evaluate all risks that may occur when doing his job. In every employee's work place, there are some notes about the risks that may occur and how often these could occur. SC usually implements new technology when it gets a new project by instruction from its principal and the customer through intensive communication. Management of the implementation of new technology is by training an employee to operate the new machine until that operator is ready to handle the machine properly. Every employee also has an activity sheet that will remind them about what they should do. Cooperation and communication between different functions in the company is managed by arranging several meetings.

Learning

For the learning factor, SC's score is 3. The performance of SC is always evaluated by its customer. Safety is evaluated from the frequency of accidents that happen in a certain period. Quality is evaluated from the parts per million (ppm) defects of production. Delivery is evaluated by the frequency of shipment delays that happened in a certain period. Cost is evaluated from the company's productivity.

Mechanisms of continuous improvement (Kaizen concepts) are in place to enable learning by continuous employee training. In addition, the company usually sends its employees to join training at the principal. SC also learns from the state-of-the-art that has been chosen by the principal company.

Exploiting External Linkages

For the exploiting external linkages factor, SC's score is 1. SC did not obtain any benefit from external sources of technology except from its principal. This situation limits the opportunity for SC to capture sources of technology externally.

3.2.7. PT. IGP

IGP was established as a private domestic investment company and at the moment has an area of 63,300 m2 and 671 employees. IGP mainly manufactures rear axle and propeller shafts. It has decided on a mission to become a reliable drive shaft and drive axle manufacturer, with a vision to become a company with competitive advantages in the global market. In Indonesia, IGP is the only company working in the rear axle and propeller shaft manufacturing sector. But in Southeast Asia, it has to compete with companies from Thailand.

Awareness

For the awareness of technology factor, IGP's score is 3. IGP has proven that technology is one of the factors that influence a firm in obtaining clients. This experience shows that a company would lose opportunities if it did not improve its technological capability. The importance of technological capability, specifically in designing, has become the main focus of the company. Quality is one of the factors

which determines the competitiveness of a company. Actually, IGP has been aware of the technological breakthroughs in rear axle and propeller shaft manufacturing carried out by Thailand companies.

Searching

For the searching of technology factor, IGP's score is 2. IGP understands factors that determine its competitiveness. These consist of price and non-price factors. The non-price factors are quality and the reputation of the company gained from past transactions with customers. The company's reputation has been achieved from the track record of its previous works. IGP has yet to place technology as its main strategy in competing with other companies. Because IGP is the sole rear axle and propeller shaft manufacturer in Indonesia, the company argues that without being innovative, it can still gain customers.

Building Core Technological Competence

For the factor of building core technological competence, IGP's score is 2. The company has no local competitor because of the high difficulty in manufacturing those products. The manufacturing operation needs particular knowledge in applying the welding process. This welding technology is IGP's core competence. Besides, the company is attempting to maintain its competitive advantage by implementing the Kaizen principle, namely gradual and continuous improvement.

IGP is undertaking improvement in propeller shaft and rear axle designs to create more advantages in the future. The company advances the designs to fulfill customers' demands and to boost its competitiveness. Customers' demands of their suppliers will keep rising, and one of their concerns is companies' capabilities in designing products.

The main basis of IGP in choosing technology is the customer's needs and requirements.

Technology Strategy

For the factor of technology strategy, IGP's score is 2. In Indonesia, IGP is the single player, while in Southeast Asia it has competitors from Thailand. The position as a single player has discouraged IGP from becoming an innovative company, which is shown by the absence of an innovation unit in its R&D department. As long as the company still gains customers' loyalty, its attention will focus on how to meet customers' demands, not on how to improve technology. The advancements done by IGP are still simple. Although the company has not advanced its technology yet, IGP has made improvements in product design. Customers' demands always increase and they request the company to always develop the product design.

