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An Empirical Analysis of New Product Development Success Among Automotive Industry Vendors in Malaysia

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Abstract

New product development in the automotive industry necessitates significant upfront investment, given the uncertainty of a product's competitiveness upon market launch. Hence, industries strive to comprehend and evaluate crucial success factors during implementation phases. This paper delves into the findings of an empirical qualitative analysis study on the success of New Product Development (NPD) in order to provide deeper insights into these success factors. The study delineates three primary dimensions: IT capability, new product development process, and new product development strategy. Conducted within the Malaysian automotive industry, the empirical results affirm the criticality of these factors to success.

Keywords: *IT Capability, NPD Process, NPD Strategy, NPD Success*

INTRODUCTION

Tavana (2021) postulate that vendors' ability to make changes in product volume is an important factor in the selection of vendors in the automotive industry. For certain industries such as electronics, market instability poses a specific challenge for vendors to vary production according to the market. Decrease or increase can occur shortly and must be sustained over a specified period. Companies' ability to respond rapidly to consumer demand depends on the vendors' response time to make volume adjustments. Expertise in new product development will boost the success of many industries. Cooper (2019) highlight that vendor can increase their productivity when new products are introduced, doubling their bottom line. This is one of the remaining parts that possess high potential enhancement.

Automotive Industry in Malaysia

The Malaysian automotive industry has been a significant contributor to economic activity, providing livelihoods for 709,457 individuals and contributing RM40 billion to Malaysia's Gross Domestic Product (GDP), accounting for 4% (MAI, 2017). While automotive products have facilitated transportation and bolstered the economy, their production processes have raised environmental concerns (Aguilar Esteva et al., 2021).

In the 21st century, there has been a heightened demand for environmentally friendly products, necessitating a shift towards greener processes that prioritize environmental sustainability over mere organizational profit (Aguilar Esteva et al., 2021). Within the automotive industry, environmental impacts span from material sourcing to vehicle production, presenting a significant challenge for both the Malaysian automotive sector and the industry at large (Baba et al., 2019; Suffian, 2020).

Malaysia stands as one of Asia's rapidly growing economies, with GDP growth rates averaging 5% in the 1980s and exceeding 7% in the 1990s (Malaysian Investment Development Authority, 2010). In 2012, the GDP

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growth rate was recorded at 5.6% (MITI, 2013), with manufacturing being a pivotal sector in propelling the Malaysian market forward.

Based on the latest available statistic, the Total Industry Volume (TIV) for 2022 registered new motor vehicles experience an increase from 508883 units to 720,658 units in 2022. The increase of 29.39% or 211,775 units is compared with 2022 as illustrated in Figure 1.

