# Corporate Environmental Management: Eco-Efficiency and Economics Benefits among Manufacturers Certified with EMS14001 in Malaysia

**Lee Ah Suat, Ong Tze San**

***Abstract:*** ***The concept of eco-efficiency suggests that firms could gain economic benefits when their environmental protection adds values to stakeholders, and results in enhanced shareholder value. This is a state which scholars denote as the optimum level of environmental protection. In contrary, any environmental protection above the optimum level is unlikely to result in economic benefits. This paper articulates eco-efficiency using two major variables of corporate environmental management. Environmental innovation reflects high level of eco-efficiency; as it measures a firm's focus on market and product development within its environmental management, which brings economic benefits. Environmental performance reflects low level of eco-efficiency; as it measures solely on a firm's achievements in reducing adverse environmental impact. This paper hypothesised environmental innovation and environmental performance as antecedents of firms' economic performance. Economic performance was represented by two variables: competitive advantage and financial performance. Simultaneous equation modelling analysis via Smart PLS 3 was performed on survey data collected from managers of 85 manufacturers certified with EMS 14001 in Malaysia. Findings indicate conflicting effects of environmental innovation and environmental performance on firms' economic performance, when being analysed simultaneously. Environmental innovation was found to be positively associated with both competitive advantage and financial performance. On the other hand, environmental performance was found to have no relation with competitive advantage and financial performance. This paper provides empirical evidences in supports of eco-efficiency concept. The findings indicate that potential for economic benefits are realised when firms' environmental protection actions are targeted at creating value for its stakeholders. These findings contribute to a better understanding of the need for strategic approach to corporate environmental management Implications are drawn from the study findings and directions for future research are provided.***

***Index Terms: Eco-efficiency, Environmental Innovation, Environmental Performance, Competitive Advantage, Financial Performance.***

**Revised Manuscript Received on December 22, 2018.**

**Lee Ah Suat** , Faculty of Economics and Management, Universiti Putra Malaysia, Serdang, Malaysia; and Faculty of Business and Finance, Universiti Tunku Abdul Rahman, Kampar, Malaysia. leeas@utar.edu.my

**Ong Tze San**, Faculty of Economics and Management, Universiti Putra Malaysia, Serdang, Malaysia.

## I. INTRODUCTION

Research in corporate environmental management is dominated by the potential for economic benefits, a notion known as "it pays to be green" or "win-win" case [1]-[6]. Relying on "it pays to be green" premise, strategic management scholars propose concept of green business case, advocating the potential for firms to leverage on their environmental strategies for economic gains [7]-[9]. Empirically, majority of reviews have shown a positive association between environmental management and financial performance [10]-[12] and meta-analysis by Orlitzky, Schmidt [13] had also reached a similar conclusion. However, despite the large volume of literature investigating "its pays to be green", there is still a lack of consistency in the research findings that could offer a conclusive direction to corporate environmental management [14]. One major deficiency of the empirical studies relates to the specification of research models which is largely based on direct link between environmental management and financial performance, thus subject to problem of omitted variables that could explain economic performance [13], [15], [16]. Further, "it pays to be green" literatures are subject to theoretical criticism. Scholars advocating a trade-off view of corporate environmentalism assert that it is too early to claim "it pays to be green" as the theoretical underpinning of green business case is overly biased towards financial objective, which could overlook the inherent trade-off between environmental management and economic performance [17, 18]. Accordingly, firms could face conflicts between improvements for environmental performance and economic performance, and there could be a negative association between corporate environmentalism and economic performance when investment in environmental protection fails to generate net benefits [19]-[23]. In view of the deficiencies as described, the relationship between corporate environmental management and economic performance warrants further investigation and clarification. Particularly, there is a crucial need to extend investigation beyond green business case hypothesis in order to seek answers that address "when it pays to be green", thus, identify insights on the environmental management conditions leading economic results [4], [16]-[18], [24], 25].

Advancing from 'it pays to be green' hypothesis, the concept of eco-efficiency adopts an integrated view of economic performance and environmental performance. Scholars adopting eco-efficiency concept advocate taking a value based eco-management principle to address environmental needs while concurrently create shareholder value [18], [26]-[31]. Thus, it is important to know when a firm could gain economic benefits from its environmental protection, rather than focusing on the link between environmental management and economic benefits. These scholars assert that firms could gain economic benefits when their environmental activities are valued by its stakeholders, which could eventually result in increased shareholder value, a state, which scholars refer to as the optimum level of environmental protection [28], [32]. In contrary, environmental protection in excess of optimum level does not result in incremental value to firms' stakeholders, thus possibly resulting in net environmental cost when such actions fail to create sufficient economic benefits (Lankoski, 2000). Thus, firms' choice of strategies for environmental improvements may influence the association between environmental performance and financial performance, suggesting the inquiries on 'When does it pay to be green?' [4], [33]

