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Exploratory Study: Design Capabilities Development for Malaysian Vendors in Automotive Industry

Ana Sakura Zainal Abidin
Department of Mechanical and Manufacturing Engineering
Universiti Malaysia Sarawak
94300 Kota Samarahan, Sarawak, Malaysia

Rosnah Mohd Yusuff
Department of Mechanical and Manufacturing Engineering
Universiti Putra Malaysia
43400 UPM, Serdang, Selangor, Malaysia

Rasli Muslimen
Department of Mechanical and Manufacturing Engineering
Universiti Malaysia Sarawak
94300 Kota Samarahan, Sarawak, Malaysia

Abstract

The involvement of vendors in product development (PD) is able to make the process more efficient, effective and economical. Since vendors account for more than half of the total cost of production, their involvement have major influence on the cost and quality of the products. Vendors' involvement in PD has significantly increased their importance; expose them to greater risks and challenges. As a return, the vendors are able to improve business performance results, productivity, and reputation, thus increasing the companies' competitive advantage. To be successful in PD require certain level of design capabilities (DC), thus huge investment is needed. However, the Malaysian automotive market size is considered small and vendors' capabilities are also limited. Since, studies on vendors' DC, particularly, in Malaysia is very limited, an empirical study was conducted to explore on the critical success factors (CSFs) in enhancing the vendors design capabilities for the Malaysian automotive industry. A series of interviews were conducted on selected automaker and vendors from different categories to identify the critical success factors (CSFs) that are able to enhance the design capabilities development for Malaysian vendors.

Keywords

Vendors, design capabilities, CSFs, Malaysian automotive industry

1.0 Introduction

The first Malaysian national automaker, Perusahaan Otomobil Nasional (Proton) was set up in 1983. Seventy percent of Proton production is mainly for the Malaysian market [1]. Proton is 100% owned by Malaysia, therefore Malaysian government has strong voice in Proton decision making. Malaysian government has implemented rules and policies to secure local companies in automotive industry [2]. All policies and rules are applicable to automakers and vendors operated in Malaysia (automotive suppliers are known as vendors in Malaysia). According to Malaysian Companies Commission or Suruhanjaya Syarikat Malaysia (SSM), the body responsible for company registration in Malaysia, a local company is defined as company who is registered and operated in Malaysia. Local company can be divided into three categories; Bumiputra, non-Bumiputra or foreign. Majority share (>50%) determine the status of the company. Hence, the actual Malaysian vendors are those from Bumiputra and non-Bumiputra companies. More than half of Malaysian vendors are fall in SME category, especially the Bumiputra ones [3].

A car requires for more than 20 000 parts, which is impossible to be manufactured by the automaker alone. Vendors account for a big amount of the total cost production; over half [4]; more than 60% [5]; about 75% [1]. The products supplied by vendors have direct impact on cost, quality, technology and time to market of new products [4], thus influence on final price and quality of the product [5]. Previous practice showed that automakers had dominant roles in product development (PD); design, testing and assemble. However, to improve the process, those important roles have now been outsourced to suppliers [5, 6]. To date, buyer-supplier relationships become more important and strongly influence on company's competitiveness [7]. Vendors has been identified as one of the important resources to the automakers[4, 8] and becomes a competitive advantage to the company[5]. Early vendors' involvement has significant impact on the products performance; cost, quality, technology[4] and project performance as well as time to market [9]. When vendors' roles become more important, their responsibility also gets bigger. The automakers defined the goals and owned ultimate authority towards the success of the goals, meanwhile vendors will assist on the goals achievement[9]. The level of collaboration between automaker and vendors is based on the degree of vendors' involvement and timing of integration; indicated as white box for low degree of responsibility, grey box for medium and black box for the highest degree of involvement. The timing of integration is also influenced by the suppliers' degree of responsibility; the earliest it can be is from the idea generation for black box level[9].

The advantageous of collaboration are remarkable. Collaboration has shortened the PD, when a car can be segregated to vendors for numbers of modules and systems; thus enable PD to run simultaneously. The product quality is improved as the job is awarded to specific vendors who owned the expertise. The buyer also can reduce cost of technology investment; practical way to have innovative technology with minimum technological risk by sharing with suppliers[10]. Consequently the risk is minimized when costs are shared with suppliers. Through outsourcing, fewer parts were done in-house[11], therefore automakers can focus on their core competencies.