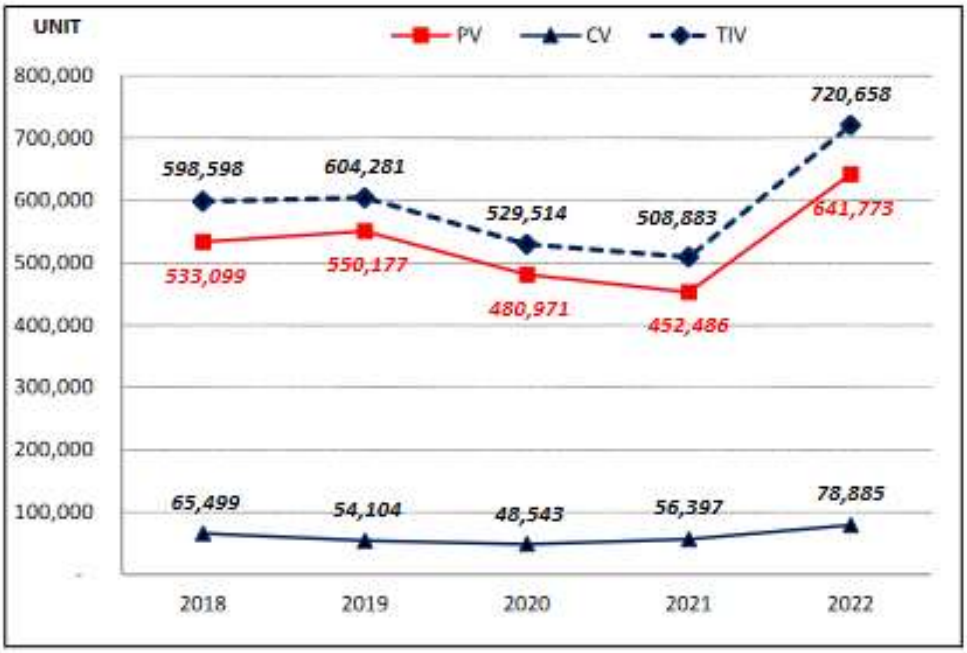


Figure 1 *TIV Trend from 2018 to 2022*

Source: (Malaysia Automotive Association, 2022)

In the year under review, both the Passenger Vehicles segment and the Commercial Vehicles segment registered very high growth in sales. The total registration of new Passenger Vehicles in 2022 rose to 641,773 units from 452,486 units in 2021. This was an increase of 189,287 units or 41.8 %. Similarly, the Commercial Vehicles segment also registered a very high growth of 39.9% or 22,488 units to reach 78,885 units. The improvement in sales of commercial vehicles was due to increasing demand as companies begun to invest in anticipation of an economic rebound after two years of slowdown due to impact of Covid-19 pandemic.

Table 1 ***TIV 2022 Versus 2021***

Market segment	2022	2021	Variance	
			Units	%
Passenger vehicles	641,773	452,486	189,287	41.8
Commercial vehicles	78,885	56,397	22,488	39.9
Total vehicles	720,658	508,883	211,775	41.6

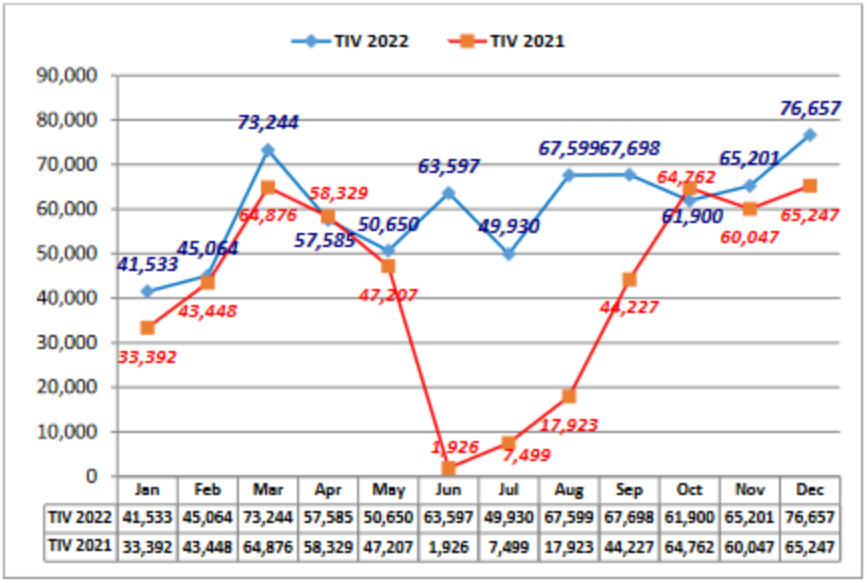
Source: (Malaysia Automotive Association, 2022)

On a year-on-year (y-o-y) basis, with the exceptions of April and October, monthly total vehicle sales consistently surpassed those of the corresponding months in 2021 throughout 2022.

Starting from August 2022 onward, the Total Industry Volume (TIV) consistently exceeded 60,000 units monthly. This surge was attributed to car companies fulfilling bookings received before 30 June 2022.