In this research, the potential for economic gains from environmental activities is being investigated among environmentally proactive manufacturing companies in Malaysia, thus, adding on to 'when it pays to be green' literature. Particularly, this research addresses the theoretical gap surrounding operationalization of eco-efficiency, for empirical testing the notion that a firm's economic performance may vary with regards to their level of eco-efficiency. In this study, a high level of eco-efficiency is represented by environmental innovation, which is measured in two dimensions i.e. environmental product innovation and environmental process innovation. A low level of eco-efficiency is denoted by environmental performance. Further, extant literature on 'it pays to be green' tends to be considered financial performance as proxy of competitive advantage, despite literature arguing for a conceptual difference between the two constructs of firm performance [34], [35]. Thus, this study differentiates economic performance into two constructs, namely competitive advantage and financial performance. The structural relationships among these five constructs were simultaneously evaluated for validating applicability of eco-efficiency concept in a developing economy such as Malaysia.

This research focuses on manufacturing firms in Malaysia as the unit of analysis. Malaysian manufacturing firms face urgent needs to handle environmental sustainability issues that could potentially affect their competitive position in both short term and long term and eventually their financial performance. Due to the highly visible environmental damages arising from the manufacturing activities, it is unavoidable that manufacturers are attracting heightened attention from regulators, society as well as environmental bodies on their environmental accountability. Thus, Malaysian manufacturers inevitably face challenges of escalating costs, which is a potential liability arises from environmental issues. Further, there is also an on-going change in competitive landscape for Malaysian manufactured products as the market for environmentally friendly product has grown substantially and will continue as consumers are becoming environmentally conscious. Manufacturing firms ought to incorporate more environmental considerations into their new product development [36], [37]. The manufacturing sector in Malaysia is highly sensitive to the influence of environmental issues arises from regulators, customers, and as well as other stakeholders due to several factors. Manufacturing firms spend a relatively large amount environmental protection cost on waste products handling [38], which affects their competitiveness. Furthermore, there is an increased global concerns over substantial waste products generated from manufacturing activities, for example stockpiling of waste electrical and electronic equipment (WEEE) have significantly contributed to the problem of resource depletion and adverse impact on health and environment [39]. In addition, a significant percentage of the Malaysian manufactured products are being exported to overseas markets that are more advanced in terms of environmental awareness. Hence, Malaysian manufacturers are subject to environmental demands of the buyer countries which could exert substantial pressure on the Malaysian manufacturers to be environmentally competent. According to Malaysian Economic Report 2015/2016, the major countries buying Malaysian manufactured products, among others include: Singapore (14.1%), China (12.8%), European Union (12.3%), the United States of America (12.5%) and Japan (6.7%) [40]. The consumers of these buyer countries tend to be more environmental concerned and the exported products are also subject to more stringent environmental controls imposed by the regulators of buyer countries especially from developed countries. As such the concept of eco-efficiency was investigated within a developing economy context, based on Malaysian manufacturing companies, in order to seek answers on how economic performance of environmentally proactive manufacturers in a developing economy such as Malaysia could be affected by their eco-efficiency.

This paper is divided into 5sections. Section 2.1 to 2.2 explores concept of eco-efficiency and economic performance. The authors identified limitations in existing eco-efficiency literature and highlighted a theoretical gap relating eco-efficiency and economic performance. In section 2.3 to 2.4, the authors represented eco-efficiency as environmental innovation and environmental performance and considered their effects on competitive advantage and financial performance. Section 2.5 considers the role of environmental innovation on environmental performance, as two diverse level of eco-efficiency. A research framework is presented as a conclusion of literature review. The next section is empirical. Section 3 outlines research methodology and instruments development. Section 4 presents findings drawn from structural equation modelling analysis. In section 5, the authors integrated findings with extant 'it pays to be green' literature, and they concluded with theoretical and industry implications, assessed limitations of current research and offered agenda for future research.


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## II. LITERATURE REVIEW

### A. Eco- efficiency

Eco-efficiency represents an integration of environmental and economic dimension of corporate environmental management [17], [18], [28]. It is the combined effects of firms' focus on economic performance and environmental performance. Specifically, achieving eco-efficiency is crucial to business sector as it represents firm's ability to integrate their environmental performance and economic performance [26]. Continuous improvements in environmental performance do not bring economic success indefinitely; increased environmental investment will lead to a net cost when net benefits derived from environmental protection efforts have been exhausted [28]. Accordingly some authors proposed an inverted U shape curve relationship between environmental improvements and financial performance [32], [41], suggesting existence of an optimal level of environmental performance, and any deviations from this optimum is likely to be associated with lower levels of economic performance. In line with Lankoski [32], several scholars advocate value based eco-management, which calls for environmental actions that concurrently create shareholder value [17], [30], [31], [33], [42].

