
Impact of organisational capabilities on R&D project innovation performance of E&E manufacturing firms in Malaysia

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Abstract: Innovation is vital as it contributes to business sustainability and success in a rapidly changing business environment characterised by high customer expectations and requirements, as well as business and technology competitions. Thus, organisational capabilities are expected to influence organisational performance directly. This research investigated the impact of organisational capabilities (i.e., technological marketing, customer relationship management, and management capabilities) on the research and development (R&D) project innovation performance of manufacturing firms. Data were collected through an online survey involving 56 electronic and electrical (E&E) manufacturing firms in Malaysia. The results indicated that marketing and management capabilities had a significant positive impact on R&D project innovation performance. However, unexpectedly, customer relationship management and technological capabilities did not show a significant effect on R&D project innovation performance. Of the two significant predictors of innovation performance, management capabilities were found to be a stronger contributor compared to marketing capabilities.

Keywords: organisational capabilities; research and development; R&D; innovation; electronic and electrical industry; manufacturing firms; performance.

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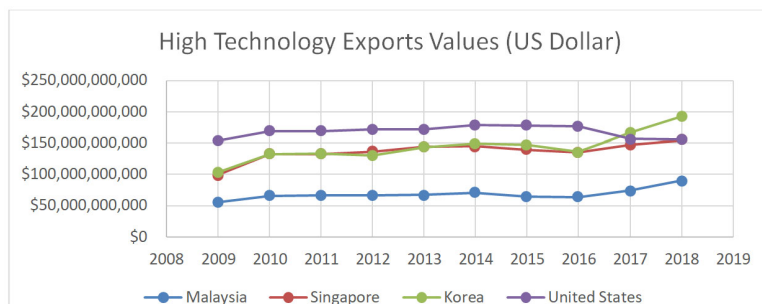
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1 Introduction

Innovation plays an important role in a country's economic growth. It also contributes to business sustainability and organisational success in a challenging market and rapidly changing business environment (Corrocher and Solito, 2017). It is characterised by high customer expectations and requirements, business and technology competitions, and short product life cycles (Bedi, 2019; Kiveu et al., 2019; Zou et al., 2017). However, Malaysia has been lagging behind other countries in the region in innovativeness. This is especially prominent in the development of high-technology manufacturing products and services, which has affected the country's economic growth and development. As a result, less value is incorporated into products than before even with the increase in manufacturing volume (Rasiah and Chandran, 2017). As illustrated in Figure 1, Malaysia is trailing other dynamic countries such as Singapore, South Korea, and the USA in high-technology export values. Malaysia's manufacturing firms have not been able to stay profitable for an extended period and survive due to low R&D project innovation performance.

Figure 1 Country comparison for high technology exports values (see online version for colours)



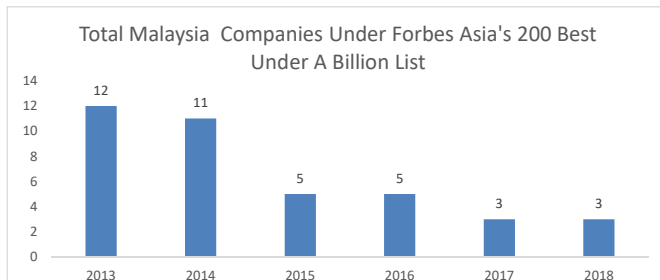
Source: Barrientos (2020)

While R&D and patenting are essential for Malaysia's export-oriented development and competitiveness strategy, R&D investment returns are dismal (Chandran and Wong, 2011; Dobrzanski and Bobowski, 2020). Patent filings by Malaysia are much fewer in number than by other energetic Asian countries. For instance, Koreans filed for 25,423 information and communication (ICT) patents in the USA between 2006 and 2011 in comparison to a mere 273 by Malaysians. According to the World Intellectual Property Organisation (WIPO, n.d.), even though Malaysia's patent applications with the patent office in Geneva have increased consistently over the years, the numbers lag far behind dynamic countries like South Korea, with 8,236 and 133,141, respectively, in 2018. Also, Malaysia observed low domestic application quantity compared to non-resident applications in 2018, at 1,116 and 6,179, respectively. The low patent filing and

application number are reflected in the declining innovation performance and global ranking competitiveness. Malaysia was ranked 37th in 2017 compared to 32nd in 2015 in the global innovation index. For global competitiveness, Malaysia was ranked 22nd in 2018 against 14th in 2015. The country dropped from the 43rd place in 2015 to 46th in 2018 for patent applications per capita.