The only way out is to have design capabilities. Design capabilities can be the companies' competitive advantage [4, 12-14] and also pre-requisite to be successful suppliers [15, 16]. Design capabilities is dynamic capabilities [12]; empowered the companies to dynamically fulfill customers' needs. Customers' favor always increase market demand and bring in more profit [17]. Design capabilities enable the vendors to determine price of the product, ability to design allow them to design according to customers' target prices [18, 19]. The capabilities also facilitate the vendors to scale up business volume [5] and capabilities enhancement also allow them to make more business. Consequently, improve their status to be Original Design Manufacturer (ODM) [5]. Design capabilities also able to enhance company competitiveness, since it is difficult to imitate by competitors [12]. Therefore, design capabilities can be a strategic weapon to face AFTA or even global competition, since design capabilities are valuable resources to improve product quality, minimize cost and expand businesses.

The problem is not many Malaysian vendors owned design capabilities. They are not able to be independent and keep relying on the government to feed them. Based on current scenario, half of Malaysian vendors solely supply to Proton [3], with 62.7% of them are Small Medium Enterprises (SMEs)[20]. However, in terms of market share, majority goes to non-SME [3] especially for high technology base parts, since most of SMEs vendors have limited capabilities. During *Waja* project, Proton had outsourced 17 modules to 19 vendors with 93.3% of them are non-SME [3]. Even those who have design capabilities are still in-complete; not up to date with current technology roadmap, without testing facilities or etc. Without sufficient capability, the vendors are not able to run the process effectively. The situation is the same with the Localization Program, Malaysian vendors were also left behind. If the situation persists, the vendors will not be able to compete, especially with the Asia Free Trade Agreement (AFTA) where they have to compete in the open market fairly with other foreign vendors. To develop design capabilities with limited resources among Malaysian vendors is really great challenge and require for proper planning. At the same time, rely on external support to assist the development [21].

2.0 Methodology

Multiple case-studies via in-depth interviews were employed. This is an appropriate approach for this study, as there are limited studies conducted on supplier DC. In-depth interview extensively able to explore on the actual scenario and latest progress occurs in the industry especially in Malaysia [8, 22]. The flow of the study begins with planning, developing instruments, conducting interview, verifying the information and finally analyzing the results. In this study, respondents are active Malaysian vendors from five automotive companies with different categories were chosen and only focussing on 1st-tier Proton vendors. Diverse set of company categories enable the study to obtain richer ideas and insight from practitioners [22]. Generally, all of the chosen companies are already involved in design process but have different roles and different level of capabilities. The interviewees' companies profile is shown in Table 1.

Instruments of this study have been developed from literature review. Prior research gave overview of design activities among vendors and collaboration of PD between OEM and vendors; thus used to structure the interview questions. All companies were given the same set of questions, to ensure consistency between interviews. At the same time, all questions developed were open-ended type, allowing for ample flexibility to explore new findings. The interviews involved 11 experts for six interview sessions and average time taken for each session is about two and half hours ($2^1/_2$ hours). Arrangements for the interview session were set earlier, to ensure availability of the interviewees. Objective of the interview and questions for interview session were given in advance to interviewees via e-mail. The interviews conducted face-to-face, entertained by at least one or maximum three personnel per session. The sessions have been recorded and transcribed, to ensure reliability and traceability of information[23]. In addition, each transcript once completed was sent to respective interviewees for content validation. Interviewees responded on any mistaken information, improved and clarified to ensure validity and reliability of the information[23]. Interview transcripts were analyzed; direct and indirect answers were determined, those answers that have similar meaning are grouped together. The most appropriate terminologies were used to represent the groups. Repetitive answers or the most frequent answers highlighted between interviews were identified, to show most significant CSFs. However, answers that had least popularity also consider in this study as far as the points are important or incorporate with prior research.