Wagner and Schaltegger [17] argue that environmental management influence on economic performance has no definite direction, and assert that for firms not emphasizing valued-based environmental management, their investment in environmental activities would not contribute to their economic performance. Thus, strategic choice in relation to environmental activities influences firms' economic performance. Environmental strategies guided by eco-efficiency concept define environmental actions that pay-off financially, thus link environmental performance to economic performance [18], [25], [33]. Competitive environmental strategies outline firms' priority in their environmental investments and specify the locus of competitive advantage fundamental to a green business case [25], [33]. Accordingly, companies could strategically choose to compete within a combination of two dimensions: green process improvements [25]; and green product differentiation [25], [33]. Similarly, such conceptualisation of competitive environmental strategies has been referred to as 'environmental or green innovation' by innovation scholars [43]-[47]. Based on these two dimensions, Orsato [25] proposes four competitive strategies that define a diverse scope of competitive locus. First, competitive locus based on integration of green products innovation and green process innovation. Such strategy seeks for product differentiation through fundamental change in products designs and materials choices leading to improved green product features and functionality. Concurrently, implements green process improvements in order to gain cost advantage. This strategy reflects highest level of eco-efficiency as economic value is created concurrently with environmental value creation through product-based and process-based environmental innovation. Second, setting competitive based on eco-branding promotion. Eco-branding strategies offer potential for price premium based on features of green products. Comparatively, this strategy reflects a reduce level of eco-efficiency as its scope of competitive advantage is confined to green product innovation from market sources. Third, setting competitive locus based on green processes improvements beyond regulatory compliance. For instance, an ISO14001 certified EMS of a firm signals its environmental accountability during its business processes, thus differentiating itself from competitors. Lastly, setting competitive locus based solely on green process improvements that offer cost advantage through improved resource productivity. Similarly, such conceptualisation of competitive environmental strategies has been referred to as "environmental performance". Whereby, environmental researchers have postulated environmental performance as indicators of improvements in a firm's operational efficiencies and also its resource productivity resulted from its environmental initiatives, hence leading to cost advantage [6], [48].

Following eco-efficiency literature as described, this paper articulates two level of eco-efficiency using two major constructs of corporate environmental protection. Environmental innovation reflects high level of eco-efficiency, as it measures a firm's focus on market and product development within its environmental management that would likely brings economic benefits to the firm. Environmental performance reflects low level of eco-efficiency, as it measures solely on a firm's achievements in reducing adverse environmental impact, with little element of market orientation. Empirical validation of eco-efficiency concept is important as its presence has a direct bearing on firm's economic performance. Extant empirical literatures have related environmental performance or environmental innovation to economic performance as distinctive model, thus, failing to examine the predictive role of each construct on firm performance in an integrated perspective. Accordingly, this study establishes an integrated model that relates two constructs of eco-efficiency: environmental innovation and environmental performance, to two constructs of economic performance: competitive advantage; and financial performance. Therefore, this enables simultaneous analysis of modelled relationship that explains the predictive role of each construct.

### B. Financial Performance and Competitive Advantage

Findings of a meta study by Albertini [49] concluded that empirical studies relating to environmental practices and firm performance have largely conceptualised financial performance as the proxy of firm performance. Financial performance is defined as "the economic outcomes resulting from the interplay among an organisation's attributes, actions and environment" [50]. Financial performance is a construct with focus on firm's profitability that can be assessed using accounting returns, growth, and stock market performance. Following extant environmental management literature, this research examines financial performance in terms of accounting returns represented by profit margin, sales revenues, returns on investment; and growth in terms of market share and new market opportunities. Competitive advantage is defined as the market position occupied by a company following its successful strategy which is not imitable by its competitors [51].

Peteraf and Barney [52] refer competitive advantage as "ability to create relatively more economic value, in comparison to marginal competitors either through superior differentiation or having lower cost". The resource-based view [51] conceptualises competitive advantage using net benefits approach, with larger net benefits generated indicates more efficient use of firm resources, however, the theory does not argue for automatic link between competitive advantage that a firm has and its ability to generate superior profitability. Researchers stress that not all rents generated by a firm are being reflected in its accounting-based or market-based performance measures, instead, superior firm performance is only achievable when firms make effective use of their competitive advantages [34], [53]-[55]. Furthermore, on top of competitive advantage factor, a firm's profitability is further influenced by its distribution of residual net benefits between various resources providers [53], [56], including debts providers, equity providers and employees. Thus, it is important to differentiate the construct of competitive advantage from firm performance in empirical studies testing sources of firm competitiveness [34], [35] in order to eliminate additional factors that could affect superior firm performance on top of competitive advantage. Accordingly, this research argues for the need to model competitive advantage explicitly as dependent variable when studying environmental strategies implementation. Such approach is in line with some empirical studies examining the resource-based view logic. For example, in their empirical studies relating resources, capabilities and firm performance, the authors have modelled competitive advantage as the dependent variable [5], [57], [58]; and argued for the antecedent role of competitive advantage on superior firm performance. Thus, competitive advantage is proposed as a dependent variable representing firm performance in this research. Accordingly, this research proposes the following hypotheses relating competitive advantage and financial performance.