Forbes' yearly list of 200 best companies in the Asia Pacific includes Asia's Under a Billion category for companies with revenues of up to USD1 billion. These companies have solid top- and bottom-line annual growth, and they are selected based on standards, including accounting practices, growth, profitability, and debts (Settimi, 2017). Their common characteristics are customer-focused and innovativeness, with mission statements usually containing keywords such as 'innovation' and 'continuous improvement' (R-Moulton, 2017). Figure 2 shows that since 2013, the number of Malaysian organisations included in the top 200 list has decreased drastically. Twelve companies were on the list in 2013, but only three made it in 2018 (Jonathan, 2019). The loss of nine seats or 75% of the places to companies from other countries indicates that Malaysian companies are losing their global competitiveness due to low innovation capability for high technology products, as well as service development and enhancement (Rasiah and Chandran, 2017). All three Malaysian companies included in the top 200 list in 2018 are from the electronic and electrical (E&E) industry, namely Vitrox, Elsoft, and Pentamaster (Jonathan, 2019).

Figure 2 Total number of Malaysia companies under Forbes Asia's 200 best under a billion list (see online version for colours)



Source: Jonathan (2019)

Job loss and unemployment are critical issues emerging from the low R&D project innovation performance, which diminish a company's competitive advantage (Akroush, 2012). It is, therefore, crucial to study the factors influencing a company's R&D innovation performance improvement to gain competitiveness and sustainability (Zou et al., 2017). According to the resource-based view, organisational capabilities could improve firms' competitive advantage (Čirjevskis, 2017; Teixeira et al., 2020). Thus, this research attempt to address the impact of organisational capabilities (i.e., technological marketing, customer relationship management (CRM), and management capabilities) on the research and development (R&D) project innovation performance of manufacturing firms. Past research has demonstrated the importance of organisational capabilities in attaining and sustaining new product competitive advantage (Akroush, 2012; Pavlou and El Sawy, 2006). Organisational capabilities consists of complex sets of skills and accumulated knowledge, thus enabling firms to utilise their resources to create value and competitive advantage. Organisational capabilities include management, technological,

CRM, and marketing capabilities (Kamboj and Rahman, 2017; Valmohammadi, 2017; Zawislak et al., 2018). Literature provides evidence of the relationship between organisational capabilities and various new product development (NPD) success measures (Akroush and Awwad, 2018; Shahin and Mahdian, 2020). However, only limited studies have looked into the effects of organisational capabilities on R&D project innovation performance, particularly within the E&E sector in Malaysia.

With critical cross-industry networks and applications ecosystem, the E&E manufacturing sector is broadly acknowledged for its tremendous contribution to Malaysia's economic development. According to the Malaysian Investment Development Authority or MIDA (2019), the E&E sector attracted RM8.2 billion or 84.5% of the total industry investments in 2017, mainly from Japan and Germany. Besides, the sector contributed RM343 billion or approximately 36.7% of Malaysia's overall export earnings in 2017 (MATRADE 2017). The sector added over 780,000 jobs for Malaysians and contributed to 23.4% of Malaysia's gross domestic product (GDP) in 2016.

This study contributes to the field in two fronts. First, by examining the influence of four organisational capabilities, namely technological, marketing, CRM, and management on the performance of innovation activities by E&E manufacturing firms in Malaysia. By doing so, it adds to the product innovation management literature. Second, the study has practical significance as it may assist managers, leaders, and organisations tasked with innovative strategies in the E&E industry to increase their organisations' productivity and performance.

In meeting the research objective, this paper is organised as follows. First, the literature review and theories, particularly the resource-based view and innovation theories to help the present researchers to develop the research hypotheses, are presented. Then, the methodical approach to carry out the study, followed by the results of data analysis and discussion, are laid out. This paper ends by highlighting some implications of the study, limitations, recommendations for future studies, and conclusions.

2 Literature review

2.1 Resource-based theory

Resources are defined as all information, knowledge, assets, processes of an organisation, and capabilities managed by the organisation to execute strategies to improve its performance (Barney, 1991). The identification and classification of an organisation's resources are valuable as effective resource utilisation could develop the competitive capability of the organisation. Edith Penrose's resource-based theory (see Rugman and Verbeke, 2002) posits the connection between talent resource management and the competitive advantage of an organisation, leading to a positive organisational performance over time (Freeman et al., 2021; Rabbi et al., 2015). According to this talent management-based theory, talent is the only resource that provides a sustainable competitive advantage. Therefore, organisations should focus on the expertise and capabilities derived from such talent. This theory further postulates that the performance differences among organisations within the same industry could be attributed to the variances in the organisations' capabilities and resources (Roos et al., 2001).

2.2 R&D project innovation performance

Simmie (2005) defined innovation performance as the discovery of new concepts, approaches, and knowledge application that improve existing processes and products. Innovation is a result of collaborative knowledge study involving the frequent use of organisations' internal and external talents. It is part of the strategic plan developed by business leaders in managing the fast-paced commercial environment and challenges (Alawamleh et al., 2020). Innovation extends beyond original product design and development to also include creative management methods (Quandt et al., 2019) and customer presentations exceeding customer expectations (Lale and Arzu, 2009; Park and Kwon, 2018). For corporates, technological innovation is required to develop original or improved products or services using new methods in shorter timeframes at cheaper costs. Innovation also encompasses new market development with breakthrough approaches to sales, marketing, and distribution channels (Deshati, 2016).