The monthly TIV peaked in December 2022, reaching an all-time high of 76,657 units. This marked the second instance in 2022 where the monthly TIV surpassed 70,000 units; the first occurrence was in March 2022, with 73,224 units registered. The notable spike in December 2022 was spurred by automotive companies rushing to meet end-of-year financial deadlines and fulfill backlogged orders. Additionally, promotional campaigns by select MAA members contributed to increased sales.

The Total Industry Production (TIP) of new vehicles in 2022 increased by 220,624 units or 45.8% to reach a total of 702,275 units compared to 481,651 units in 2021. Similar to TIV, this was an all-time high TIP and the first time the TIP exceeded the 700,000 units mark. This big increase in production volume was in tandem with the higher overall sales in 2022. The trend is shown in Figure 2.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TIV 2022	41,533	45,064	73,244	57,585	50,650	63,597	49,930	67,599	67,698	61,900	65,201	76,657
TIV 2021	33,392	43,448	64,876	58,329	47,207	1,926	7,499	17,923	44,227	64,762	60,047	65,247

Figure 2 *TIV Trend 2022 versus 2021, by Month*

Source: Malaysia Automotive Association (2022)

LITERATURE REVIEW

Relationship between IT Capability and NPD Success

NPD success is considered essential for an industry's long-term existence (Dias & Lages, 2021). Simultaneously, it is precarious and time-consuming due to complexity arising from work, which would increase costs (Morais et al.,2021), costs money (Coleman, 1998). It also involves communication, collaboration, cross-regional groups, and cross-functional coordination Giampieri et al., 2020). Moreover, NPD includes multiple activities such as preliminary detailed investigation, development, validation and testing, market launch, and full production (Cooper, 2019). This also includes the creation and sharing of information (Jamaludin et al.,, 2018). Lastly, it involves tough decision-making process (Gholizadeh & Esmaeili, 2020) and NPD essentials to produce greater products that will bring benefits and success (Araujo et al., 2022).

Successful implementation of these activities depends on the quality of a new product. Another approach of enabling the execution of certain activities is to apply the media of IT capability. Overall, information technology capability contains computer hardware and software, communication technologies like people behind the scenes, and sanctioned resources devoted to supporting those competences. Information technology capability is used to support the analysis aspect, compilation, and dissemination of information related to the tasks (Zaman et al., 2023).

Companies heavily invest in IT capability to increase their financial performance and increase their market competitiveness with new product development success (Sewaid et al., 2021). For example, information

technology (IT) capability has been used in purchasing (Zaman et al., 2023), manufacturing (Jafari-Sadeghi, 2021) , and sales (Hashim, 2022).

Information technology (IT) capability has been applied to new product development (NPD) success. Increased competition needs quicker new product introduction to the market, global trade of new product talents make it harder to get new product teams to one place for production, and therefore, the need for the use of electronic data sources to distribute information among new product teams arises (Centobelli et al, 2020). While crossing regional groups, electronic data resources are saved for the future. Information technology (IT) capability can also forecast potential pitfalls while gearing it to success.

Relationship between NPD Process and NPD Success

New product process is crucial and is the first matter that needs to be contemplated in ensuring the success of NPD (Booz-Allen & Hamilton, 1982). Martínez-Lobatón (2023) took this a step further by examining the link among new product development success and also the activities conducted throughout this NPD process. Their findings indicate that increasing performance includes performing preliminary market and technological assessments, production start-up, in-house product testing, product development, business analysis market launch, and customer prototype testing. In another research, Cooper (2019) postulated that industrial aggressive in the efforts to generate ideas to be high performers of new products.

Every industry needs to refresh the market with NPD success. NPD success is generally highlighted as an essential source of the competitive market that determines an industry's survival. NPD is constructed on structures that simultaneously produce quality, variety, customisation, intensity, and response speed (Sutrisno, 2023; Park et al., 2023). Internal mechanisms are rearranged for the optimisation and integration of NPD processes like concurrent engineering, cross-functional work, early involvement, and advanced tools (Bican et al, 2020). Despite shorter product life cycles and greater demand for product variety, a strain is also put on NPD success whether it should work with global sectors of new product ideas and handle the associated risks with progressing till completion and introduction to the market (Rexed & Wikman., 2020).