H1: A firm's competitive advantage is positively related to its financial performance.

### C. Environmental Innovation

This research defines environmental innovation as the implementation of new product, processes, or methods on the basis of reduced negative environmental impact, aiming to better satisfy users' needs, and therefore leading to improve competitiveness [59]-[61]. In line with OECD [59], this research represents environmental innovation as technical innovation which consists of environmental product innovation and environmental process innovation, and considered the role of marketing related innovation and management practices related innovation as antecedents environmental innovation. Within this context, environmental product innovation refers to improvements to a firm's existing products or development of new eco-products [60]; and environmental process innovation refers to the implementation of a new or significantly improved production or delivery method; both with the aim to reduce harmful environmental impact [59], [60]. The focus on products and process aspects of environmental innovation enables an outcome approach in examining a firm's environmental innovation. Superior products and processes exert the most apparent influence on a firm's competitive position. Superior green products allow effective products differentiation, whereas superior processes create cost advantage as well as product advantages. Innovation research studies have largely postulated environmental innovation as a core antecedent of a firm's financial performance [43]-[47], [62]. Environmental innovation contributes to improving financial performance in two manners: (1) firms equipped with high level of environmental innovation are more likely to realize their competitive benefits in the form of innovative products, improved manufacturing and operational processes, and reduced operational costs [11]; and (2) these firms can differentiate themselves from their competitors, gain external reputation and legitimacy, thereby increase their total revenues [6], [11]. Empirical studies reported a positive association between environmental innovation and various aspect of financial performance including: turnover and export [62]; as well as return on investment, profits, market share and sales [44]. Further, empirical studies reported evidences for predictive effects of environmental innovation on competitive advantage. Both the environmental related products and process improvements contribute to a firm's ability to compete [43], [45], [47]. These studies argue that environmental product innovation in terms of superior green designs allows a firm to (1) charge a premium price in the growing green markets; (2) improve a firm corporate image; and (3) enjoy first mover advantage in the new market opportunities, thus providing opportunities for venturing into new markets [45]. Accordingly, this research proposed the following hypotheses relating environmental innovation and firms' competitive advantage and firm performance:

H2a: A firm's environmental process innovation is positively related to its financial performance.

H2b: A firm's environmental process innovation is positively related to its competitive advantage.

H3a: A firm's environmental product innovation is positively related to its financial performance.

H3b: A firm's environmental product innovation is positively related to its competitive advantage.

### D. Environmental Performance

According to the natural resource-based theory, environmental strategies implementation results in competitive benefits of a firm in two major forms: cost advantage and differentiation advantage. Environmental researchers have postulated environmental performance as indicators of improvements in a firm's operational efficiencies and also its resource productivity resulted from its environmental initiatives, hence leading to cost advantage [6], [48]. Further, a firm performs well in environmental protections is able to differentiate itself from others with poor environmental performance in the green markets [11], [63], thus leading to differentiation advantage. The creation of environmental performance by a firm is causally ambiguous, process-based, rare, firm specific, thus, fulfilled the attributes of valuable characteristics that contributes to its competitive advantage that would eventually enhance a firm's financial performance [1], [4], [64], [65]. Numerous empirical studies reported a positive association between environmental performance and firm performance [17, 65]-[70].

Further, longitudinal design study concluded improvements in prior period environmental performance experienced improvement in financial performance in the subsequent period and vice-versa [67]. Empirical studies in Malaysia have also reported evidences for the positive link between environmental initiatives and firm performance [71, 72]. Lee, Ooi [72] investigated the effects of greening of suppliers and performance outcomes among 119 ISO 14001-registered manufacturing firms in Malaysia. Findings showed that environmental performance has a positive significant relationship to competitive advantage. Likewise, Eltayeb, Zailani [71] investigated the effects of green supply chain initiatives and firm's outcomes among 132 EMS ISO 14001 certified manufacturing firms in Malaysia. Findings show green supply initiatives are positively associated to firm's environmental performance and also financial performance in terms of profitability, productivity, sales improvements as well as reductions in cost. On the contrary, numerous empirical studies found a negative relationship between environmental performance and financial performance [73]-[77]. Accordingly, this research posits a positive link between environmental performance and financial performance among manufacturing firms in Malaysia and proposes the following hypotheses relating environmental performance and firms' competitive advantage and financial performance:

H4a: A firm's environmental performance is positively related to its financial performance.

H4b: A firm's environmental performance is positively related to its competitive advantage.