Many past studies have shown the positive contribution of innovation to company performance measured using economic development (Camison and Villar-Lopez, 2014). Maldonado-Guzmán et al. (2019) found significant and positive effects of product, process, marketing, and management innovation on the business returns of small and medium enterprises (SMEs) in Mexico. They concluded that SMEs gained many benefits, including a better commercial performance from product development, management, and marketing innovation capabilities. Valmohammadi (2017) demonstrated that product innovation improvement that resulted from CRM improved company performance. Fregidou-Malama et al. (2019) found product innovation to have a significant influence on the marketing performance of companies. They also revealed that market orientation had a significant impact on product innovation, which affected competitive product advantage and marketing performance.

2.3 Organisational capabilities and R&D project innovation performance

Underpinned by the resource-based theory, this study focuses on the internal resources or capabilities of firms to explain organisational innovation performance. They are technological, marketing, CRM, and management capabilities. Firms develop and manage organisational capabilities in order to gain competitive advantage by creating organisational-specific competencies. Through continued use, capabilities become stronger and more difficult for competitors to imitate. Thus, organisational capabilities have been argued to contribute to organisational performance and survival in a challenging business environment (Kunc and Bhandari, 2011; Pertuz et al., 2020).

Liu and Jiang (2016) found that organisational capabilities significantly impact NPD and product performance of manufacturing firms in China. Various scholars have stressed the need to understand and strengthen organisational capabilities for better organisational productivity and performance, thus fulfilling customer and market requirements and bringing long-lasting business sustainability (Olsson et al., 2010; Singh et al., 2012). Efficient and effective use of resource capabilities will yield better innovation results, leading to organisational performance and product value improvement (Forsman, 2009; Nandakumar et al., 2010).

2.3.1 Technological capabilities

Technological capabilities refer to a firm's ability to execute its technological function. The development of new products, methods, and technical know-how for corporate efficiency improvement is part of technological capabilities (Tsai, 2004; Zawislak et al., 2018). Technological capabilities enable companies to gather technical information for developing new products or improving existing products (Kylaheiko et al., 2011). Such capabilities include organisational learning, product development and manufacturing, technological complementarities, and design capabilities. Organisational learning capabilities were found to have a significant positive effect on corporate innovation (Bakar and Nizam, 2013; Aminbeidokhti et al., 2016).

For Martín-de Castro (2015), the competitive achievements in knowledge-based and high-technology industrial markets result from consistent technological creation and development as organisations cannot effectively innovate by themselves. Hence, they must engage external networks and relationships to augment their technical know-how in accelerating improvements and innovation developments. Akinwale et al. (2018) and Zawislak et al. (2012) noted that organisations that collaborated with research and scientific institutes and those that did not collaborate revealed significant differences in innovation capabilities. Organisations with collaborations possessed better operations, management, development, and transaction capabilities. Besides, interacting organisations demonstrated better innovation performance in profit, market share, and revenue growth. Interactions with scientific and research institutes not only improved the development capability of firms, but also enabled them to profit (Najafi-Tavani et al., 2018). For Ahmadi and O'Cass (2018), product advantage could be indirectly enhanced by promoting R&D-marketing capability complementarity and cross-functional collaboration through entrepreneurial posture.

An adequate and competent R&D workforce is crucial for open innovation, which improves organisational performance (Kim et al., 2018). They are indispensable in patent generation and acquisition during the NPD process. Appropriate governmental and political support are needed in ensuring an adequate supply of R&D human resources to support industry requirements. To sustain their competitive advantage and protect their market share, SMEs need to formulate a suitable resource management strategy to acquire and retain sufficient R&D resources. Small enterprises that cannot afford to hire enough R&D talents might be better off leveraging external resources than building up the internal team. Given the highly technical and intensive nature of R&D activities, resources and knowledge must be managed effectively to produce the best results, including resolving innovative issues and deciding on the technical direction (Singh et al., 2012; Taghizadeh et al., 2020).

Zawislak et al. (2018), however, did not find a relationship between technological intensity and innovation capabilities. While firms with a technical focus could gain better innovation capabilities, low-technology firms do not necessarily lack innovation capabilities if equipped with the right organisational culture and employee mind-set. Stanko et al. (2015) found that technological resources had a negative relationship with both technological and market innovativeness performance. However, marketing resources were found to have a positive effect on technological innovativeness. They suggested developing long-term CRM to promote technological innovativeness.

Wu (2014) noted a moderate but negative influence of technological capabilities and collaboration with research institutes or universities on successful product innovation. Rubera and Kirca (2012) demonstrated that low-tech firms had better technological innovation performance as compared to high-tech firms. As technological innovation involves high risks and costs, the chances to fail the innovation objectives are high even with capable technical resources.

Based on the above arguments and research findings, this study hypothesised the following relationship:

H1 Technological capabilities have a significant positive effect on R&D project innovation performance.