Table 1: Interviewees profile

Company	Representative	Status	DC Level	Products	Customers Proliferation
GP	_Section Manager of Strategic Supplier Management _Section Manager of Vendor Management Development	Malaysian OEM	Established whole package of DC	Car manufacturer	Malaysian market (70%) and export market (30%)
ED	_General Manager of Engineering Division _Head of Product Service Engineering				
MZ	Manager of Tooling	OEM-subsidiary	World-class DC and aligned with customers' technology	Dies design (engineering and manufacturing), moulds (design and engineering) and stamping	Perodua, Toyota, Honda, Mazda, Nissan, Subaru, Isuzu, Lotus and Takao.
DN	_Manager of Engineering Department _Assistant Manager of Engineering Department	Foreign-vendor (73% share owned by parent company)	Sufficient DC to conduct in-house design and supported by other branches for testing facilities	Intrument cluster, engine management system, air conditioning system, radiator, starter and alternator	Toyota (37%), Denso other group companies (OGC) (28%), Perodua (23%), Honda (5%) and Proton (3%).
IG	_Senior Manager of Group R&D _Assistant Manager of Group Sales & Project _Executive of NPD, Group R&D	Bumiputra-vendor	Sufficient DC to conduct in-house design and hire consultant for advance analysis software and testing equipments	Sealing system, door module, impact system, exhaust system, under body module, heat management	Ingress Group of Companies: Ingress Eng. Sdn Bhd, Ingress Technologies Sdn Bhd, Ingress Autoventures Sdn Bhd and Ingress Precision Sdn Bhd
DL	Senior Manager of R&D Dept.	Non-bumiputra Vendor	Full-range DC and qualified for "Design-in Vendor" by customers	Rear view mirror, power window, column switch, plastic trims and locking systems.	Proton 50%, Perodua 14% and others 36%.

3.0 Results and Discussion

Results and discussion are based on series of interview conducted, as reported in section 2.0. Throughout the interview sessions, all agreed that design capabilities develop by vendors have contribute significant benefits to their company. Companies role affect on how the benefits are significant to them. Those vendors who owned the capabilities received direct impact on their business performance; bigger market created, improved PD process and product quality, reduced time and production cost, gained trust and confident from customers, knowledge and skills enhancement. Meanwhile, OEM or buyer also benefited from vendors' capabilities improvement especially on final product quality, production cost, development process, etc. The benefits addressed by interviewees are summarized in Table 2.

The interviewees have highlighted CSFs based on their experience and knowledge. There are two ways on how the CSFs were gathered; from direct question and indirect questions. The CSFs can be grouped into 10 categories as shown in Table 3. Description or details of categories are according to the answers given by interviewees. All the CSFs mentioned have direct and indirect influence towards vendors' design capabilities. In addition, those CSFs also interrelated to each others. For instance is working cultures that have direct influence on human resource skill, experience and knowledge level. Positive culture able to develop quality employees, as a results there will be continuous improvement process, while skills and knowledgeable workers able to optimize technology and tools used, finally improve business performance results. Rank of CSFs are shown by mean of frequency answers mentioned by interviewees; thus identified technical assistant as the most critical factor followed by financial capabilities, human resource, technology and tools, mean while top management, culture, prospect market and proximity have carried equal important factors, established processes and finally focus in business. The CSFs are collectively discussed based on detail of interview sessions.

Table 2: Benefits of vendors owned DC according to company roles in PD

Company	Status/ Role	Benefits of vendors owned design capabilities
ED	OEM/	- Reduced number of Proton's employees allocated for each project. - Received technology transfer from expert vendors.
GP	OEM	-Shorten development time. -Produce quality products. -Minimize risks of failure. -Sometime, it is economical to outsource rather than develop own capability.
MZ	Subsidiary-vendor/ Grey Box	-Development of local capabilities on high degree of precision and accuracy of dies. - Localize dies production. -Product cost reduction.
DN	Foreign-vendor/ Black Box	-Trust from customers. -Improved time development. -Able to give immediate feedback. -Better understanding on customers' needs (especially Malaysian customers). -Gained trust and confident from parent company.
IG	Bumiputra-vendor/ Grey Box	-Immediate decision making. -Cut down cost especially on technical assistance fee (about 40% and more). -Able to fulfil customers' needs. -Better understanding from PD experience. -Expand knowledge through hands on experience. -Able to work independently. -Improve products manufacturability.
DL	Non-Bumiputra/ Black Box	-Received more projects from customers.

a. Technical assistant (Table 3, item 6)

The most frequent answer gathered from every session is receiving technical assistant (TA) like joint venture activities and technical partner from established companies or parent company. This point is strongly important in Malaysian automotive industry due to several reasons. According to MZ, automotive is a high technology industry and involvement in this industry considered as new compared to other established automakers. Therefore, it is important for Malaysian vendors to have assistance from reputable partners since TA is able to shorten learning process, minimize mistake and optimize use of resources. Thus, aligned with GP's perspective; TA is the fastest way to get the technology from established experts. Meanwhile DL needs TA to support them to adopt new technology.