### E. Environmental Innovation and Environmental Performance

Environmental innovation improves performance of environmental management in fulfilling responsibility of environmental protection. Dangelico and Pujari [36] argue that green product innovation emphasises on conserving energy and materials use and prevention of pollutions throughout the entire life cycle of products, from manufacturing, products use and to products disposal. Innovations in any stage of the life cycle would significantly reduce environmental impacts and improve firm's environmental performance. Similarly, empirical studies reported evidences that environmental innovation contributes towards achievement of environmental performance. Environmental innovation measured as environmental patents is found to be associated with environmental performance in terms of reductions in toxic pollution [78]. Green product innovation is reported to be correlated positively to environmental performance in Taiwan manufacturing sector [45]. Green process innovation that improves effectiveness of environmental management and leads to better environmental performance was reported for manufacturing sector in Taiwan [43] and Turkey [79]. Accordingly, this research proposes the following hypotheses relating environmental innovation to environmental performance among manufacturing firms in Malaysia:

H5a: A firm's environmental process innovation is positively related to its environmental performance.

H5b: A firm's environmental product innovation is positively related to its environmental performance.

H5c: A firm's environmental process innovation is positively related to its environmental product innovation.

Fig. 1 illustrates the proposed research framework.

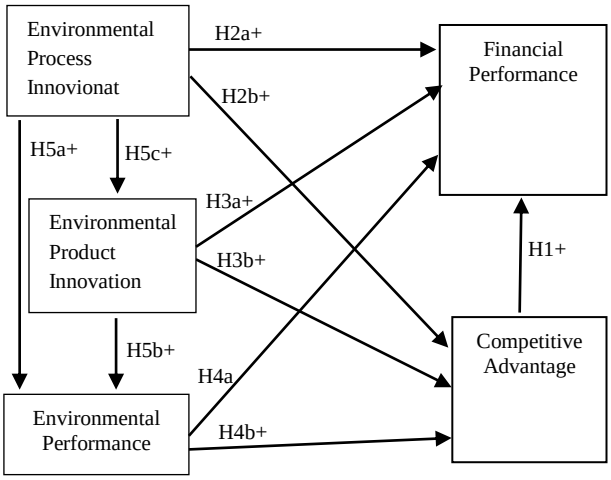


Fig. 1: Proposed Research Framework.

## III. METHODOLOGY

### A. Data Collection Procedures and Sample Characteristics

This research follows a correlational survey design. As public information is not available for constructs understudy, a cross-sectional survey study was implemented for data collections. Data collected was subject to structural equation modelling analysis via Smart PLS 3. This research focuses on manufacturing firms as the unit of analysis and seeks to evaluate how proactivity in environmental management could enhance firm performance in the manufacturing sector. Thus, the populations of study include only manufacturing firms that reflect a high level of environmental accountability. All ISO 14001 Environmental Management System (EMS) certified manufacturing firms in Malaysia are selected as population of study. Environmental management system (EMS) represents advanced environmental practices by manufacturing firms and its implementation consumes substantial resources of a firm. A certified ISO 14001 EMS is not mandatory for manufacturing firms in Malaysia; instead EMS certification serves as signals to stakeholders about their commitment in environmental protection. Thus, ISO 14001 EMS certified manufacturing firms in Malaysia serve as an appropriate population for current research. The sampling frame was based on a list of 483 ISO14001 certified Malaysian manufacturing companies, as included in the Federation of Malaysian Manufacturers directory 2015 of Malaysian manufacturers [80]. As size of sampling frame is small, this research adopts census sampling technique, and questionnaire was mailed to all the 483 manufacturing firms. The appropriate respondent should be someone assuming managerial role in the targeted firms who is knowledgeable about environmental aspect of its firm as well as the business aspects related to environmental practice. Such a person involves in decision makings related to environmental management planning and

implementation in the respective targeted firms.

These targeted respondents could possibly occupy various positions within the targeted firms, among others include: environmental managers, chief executive officer, managing director, general manager, operational managers, and any other positions that fulfilled the targeted respondent's criteria as described. The study received 86 usable responses from the targeted companies, at a response rate of 18%.

Table I: Company Profiles.

| Description | Frequency | % |
|---|---|---|
| Companies' main activities | | |
| Electrical machinery, radio television & communication equipment, optical equipment | 17 | 20 |
| Rubber and plastics products | 12 | 14 |
| Chemicals, chemical products and man-made fibres | 10 | 12 |
| Basic metals and fabricated metal products | 9 | 10 |
| Motor vehicles and transport equipment | 9 | 10 |
| Food products & beverages | 7 | 8 |
| Others | 22 | 26 |
| Most recent year annual sales (RM) | | |
| 10 million - 200 million | 63 | 74 |
| 201 million - 500 million | 23 | 8 |
| > 500 million | 16 | 18 |
| Employees size | | |
| < 100 | 51 | 59 |
| 100 - 200 | 15 | 17 |
| 200 and above | 20 | 24 |
| Company's Age (years) | | |
| 6 - 15 | 35 | 41 |
| 16 - 25 | 19 | 22 |
| Above 25 | 32 | 37 |