2.3.2 Marketing capabilities

Marketing capabilities are defined as a firm's marketing management, marketing research, marketing mix, and complementary skills to understand and meet customers' requirements better (Kiveu et al., 2019; Krasnikov et al., 2008). A dynamic and competitive business environment necessitates a market orientation on NPD. Resilient market-oriented firms with sufficient resources pool support, good cross-functional collaboration (Ferreira et al., 2020), and high NPD efficiency tend to demonstrate better performance in new product design (Hong et al., 2013; Hosseini et al., 2018).

For global high-tech firms, marketing capabilities were found to enhance their competitive strategy (Martin et al., 2017). Najafi-Tavani et al. (2018) found that market orientation and marketing capabilities had a positive relationship with NPD performance. Others revealed that market orientation had a significant and positive impact on innovation and business performance (Zamani et al., 2016).

For Kuncoro and Suriani (2018), marketing capabilities had a significant influence on marketing performance through product innovation. Mu (2015) and Ali and Matsuno (2018) demonstrated a positive relationship between marketing capabilities and a firm's performance, as well as innovation capability, and hence, competitive advantage. Ren et al. (2015) showed that marketing capability enhanced the positive impact of R&D capability on innovation performance.

Meanwhile, Zhou et al. (2012) revealed that new companies with a high senior management commitment to international markets recorded improved marketing capabilities. Effective product pricing, channel establishment, publication, and advertisement require strong marketing capabilities, which are also crucial in NPD.

Despite the limited literature available on the effects of marketing orientation and capabilities on firms' sustainable innovation, there is evidence that marketing orientation has a positive influence on marketing capabilities, and, subsequently, sustainable organisational innovation (Kamboj and Rahman, 2017; Ren et al., 2015). Thus, the following hypothesis was developed:

H2 Marketing capabilities have a significant positive effect on R&D project innovation performance.

2.3.3 CRM capabilities

CRM is defined as organisations' capability to detect, get interested in, and prolong the holding of valuable customers (Migdadi, 2020; Valmohammadi and Beladpas, 2014). Through CRM capabilities, companies could obtain dynamic customer feedback and fulfil their requirements in social exchange. CRM allows companies to involve their customers in product value creation through the innovation process (Fernandes and Remelhe, 2016). The direct (Mandolfo et al., 2020) or indirect involvement (DeRosia and Elder, 2019; Yang et al., 2018) of customers is critical in value creation and development activities (Tapscott and Williams, 2006). Relational benefits and future commercial opportunities could arise from the participation of customers in the value creation process (O'Cass and Ngo, 2012).

Corporations have started to gradually adopt social media to deliver excellent customer experience through innovative customer engagement systems. International corporations have transformed customer engagement operations to include cloud computing, mobile, and computer intelligent-based business systems to meet client expectations and improve customer experience. Such technology enables mutual communication with customers through online communities, resulting in new product co-innovation, co-design, and co-development (Bugshan, 2015).

Social media creativities of organisations enable mutual information sharing and collaboration across and within organisations for operational efficiency, innovativeness, and firm-customer interaction enhancement (Lam et al., 2016). Social CRM capability was found to improve customer engagement and firm performance when organisations utilised social media in their marketing strategies (Wang and Kim, 2017). Ryzhkova (2015) demonstrated that online customer interaction methods had a positive impact on organisational innovation results. Such methods enable easy collaborations between organisations and customers to introduce innovative services or products (Wadell et al., 2013). As asserted by many scholars, customers could play an important role in improving firm innovation performance (Acar, 2020; Edvardsson et al., 2010).

Jang and Chung (2015) found a positive effect of customer empowerment on innovative product development and success. When customers are empowered to participate in the NPD process, they are likely to offer new and different ideas about the product (Akman et al., 2018; Franke et al., 2010). Product design that incorporates customer knowledge and skills tends to be successful because it is developed with clear differentiation that could sell well in the marketplace (Gallino and Rooderkerk, 2020; O'Hern and Rindfleisch, 2017; Pratono, 2018). Hence, customers are likely to accept the new product.

Perks et al. (2012) found that customer orientation supported both exploitative and exploratory innovation, especially the latter. Among Iranian manufacturing companies, customer relationship practices were found to have a positive effect on organisational innovation capabilities and performance (Valmohammadi, 2017). Zhang and Yang (2016) also found that CRM led to innovation enhancement and hence, better firm performance. However, Zaefarian et al. (2017) found that ending customer relationships helped boost organisational innovation performance because organisations could focus their resources on working on critical innovation projects instead of using the resource to fulfil all customer needs.

