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Learning Mechanism Used In Strengthening Local Automotive Vendor's Absorptive Capacity

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LEARNING MECHANISM USED IN STRENGTHENING LOCAL AUTOMOTIVE VENDOR'S ABSORPTIVE CAPACITY

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ABSTRACT

In attaining competitive advantage, inevitably, firms had to innovate. The development of innovation capability was crucial for firms to stay in competition. In developing firm innovation capability, absorptive capacity and learning mechanism were important factors. Absorptive capacity is built through accumulation of prior knowledge base and internalization of the knowledge in an organization. The purpose of the study was to describe learning approach used by firms in strengthening local automotive vendor's absorptive capacity. This paper also explored one component of absorptive capacity named firm's knowledge base. The research design used in this descriptive study was quantitative method with questionnaires mailed to the respondents. The sampling technique for this study was random sampling with a sample size of 113 automotive component manufacturers, who supplied automotive parts to various car assemblers and manufacturers. Out of 113 automotive manufacturers, only 45 respondents responded to the survey sent to them. The results of the study indicated the level of manufacturers' absorptive capacities was high in the project management, product development performance measurement, cost benefit analysis and early production output evaluation areas. In addition, the learning mechanism adopted by most of the manufacturers were interacting among employees in the R&D or engineering department as a means for them to solve problem related to product development design and acquiring knowledge in PDD through documenting explicit knowledge in a manual or product catalogue. The implication of this study was the manufacturers needed to improve their knowledge absorption capacities through proposed learning mechanisms.

Keywords: Learning mechanism; absorptive capacity; product development design; innovation capability.

1. INTRODUCTION

The changing trend of supply chain strategy, from the disintegration approach between supplier and assemblers toward a more collaborative approach, would impact supplier roles. The responsibility that suppliers have to assume is much larger and greater. Suppliers are assuming a larger percentage of the engineering and manufacturing of modules for the car manufacturers as the carmakers are pushing more manufacturing out to the suppliers (Anon, 2003). Suppliers are expected to acquire technical and design innovation capability. They are responsible for shortening the product life cycle and evaluation, product reliability, and warranty. The basis for selecting suppliers is no longer on nationality but the trend is to move toward choosing suppliers who can supply components of high quality with lower associated cost. International car manufacturers are going for the global market, and so is Proton. The competition for automotive component suppliers has become more intense than before.

The local initiative through technology transfer effort undertaken by vendors to boost their technological capability does not represent the actual capability that vendors may have attained. Apparently, despite the maturity of the automotive technological knowledge, some local vendors still lack in innovative capability pertaining to acquiring excellent research and development skills compared to other global suppliers. The process of capability development through technology transfer from the inception of the national car project until present, which makes up for almost two decades, does not benefit the recipient or vendor. Vendors do not attain the upstream capabilities although they have invested in foreign technology for quite a long time.

In other words, their investment in monetary value is not equivalent to the expected capability attained by them. No matter how long the duration of technology transfer activity has occurred, firms in the developing countries are still unable to attain much advancement in their technological capabilities (Ali, 1993). Even though there is an argument that technology transfer is a popular option for firms to develop their capabilities through acquisition of technological know-how (Madanmohan *et al.*, 2004; Kumar *et al.*, 1999), the benefits that recipients acquire from the technology provider via transfer of technology is minimal at large.

Despite their involvement in product development and design activities, local vendors' absorptive capacities have not been assessed extensively. Thus, it is a fundamental issue to find out their absorptive capacities and their level of readiness to innovate. Besides, the technological knowledge acquired and the extent of knowledge application related to product development and design need to be assessed to find out whether vendors acquire necessary knowledge for them to perform in the product development and design tasks.

