

Market demand, green product innovation, and firm performance: evidence from Vietnam motorcycle industry

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ABSTRACT

This study examines how market demand affects green product innovation, and firm performance in the context of Vietnamese motorcycle industry. The paper seeks to answer two key questions: (a) how does market demand influence a firm's green product innovation? and (b) how can green product innovation affects firm performance? This study collected a total of 208 valid questionnaires from four leading foreign motorcycle firms in Vietnam. The empirical findings show that market demand is positively correlated to both green product innovation and firm performance; while green product innovation performance is also positively correlated to firm performance. In addition, this study also categorizes three types of green product innovation and discusses their effects on market demand and firm performance.

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1. Introduction

In recent years, an increased debate and interest in green product innovation was clearly observed. Pujari (2006) points out that green product innovation is increasingly being portrayed as an opportunity; while some also considers it as a win–win logic of being 'green and competitive' (Porter and Linder, 1995). Examples of success stories are the Body Shop's range of cosmetic products and Toyota's hybrid car. However, Hall and Vredenburg (2003) argue that sustainable product innovation in these companies are either public policy induced or is market-driven. Nevertheless, the debate on what is sustainable or what compose a green product is still on-going (Chen, 2001; Berchicci and Bodewes, 2005).

Although green product innovation does address environmental issues very explicitly, but it is far from certain whether these products can truly achieves market success (Pujari, 2006). Furthermore, there is little empirical support that clearly demonstrates how green product innovation affects firm performance. Some of the empirical findings demonstrated a positive relationship between product innovation and firm performance, whereas a significant number of them indicated otherwise (Capon et al.,

1990; Koellinger, 2008; Tseng et al., 2008). In addition, Wei and Morgan (2004) also disputed that market demand could be an important factor in inducing green product innovation. Berthon et al. (1999) also added that market demand plays a critical role in firm's innovation performance. However, they also pointed out that listening too closely to the voice of customers may impair firms' innovation performance. Inkpen and Pien (2006) suggested that firms collaborating with rivals are more likely to perform better in innovation than they would otherwise and firms can accelerate their capability development by R&D cooperation which helps them to decrease the time and risk involved in product innovation.

The conflicting findings actually illustrated a gap in green product innovation literature. To enhance our knowledge and understanding of green product innovation and to benefit product designers, marketers, and senior managers, more research is needed. Therefore, this research aims to address this gap i.e. lack of empirical research in understanding the relationship of green product innovation, market demand, and firm performance. More specifically, the study addresses two important research questions: a) How does market demand influence a firm's green product innovation? and (2) How can green product innovation affect firm performance? These issues have considerable significance for the field of sustainable operations and new product introduction. In essence, green pressures may provide a key channel in the

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evolution of firms' operations and new product introduction (NPI) strategy. An understanding of the strategic implications of market demand, green NPI and firm performance is therefore an important aspect in the context of operations management.

There are a number of compelling reasons why Vietnamese motorcycle industry is the focus of this study. First, Vietnam is the world fourth largest motorcycle market. Thus, no operations or strategic theory can claim to be complete without Vietnam. Second, because Vietnam shares many important common development paths with developing countries like Indonesia, Philippine, and China. Hence, the Vietnamese experience can help shed light on future firm growth in Asia. Third, motorcycle industry is one of the main sources of pollution in Asia. Finally, Vietnam is an upcoming economic superpower; improved understanding of Vietnamese firms will have enormous practical implications for Western firms that have business dealings with them.

The paper begins with a discussion on theoretical context and research propositions. Next, the empirical research method is described and the findings are discussed. Finally, the paper closes with implications for future research and practice.