In addition, IG has different reason about the importance of having TA. During their early involvement in auto industry, TA is able to build up confident and trust from buyer. Gradually they become independent and able to run on their own. Even today IG has appointed to be TA for an automotive vendor in India and the company has been awarded as "Best Vendor Achievement for Design and Development" by Maruti groups. Indirectly, it shows that through proper technical collaboration, the company is effectively able to gain the technology within short time and expend the knowledge to higher level. Mean while, DN as a Malaysian foreign-vendor received solid TA from parent (Japan) and other branches as well. DN received experts from Japan to guide and assist local engineers especially in Engineering Department; standardize processes; training for new engineers conducted in Japan (headquarters) and training centre at other group company; shared standard and drawing database with other branches; and also supported by other branches for laboratory and testing facilities to ensure the quality design produced as perceived. As a result, DN products are recognized as number one (1) in Malaysia and number two (2) for the whole world level.

Table 3: CSFs for Malaysian vendors design capabilities development

CSFs	Description	VE	GP	MZ	DN	IG	DL	(%)	Mean
1.Human Resource	a.Skillful	X				X		0.33	0.55
	b.Experience	X	X	X	X		X	0.83	
	c.Technical knowledge	X			X	X		0.50	
2.Technology & Tools	a.Facilities (e.g laboratory,prototype,testing)	X	X	X		X	X	0.83	0.40
	b.PDCA (Tools)				X			0.17	
	c.Reverse Engineering (Tools)					X		0.17	
	d.Computer software (e.g CAD/CAE/CAM)	X			X	X	X	0.67	
	e.VA/ VE (tools)	X	X		X		X	0.67	
	f.Database; drawings and standards				X			0.17	
	g.Aligned technology used			X				0.17	
3.Established Processes	a.ISO certification	X		X				0.33	0.26
	b.Quality Engineering (APQP)			X				0.17	
	c.Customers involvement			X				0.17	
	d.Employee development program			X	X	X		0.50	
	e.More attention on planning				X			0.17	
	f.Sandard PD processes			X	X			0.33	
	g.SIPD			X				0.17	
4.Financial Capabilities	a.Investment	X	X	X		X	X	0.83	0.83
5.Culture	a.Positive culture: loyal, hardworking, teamwork		X	X	X			0.50	0.33
	b.Spiritual believe " working is ibadah"					X		0.17	
6.Technical Assistant	a.Joint venture/ partner/parent	X	X	X	X	X	X	1.00	1.00
7.Prospect Market	a.To attract foreign investee/partner			X				0.17	0.33
	b.Decision on facilities investment				X	X	X	0.50	
8.Proximity	a.Better communication and integration			X	X			0.33	0.33
9.Top Management	a.Technical background				X			0.17	0.33
	b.Commitment		X			X	X	0.50	
10.Focus	a.Focus in business		X					0.17	0.17

b. Financial capabilities (Table 3, item 4)

Majority of interviewees (83%) think financial capabilities is the most critical factor to success in design. This is due to importance of the capabilities that has direct influence on design components development, namely human resources, technology and tools, TA and etc. In addition, automotive is a high technology industry and require for big investment. According to GP, most of Malaysian vendors have limited financial capabilities, consequently bound their technology development. In addition, MZ highlighted that is difficult to convince Malaysian Bank for loan, due to lack of understanding from public society about the technology, bigger amount of money involved and higher risk face. Besides, Malaysian automotive market size considered as small, thus unfavorable on investment decision.

c. Human resources (Table 3, item 1)

Interviewees commonly agreed on this point, since human resources received highest attention for design capabilities components. Human resources based on interviewees' point of views are defined as employees that owned skills to handle relevant tools, sufficient level of technical knowledge background and well experience that able to influence their judgment on decision making during PD process. DL identified human resources as one of core capabilities to their R&D activities. Currently, Malaysian automotive industry are facing serious problem on this matter. One of the crucial barriers to Malaysia DC development is difficulties to retain experience workers. There are some related issues to the matter identified, namely low salary, lack of incentives and culture. Companies have spent big amount of money to train employees and expect them to serve the companies in return. However, once experience workers run away, companies have to recruit new staffs, train and guide them again. Definitely the staffs need some time to groom. Surprisingly, IG has the lowest record of resignation level compared to other vendors. IG successfully manages to take care of employees' needs and developed positive working culture in the company.

d. Technology and tools (Table 3, item 2)