Given the past literature supports, the third proposed hypothesis was as follows:

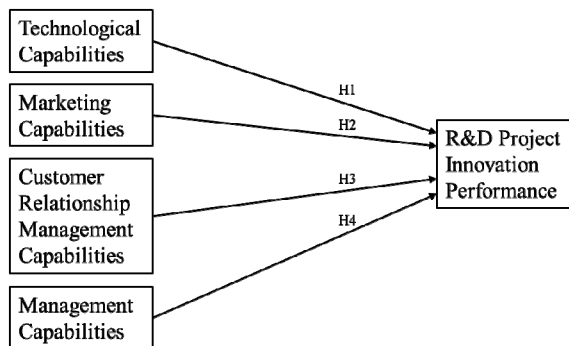
H3 CRM capabilities have a significant positive effect on R&D project innovation performance.

2.3.4 Management capabilities

Zawislak et al. (2012) defined management capabilities as the coordination capabilities to transform technical outcomes into an understandable way of working and transactional process management. Its priority is to uphold flawless information and production in achieving better efficiency and strategic aims. It allows firms to deal with unpredictable circumstances by using a range of skills, practices, and techniques to solve problems and act when technology fails to be perfectly routinised. Managers play entrepreneurial and leadership roles to identify opportunities, develop, and apply practical business structures, develop capabilities, as well as lead and transform the organisations whenever necessary. Enterprise management and leadership teams are critical resources for enhancing organisations' innovation capabilities, productivity, and competitive advantage, which are essential for the organisations' sustainability (Jung et al., 2008; Koziol-Nadolna, 2020).

Studies have found that innovation capability improvement could be strengthened when the management team exercised transformational leadership because such a leadership style allowed employees to embrace innovation (Zheng et al., 2016). Liu et al. (2017) found that entrepreneurship and entrepreneurial training orientation had a significant positive relationship with market performance. Entrepreneurship orientation facilitated faster innovation, resulting in new venture performance and a higher survival rate due to the improvement in firms' innovativeness (Shan et al., 2016). Dobni et al. (2015) highlighted the relatively weak innovation performance of American organisations, which they believed was mainly caused by inadequate corporate leadership support in knowledge and resource management, as well as innovation strategy.

Figure 3 Research framework



The management team should focus on improving dynamic organisational capabilities, which are critical in ensuring business competitiveness and sustainability in a fast-changing environment. Organisational dynamic capabilities have been found to positively affect the performance of organisational innovation and R&D (Babelyte-Labanauskas and Nedzinskas, 2017). Charterina et al. (2017) also documented the positive effect of managerial innovation on organisational performance. Therefore, the following hypothesis was proposed:

H4 Management capabilities have a significant positive effect on R&D project innovation performance.

Figure 3 illustrates this study's research model on the factors determining organisational performance with the incorporation of four postulated constructs, namely technological capabilities, marketing capabilities, CRM capabilities, and management capabilities. The model is an extension of Akroush's (2012) model with the inclusion of management capabilities.

3 Method

3.1 Population and sample

This study's hypotheses were tested on a sample of E&E manufacturing firms in the state of Penang, Malaysia which has a high concentration of such firms. The E&E industry is critical to Malaysia's economic growth, particularly in the global supply chain arena and the acceleration of knowledge- or high technology-driven industrial development (Ashari, et al., 2018). Among Malaysian states, Penang is one of the top ten active global industrial areas, having established a successful manufacturing experience among developing nations. The 2009 industrial development report by the United Nations Industrial Development Organization (UNIDO) acknowledged Malaysia as a hub for E&E industrial development. This was due to its complete ecosystem to host export-oriented and labour-intensive E&E manufacturing companies. Most of the manufacturing companies in Penang have shifted from manufacturing processes to modern manufacturing practices characterised by value-added activities, domestic outsourcing of non-core businesses, and highly-skilled workforce. They have initiated R&D activities for a full range of semiconductor, solar, test and measurement instrument, biotechnology, and LED segments. Therefore, Penang's E&E sector not only creates jobs, but also develops engineering resources with solid technical knowledge and skills that have effectively enabled investors to compete on the global stage (Invest Penang, 2019a). It contributed RM289 billion or 38% of Malaysia's total export in 2018 (Invest Penang, 2019b). Hence, the survival of Penang manufacturing firms needs to be safeguarded for the social stability and economic growth of Malaysia through low unemployment rates (PERKESO, 2019).

We used Invest Penang E&E Directory (2019c) to acquire the sample of E&E manufacturing companies that have R&D functions and facilities. The directory listed 189 E&E manufacturing companies. The target participants were mainly directors, senior management, and R&D project managers in the manufacturing firms. Emails with web-based survey links were disseminated to 127 participants in the manufacturing organisations, who were willing to participate in the survey. At the end of the data collection, 56 survey forms were returned, giving an effective response rate of 44.1% which exceeded the minimum acceptable response rate of ten samples per independent variable (Hair et al., 2013).

3.2 Measures

Established instruments were used to measure the key constructs of the study. A seven-point Likert scale was adopted to measure all items as it is more appropriate for a web-based survey and other electronically circulated questionnaires (Finstad, 2010, Abdul-Talib and Adnan, 2017). Although established instruments were used, technical jargon was avoided as much as possible to ensure the clarity of questions to participants. Some modifications were also made to selected items to fit the context of the research.