2. Vietnam motorcycle industry – a background

Prior to 1990s, almost all motorcycles in Vietnam were imported and the market was rather small. Motorcycle industry gained significant momentum when foreign firms begun investing in Vietnam after 1990s. In 1992, the first motorcycle company established in Vietnam was Vietnam Manufacturing and Export Processing (VMEP), a subsidiary of Sanyang motor industrial Corp. [DucTho \(2011\)](#) points out that Vietnam has a huge motorcycle market potential and is the world fourth largest after China, India, and Indonesia. Recognizing the market potential, Japanese firms such as Suzuki, Honda and Yamaha have a strong presence in the Vietnam market.

Moreover, the government's friendly localization policy further encouraged the development of the motorcycle industry, in particular with the presence of Chinese motorcycle manufacturers in early 2000 ([Jalaluddin, 2002](#); [Tseng, 2011a, b](#)). Thus, Vietnam becomes a fierce competition market for Japanese, Taiwanese, and Chinese motorcycle manufacturers. The emergence of Chinese motorcycle manufacturers created an unprecedented change in the motorcycle market landscape. [DucTiep \(2007\)](#) indicates that Chinese motorcycles are basic, but affordable to the general public at low prices. Thus, indirectly helps raise motorcycle ownership in Vietnam (see [Fig. 1](#)).

In contrast, there is a price to pay for the increasing motorcycle usage i.e. pollution. There are environmental issues at all stages of a motorcycle's product life cycle. The need for raw materials led to

scarcity of resources ([Zhu et al., 2007](#)). Moreover, exhaust emissions, gasoline consumption, recycle and disposal of wastes, places much pressures on the natural environment. Recent global initiatives on green and sustainable consumption have awakened Vietnamese consumers i.e. in choosing the most environmental friendly motorcycles. The green move, in a way, has shifted the motorcycle market competitive criteria from price to 'green', and created considerable opportunities in the motorcycle industry.

A few researchers ([Hoffmann, 2007](#); [Zhu et al., 2008](#); [Yung et al., 2011](#)) argue that customers increasing awareness of environmental issues and expectation for gasoline savings have forced motorcycle manufacturers to innovate their products. Especially in incorporating "green" into products and developing environmental friendly production programs. The development of green product innovation is becoming a need and an opportunity for firms to reduce the negative influences of production on the environment and gain competitive advantage with competitors ([Dangelico and Pontrandolfo, 2010](#)). In other words, green product innovation has become the critical basic for improving a large motorcycle enterprises' productivity, by maintain their competitive advantage and achieving larger market share.

3. Theoretical context and research propositions

3.1. Market demand

Market demand is a critical factor in today's business environment. Fierce competitions in the market force firms to have flexible strategies for their products and process ([Chang and Chiu, 2007](#)). Various studies have emphasized that customer benefit and price are key elements for market demand ([Kammerer, 2009](#); [Zhou et al., 2009](#)). [Monroe \(1990\)](#) points out that customers perceive value differently, thus their demands are diversified and heterogeneous. [Zhou et al. \(2005\)](#) further added that over time, customers will become more sensitive and fussy. Hence, firms must understand their target customers and anticipate the changing preferences of customers in order to meet market demand promptly and gain competitive advantage ([Desarbo et al., 2001](#); [Zhou et al., 2009](#)).

[Zhou et al. \(2009\)](#) show that customer preference can be influenced by price. Thus, customers' requirements sometimes conflict with their price-consciousness. For instance, 'green' demand from customers may force manufacturers to introduce sustainable products and integrate environmental friendly production processes. Nevertheless, many customers are unwilling to trade off product qualities for a product's green attributes ([Peattie, 2001](#)). Additionally, customers' requirements about green attributes may not align with their actual purchasing behavior ([Wong et al., 1996](#); [Kuckartz, 1998](#); [Prakash, 2002](#)). Hence, how to harmonize these factors in order to meet market demand is a big challenge for all existing manufacturing firms. [Slater and Narver \(1998\)](#) argue that when firms' timely notice a gap between supply and demand in the market, the firms can carry out a breakthrough to fill this constraint through successful innovations. Hence, innovation is becoming a critical mean for manufacturing firms to survive and improve market position ([Bueno and Ordenez, 2004](#); [Alegre and Chiva, 2008](#)).