Relationship between NPD Strategy and NPD Sucess

Jamaludin (2022) suggests that the degree of product innovation does is relevant for effectiveness as a larger degree of product innovation contributes to stronger success. Davis (1988) studied three new case studies of NPD with seven proposed activities by Booz, Allen and Hamilton, two of which failed and one was successful.

These showed that the lack of the main production tasks and product evaluation led to failure. In contrast, the step-by-step implementation of NPD activity contributed to the success of new service in a hotel. Cooper (1984) studied 58 creative industrial sectors from 30 various industries and identified that only seven industrial companies follow NPD activities. The successful cases fully complied. On the other hand, essential tasks such as filtration development, customer-based market research, and prototype product testing were overlooked and determined as failing issues (Cooper, 1984).

Cheah et al., (2021) postulate that an industry that does its operations without a particular method or without a comprehensive development plan will reduce its rate of success for NPD and market entry. If a non-dominant industry continues to create a brand new product for that new market, the industry will need to adopt a complete success procedure. If that industry wants to produce an escaping product into the global markets, conception evaluation, creation generation, and other rules should not be ignored.

New Product Developmet Success

The problem of defining success is not a novel one. There is a vast array of literature dealing with overall competitive performance and different ways in measuring this construct (Kazem et al., 2022).

According to Subedi (2021), a two-dimensional assessment model was developed which highlighted 10 various approaches for measuring business performance. The first dimension is concerned with financial use (profit, turnover, sales growth and ROI) versus broader operational criteria (innovativeness, market standing, and social responsibility). The second dimension is focused on two alternate data sources (primary versus secondary).

(Dess & Robinson (1984) examined the effectiveness of the measured subjective results gathered from top management teams as difficulties occur in extracting reliable performance data.

They concluded that researchers could consider using subjective perceptual measurement when appropriate objective measurements are not available, and the option would be to exclude performance concern from the study design. This finding has been replicated by Rexed & Wikman., (2020) because new product success is one aspect of an industry's complete success, most of what has been written on industry success is also relevant to NPD success measurement (Cheah et al., 2021).

For instance, the distinction between financial and operational criteria is also relevant in a new product success setting ((Kazem et al., 2022). Other authors have dealt with new product success measurements more explicitly. For instance, Cooper (1984) and Cooper & Kleinschmidt (1987) examined how NPD success would be evaluated, whether there were independent tests or specific ways to look at achievement, and what are the elements of achievement when achievement is viewed differently.

RESEARCH FRAMEWORK AND HYPOTHESIS

The development of the conceptual framework of this research is done based on the outcome of the review of the theories and concept of IT Capability, NPD process, NPD strategy, and NPD success inclusive of related empirical research on the subjects. There are three independent variables and one dependent variable. Figure 4 below depicts the conceptual framework which represents the main variables of this study.