2. LITERATURE REVIEW

The concept of absorptive capacity is originated from the macroeconomics field, where it represents the ability of an economy to use and absorb external information and internal resources (Adler, 1965). Cohen and Levinthal (1990) modified this concept by adding the organizational level and they defined absorptive capacity as "the ability of a firm to recognize the value of new, external information, assimilate it and apply it for commercial ends." Cohen and Levinthal (1990) stated that organization's existing base of knowledge is the key to organizational innovation. The definitions and the use of absorptive capacity concept are used differently such as focusing on wide range of skills dealing with tacit components and modifying the external knowledge gained (Moxley & Oxley, 1995). However, for the purpose of this study, the concept of absorptive capacity is based upon Kim (1997) definition. According to Kim (1997), relevant prior knowledge base increased firm ability to make sense and to assimilate the new information. Relevant prior knowledge base was consisted of basic skills and general knowledge, which normally pertaining to firms in developing countries. As indicated by Kim (1995), prior knowledge base should be evaluated based upon the degree of task difficulty. In addition to firm knowledge base, effort to internalize the knowledge or intensity of effort, acquired through practices was important and became precedence before being able to solve complex problems. Such effort instigated interaction among members in the organization, whereby exchanged of information as well as conversion and creation of knowledge occurred.

The building of a knowledge base from the technological knowledge acquired from technology transfer is not attainable automatically. A firm needs to learn in order to acquire the knowledge. Firms do not necessarily inherit TCs. The process of acquiring TCs is a vital part in ensuring whether the firm really has in-depth understanding about the technology it attempts to adopt. Therefore, in the process of acquiring technology, learning is a significant key to TC building (Westphal *et al.*, 1985). According to Westphal *et al.* (1985) TC is the ability to use technological knowledge effectively.

Therefore, in order acquire TC, firms must actively emphasise learning in the organisation (Westphal *et al.*, 1985). Figueredo (2001) argued that TC development accompanied by technological learning activities or the act of learning is essential for a firm to capture and digest the knowledge transferred through the technology transfer effort. The development of TC depended on the learning process undertaken by firms.

Firms use different learning processes in acquiring their TC. Learning processes can be taken in a variety of forms. Lall (1982) and Bell (1984) has proposed taxonomies of learning which are used in developing countries. According to Lall (1982), all progress in technology and efficiency can be regarded as forms of learning because they involve the accumulation of experiences that had taken time to be realised.

Furthermore, he had distinguished technical and non-technical learning. From the technical learning, there are three stages of technological learning that takes place. The first stage was to learn within the given technology or imported technology. The second stage was to learn the embodied technology or implicit technology when some of the machinery required is manufactured within country with certain reproduced or improved functions. The final stage is entirely learning the technology and production system, which involves the transition from capability to produce products up to training others to acquire technology. Meanwhile, non-technical learning is achieved through organisational, managerial, financial, planning and other activities.

Another aspect of learning content is know-how (Lall, 1985). Know-how, a kind of practical knowledge, tends to be useful in using technical and production systems. On the contrary, the know-why or theoretical knowledge is appropriate for changing the technical and production system. Bell (1984) has categorised learning into learning by function, which focuses on a firm's performance of functional tasks. This type of learning does not require the accumulation of experience.

Besides, Bell (1984) also differentiated two types of experienced-based learning, which are learning by operating and learning by changing. Learning by operating is a flow of experiences derived from the performing of operational tasks while learning by changing is doing various technical change activities. Another form of learning is through training in which formalised training is a source of strengthening technological capacity. Learning by hiring can be acquired through the skills and knowledge imparted by hiring people who embodied them. Learning by searching is to look for forms of disembodied knowledge and information.

Bell (1984) focused more on a firm's level and action orientation compared to Lall (1982) who focuses more at the country level. Whilst taxonomies developed by Bell look into learning by various means, Lall's taxonomy answers questions on what to learn. Besides these two taxonomies developed by Lall (1992) and Bell (1984), other scholars tended to reflect different facets on how learning takes place. Some authors like Amsden and Kim (1986), Pyke *et al.* (1990), Nohria and Eccless (1992), Kogut *et al.* (1993), and Lundvall and Nielsen (1999) focused on the formality of learning as a distinct factor for excelling. Teubal (1997) mentioned two types of learning or purpose of learning; process and product learning. Process learning includes exploiting the current market whereas product learning is a type of learning associated with complex high technology products, which requires high levels of design capability.

In addition to how learning takes place, Powell and Brantley (1993) described the network between provider and recipient as a source of technological learning. They classified learning as formal and informal learning. The informal way works well when a more tacit understanding of knowledge is required. Learning in the organisation also involves two parties, the provider of knowledge and the recipient.