Assessing and Selecting Technology

For the assessing and selecting technology factor, IGP's score is 2. The company obtains technology through a stock release mechanism and the purchasing of production machines. As the new machines stock release has a strong relationship with investment, a fit-and-proper test for the investment is required before purchasing. In purchasing new machines, the company has various choices of machines. There are two factors considered by IGP in choosing machines: appropriateness with customers' demands and proper economic investment.

Technology Acquisition

For the technology acquisition factor, IGP's score is 2. The company has a mechanism for obtaining knowledge from external sources, such as customers,

suppliers, and the Internet. IGP utilizes information from customers which is mainly related to improvement in the production process. Information from suppliers is usually about the trends of new machines and materials used by the company. Information from competitors is obtained by comparing the technology utilized by IGP with the technology of competitors. The company also has an awareness of the importance of up-to-date information, so it is able to follow market demands.

Implementing and Absorbing Technology

For the factor of implementing and absorbing technology, IGP's score is 3. The company has good management in finishing clients' orders, as revealed by various awards received from customers as symbols of satisfaction. In terms of risk management, IGP does not have a special department for this yet. The company conducts risk management in the production plant through the General Affairs department. This department manages risks that include environment, health, and safety issues. The company organizes a work meeting every year to discuss the annual planning cycle. Cross-communication in the company is built through numerous regular coordination meetings, including order reviews and price reviews, which entail all functions in the company.

Learning

For the learning factor, IGP's score is 3. The learning mechanism implemented by the company is for gradual and continuous improvement based on the Kaizen principle. IGP also regularly sends employees to many kinds of training, both in Indonesia and Japan. Since 2009, IGP and other companies under the IGP group have organized in-house training and invited professors from Bandung Institute of

Technology (ITB) for seminars and workshops about the latest automotive technology improved by ITB.

Exploiting External Linkages

For the factor of exploiting external linkages, IGP's score is 3. IGP utilizes information sources and external knowledge coming from customers, competitors, vendors, and the Internet. Information is usually obtained in the form of production process improvements compared to other customers' suppliers, and as technology expansion in the form of the latest machines. The company also searches for information about the technologies and processes of propeller shaft and rear axle manufacturing through the Internet. In addition, IGP regularly invites professors from ITB to join the in-house seminars and workshops.

3.2.8. PT. AWI

AWI, founded in 2006, is located in Kelapa Gading, Jakarta. AWI is a joint-venture company with 49% of shares held by IGP and 51% by the company's principal from Japan. AWI is engaged in the assembly of automotive transmission components. This company has only one customer, Daihatsu Motor Japan, because it is a subsidiary of Daihatsu Motor Japan.

Awareness

For the factor of technology awareness, AWI's score is 2. AWI believes that the mastery of technology plays an important role in corporate competitiveness. But today, AWI is only conducting the assembling process, and it does not manufacture transmission components. Therefore, this company believes that so far it does not need

to develop technology because assembling does not require high technology.

Searching

For the searching technology factor, AWI's score is 2. AWI is a joint-venture company established to meet the demands of Daihatsu. The company is bound by an agreement with its principal, so it only has one customer, which is Daihatsu. Daihatsu Japan as AWI's customer has a requirement in choosing AWI as its localization. The customer controls the priorities of the company, especially in terms of quality and technology.

Building Technological Core Competence

For the factor of building technology core competence, AWI's score is 2. The company has advantages compared to its competitors, including lower prices. Another company strategy is to develop a general assembly line that could be used for assembling various types of components. The company creates some innovations that serve as improvements to the production process, reducing the cycle time. The company does not have an R&D division, and there is only the localization unit. This localization unit provides recommendations to Daihatsu Japan when there is a local component or material that may be used. But the final decision remains in the hands of the principal.