The web-based survey comprised seven sections. The first section asks for demographic questions, namely the participant's job title, name, gender, total years of work experience in the current company, and total years of work experience in the E&E industry. The second section contains organisational details, such as the name of the company, years of establishment, type of business, yearly revenue, and the total number of employees. The third section consists of seven items on technological capabilities (Ahmadi and O'Cass, 2018; Stanko et al., 2015). Six items on marketing capabilities are in the fourth section, and six items on CRM capabilities are in the fifth section (Mu, 2015). 12 items on management capabilities are in the sixth section (Krig and Sandra, 2017; Zhao et al., 2017). Finally, the seventh section measures R&D project innovation performance with five items adapted from Stanko (2015).

4 Results

Of the 56 participants, 19.6% were females and 80.4% males. Half of them (50%) and slightly more than half (57.1%) had more than five years of experience in the existing companies and E&E industry, respectively. More than half (57.1%) of the companies sampled had been established for more than 21 years, while 58.9% were large scale companies with more than 1,000 employees, 30% reported more than USD2,000 million annual revenues, and 28.6% achieved less than USD100 million revenues per year.

Exploratory factor analysis (EFA) with varimax rotation was performed. Due to cross-loading, one item from technological capabilities, one item from CRM, and three items from management capabilities were deleted. The results as presented in Table 1 showed the final five-factor loadings with all the independent and dependent variables had values exceeding the threshold value of 0.5 (Hair et al., 2019). The correlations, means, standard deviations, and reliabilities for the study's variables are presented in Table 2.

Table 3 presents the results of hierarchical multiple regression, which was used to analyse all the hypotheses. The results demonstrated that technological capabilities ($t = -0.794$, $\text{Sig} = 0.431$) and CRM capabilities ($t = -0.427$, $\text{Sig} = 0.671$) had no significant effect on R&D project innovation performance. Thus, H1 and H3 were not supported. However, marketing capabilities ($t = 2.324$, $\text{Sig} = 0.024$) and management capabilities ($t = 6.045$, $\text{Sig} = 0.000$) had significant effects on R&D project innovation performance. Therefore, H2 and H4 were supported.

Table 1 EFA factor matrices

	1	2	3	4	5
<i>Technological capabilities</i>					
technical resources more than adequate for R&D activities [Tech1]	0.706				
technical resources more than adequate for engineering and design activities. [Tech 2]	0.652				
technical resources more than adequate for new technology dev [Tech 4]	0.780				
technical resources had more than adequate for technologies changes and trends prediction. [Tech 5]	0.708				
<i>Marketing capabilities</i>					
able to scan emerging market, trends and events. [Mkt1]		0.847			
alert to changing market conditions. [Mkt2]		0.825			
sensitized to listen to problem and opportunities in the market. [Mkt3]		0.868			
anticipate market trends and events [Mkt4]		0.745			
triangulate market information from different sources. [Mkt5]		0.876			
listen to understand, and rapidly respond to market requirements. [Mkt6]		0.810			
Customer Relationship Management Capabilities					
invests the resources necessary to closely connect with customers. [Cust2]			0.566		
customer presents ideas/suggestions for new product features [Cust3]			0.589		
customer presents ideas about new materials. [Cust4]			0.757		
customer communicates to us their needs.[Cust5]			0.716		
not possible for our firm to have an efficient product development without the competence that the customer possesses. [Cust6]*			0.596		
<i>Management capabilities</i>					
obtains patents not only internally but also externally. [Mgt4]				0.845	
considers patents as an important strategic resource [Mgt5]				0.884	
regularly assesses its patents risks. [Mgt6]				0.801	
regards patent protection to protect its innovative technologies. [Mgt7]				0.816	
special department or designated staff to deal with patent protection. [Mgt8]				0.763	
owned the patents in the production of its leading products/ services [Mgt9]				0.803	

Table 1 EFA factor matrices (continued)

	1	2	3	4	5
<i>Management capabilities</i>					
Our company's patents receive market recognition. [Mgt10]				0.678	
resources for product development is mostly satisfied with top mgt. [Mgt11]				0.679	
R&D/production/marketing, and other team collaboration for NPD. [Mgt12]				0.752	
<i>R&D Project innovation performance</i>					
technology used to develop new product was new for our company. [Innv1]					0.606
Engineering and design activities were new to our company. [Innv2]					0.670
Compared with competitors, our company has more patents. [Innv3]					0.561
Our company's patents are the main contributors to profit growth. [Innv4]					0.702
Compared with competitors, our company has higher innovation success rate. [Innv5]					0.710
*Reverse coded					
Eigenvalue	4,505	2,829	2,486	1,368	0.563
Percentage of variance explained	18.80	11.80	10.40	5.70	2.300
Cumulative percentage of variance explained	18.80	30.60	40.90	46.60	49.00
No of items	4	6	5	9	5

Table 2 Correlation matrix and scale properties

	<i>Variables</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>
1	Technological capabilities		0.463*	0.645*	0.639*	0.506*
2	Marketing capabilities	0.463*		0.477*	0.439*	0.350*
3	Customer relationship management capabilities	0.645*	0.477*		0.602*	0.611*
4	Management capabilities	0.639*	0.439*	0.602*		0.781*
5	R&D Project innovation performance	0.506*	0.350*	0.611*	0.781*	
	Mean	5.147	5.17	5.792	4.998	4.646
	s.d	1.270	1.162	0.770	1.440	1.228
	Reliability(α)	0.8701	0.956	0.743	0.953	0.882

Notes: * Correlation significant at the 0.01.