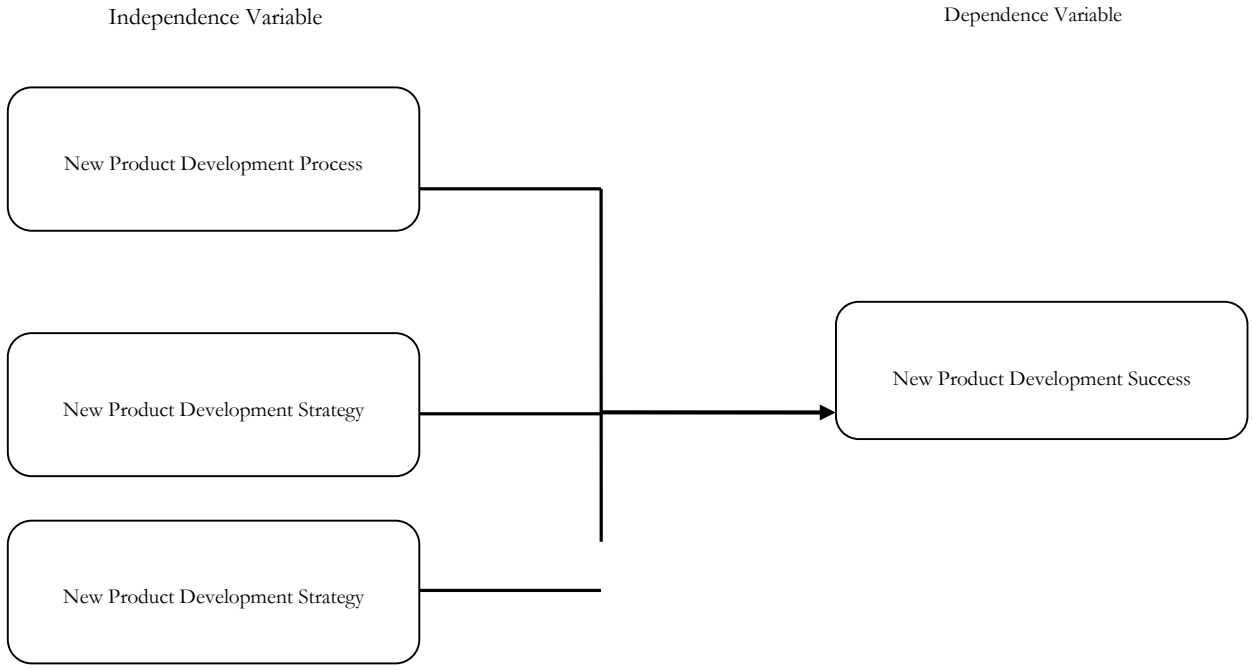


Figure 4 Conceptual Framework

An underlying theory is used to promote awareness of the notion beyond the investigated phenomenon. The theory describes the logical interaction between various structures or ideas, allowing a deeper understanding of their interactions and how they influence one another (Jamaludin et al., 2021). This study employs two theories in explaining the relationships that exist between information technology capability, NPD process, NPD strategy and NPD success. The theories are resource-based view theory and contingency theory.

Hypotheses are conclusions in a quantitative study in which the researcher formulates a hypothesis or conclusion with respect to the outcome of a calculation or reference relation. Creswell (2012) states that

hypotheses are usually used in research and that they serve as test questions that narrow down specific conclusions of purpose. The hypothesis is an instant indicator of whether to evaluate.

The proposed theoretical framework, based on deliberate literature reviews, formulated statements of hypotheses based on the relationship between the independent variable and dependent variable. This study looks specifically at the relationships between an independent variable and a dependent variable.

H1: There is relationship between information technology capability and new product success.

H2: There is relationship between new product development process and new product success.

H3: There is relationship between new product development strategy and new product success.

POPULATION AND SAMPLING DESIGN

In this study, the term "population" encompasses all manufacturers of automotive components who supply products to leading automotive companies in Malaysia, such as Proton, Perodua, Suzuki, Naza, and Toyota. A careful filtration process was undertaken, focusing solely on companies actively and directly engaged with these carmakers.

A total of 325 companies were identified as involved in supplying automotive components to the main suppliers in Malaysia. These component suppliers were selected from associations listed in directories of Proton, Toyota, Perodua, MATRADE, and the Malaysian Automotive Institute (MAI). Through filtration, only companies engaged in active and direct dealings with carmakers were included in the population.

The objective of developing the instruments is to establish research-oriented measurements. The foundation for crafting the instruments in this study is drawn from the proposed conceptual framework and existing literature on IT capability, NPD process, NPD strategy, and NPD success.

Data collection for this study was conducted through questionnaires. This method was chosen as it is widely regarded as one of the most suitable instruments for survey-based research (Sekaran, 2003).

RESPONDENT PROFILE

This segment elucidates the demographic profile of the respondents within the sample. The analysis delves into various demographic factors, including the duration of the organization's existence, position within their organization, type of ownership, number of full-time employees, years of experience in the automotive sector, types of products manufactured, product launches in the past five years, and the percentage of the organization's budget allocated for annual R&D expenditure. The findings are presented in Table 2.