The learning process requires interaction with the technology provider or among members in an organisation. Nonaka (1994) stressed that during the socialisation mode, tacit knowledge is transferred through interactions between individuals whether using verbal or non-verbal communication. Thus, interaction is important in the learning process, which is also important for determining the firm's capacity building.

In undergoing the learning process, firms use various types of mechanisms. These mechanisms for developing a firm's technological capability have been documented in past research, although the number of studies is not extensive. These mechanisms are used to capture technological knowledge acquired by firms. The mechanisms are quite generic and applicable to firms in developing countries or technologically advanced countries. The majority of companies would normally pursue more than one mechanism at any one time and often change the mechanisms to adapt to the business environment and firm's capability development (Wong, 1999). The list of mechanisms as supplied by Wong (1999) is shown in the Table 2.1

No	**Types of Learning Mechanisms**
1	Learning by working in companies processing the technology
2	Imitation/reverse engineering
3	Subcontracting (learning associated with process)
4	Licensing
5	Technology transfer agreements (TTA)
6	Recruitment of experienced/trained personnel
7	Use of consultants/contract R&D firms
8	Purchase of technology
9	Acquisition of technology sources
10	Own R&D
11	Joint R&D with others
12	Technology swapping (cross-licensing)

Table 1 : List of learning mechanisms used in developing firm technological capability

The learning mechanism can be in the form of in-house training programmes, strong networking between units in a firm, strong linkages with suppliers, customers, and research institutes, government bodies, and others (Biggs *et al.*, 1988; Teubal, 1987). The mechanisms of learning also come from the external sources (Almeida *et al.*, 2003). The reason for utilising external sources is that few firms possess all the required resources for successful and continuous technological development.

A variety of mechanisms are used to access technological knowledge, such as hiring engineers and scientist (Almeida & Kogut, 1999), strategic alliances (Mowery *et al.*, 1996), and through informal networks (Almeida & Kogut, 1999). Others have indicated the mechanism of learning through OEMs (Chyn, 2000). To determine whether learning mechanisms and interaction relate to a firm's TC, hypotheses on firm learning mechanisms and interaction are developed in this research.

3. RESEARCH METHODOLOGY

The research design used in this descriptive study was quantitative method with questionnaires mailed to the respondents. This study is an exploratory type of study where the main objective of the study is to describe learning approach used by firms in strengthening local automotive vendor's absorptive capacity. It was a cross sectional study where data was collected once at a single point in time. The unit of study under observation in this research is the firm or company. The manager or general manager of the unit that are heavily involved in the transfer of technology was selected to answer the question. The respondents would normally come from the engineering or R&D department. In this study, the unit of analysis is the automotive parts and component manufacturers that have been dealing with various customers, such as Proton and Perodua.

The initial sampling frame was complied using the MIDA Automotive manufacturers Directory 2008 obtained from MIDA. A total population of 220 companies was registered as automotive vendors. The sample size is 113 according to the rule of thumb based upon Krejie and Morgan (Sekaran, 1998). The questionnaire was mailed and self administered to all the suppliers that were supplying the various parts and components to Proton. Furthermore, there was a need to address the small medium enterprises (SME) since the SMEs made up a large proportion of the automotive parts and components industry. During the course of determining the sample size, there were 68 companies that were no longer at the addresses indicated and no longer in operations while 45 companies returned the questionnaires. For the purpose of this study, the response rate for this study was 39.8 percent.

4. RESULTS OF THE STUDY

Findings shown that only 15.6% of the companies did not deal with car assemblers in developing and design products. In contrast, 84.4% of the companies dealt with car assemblers in developing and design products. The results also showed that 75.6% of the companies had R&D department rather than 15.6% of the companies does not have R&D department.

Results for the types of specification that had been provided by the customer(s) was indicated in Figure 1. Most of the companies or 31.8% received specification by the customer in terms of complete design or blueprints and followed by 20.5% of the companies that received specification by the customer until detailed specification only.