Technology Strategy

For the factor of technology strategy, AWI's score is 2. To develop its technological capability in the future, this company plans to absorb technology from Daihatsu when Daihatsu is localized in Indonesia. AWI will learn about the manufacturing processes of transmissions, ways of measurement, and the factors

involved in the eligibility standards of the product. After successfully learning these things, the company will carry out product re-engineering in order to produce the components itself. The company's concern is product testing. Procedures for testing and the quality-testing technology are not yet available in Indonesia, so it will be difficult to convince customers because the company has not proven the quality of its own designs.

Assessing and Selecting Technology

For the factor of assessing and selecting technology, AWI's score is 1. AWI is a company engaged in the assembly of automotive components, so the technology used is not high technology. As the assembly process involves assembling some components, the value added of this process is also low. The company is obtaining all the technology of its principal in Japan. The decision to bring in and change technology is strictly by the authority of the principal.

Technology Acquisition

For the technology acquisition factor, AWI's score is 1. The proportion of the technologies used in the company is 100% from its principal in Japan. The company stated that there has been no transfer of technology by its principal. So far, the principal only provides information about the check point or control point to ensure the quality of products assembled by the company.

Implementing and Absorbing Technology

For the implementing and absorbing technology factor, AWI's score is 2. The company is doing risk management on work orders by setting a buffer stock for a particular component to prevent any delivery delays. The company does not have

accident risk management because it assumes that assembling is a safe process with a low risk of accidents. Communication in the company takes place through inter-departmental meetings conducted once a week. Besides the mechanism of meetings, communication is also established through the joint core activity which is conducted every morning. In this activity, every section will provide information about issues still pending from the day before, for discussion on what should be done today and what would be the next target.

Learning

For the learning factor, AWI's score is 3. AWI has a series of training packages for each level in the company, such as training for the supervisor's level and a training package for the operator and manager level. In addition, the company provides additional training materials in the form of organizational culture and the type of product. Learning in the company is also carried out by applying the concept of Kaizen for gradual and continuous improvement. In addition, the company does benchmarking with other Daihatsu suppliers to follow the development of methods and processes that may be applied in AWI.

Exploiting External Linkages

For the exploiting external linkages factor, AWI's score is 3. External sources used by the company are still very limited and only from Daihatsu principals and other suppliers. The company uses the principal as its sole source of technology. In addition, the company is capitalizing on Daihatsu's other suppliers with a benchmarking mechanism.

3.2.9. PT. TKM

TKM is an SME engaged in manufacturing parts for machining and the manufacture of jigs. It was established in 2002 and is located in the JABABEKA Industrial Area is a private domestic investment company. Currently, it has45 workers. It serves 90% of which are in the automotive industry.

Awareness

For the awareness of technology factor, TKM's score is 2. TKM acknowledges that technology may affect the competitiveness of the firm. The influence of technology at the company is primarily in the production process. The company is also aware that the needs of customers in the market are increasing. The company needs to develop the technology to be able to keep up with customers' needs and market demands. It develops technologies especially for application to the repairing process.

Searching

For the factor of searching technology, TKM's score is 3. The company has a lot of competitors and the majority of them are SMEs. TKM has been able to identify the factors that affect receiving orders from customers. These consist of price and non-price factors. The quality factor is the focus of the company for getting orders from customers. This company already has ISO TS as a guarantee of product quality. In addition, delivery accuracy is a factor considered in customer orders.

Building of Technological Core Competence

For the building technological core competence factor, TKM's score is 3. TKM has two divisions, which are the division that manufactures the spare parts and the division that develops production machinery. The development of this production

machinery becomes a competitive advantage for TKM. The company's basic principle in the development and production of machines is to customize and modify the principles that already exist in production machines on the market. The main technologies used are the same as the existing engine, and then the company makes some modifications and customizations as additional functions of the machine to meet the customer's needs.

The company does not attempt to patent the machines that it developed, because the patents would be difficult to obtain. It does not use patents of machines that it develops to boost its competitiveness. However, competitiveness is supported through other efforts. The efforts are always aimed at providing added value to customers, one of which is to give good after-sales service. Another attempt is to establish standard operating procedures and evaluate the extent of implementation. Production machinery maintenance is also a concern of the company.