In addition, [Monjon and Waelbroeck \(2003\)](#) found that customer collaboration has an insignificant impact on product innovation. [Wei and Morgan \(2004\)](#) posit that market orientation is a key criterion in successful new product performance. [Triebswetter and Wackerbauer \(2008\)](#) also argue that market demand is the necessary factor for environmental innovation. [Chiou et al. \(2011\)](#) identify that increasingly customers are more green conscious i.e. looking for products that are fuel efficient, and environment friendly. Hence, innovation, especially green product

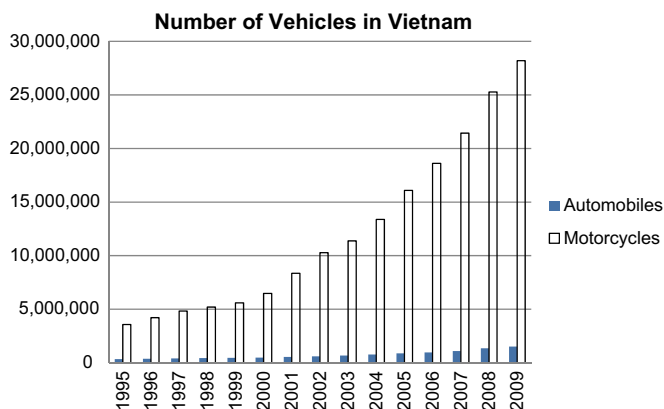


Fig. 1. Motorcycle statistic in Vietnam. (source: [Anh Nam, 2007](#); [Hong Do, 2010](#)).

innovation, is being adopted to meet market demand and gain a competitive advantage (Reinhardt, 1998). These discussions suggested that customers' green value demand drives firms to innovate so that they can meet and beat the competition. Hence,

H1: Market demand is positively associated with green product innovation performance

H1a: Market demand is positively associated with environmental performance

H1b: Market demand is positively associated with products

H1c: Market demand is positively associated with economic performance

3.2. Green product innovation

Nowadays product innovation has become a significant means of firms' survival and a weapon to sustain market competitive advantage (Gronhaug and Kaufmann, 1988). A good product innovation performance can help firms to improve market position, affirm brand name, leapfrog competition, creates a breakthrough and attract new customers (Chandy and Tellis, 2000; Mu et al., 2009). Wagner (2005) found that focusing on improvements of environmental performance in terms of reducing (undesired) outputs (i.e. emissions) from production is unlikely to bring about a positive influence on economic performance beyond relatively low levels of environmental performance. However, the debate is still on-going whether the green product design is really improved the economic performance (Tyteca et al., 2002).

Commission of the European Communities (2001) defines green product innovation as products that reduce the negative impacts and risks to the environment, utilize less resources and prevent waste generation in the product's disposal phase. In other words, green product innovation not only protects the natural environment, but also provides environmental benefits higher than conventional products (Reinhardt, 1998).

Moreover, EEIG (2004) points out that product innovation have the biggest impact on the environment (Hoffmann, 2007; Kammerer, 2009). Poor product design and environmental standards of developing countries (i.e. in the product's disposal phase) could turn waste issues into serious problems in the future (Puckett and Smith, 2002; Greenpeace, 2005). Hence, many firms are integrating "green" into product innovation in order to achieve differentiation from competitors and gain a competitive advantage (Reinhardt, 1998).

Thus, green product innovation can serve as a means for firms to gain sustainable development and achieve their business targets.