Nevertheless, the least percent of the companies or 2.3% of the companies had been able to provide the customer(s) from product concept only, up to critical and detailed specifications and complete design. 4.5% of the companies were provided specification under three categories, which were concept only and up to critical and detailed specifications, concept only and up to complete design, and also critical and detailed specifications and up to complete design by the customer(s). 9.1% of the companies were provided with critical specifications and all of the specification categories stated in the questionnaire.

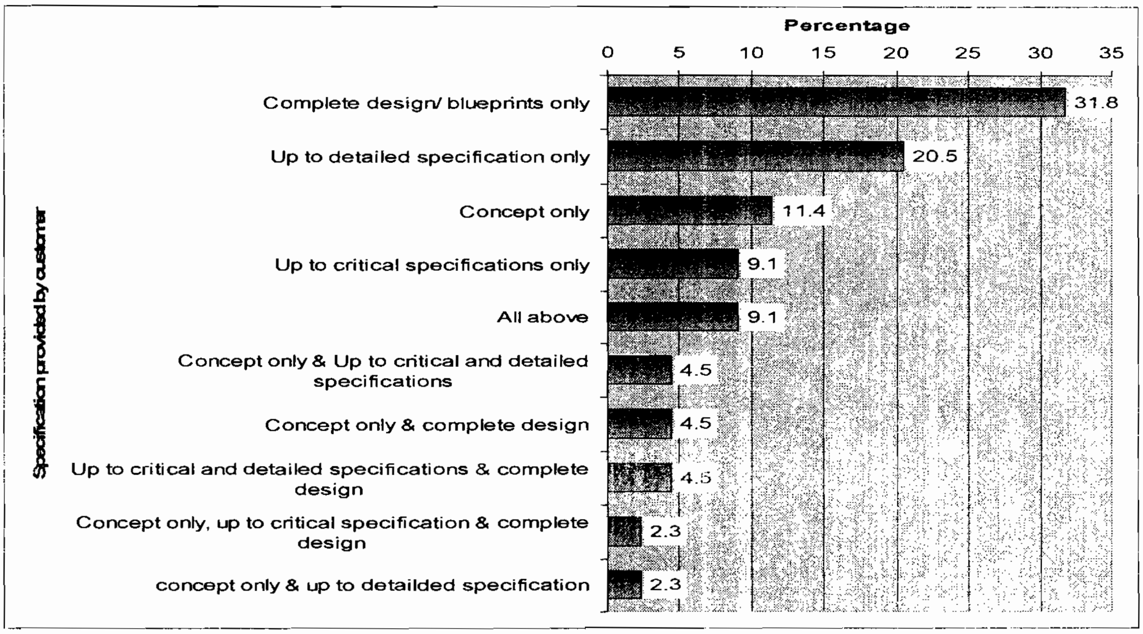

Figure 1 : Specification Provided By The Customer(s)

This analysis was done to identify the various product developed by the company and the results was shown in Figure 2. 2.3% of the companies developed assembled unit and completed sub-system only while 4.5% of the companies developed others. 9.1% and 13.6% of the companies developed completed sub-system only and individual part and the assembled unit only for each. 20.5% of the companies developed individual part only and the assembled unit only. Most of the companies or 29.5% of the companies developed individual part, assembled unit and completed sub-system.