There are bigger areas covered under this category that include facilities, computer software, database that similar to library function (consist collection of drawings and standards to facilitate new PD) and finally technology and tools used has to be aligned with customers. Technology and tools are important to support PD activities, DL name it as core component of design capabilities. MZ and DN agreed that appropriate technology and tools used like PDCA and APQP are able to determine end-quality of products. However, financial capability has restricted most of local vendors' ability to have full range of equipment. However, it is mandatory requirement from OEM that any new design proposed has to be tested. Therefore, IG has to hire certified consultant to do certain testing work for them. Even it is costing, but still considerable rather than invest on high cost testing equipment but seldom used (due to small market size in Malaysia). Mean while, DN (foreign-vendor) does not have in-house testing facilities, if necessary DN utilizes testing facilities at other branches or headquarters. Furthermore, it is important to ensure the technology and tools used by vendors are aligned with buyer especially those who are involved in PD (SIPD). Regarding on ED experience, aligned technology for instance computer software is able to ensure effective communication and accurate data transfer.

e. Top management (Table 3, item 9)

Top management play important role towards DC development. Since, DC involved with big investment makes it heavily rely on top management commitment and support to ease the development. DL main challenge during initial stage to set up DC is to convince top management for financial approval. Meanwhile, IG received full commitment from top when specific amount of their annual profit allocated for R&D activities. GP has concluded that top management commitment reflects on allocation or investment on R & D activities.

f. Culture (Table 3, item 5)

Culture is a soft element and less tangible. Positive working cultures shown by employees are identified as associated factor to quality human resource (refer 3.c). Those vendors (MZ, DN and IG) who have parent company or TA from Japan prefer to send their staff for training at Japan. Instead of receiving technical knowledge, they also expose to Japanese culture and indirectly build Japanese positive working culture among local employees. Furthermore, IG (please refer prior discussion on 3.c) has develop their culture based on Islamic principal.

g. Prospect market (Table 3, item 7)

In Malaysia context market size is a serious issue. Majority of interviewees agreed that DC development required big investment. MZ mentioned that prospect market has significant influence on decision for facilities investment. According to IG, Malaysia has smaller market, thus restricted the development. Therefore, it is important to create secure market from local OEM and penetrate overseas market to ensure return of investment allocated.

h. Proximity (Table 3, item 8)

According to MZ and DN, proximity is important for better communication and integration. Nature of automotive industry involved with thousands of components, high precision and complex technology really need frequent face-to-face communication. Especially when current trend of PD in Malaysia is using concurrent engineering and some portion of car design also outsourced to vendors make proximity factor becomes more stringent. On the contrary, ED has opposite opinion; distant is no longer crucial as today's modern IT and communication tools has closing the gap. Contradict responses on this factor require for further investigation to confirm on this CSF.

i. Established processes (Table 3, item 3)

VE, MZ and DN agreed that standardize PD processes is important CSF. Well established process can be evaluated or audited periodically through ISO certification like ISO/TS 16949 or ISO 9001:2008 for continuous improvement. Furthermore, some customers have made ISO certification as one of pre-requisite criteria for vendors before being selected for project awarded.

j. Focus (Table 3, item 10)

Focus in business only aroused by GP; since they have been involved directly to manage Proton vendors, this factor become severe to them. One of the vendors failure reason noticed is due to lack of focus in business. Vendors suppose to have simultaneous progress with OEM and put effort on expanding their automotive business. However, some of them have diversified profit gained by investing to other business. Therefore, part of R&D budget has been taken away. As a result, companies' performance left behind due to insufficient financial support.

4.0 Conclusion and Further Research

As a conclusion, important CSFs provide useful insight for design capabilities development or enhancement especially for Malaysian automotive vendors. Lack of adequate financial funding has denied many Malaysian vendors to invest on design components including TA. This factor has preventing Malaysian vendors from successfully develop their design capabilities. Inevitably, effective development of design capabilities will be delayed or may not be achieved at all unless top management are pro-active and dare to explore new over sea market.

All CSFSs gathered from the interview will be refined for significant and incorporate to prior research. The refine CSFs will be validated through questionnaire survey based on Analytic Network Process (ANP) format. ANP is a multi criteria decision making (MDCM) techniques, type of measurement used to derive relative priority scales of absolute numbers from individual judgments [24]. Then ANP model will be develop and potentially able to rank CSFs according to priority [25], thus able to identify most important among the other CSFs. In addition, ANP also capable to structure (relationship between attributes) and integrate all influential factors (e.g link DC components to relevant BPR)[24, 25]. It is hope that final result would be able to ease DC development process not only in Malaysia but also applicable to neighborhoods countries.

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