Dangelico and Pontrandolfo (2010) report a significant increase in green production innovation in today's businesses. There are three main aspects of green product innovation on firm performance, namely a) environmental performance (Chiou et al., 2011; Awasthi et al., 2010); b) products (Li et al., 2010; Triebswetter and Wackerbauer, 2008); and c) economic performance (Zhu and Sarkis, 2004; Tseng et al., 2009). This discussion suggests that green product innovation has an impact on firm performance. Therefore:

H2: Green product innovation performance is positively associated with firm performance

H2a: Environmental performance is positively associated with firm performance

H2b: Green Products is positively associated with firm performance

H2c: Economic performance is positively associated with firm performance

3.3. Firm performance

Reputation and market position are among the most important competitive factors for manufacturing firms. Tseng et al. (2009) show that many firms are beginning to realize the importance of sustainable development, as well as the deterioration of the global environment. Nevertheless, applying it to firm's business activities is not certain and easy. Consequently, firms must integrate these issues to ensure survival and development in the market. This is especially true in the motorcycle industry where environmental issues are becoming the main concern (Hoffmann, 2007). However, Berthon et al. (1999) show that there are conflicting results between market demand and firm performance. Market plays a critical role in firm's innovation performance but a firm's performance does not necessarily depend on it. However, market demand is the key to firm performance in the market place. Atuahene-Gima et al. (2005) confirmed that working closely with customers, and particularly influential customers a firm may uncover latent customer needs. Oltra and Jean (2009) argue that pollution and environmental criteria have a little impact on customers' preferences. On the contrary, fuel consumption and price are the important criteria to be considered in their purchase behavior (Meyer and Clavel, 2006). Hence, manufacturing firms that pioneer in their green products will take the "first mover advantage" and meet customers green demand. Hence:

H3. Market demand is positively associated with firm performance

Fig. 2 shows the relationship among market demand, green product innovation and firm performance.

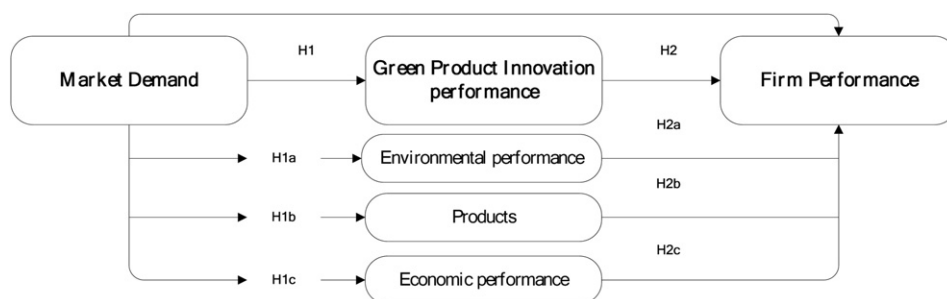


Fig. 2. Conceptual framework.

4. Methodology

4.1. Data collection

To test the hypotheses, this study selected the Vietnam motorcycle industry as the empirical setting. It is not practical to survey all the motorcycle manufacturers in Vietnam. Thus, in this study, two criteria were used to narrow down the potential manufacturers to be targeted in the survey, namely: a) Green – these firms should have a diversity of ‘green’ motorcycle models; and b) Market – these firms should be a significant player in the Vietnam motorcycle market. Upon close scrutiny, only four major motorcycle firms in Vietnam i.e. one local and three foreign firms were identified to meet the selection criteria.

Prior to data collection, the survey instrument was pre-tested for content validity in two stages. In the first stage, six experienced researchers were asked to critique the questionnaire for the ambiguity, clarity and appropriateness of the items used to operationalized each construct (Cooper and Schindler, 2001), based on feedback received from these researchers, the instrument was modified to enhance clarity and appropriateness of the measures purporting to tap the constructs. In the second stage, the survey instrument was mailed to five management executives affiliated with the motorcycle industry. These executives were asked to review the questionnaire for structure, readability, ambiguity and completeness.