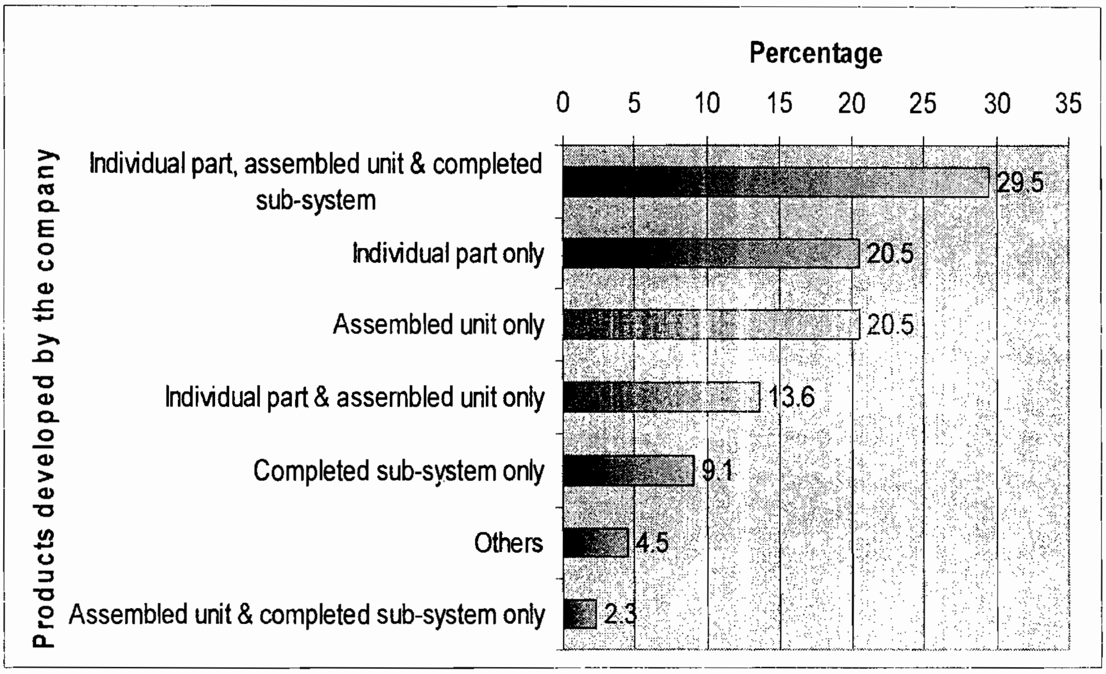

Figure 2 : Product Developed By The Company

The analysis of involvement of the vendors in product development with customer. shown that the highest percentage; 26.2% have been involved for 15 years in product development activities with customer. This was followed by 16.7%, 9.5% and 7.1% with each involvement were 20, 10 and 8 and also 11 years. Nevertheless, some of the companies with 2.4% and 4.8% involved in the range of 2 to 7 years, 17 to 18 years and 23 to 35 years for their product development with customer.

4.1 Firm Absorptive Level in Product Development Design Process (PDD)

This section will highlight the results related to firm absorptive level in product development design. Descriptive analysis by using mean score was used in this part because of the Likert Scale application. This part was done to identify the level of firm knowledge based on product design and development (PDD). The first five highest mean scores for knowledge in product development and design process were;

1) Measuring product development performance (3.62)
2) Project management (3.6)
3) Evaluating early production output (3.42)
4) Cost benefit analysis (3.4)
5) Performance testing (3.36)

These mean scores indicated that companies fully acquired the knowledge in the five areas.

On the other hand, the last five lowest mean scores that indicated less acquired by companies were knowledge in

1) Defining major subsystems and interfaces (2.87)
2) Refining industrial design (2.96)
3) Considering product platform (2.98)
4) Obtaining regulatory approvals (3.0)

5) Defining part geometry (3.07)

The low mean scores also indicated that these were the areas which were not exploited by the companies currently.

Based on the results, the first five knowledge on tools scored high, which indicated that they fully acquired by companies were

1) Ability to manage project involving product development and design (3.49)
2) Failure mode evaluation analysis (3.49)
3) CAD application (3.4)
4) Basic operating and maintenance knowledge (3.38)
5) Value analysis/ value engineering (3.13)

On the other hand, companies scored less on these last five tools, which were less acquired by companies. These tools were;

1) Taguchi method (2.41)
2) E-business application (2.49)
3) CAM application (2.61)
4) CAD/CAM application (2.49)
5) Design of Experiments (2.78)

4.2 Learning Mechanism Used in Strengthening Local Automotive Vendor's Absorptive Capacity

This section will highlight the results related to learning mechanism used in strengthening local automotive vendor's absorptive capacity. Descriptive analysis by using mean score was used in this part because of the Likert Scale application.