Table I above shows characteristics of sampled companies. The main activities of these firms include electrical and electronics (20%); rubber and plastics (14%); chemicals and chemical products (12%); metal products (10%); motor vehicles and transport equipment (10%); food and beverages (8%); and others (26%). The age distributions of the firms are: between 6 to 15 years (41%); between 16 to 25 years (22%); and more than 25 years (37%). Their most recent annual sales and number of full time employees indicate relative size of sampled firms. The majority of the sampled firms (74%) are of small to medium size with most recent annual sales between RM10 million to RM200 million. The remaining are larger size firms with most recent annual sales between 201 million to 500 million (8%); and above RM500 million (18%). In terms of labour force, majority of the firms (59%) are employing less than 100 employees; 17% of the firms have workforce between 100-200 employees; and remaining firms (24%) have workforce above 200 employees.

### B. Research Instrument

This research used self-administered questionnaires as the tool for collecting data on managers' opinions regarding environmental constructs in their respective firms. The questionnaire consists of six sections. Section 1 measures financial performance using scale adapted from a few authors in environmental management studies [81]-[83]. Section 2 measures competitive advantage using scale adopted from Karagozoglu and Lindell [81]. Section 3 measures environmental performance using scale adopted from Zhu and Sarkis [84]. Section 4 measures environmental innovation using items adapted from numerous environmental innovation studies [43], [45], [82], [83], [85], [86]. Following suggestions from these authors, this study operationalised environmental innovation into two dimensions: environmental product innovation and environmental process innovation. Section 5 and section 6 include items regarding company profiles and respondents' profiles respectively. Table II below shows details of items for measuring each construct.

Table II: Constructs Measurement.

| Constructs | Item | Mean | SD | Code |
|---|---|---|---|---|
| Financial performance (FP) | Results in increase in profit margin. | 4.80 | .73 | FP1 |
| | Results in increase in market share. | 4.77 | .71 | FP2 |
| | Results in increase in sales revenues. | 4.76 | .78 | FP3 |
| | Results in increase in return on investment. | 4.74 | .81 | FP4 |
| | Results in increase in overall financial performance. | 4.87 | .76 | FP5 |
| Competitive advantage (CA) | Results in cost advantage relative to key competitors. | 4.76 | .67 | CA1 |
| | Results in quality improvement in our products. | 4.71 | .68 | CA2 |
| | Making our firm gains stronger reputation with customers. | 4.72 | .64 | CA3 |
| | Making our firm a leader in the market. | 4.64 | .63 | CA4 |
| | Making our firm enter lucrative new markets. | 4.66 | .73 | CA5 |
| Environmental performance (EP) | Reduction of air emission. | 4.72 | .63 | EP1 |
| | Reduction of waste water. | 4.78 | .62 | EP2 |
| | Reduction of solid waste. | 4.77 | .64 | EP3 |


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|---|---|---|---|---|
| | Decrease consumption of hazardous / toxic materials. | 4.74 | .75 | EP4 |
| | Decrease frequency of environmental accidents. | 4.73 | .74 | EP5 |
| | Use non-polluting or non-toxic materials. | 4.87 | .63 | ENP1* |
| | Are designed for recycling, reuse, decompose. | 4.94 | .49 | ENP2* |
| Environmental product innovation (ENP) | Are collected back after end-of-life for recycling. | 4.72 | .73 | ENP3* |
| | Use environmental friendly packaging. | 4.73 | .69 | ENP4 |
| | Use materials that consume lower energies. | 4.72 | .70 | ENP5 |
| | Use materials to the least amount possible. | 4.83 | .62 | ENP6 |
| | Use eco-labelling. | 4.86 | .67 | ENP7 |
| | Carried out recycle, reuse, or remanufacture of materials / parts. | 4.73 | .64 | ENC1 |
| | Redesign manufacturing process to lower pollution (air, water, noise). | 4.73 | .58 | ENC2 |
| Environmental process innovation (ENP) | Redesign manufacturing process to lower solid waste. | 4.76 | .59 | ENC3 |
| | Redesign manufacturing process to lower energies consumption (water, electricity, gas, petrol). | 4.60 | .62 | ENC4 |
| | Redesign manufacturing process to lower materials use. | 4.51 | .59 | ENC5 |
| | Use cleaner technologies to make savings (e.g. energy, water, waste). | 4.51 | .61 | ENC6 |

* Items ENP1, ENP2, ENP3 were deleted subsequently during data measurement assessment.

Notes: ENP = environmental product innovation; ENC = environmental process innovation; EP = environmental performance; CA = competitive advantage; and FP = financial performance.

### C. Control Variable

Firm size was included as a control variable in this study due to its profound effect on a firm's economic performance. Past researches asserts that bigger companies are better in their profitability [4], [5], [16], [66]. The natural logarithm of most recent annual sales value at time of survey was taken as the measure of size.