Table 3 Hierarchical multiple regression analysis

<i>Hypotheses</i>	<i>Relationship</i>	<i>Standardised beta</i>	<i>Standard error</i>	<i>t- values</i>	<i>Decision</i>
H1	Technological capabilities → R&D project innovation performance	−0.096	0.117	−0.794	Not supported
H2	Marketing capabilities → R&D project innovation performance	0.273	0.124	2.324	Supported
H3	Customer Management relationship capabilities → R&D project innovation performance	−0.042	0.156	−0.427	Not supported
H4	Management capabilities → R&D project innovation performance	0.697	0.098	6.045	Supported

5 Discussion and recommendations

The present study contributes to the literature by using the resource-based view to examine the determinants of R&D project innovation performance of E&E manufacturing firms in Penang, Malaysia. A new contribution of the study to the theoretical understanding of organisational capabilities is the inclusion of management capabilities, which tended to be neglected in the past, and the specific innovation performance of R&D projects that could help organisations achieve a competitive advantage for a long-term sustainability. As expected, the findings demonstrated that management capabilities had a positive and significant effect on the innovation performance of R&D projects in the E&E industry. More importantly, management capabilities were found to be the strongest determinant of innovation performance,

followed by marketing capabilities. Unexpectedly, technological capabilities and CRM capabilities did not have significant impacts.

The findings support past studies that reported a similar result on the positive effect of marketing capabilities (Cacciolatti and Lee, 2016; Hong et al., 2013; Najafi-Tavani et al., 2018). Hence, firms may consider improving their R&D innovation results by boosting their marketing capabilities. Also, the findings are in line with past studies that management teams are a critical resource in enhancing organisations' innovation capabilities, productivity, and competitive advantage, which are essential for the sustainability of the organisations (Jia et al., 2018). Organisations with an integrated innovation performance strategy and strong senior management support can achieve better innovation performance (Krig and Sandra, 2017). Thus, Penang E&E firms may consider formulating the correct innovation performance strategy to boost R&D project innovation performance.

Unexpectedly, technological and CRM capabilities did not show significant influences on R&D project innovation performance. Similarly, Stanko et al. (2015) found no significant effect of technological resource capabilities on technological innovation performance. The insignificant role of technological capabilities could be due to inadequate technical resources in E&E manufacturing companies in Penang to develop high-technology products (Rasiah and Chandran, 2017). Besides, manufacturing firms are more inclined to rely on their home country's engineering support and collaborate with local universities to close the technological gap in meeting the need for NPD and innovation.

On CRM capabilities, the findings of the present study contradict past studies that found a positive relationship (Fernandes and Remelhe, 2016; Liu and Atuahene-Gima, 2018). This could be due to the failure of many firms to yield the intended performance from CRM capabilities as such capabilities require cross-functional, organisation-wide, and process re-engineering for the right client-focused business orientation, which necessitate a joined and balanced approach to process, people, and technology. Internet technology advancement has amplified the influence of e-commerce on the entire global business events, giving prominence to electronic CRM, and redesigning the way of commerce mainly by eliminating the meeting place and time between suppliers and customers, and introducing new services and product demands. Hence, support from the information technology department and other functions is crucial for CRM and e-commerce.

5.1 Practical implications

The empirical findings have important practical implications for E&E manufacturing firms. First, the top management of E&E manufacturing firms should take a proactive role in developing internal management and marketing capabilities as these were shown to enhance the innovation performance of R&D projects significantly. The management of manufacturing firms is strongly recommended to establish an effective talent development programme, which includes learning-need identification, coaching, and mentoring for the progressive growth of talented management employees to deliver a competitive edge for business success. Internally-trained managers perform better than external hires as they understand the work culture, systems, and practices. Knowledge of the internal systems can help them coordinate and manage their daily tasks, and drive substantial innovative changes for the benefits of the company.

Management capabilities can also be improved by encouraging managers to participate in inter-country manager exchange programmes within the organisations. Such programmes provide the local management teams with the opportunity to learn about good management practices and culture in other countries like the USA, which would equip domestic organisations with better capabilities to improve innovation performance.