The data for the empirical investigation obtained through a field study. Data were collected from 208 participating firms and gather information from relative departments, predominantly via face-to-face interviews with executives in charge of the manufacturing function from selected firms in Vietnam. Since the administrators are widely believed to provide reliable information regarding the basic knowledge of market demand, green product innovation, and firm performance. The final survey instrument incorporated feedback received from these executives, which enhanced the clarity of the instruments. This process yielded a survey instrument that was judged to exhibit high content validity. The interview took place gradually from January to July 2011.

This study utilized a multiple-source approach in identifying the respondent list. Only respondents that have knowledge of market demand, green product innovation, and firm performance will be targeted. The respondents of the questionnaires included CEOs, Manufacturing Director, Marketing Director, and R&D managers. The respondents were asked to return the completed questionnaires through email. Questionnaire was initially developed in the English version. To ensure conceptual equivalence, it was translated into Vietnamese and then back-translated into English by independent translators. The questionnaire survey items were based on existing literature. Before mailing to the respondents, three experts were asked to pre-test the questionnaire. Feedback from the experts was used to improve the questionnaire. In the second pre-test, the revised questionnaires were e-mailed to eight CEOs or managers of customer care, marketing, manufacturing, and management and research and development (R&D) departments in different motorcycle firms. They were asked to fill in the questionnaire and identify any vagueness in the survey items. A five-point Likert scale with 1 representing “strongly disagree” to 5 representing “strongly agree” was adopted in this study.

4.2. Variables and measures

The questionnaire consisted of four parts. The first part of the questionnaire comprised the descriptive data such as number of employees, year founded, market size, product names, and turnover. The second part is the measurement of market demand; the third part is the measurement of green product innovation

Table 1
Questionnaire variables.

Constructs	Variables	References
Market demand	The segmentation of market Customers' requirements about green products Price flexibility of demand for green products Customer benefit for green products	Ultra and Jean (2009), Kammerer (2009)
Environmental performance	Reduction of air emission Reduction of hazardous waste/scrap Less consumption of gasoline/fuel Partnership with green organizations and suppliers Using eco-labeling Improvement of environmental compliance Use of environmental friendly material	Chiou et al. (2011), Awasthi et al. (2010)
Green products	Increase of the product's variety Design for recycling Quality improvement Expanding the market coverage of green product Raising the manufacture technology of new green product	Li et al. (2010), Triebswetter and Wackerbauer (2008)
Economic performance	Increase of investment for environmental friendly technology Decrease of cost for hazardous materials purchasing Zero customer complaints or returns	Zhu and Sarkis (2004), Tseng et al. (2009), Chiou et al. (2011)
Firm performance	Market position improvement Enhancing sale volume Enhancing the profit rate Enhancing the reputation	Li et al. (2010)

and the fourth part is the measurement of firm performance. Table 1 shows the variables for each of the constructs in the questionnaire.

5. Empirical results

5.1. Descriptive analysis

Table 2 provides a brief summary of the responses. Most of the respondents come from the following five departments of motorcycle manufacturing firms, namely manufacturing, marketing, customer care, R&D and management. The mean and standard deviations were calculated to explain the current situation for market demand, green product innovation and firm performance in the Vietnam motorcycle industry. The means shows in Table 2 are in the range of 3.84–3.93. It points out that many motorcycle firms in Vietnam have already implemented actions to integrate green

Table 2
Descriptive statistics.

	N	Minimum	Maximum	Mean	Std. deviation
Market demand	208	1.50	4.90	3.96	0.75
Environmental performance	208	2.43	4.57	3.74	0.55
Products	208	1.60	4.80	3.95	0.68
Economic performance	208	1.67	5.00	3.73	0.82
Firm performance	208	1.25	4.75	3.94	0.78

Table 3
The Cronbach's α coefficients of the constructs

Constructs	Number of items	Cronbach's α	Remark
Market demand	4	0.86	Acceptable
Environmental performance	7	0.77	Acceptable
Green products	5	0.79	Acceptable
Economic performance	3	0.86	Acceptable
Firm performance	4	0.89	Acceptable

product innovation in order to improve their organizational performance.