Technology Strategy

For the factor of technology strategy, TKM's score is 3. The company believes that technological developments in the automotive industry, especially in manufacturing, are evolving gradually and over a relatively long time. The company has not set a specific technology strategy that it will use to build core competence. The limited technology development of the company is a reaction to meeting customers' needs in the market.

The company's core competence is in the development, modification and customization of production machinery in accordance with customer requirements. The experience and creativity of human resources in TKM are driving the emergence of the company's ability to create its own machines. In the long term, the company

will not only develop machines but will also attempt to expand its business through the development of after-market products. In terms of quality, the company will also make improvements to maintain ISO TS.

Assessing and Selecting Technology

For the factor of assessing and selecting technology, TKM's score is 2. In technology development, TKM has two options, namely to develop its own technology or to buy from outside vendors. There are two things considered as a basis for choosing, which are the company's technological capabilities and the ability of corporate investment. So far, the company is able to build the machines that were ordered by the customer through the customization and modification of existing machines on the market. The second option is that the company would buy the machines from external parties to obtain the required technology. This option usually comes up when the company has to manufacture certain products that require new technologies which it does not own. Absorption of foreign technology in the form of purchases of machinery is a corporate investment decision.

Technology Acquisition

For the technology acquisition factor, TKM's score is 2. TKM uses knowledge resources from outside and employs the knowledge to make improvements in the company. This company has two divisions, namely a job order division and a mass production division for automotive components. The first division is absorbing knowledge by doing some imitations of production machinery made in Japan. The division of mass production is utilizing external sources of knowledge in the form of books/journals and information from its competitors. The mass production division

also benefits from the mass production knowledge of competitors. In addition, TKM utilizes external sources of knowledge through various exhibitions and training. The proportion of technology that the company sources from outside is as much as 95%, while technology it owns makes up 5%.

Implementing and Absorbing Technology

For the factor of implementing and absorbing technology, TKM's score is 3. The execution of the project is initiated by the engineer who translates customer requirements in the form of design drawings. Once the design is approved by the customer, the engine will be produced. The company conducts risk management in construction projects, part of which involves quality risk management. The buffer stock function anticipates when production might suddenly stop so as to maintain schedules and avoid delivery delays. The company also conducts management of the risk of work accidents. All employees are covered by company insurance and the standard use of personal protective equipment during their work. The company does not have a scheduled communication mechanism. Meetings are held only when there are some problems with production, and these meetings do not involve all the divisions in the company but are only a part of engineering and production.

Learning

For the learning factor, TKM's score is 2. TKM uses information from competitors, especially as relates to their methods or processes. The company usually compares the methods or processes used by competitors to the methods used in TKM. If there are differences in the process, the company will seek more information about

the process. Then it will experiment with the process, and if proven that it could increase production efficiency, then the process will be incorporated by the company. TKM does not have an internal learning mechanism because the company is focused on production orders. Learning from the outside is done by sending TKM employees for training facilitated by private parties or by the government.

Exploiting External Linkages

For the factor of exploiting external linkages, TKM's score is 3. The company exploits knowledge from external sources such as competitors, the private sector, and the government. The company gains knowledge about the methods and processes from its competitors. It also receives training in both managerial and technical fields from the private sector and the government. In addition, the company utilizes knowledge from machinery developers in Japan and modeling technology used in the machines.

3.2.10. PT. GT

GT was established in 1998 as an SME and started operations in 2000. This company is capitalized by 100% domestic direct investment and is currently serving domestic and foreign customers. GT is located in Cikarang, Bekasi. The company is specialized in dies manufacturing, jigs, checking fixture, and parts stamping. The majority of components made by the company are for two-wheel vehicles (90%), with the rest for four-wheel vehicles (10%).