Table 2 : Demografik Respondent

Items		Frequency	Percent
The organization has been in existence for …	Less than 1 year	2	2.2
	1 to 5 years	9	10.0
	6 to 10 years	14	15.6
	More than 10 years	65	72.2
The current position is …	Executive	48	53.3
	Senior Executive	11	12.2
	Manager / Head of Department	18	20.0
	Senior Manager	6	6.7
	General Manager / Senior Management	5	5.6
	Managing Director	2	2.2
Type of ownership of organization	100% Local	67	74.4
	100% Foreign	3	3.3
	Joint venture	20	22.2

Number of full-time employees in organization …	Less than 75	15	16.7
	75 to 199	16	17.8
	More than 200	59	22.2
Have been working in automotive sector for …	1 to 5 years		
	6 to 10 years		
	More than 10 years		
Types of product produced in organization …	Metal Parts		
	Plastic Parts		
	Electrical Parts		
	Rubber Parts		
	Other		
Products launch in the last 5 years	1 to 5 products		
	6 to 10 products		
	More than 10 products		
Percentage allocate for R&D expenditure per year	Below 1%		
	1% to 1.99%		
	2% to 2.99%		
	3% to 3.99%		
	4% to 4.99%		
	More than 5%		

Table 2 outlines the characteristics of the companies and respondents based on their demographic backgrounds. The results indicate that 2 respondents (2.2%) represent organizations existing for less than 1 year, 9 respondents (10.0%) for 1 to 5 years, 14 respondents (15.6%) for 6 to 10 years, and 65 respondents (72.2%) for over 10 years, demonstrating a significant level of experience within the automotive industry.

Regarding current positions, 48 respondents (53.3%) hold executive roles, 11 respondents (12.2%) are senior executives, 18 respondents (20.0%) are managers/heads of departments, 6 respondents (6.7%) are senior managers, 5 respondents (5.6%) are general managers/senior management, and 2 respondents (2.2%) are managing directors, indicating a predominance of executive-level representation.

In terms of ownership, 67 respondents (74.4%) belong to 100% local companies, 3 respondents (3.3%) to 100% foreign companies, and 20 respondents (22.2%) to joint ventures, with the majority representing local companies.

Regarding the number of full-time employees, 15 respondents (16.7%) represent organizations with fewer than 75 employees, 16 respondents (17.8%) with 75 to 199 employees, and 59 respondents (65.6%) with over 200 employees, suggesting a prevalence of larger companies.

Regarding the types of products manufactured, 57 respondents (63.3%) produce metal parts, 12 respondents (13.3%) produce plastic parts, 2 respondents (2.2%) produce electronic parts, 8 respondents (8.9%) produce electrical parts, 3 respondents (3.3%) produce rubber parts, and 8 respondents (8.9%) produce other types of parts.

Regarding the number of new products launched in the last 5 years, 25 respondents (27.8%) launched 1 to 5 products, 22 respondents (24.4%) launched 6 to 10 products, and 43 respondents (47.8%) launched more than 10 products.

Concerning the percentage of the organization's annual R&D expenditure, 10 respondents (11.1%) allocate below 1%, 10 respondents (11.1%) allocate between 1% and 1.99%, 12 respondents (13.3%) allocate between 2% and 2.99%, 15 respondents (16.7%) allocate between 3% and 3.99%, 7 respondents (7.8%) allocate between 4% and 4.99%, and 36 respondents (40.0%) allocate more than 5%, indicating a significant investment in R&D within the automotive industry.

DESCRIPTIVE ANALYSIS

Table 3 demonstraed that the mean of IT Capability is 3.98 with a standard deviation of 0.816, in the score between 1.75 and 5.00. The mean of NPD Process is 4.08 with a standard deviation of 0.720, in the score between 2.23 and 5.00. Similarly, the mean for NPD Strategy is 4.05 with a standard deviation of 0.747, in the score between 2.25 and 5.00. Lastly, the mean of NPD Success is 4.21 with a standard deviation of 0.713, in the score between 2.00 and 5.00.