## IV. RESULTS AND FINDINGS

### A. Measurement Model Assessment

This research adopts partial least squares structural equation modelling (PLS-SEM) as the statistical tool for inferential analysis of data. All PLS-SEM analysis was executed using the Smart PLS 3 software. This study utilises reflective measurement scales for all constructs. Table III shows factor loadings and reliability of measurement scales. Findings show item loading values range from lowest 0.689 to highest 0.900; composite reliability values range from lowest 0.870 (ENP) to highest 0.938 (FP); and AVE values range from lowest 0.589 (ENC) to highest 0.753 (FP). Following Hair, Hult [87], the measurement scale shows convergent validity as data fulfilled all the three criteria: (i) the factor loadings of each item exceeds 0.5 indicating the relevance of each item to the construct being measured; (ii) composite reliability (CR) is 0.7 or greater; and (iii) average variance extracted (AVE) which measures the variance captured by the items relative to measurement error, is greater than 0.5. Further, Cronbach's Alpha value for each construct ranges from lowest 0.801 (ENP) to highest 0.918 (FP), all above minimum threshold of 0.7, indicating reliability of measurement scales. As such, the measurement scales demonstrated adequate convergent validity.

Table III: Factor loadings and reliability assessment.

| Items | Loadings | Constructs | AVE | CR | CA |
|---|---|---|---|---|---|
| ENP3 | 0.837 | Environmental Product Innovation (ENP) | 0.627 | 0.870 | 0.801 |
| ENP4 | 0.727 | | | | |
| ENP5 | 0.780 | | | | |
| ENP6 | 0.820 | | | | |
| ENC1 | 0.723 | Environmental Process Innovation (ENC) | 0.589 | 0.895 | 0.859 |
| ENC2 | 0.822 | | | | |
| ENC3 | 0.823 | | | | |
| ENC4 | 0.711 | | | | |
| ENC5 | 0.811 | | | | |
| ENC6 | 0.702 | | | | |
| EP1 | 0.865 | Environmental Performance (EP) | 0.690 | 0.917 | 0.887 |
| EP2 | 0.900 | | | | |
| EP3 | 0.773 | | | | |
| EP4 | 0.792 | | | | |
| EP5 | 0.818 | | | | |
| CA1 | 0.822 | Competitive Advantage (CA) | 0.594 | 0.879 | 0.827 |
| CA2 | 0.805 | | | | |
| CA3 | 0.699 | | | | |
| CA4 | 0.689 | | | | |
| CA5 | 0.827 | | | | |
| FP1 | 0.882 | Financial performance (FP) | 0.753 | 0.938 | 0.918 |
| FP2 | 0.877 | | | | |
| FP3 | 0.864 | | | | |
| FP4 | 0.864 | | | | |
| FP5 | 0.852 | | | | |

Notes: (1) CR = Composite reliability; AVE = Average variance extracted; AC = Cronbach's Alpha, ENP = environmental product innovation; ENC = environmental process innovation; EP = environmental performance; CA = competitive advantage; and FP = financial performance. (2) Items ENP1, ENP2, ENP3were deleted in order to improve AVE of ENP.

Discriminant validity of measurement scales was evaluated following Fornell and Larcker [88] procedures. Table IV below presents statistics on inter-construct correlations. Findings show AVE square roots value of each construct (bold diagonal values) is larger than the inter-construct correlation values for each construct respectively. Thus, the measurement scales for each construct reflect adequate discriminant validity.

Table IV: Inter-construct correlations assessment.

| | ENC | ENP | EP | CA | FP |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| ENC | 0.767 | | | | |
| ENP | 0.412 | 0.792 | | | |
| EP | 0.520 | 0.308 | 0.831 | | |
| CA | 0.088 | 0.413 | 0.021 | 0.771 | |
| FP | 0.460 | 0.570 | 0.244 | 0.472 | 0.868 |

Note: Diagonal elements are the square root of the AVE of the reflective scales while the diagonals are the correlations between constructs. ENP = environmental product innovation; ENC = environmental process innovation; EP = environmental performance; CA = competitive advantage; and FP = financial performance.

### B. Structural Model Assessment

Fig. 2 presents structural model of this study and table V presents the results of simultaneous testing of structural model. Results in table V show competitive advantage (β=0.299, p<0.01), environmental process innovation (β=0.309, p<0.01), and environmental product innovation (β=0.305, p<0.01) are positively associated with financial performance. Thus hypothesis H1, H2a and H3a were supported.