The cronbach's alpha was calculated to test the reliability of the questionnaire (see Table 3). The cronbach's alpha coefficient of "market demand" is 0.84, environmental performance is 0.71, green products is 0.76, "economic performance" is 0.76 and firm performance is 0.79. In general, the cronbach's alpha coefficients of all five constructs are more than 0.7. Hair et al. (1998) argue that the minimum requirement of cronbach's alpha coefficient is 0.7. Thus, reliability of the measurement of this study is acceptable and highly consistent.

5.2. Reliability measures and correlation coefficients

Table 4 shows the results of the correlation coefficient analysis. It shows that market demand has significant positive correlations with environmental performance, green products, economic performance, and firm performance. Moreover, there were significant positive correlations among environmental performance, products, economic performance with firm performance.

5.3. Regression analysis

Table 5 shows the results of the regression analysis. In Model I, Model II and Model III, the results show that market demand was positively correlated to the three types of green product innovation performance: environmental performance, products and economic performance. Hence, H1a, H1b and H1c were supported in this study. In Model IV, the results show that market demand, environmental performance, products and economic performance were positively correlated to firm performance. Accordingly, H2a, H2b, H2c and H3 were supported in this study. In addition, this research also verified that the three types of green product innovation had partial mediation effects between market demand and firm performance. This study found that market demand had positive effects on environmental performance, products, economic performance and firm performance.

In general, the results in Table 6 shows green product innovation had positive effect on firm performance. The empirical findings

Table 4
Correlation coefficient matrix.

	Market demand	Environmental performance	Green products	Economic performance	Firm performance
Market demand	1.00				
Environmental performance	0.76**	1.00			
Green products	0.73**	0.75**	1.00		
Economic performance	0.75**	0.53**	0.83**	1.00	
Firm performance	0.66**	0.77**	0.75**	0.65**	1.00

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Table 5
Empirical results of regression analysis.

Dependent variable	Model I environmental performance	Model II products	Model III economic performance	Model IV firm performance
Independent variables				
Market demand	0.56	0.67	0.79	0.56
Green product innovation				
Environmental performance				0.45
Green products				0.58
Economic performance				0.43
R^2	0.48	0.52	0.59	0.63
Adjusted R^2	0.48	0.52	0.59	0.63
N	208	208	208	208
F	25.264	32.07	38.117	120.52

indicate that all hypotheses in this study were supported. It means that if a firm manages the market demand well, then its green product innovation performance and firm performance will improve. Hence, investment in environmental performance, products and economic performance combining with a better understanding about customers' requirements is helpful to businesses. Indeed, manufacturers should understand the market demand and implement green product innovation in order to improve their position as well as reputation.

6. Managerial implications

This study is first of its kind to investigate the effects of market demand, green product innovation performance and firm performance in Vietnamese motorcycle industry. This sector is particularly important because Vietnamese motorcycle market is the four largest in the world (DucTho, 2011). Moreover, there are few studies exploring the impact of Vietnamese motorcycle manufacturing industry and sustainability operations, and green product innovation.

Although previous studies had paid much attention to explore the relevant issues of market and proposed the concepts of green product innovation in different industries, there was no study that explored the relationship between market demand, green product innovation performance and firm performance, especially in the motorcycle industry. Hence, this study addresses the argument by proposing a framework integrating market demand, green product

Table 6
Results for hypotheses.

Hypotheses	Support (Yes/No)
H1a: Market demand is positively associated with environmental performance	Yes
H1b: Market demand is positively associated with products	Yes
H1c: Market demand is positively associated with economic performance	Yes
H2a: Environmental performance is positively associated with firm performance	Yes
H2b: Green products is positively associated with firm performance	Yes
H2c: Economic performance is positively associated with firm performance	Yes
H3: Market demand is positively associated with firm performance	Yes

innovation performance, and firm performance. Moreover, this study also explores how the three main constructs of green product innovation performance: environmental performance, green products and economic performance and their effects on market demand and firm performance.