Table 3 ***Mean and standard deviation for each variable***

Variable	Minimum	Maximum	Mean	Std. Deviation
IT Capability	1.75	5.00	3.98	0.816
NPD Process	2.23	5.00	4.08	0.720
NPD Strategy	2.25	5.00	4.05	0.747
NPD Success	2.00	5.00	4.21	0.713

In particular, the results showed that the mean of all the variables and measurements are high as the mean for all variables is between 3.98 and 4.21. This indicates that IT Capability, NPD Process, and NPD Strategy are of particular significance. In other words, the statistical data also showed that the standard deviation increased from 0.713 to 0.816, below 1, which indicated the variability of the data (Sekaran & Bougie, 2013).

CONVERGENT VALIDITY

Convergent validity is the degree where a group of variables changes to measure a particular concept (Hair et al., 2010). As mentioned by Hair et al., (2010), the three criteria must be simultaneously examined to determine the accuracy of convergence: extracted mean variability (AVE), factor loading, and composite reliability (CR). Accordingly, the composite approximation of the reliable coefficient of a latent variable mostly to the observed variable will exceed 0.50 (Byrne, 2010; Hair et al., 2006).

Table 4 examined the composite reliability and Cronbach Alpha values. The composite reliability value ranged from 0.931 to 0.953 and the Cronbach Alpha value ranged from 0.913 to 0.943, exceeding the suggested level of 0.7 (Hair et al., 2010; Fornell & Larker, 1981). Thus, these findings show the outer model's convergent validity. Additionally, the average extracted variance values have been tested to verify the outer model's convergent validity. AVE represents the average variance derived from a group of items compared to the variance associated with the measuring errors. Therefore, AVE measures the variance that indicators obtain in comparison to the variance attributed to the errors of measurement. Therefore, in which the AVE value has been at 0.5, these sets of elements demonstrate a significant conversion in the measure of the construct in question (Barclay et al., 1995). For this study, the AVE value for each measure used is between 0.625 and 0.723, suggesting a significant level of construct validity (Barclay et al., 1995).

Table 4 ***The Convergent Validity Analysis***

Construct	Items	Cronbach Aplha	Composite Reliability	Average Variance Extracted (AVE)
IT capability	7	0.913	0.931	0.661
NPD process	11	0.939	0.948	0.625
NPD strategy	6	0.923	0.940	0.723
NPD success	8	0.940	0.950	0.705

Discriminant Validity

The discriminant validity of the steps was verified by using the approach of Fornell & Larker, (1981). Table 5 states that the square root of AVE was substituted with the diagonal elements of its correlation matrix for all constructs' element. In this study, the discriminant validity of the outer model was verified where the diagonal components in the table were greater than other elements in the row and column in which they have been

placed. The below tests resulted in for the outer model's construct validity. It is assumed that the results obtained regarding hypothesis testing must be valid and reliable.

Table 5 ***Forner Larker Criterion***

	ITC	NPDPro	NPDStra	NPDSuc
IT Capability	**0.813**			
NPD Process	0.601	**0.790**		
NPD Strategy	0.643	0.726	**0.850**	
NPD Success	0.573	0.764	0.679	**0.840**

Hypothesis Testing

Hypothesis 1(H1): There will be a positive relationship between information technology capability and new product development success.

The results showed that the IT capability is not related with NPD success at $p<0.005$. ($\beta=0.092$, $t=0.925$, $p=0.355$). This finding is consistent with the literature which reported that IT capability alone is not enough to assure sustained competitive advantage. It has to work hand in hand with other elements such as complementary human involvement and intangible business resources to achieve success (Schweikl & Obermaier, 2023). According to EFPIA (2015), the automotive industry should allocate 4.4% for R&D expenditure per year. Other reasons why the relationship between IT Capability and NPD success was not supported is due to the outcomes of the study which show that only 47.8% of vendors allocated for R&D expenditure per year. This implies that 52.2% of vendors fail to allocate for R&D expenditure per year. This affects the relationship between IT capability and NPD success in the Malaysian automotive industry.