Awareness

For the factor of awareness, GT's score is 2. GT acknowledges that technology affects the company's competitiveness. Improvement in production machines which

have been done by GT itself can save on production costs because the improvement cost is much smaller than the price of new machines. Machine development also provides the benefit of technology mastery because the company has the ability to expand its capacity not only as a technology user but also as a technology designer. Continuous improvement in the production process is expected to boost the company's competitiveness, especially in production costs and processing time.

Searching

For the factor of searching technology, GT's score is 3. The factors influencing customers to make transaction deals with GT are quality, price, and delivery service. Price is the customers' main consideration. GT is currently in the process of requesting ISO 2001. The company also keeps improving the production process to shorten cycle time so that it can finish orders faster. Besides that, GT also has to build close relationships with customers. Visiting the customers is one type of after-sales service from the company.

Building Core Technological Competence

For building core technological competence, GT's score is 3. GT has not had special or unique competency compared to its competitors. In terms of technology, GT and other companies utilize the same level of technology. GT realizes that there are other factors besides price that influence customers' decisions on whether to place purchase orders. The non-price factors are quality, delivery service, and close relationships with customers. The company improves its production process, for example, by modifying production machines to advance efficiency, and by making production supporting tools in some processes.

Technology Strategy

For the factor of technology strategy, GT's score is 2. In its technology strategy, GT attempts to improve technology through equipment and production machines advancement. However, this equipment advancement is still limited to modifying the machines and making its own production machines. The company does not yet have enough knowledge about technology, and improvement of this should be a priority. Thus, the company still considers the market condition in improving technology, meaning that it is concerned about the technology utilized by competitors. The company does not yet have a clear idea of technology improvement in the future.

Assessing and Selecting

For the factor of assessing and selecting technology, GT's score is 2. The company has two sources of technology improvement, which are external and internal. But mostly, it comes from outside. Technology obtained externally is from buying production machinery. But there are some technologies that the company improves by itself. The chosen technology has to be able to provide concrete improvement results on the production process. Examples are technology which can reduce the number of rejected products and technology which may shorten the product time cycle. Decisions on choosing technology from external parties have a strong relation with investment.

Technology Acquisition

For the technology acquisition factor, GT's score is 2. Generally, the company does not have a clear and programmed technology absorption mechanism. The process of technology absorption is applied only if there is a need for additional new machines. The mechanism used by the company to gain knowledge from external sources is

undertaken through, for example, regular monthly meetings facilitated by the YDBA. GT gains information about the technologies and processes used by competitors which may be relevant and applicable for the company. It also obtains information from outside by participating in exhibitions related to technology advancement in the automotive industry. Furthermore, the company actively searches the Internet for the latest information about various methods of production process improvement. The proportion of technology used in GT is 90% from external sources and only 10% from the company's own development.

Implementing and Absorbing Technology

For the factor of implementing and absorbing technology, GT's score is 2. When the company has a new purchasing order, it forms a team consisting of people from management, the engineering department, and the production department. The team will discuss needs such as materials and production machines, and it arranges the schedule of the production process. Production scheduling is also important because the company has to consider its capability in meeting customers' requirements regarding delivery service. The company applies risk management through the buffer stock mechanism that is used to anticipate particular circumstances such as a sudden interruption in the production process. GT does not have a continuous communication mechanism yet. Communication is not regularly arranged in meeting activities, but only when there is a problem in the production process.

Learning

For the learning factor, GT's score is 1. The company searches for information about competitors' technologies and production processes. This information is

obtained from monthly meetings facilitated by the YDBA. In these meetings, the participants share their knowledge with each other. They discuss the technology and production processes used in their companies.

Exploiting External Linkages

For the factor of exploiting external linkages, GT's score is 3. One of the external incentives utilized by GT comes from the government, or the Ministry of Industry to be specific, in the form of guidance cost and ISO certification cost. GT is currently in the process of requesting ISO 2001 as facilitated by the Ministry of Industry. Furthermore, the ministry often invites SMEs to participate in seminars or workshops.