Based upon the findings, the mean scores of firm's learning mechanism used were in the mean range of 3.96 to 2.95. The first three highest mean scores of learning mechanism used;

1) undocumented share ideas (3.96)
2) tacit knowledge through on the job training (3.91)
3) exercise on problem solving (3.80)

On the other hand, companies scored less on these last three mechanism, which were;

1) unused explicit knowledge (2.95)
2) undocumented individual knowledge (3.11)
3) undocumented coordination through documentation and records (3.64)

5. DISCUSSION

From the research findings, most of the vendors rated high level of knowledge base in project management, product development performance measurement, and early production output evaluation. Project management is rated highest among vendors indicated that they have acquired initial and necessary knowledge in conducting product development and design. Product development and design is conducted in project based. In other words, one project which is done one at a time or in some companies, vendor undertakes product development and design project simultaneously especially when involving more than one customer. In developing and designing product, vendors are required to meet the deadline given by the customer and in some instances, customer requires vendors to deliver in short notice. This situation in product development and design requires vendor to acquire project management knowledge to ensure the activities or tasks undertaken can be accomplished within the deadline given by the customers. This is in line with Owens (2006) who indicated that project management is important for SMEs to ensure development delays can be avoided.

Furthermore, product development performance measurement is the next highest knowledge base attained by vendors. This measurement objective is to evaluate the project deliverables. Product development performance measurement is important to make sure product quality such as specification and requirement provided by customers is met. Other than that, product development performance also is measured in terms of delivery and cost. After product development activities or task are completed, the vendors are assessed in terms of their capabilities of producing product that satisfied customer in terms of quality, cost and delivery. The importance of product development measurement is to ensure vendor will be able to produce quality product prototype faster than other competitors and at a reasonable price. Inability to deliver faster quality and low cost prototype than the competitors will cause vendors to lose business from customers (Eppinger & Ulrich, 2008).

The third highest knowledge base attained by vendors is early production output evaluation. The knowledge is essential because before product is sent for mass production, an evaluation on early production output during the production ramp up phase is to train the work force and to work out any remaining problems in the production processes. The early production output measurement knowledge is important to identify any remaining flaws before production takes place (Eppinger & Ulrich, 2008). In other words, the early production output evaluation knowledge is important because this knowledge will enable product in the production ramp up to be transferred to the ongoing production gradually. From the ranking of the knowledge base attained by vendors, it is apparent that these knowledge bases are essential and most importantly, these knowledge is a subsequent from one knowledge to another knowledge, for example, project management knowledge is required to ensure the product development and design project can be completed within the time frame provided by supplier and within the product development design process, product development performance knowledge is important to evaluate project deliverables and after product is accepted by customer for production, an early production output evaluation knowledge is important so that any flaws or problems with the product production processes before mass production takes place. In early production output, cost benefit analysis is done to ensure the cost effective product is produced.

The knowledge attained by vendors indicated that it is more on management, coordination on product development design project and early production evaluation of product before mass production takes place. Majority of local vendors indicated that customer provides them with complete design or blueprint of the product. There are many indications that can be made due to the research results. Firstly, most local vendors depend on customer complete design or blueprints. In other words, they do not work from scratch, such as developing product concept. Their roles are to follow exactly the blueprints or the drawing supplies to them. By supplying blueprints to the vendors, nothing much in terms of innovation capability can be acquired by them. Their innovating and creativity capabilities can not be developed any further because they are bounded to follow the drawing provided by customer. This situation depicts that the product development process undergone by them does not show that they involve from the first stage however, they start off with phase 4 (testing and refinement) and phase 5 (production ramp up). In other words, they have limited experiences in developing product from concept, which are essential experiences for them to develop their innovation capabilities.