Hypothesis 2(H2): There will be a positive relationship between new product development process and new product development success.

The results showed that the relationship between NPD process and NPD success is supported at $p<0.005$. ($\beta=0.306$, $t=2.688$, $p=0.007$). This finding is in line with the literature which identified that NPD process has a positive effect on new product development success (Griffin, 1997; Brentani de, 1989).

Hypothesis 3(H3): There will be a positive relationship between new product development strategy and new product development success.

The results showed that the relationship between NPD and NPD success is supported at $p<0.005$. ($\beta=0.181$, $t=1.668$, $p=0.096$). This finding is consistent with findings reported in the literature. Industry with outstanding R&D organisations has a greater possibility of occurrence in NPD success strategy which is attributed to the comprehensiveness of production practices (Zirger & Maidique, 1990).

Summary of Hypothesis Testing

Table 6 summarises the result of the direct hypothesis testing impact between the variables from this study. Based on the results, H1 was not supported (T Value 0.925), H2 was supported (T Value 2.688), and H3 was supported (T Value 1.668).

Table 6 ***The Results of the Inner Structural Model***

Ho	Hypothesis	Path Coefficient	Standard Error	T Value	P Value	Decision
HI	ITC → NPDSuc	0.092	0.099	0.925	0.355	**Not Supported**
H2	NPDPro → NPDSuc	0.306	0.114	2.688	0.007*	**Supported**
H3	NPDStra→ NPDSuc	0.181	0.108	1.668	0.096*	**Supported**

Note: ITC=Information Technology Capability, NPDPro=New Product Development Process, NPDStra=New Product Development Strategy, NPDSuc=New Product Development Success

*significant level p<0.005

In addition, the results show that IT Capability is the only exogenous variable that does not support endogenous variable which is new product development success.

RECOMMENDATION FOR FUTURE RESEARCH

This research, centered on IT Capability, NPD Process, NPD Strategy, and NPD Success within Malaysia's automotive industry, offers several recommendations for future endeavors. Firstly, expanding the research scope beyond the automotive sector to include industries like services, banking, and food could provide a broader perspective and comparative insights. Secondly, conducting comparative analyses between Malaysia's automotive industry and others could illuminate unique industry dynamics. Delving deeper into IT Capability, perhaps by focusing on specific functional units or limiting samples to specific occupational levels, could yield more nuanced findings. Moreover, integrating qualitative data alongside quantitative research methods could enrich understanding by capturing contextual nuances and complexities inherent in IT Capability, NPD Process, NPD Strategy, and NPD Success within the automotive sector.

CONCLUSION

The Malaysian automotive industry was specifically chosen due to several factors. The automotive industry is one of Malaysia's productive industries. The second reason is that Malaysia's Gross Domestic Product (GDP) holds RM40 billion or 4 % (Malaysian Automotive Institute, 2017). Third, the Malaysian economy provides a livelihood to 709,457 people (MAI, 2017). Fourthly, domestic car makers look forward to exporting their products to world market in response to the ASEAN Free Trade Agreement (AFTA) (Fazilah et al., 2014). Fifth, the National Industry Policy 4.0 encourages the manufacturing industries to shift towards Industry 4.0 and contributes to the fulfillment of Malaysia's contribution to the United Nations Sustainable Development Goals (SDGs) (MITI, 2018).

Given the intense competition, evolving consumer aspirations, growing demands, and the volatile market landscape, the Malaysian automotive industry must recognize New Product Development (NPD) as a significant challenge. This study aims to explore the critical success factors for NPD within the Malaysian automotive industry context. Its primary goal is to enlighten managers about the pivotal role of these factors in driving the performance and successful completion of projects within automotive companies in Malaysia.

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