The empirical findings show that market demand has significant effects on both green product innovation performance and firm performance. In addition, the results also show that green product innovation performance had positive correlation with firm performance. Hence, hypothesis 1, 2, and 3 were supported in this study. In other words, the more a firm considers its market demand; the better will be its green product innovation performance and firm performance. This research also verified that the three types of green product innovation performance had (positive) partial mediation effects between market demand and firm performance.

This study provides both theoretical and methodological contributions to existing sustainability body of knowledge, especially in the motorcycle industry in Vietnam. In a highly competitive market, obviously, implementing green product innovation is necessary in order to differentiate a firm product and to achieve competitive advantage. However, the findings of this study suggest that firms should first understand consumers' requirements, and then align green product innovation initiatives with consumers' values. In today's green conscious market, fuel consumption, exhaust emission, price and identity (brand and design) are the key criteria that consumers will consider when purchasing a motorbike. Fuel (especially gasoline) is scarce and its price is ever increasing. Consumers also wanted products to be produced in the most environmental friendly ways. Thus, the success of a firm green product innovation is depending on its appreciation of market demand as well as sustainable business operations.

The findings of this study also indicate that motorcycle firms should pay attention to their products and economic performance, in addition to environmental performance. Environmental performance is just an outcome while products and economic performance are necessary conditions for achieving green product innovation performance. Manufacturers should enhance quality, as well as developing new environmental friendly motorbike technology in order to surpass competitors and establish a leadership position. Design of new motorbikes should be impressive, eye-catching and practical (i.e. its U-box must be large to store one or two helmets). In addition, firms should reduce unnecessary costs in the production in order to keep the price low and be consistent with consumers' needs. In other words, this study demonstrated that green product innovation is an important strategy for motorcycle manufacturing firms to gain competitive advantage, attract more customers and improve market position, if they were able to understand market demand well.

7. Conclusion

The empirical findings show that market demand had significant effects on both green product innovation performance and firm performance. In addition, the results also indicate that green product innovation performance has positive correlation with firm performance. Hence, all hypotheses in this study were supported. In contrast, market demand dictates green product innovation performance, and hence firm performance. Achieving environmental performance, improving products and economic performance are also critical to businesses in general, and motorcycle manufacturing industry in particular.

For managers, this study underscores the strategic importance of green product innovation decisions and demonstrates that green product innovation and firm performance should incorporate considerations related to the access of knowledge about market

demand characteristics. This result emphasizes that firms may need to focus market demand in Vietnam in order to understand the complicated and interrelated criteria of market demand, green product innovation and firm performance and determine demand for green products. When market demand knowledge is specialized to a given R&D direction and hard to transfer to green product innovation in other countries, the benefits of green product innovation may lead to firm performance. Results reported here, which focus on green product launches provide evidence that the later mechanisms is, in fact, occurring: firms are innovating more to meet the needs of their market.

This study contributes to the existing body of literature in two ways. First, the research pioneers the effort in taking market demand perspective in understanding how customer value affects a firm's green product innovation orientation and consequently its organization performance. Second, this study considers customer reactions to motorcycle manufacturers' market offerings (new production introduction). The results indicate that a firm excels in green innovation can attain higher levels of market performance. In other words, it is vital to meet customers demand in enhancing organization performance.

This study is not without its limitation, as the main focus is on the motorcycle manufacturing industry in Vietnam. However, the findings of this study could be generalized to other motorcycle markets, especially in Asia. Further studies could include other industries in Vietnam (such as automotive) or a comparison study with other country (such as China). The variables of three main constructs were chosen from literature reviews and may not be comprehensive. Future studies may include wider variables to examine the effects of market demand, green product innovation and firm performance in more depth.

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