On the other hand, the knowledge base attained by vendors is very low in defining major subsystem and interfaces. Defining major subsystem and interfaces include the definition of product architecture and the decomposition of product into subsystems and components (Eppinger & Ulrich, 2008). Their inability to define major subsystem and interfaces are due to their design and development focus, which is more on individual and assembled unit compared to complete system. In other words, in automotive industry, each automotive component is less separable from main body (Lee & Lim, 2001). Thus, vendors must have knowledge in ensuring the product developed nicely fit and form a functioning and manufacturability subsystem such as braking system. Product modularization as emphasized by local car manufacturers is still at an infant stage. For instance, Proton has only around 10 or lesser than 20 vendors, who have capabilities in producing complete system such as transmission system (Mohamad, 2007). These vendors have their own in house R&D and in terms of size, they are large companies with resources. Defining major subsystem and interfaces is in the system level design and to be able to design system, companies need to conduct its own R&D. The ability to conduct R&D is one of the indicators of achievement of innovation capability. In addition to defining major subsystem and interfaces, the next lowest knowledge base attained by suppliers is refining industrial design. To enable vendors to refine industrial design, vendors must involve in the initial stage, which is product concept development. However, local vendors are given complete design of the component and they are required to follow the drawing as instructed by the customer. Nothing much could be done by the vendors as they are required to produce the components exactly according to customer requirement. Finally, the third lowest knowledge base indicated by vendors is the knowledge in product platform. Product platform is the set of assets shared across set of products and allow a derivative product to be created more rapidly and easily, with each product providing the features and functions that cater specific market segment. In practice, local vendors normally design and develop single component and if customer manufactures new model, even though the component is similar, different supplier is granted contract. This practice somehow hampers the ability of vendors to generate derivatives products, which is again a means for firm to develop their innovation capability.

The development of innovation capability is depended on the learning mechanism used by vendors in strengthening their absorptive capacity. Most of the vendors interact among employees in the R&D or engineering department as a means for them to solve problem related to product development and design. This can be comprehended using Nonaka's (1994) model of organizational learning that proposes four knowledge transitions among individuals and groups in organization. From interaction, they are able to socialize and normally triggered by team building, which is facilitated by sharing member's experiences and perspectives. During socialization, members use common experiences as the basis for developing verbal and non-verbal communication to communicate ideas that difficult to articulate explicitly. From socialization, it moves to externalization where meaningful dialogue occurs and knowledge that is tacit or invisible becomes visible. As it moves to combination, members are coordinated through testing process and documentation of the process in record, drawings, and written procedures of the organization. They also acquire knowledge in PDD through explicit knowledge that is documented in a manual or product catalogue. Finally, as the knowledge becomes explicit and tacit knowledge can be interpreted effectively, internalization takes place. The workers begin to master their tasks due to routine tasks and company wide experimentation or learning by doing. Repetitions in doing tasks results in embedding the innovation in worker's personal routines and finally providing them the sense of quality, for instance, the sound of engine becomes one of the signal of good or poor engine performance (Dyck, Starke, Mische & Mauws, 2005).

In this study, the learning mechanism approach does not help organization to develop high innovation capability. One of the reasons is their ability to understand the tacit part of product development and design knowledge in automotive part. In automotive industry, tacit knowledge is more important than other industry. In manufacturing automotive components, the ability to internalize knowledge is very essential and one way to internalize knowledge is through R&D (Lee & Lim, 2001). However, in this study, local vendors do not conduct R&D even if they have R&D center. Their understanding and practices in R&D is actually the product development and design tasks. This implicates the development of their innovation capability since their tasks in PDD only start in the phase of translating the drawing to manufacturing.

Furthermore, in Malaysia, as in many developing countries, the skills attained by local firms are more on operative and maintenance tasks. Experimentation and reverse engineering are not promoted in the company due to restriction such as transfer technology agreement (Malairaja & Zawdie, 2004). In the context of automotive industry, local vendors are too dependent on customers' drawing, which in the long run hamper them from acquiring innovation capability.

6. CONCLUSIONS

With due reference to the responding firms, the objective of this study has been to describe learning approach used by firms in strengthening local automotive vendor's absorptive capacity. Besides, one component of absorptive capacity named firm's knowledge base has been determined. Those elements are measured descriptively. The results of the study indicated the level of manufacturers' absorptive capacities was high in the project management, product development performance measurement, cost benefit analysis and early production output evaluation areas. The results of the study also indicated that in the process of acquiring technology, learning is a significant key to technological capability building. The importance of learning is recognized in this study whereas the level of implementation of learning mechanism such as learning by working in companies processing the technology, own R&D and so on, by the responding firms is above average. As argued by the literature, the previous findings might be reflecting the achievement level of firm's innovation capability. The level of capability or specifically product centered capability by the responding firms is medium. Therefore, in order to achieve higher capabilities, firms must improve their absorptive capacities and more actively emphasize learning in the organization. The implication of this study was manufacturers needed to improve their knowledge absorption capacities through proposed learning mechanisms.

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