Furthermore, managers should be encouraged to play effective leadership and entrepreneurial roles. They must be good at identifying opportunities, creating and establishing practical business structures, developing organisational capabilities, and leading organisational transformation, all of which have been shown to affect organisational innovation performance positively (Hanifah et al., 2019; Teece, 2016). Managers should implement sound strategies to foster an innovation culture that leads to competitive success. An E&E manufacturing firm that embarks on an innovation culture to accelerate product or process innovation needs to have a product innovation development process for high performance and differentiation while promoting a long-term organisational growth. Eventually, this strategy will lead to the development of a series of highly competitive products for their market and long-term business success.

Managers must pay more attention to developing marketing capabilities so that they can introduce highly innovative, differentiated, and suitable products to the market. The marketing function should collaborate with the R&D team. Besides, the management team must treat the marketing concept as a philosophy and promote it across the entire firm. They should encourage a global export orientation, which has been found to enhance the competitive advantage of distribution and costs (Tsoungkou et al., 2018). The management team also needs to promote internal collaborations among different departments and functional teams to generate more patents and filings, along with the R&D process for NPD (Jeng and Pak, 2016). Since teamwork quality was found to have a positive influence on the NPD speed (Abdul-Talib et al., 2020), the management team can assist the team members if they encounter any financial or technical roadblocks by engaging the right government bodies, such as MIDA and MyIPO, as well as local universities.

The marketing team must also equip themselves with enough technical knowledge to deal with clients. Such knowledge helps them understand their customer requirements for NPD and avoid unnecessary problems related to new product redesign. Hence, internal product technical training must be periodically conducted for marketers to ensure their product technical knowledge is up to date. Moreover, the marketing team must have a high sensitivity to market changes and opportunities, such as consumer spending trends and preferences (Talib and Abd-Latif, 2015). They can obtain related information through consumer big data analysis, which utilises raw data from social media interactions and market surveys. The data provide organisations with information on future consumer needs so that they can release their products early to address the new market requirements.

The marketing team may explore new sales channels and methods for their products. Retail shops and distributors may not be efficient anymore in the globalisation era. A new generation of consumers is already utilising the online purchase method without any physical interference from salespeople. However, customers may seek technical advice from time to time on their purchase. The technical marketing team should be accessible online to respond to customer inquiries without the need to interact with the customers physically.

Although technological and CRM capabilities were found not to have a significant effect on R&D project innovation performance, collectively, they were found to be significant in influencing innovation performance. On technological capabilities, Penang E&E manufacturing firms may consider collaborating with or outsourcing to external research institutions or universities to improve their innovation performance, which can improve the rate of patent commercialisation. Environmental dynamism, including client requests, technological changes, and market competition levels, was found to improve the outsourcing management success (Hassan et al., 2014). Besides, Penang E&E manufacturing firms may consider utilising social media channels to interact with customers and understand them better, hence improving their CRM capabilities.

Finally, Penang's E&E manufacturing firms may apply the findings to benchmark their R&D innovation activities and processes. They can further develop their company's innovation strategies to improve the innovation performance of different activities and processes.

5.2 Limitations and future research directions

The present study has some limitations, which need to be considered when interpreting the results. First, the generalisability of the findings in this study is only restricted to manufacturing firms operating in the E&E sector in Penang, Malaysia. The results may not necessarily be generalisable to other industries or sectors, such as the food industry, due to the different characteristics and structures. Furthermore, the generalisability is limited because of the small sample size. Second, this study was cross-sectional and exploratory, which provides a preliminary and static view of the phenomenon under investigation. Hence, any changes in innovation performance as a result of organisational capabilities could not be discerned.

The current study offers some insights into the contribution of organisational capabilities to the R&D project innovation performance of manufacturing firms. However, more studies need to be undertaken in the future to validate the findings further. First, this study suggests that future researchers consider controlling some variables that may confound the result, such as firm size. Second, future research can expand the sample coverage to include manufacturing firms in the northern region or across Malaysia to address the issue of limited generalisability. Third, the same research model can be applied to the service industry or other manufacturing sectors, such as food and automotive, for a meaningful comparison.

5.3 Conclusions

In the wake of competitive pressures because of the low R&D project outputs in Malaysia, E&E manufacturing firms face a high risk of not being able to compete and sustain in the long run. Therefore, superior organisational capabilities are crucial in managing R&D projects for better innovation performance. Specifically, this study examined the effects of organisational capabilities, namely management, technological, marketing, and CRM capabilities on the R&D project innovation performance of manufacturing firms in the E&E industry in Penang. Unexpectedly, only management and marketing capabilities were found to enhance innovation performance significantly. Of the two, the former was found to be a stronger predictor of R&D project innovation performance.

Nevertheless, collectively, the four organisational capabilities were found to significantly enhance innovation performance, suggesting the importance of developing internal capabilities for the future growth and sustainability of manufacturing firms in the E&E industry in Penang. Of the four, manufacturing firms should prioritise on strengthening their management capabilities. As the research model showed a moderately strong explanatory power, it is expected to benefit E&E manufacturing firms in Penang and researchers in the strategic management field.

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