3.3. Stylized Findings from the Interviews

From the 10 firms interviewed, their weaknesses in technological capability seem to be in the areas of assessing/selecting technology and acquiring technology. In the area of assessing/selecting technology, they do not have sufficient information on the technological options available or a clear framework for assessing the options or choosing the most appropriate one to suit their needs. Respondents with the lowest score in this area are SRM and AWI since their technology is fully supplied by their principals. The other respondents are also weak in assessing and selecting technology since they select technology exclusively on the basis of price. In assessing the technological options, they do not consider other factors such as the effective use of the opted technology with the firm's needs and the possibility of extending the utilization of the selected technology. Therefore, choosing technology with price as the only consideration is a risky activity since the chosen technology may not be properly in accordance with the company's technology needs and long-term vision.

Another weakness of the respondents is in the area of technology acquisition. Most respondents acquire technology from outside sources. Purchasing machines is the most common method. They do not combine this with trying to develop the machine in-house. This may indicate that the learning process of the firms' personnel does not occur in the technology acquisition process. Even more, AWI reported that it does not have a process of adopting new technology since the technology it uses is the responsibility of its foreign principal. There is only one company, NL, which reported usage of both internal and external sources in acquiring technology. This firm asserts that its technological capability is improved through the self-development of technology.

As for the strengths of all respondents, building core technological competence, implementing technology, and learning seem to be the strong areas of their technological capability. As for core competence, most firms mentioned that their competitive edge is not only cheap products but also good quality and in-time delivery because many buyers require QCD for their purchasing. However, they are not actively seeking and developing new technology for their future competitive edge. Four firms revealed that their competitiveness is only in price as competitors have the same technology as they do. Regarding technology implementation, five out of 10 respondents are skilled in project management and have risk management frameworks. Before implementing new technology such as operating the machine, AGI usually sends its engineers abroad to learn how to operate the machine. In addition, the company also has daily routine control as its risk management mechanism. Four respondents are skilled in project management as they also have cross-functional communication in the progress of the project, but they do not have a clear framework

in risk management. One firm has little project management experience and no risk management. This may cause implementation of technology-based projects to go over budget or over schedule.

With regard to the learning process, most respondents learn from the past technology-based projects either formally or informally. Six respondents always formally review the projects which have been completed and take lessons from that experience. Respondents also benefit from meetings conducted by the YDBA, where companies exchange knowledge and information in the meetings.

In brief, the technological capability of automotive companies in this survey may provide signs about the capability of all automotive companies in Indonesia. They seem to focus on short-term gains in their business as they excel in meeting demands with QCD criteria, managing the assigned projects well, and learning from the experience. However, they seem to not have long-term technology strategies, as most of them have not started research and development and do not put technological learning as a priority when selecting technology or other activities.

4. Policy Implications

According to Tsuji and Miyahara (2010), the innovation capability of firms is related to the patent rights, the top management having experience in MNCs (multinational companies), engineers being college-level graduates, and the granting of licensing technologies from MNCs. Therefore, the shortcomings of the Indonesian automotive manufacturing firms in technological competence may relate to these factors. On the other hand, the possibility of a company being substituted by other companies to be the supplier of the regular buyer would enhance the awareness of the

company to maintain or improve its technological capacity. Since few respondents pointed out that they are sole suppliers to certain buyers, they do not upgrade their capacity due to the constant demands from customers.

Therefore, some factors require attention in order to boost the technological capacity of Indonesian automotive firms. Human resources should be developed in order to strengthen firms' capability to absorb technology spillover from linkages with other companies/institutions. Experiencing job assignments in MNCs and having at least college-level education for engineers may assist the development of human resource and, thus, promote innovation capability. Moreover, a pro-competition policy environment is needed to induce firms to raise their technological capacity. Improving the ease of doing business is also a policy measure that would encourage entry into the industry, which would then produce more competitive establishments.

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