On the contrary, findings reported no significant association between environmental performance (β=-0.040, p>0.01) and financial performance, leading to non-support of hypothesis H4a. Next, findings reported a significant positive association between environmental product innovation (β=0.439, p<0.01) and competitive advantage, thus hypothesis H3b was supported. Nevertheless, findings indicate environmental process innovation (β=-0.059, p>0.01) and environmental performance (β=-0.112, p>0.01) were not significantly related to competitive advantage, leading to non-support of hypothesis H2b and H4b. Further, it was found that environmental process innovation was significantly associated with environmental performance (β=0.473, p<0.01), and environmental product innovation (β=0.412, p<0.01), thus supported hypotheses H5a and H5c. However, the findings found no association between environmental product innovation and environmental performance (β=0.113, >0.01); and leading to non-support of hypothesis H5b. In addition, the impact of each exogenous variable on endogenous variable was assessed using $f^2$ effects size. According to Cohen [89], $f^2$ effects size of 0.02, 0.15, 0.35 are generally considered as small, medium and large effects, respectively. Hence, $f^2$ effects size enables evaluating an independent variable's contribution towards dependent variable [90]. Findings as per table V below show environmental process innovation has an above medium effect size on environmental performance (f2=0.258); and environmental product innovation (f2=0.205). A close to medium effect size was reported for all remaining significant paths.

**Table V:** Results of hypothesis testing.

| Hypothesis | Path | Std. beta | Std. error | t-value | Results | $f^2$ |
|---|---|---|---|---|---|---|
| H1 | CA - FP | 0.299 | 0.112 | 2.668** | Supported | 0.137 |
| H2a | ENC - FP | 0.309 | 0.106 | 2.931** | Supported | 0.120 |
| H2b | ENC - CA | -0.059 | 0.134 | 0.437 | Not supported | 0.003 |
| H3a | ENP - FP | 0.305 | 0.112 | 2.729** | Supported | 0.118 |
| H3b | ENP - CA | 0.439 | 0.114 | 3.838*** | Supported | 0.190 |
| H4a | EP - FP | -0.040 | 0.111 | 0.360 | Not supported | 0.002 |
| H4b | EP - CA | -0.112 | 0.190 | 0.590 | Not supported | 0.011 |

Table V: Continued

| Hypothesis | Path | Standard beta | Standard error | t-value | Results | $f^2$ |
|---|---|---|---|---|---|---|
| H5b | ENP - EP | 0.113 | 0.127 | 0.887 | Not supported | 0.015 |
| H5c | ENC - ENP | 0.412 | 0.103 | 4.010*** | Supported | 0.205 |
| Control | Sales - CA | 0.128 | 0.113 | 1.134 | Not supported | 0.019 |
| Control | Sales - FP | 0.103 | 0.080 | 1.286 | Not supported | 0.018 |

* $p \leq 0.05$; **$p \leq 0.01$., ***$p<0.0001$

ENP = environmental product innovation; ENC = environmental process innovation; EP = environmental performance; CA = competitive advantage; and FP = financial performance.

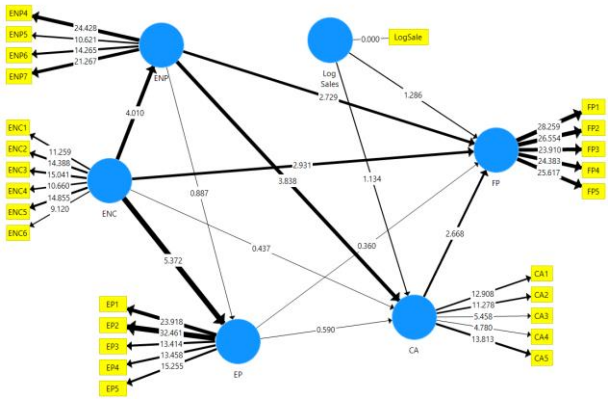


Fig. 2: Structural model.

Note: The width of each path indicates the relative size of path coefficients.

ENP = environmental product innovation; ENC = environmental process innovation; EP = environmental performance; CA = competitive advantage; and FP = financial performance.

Table VI presents results of predictive accuracy ($R^2$) and predictive relevance ($Q^2$) of structural model. $R^2$ value measures the total variations in dependent variable as explained by independent variables linked to it. Evaluating ($R^2$) provides indication towards model's predictive accuracy. $R^2$ value of 0.26, 0.13, 0.03 are generally considered as substantial, moderate or weak respectively [89]. Likewise, $Q^2$ value assess whether an exogenous variable is able to predict the endogenous latent variable [91]. $Q^2$ value of 0.02, 0.15, 035 suggest an independent variable has small, medium and large predictive

relevance on dependent variable, respectively [87]. The findings show all values of $Q^2$ are positive which supported the predictive relevance of the structural model [92] and $R^2$ values are 0.478, 0.200, 0.281 and 0.170 for financial performance, competitive advantage; environmental performance, and environmental product innovation respectively. Thus, it can be concluded that the modelled constructs explain 47.8% of variation in financial performance ($Q^2 = 0.322$); 20% of variation in competitive advantage ($Q^2 = 0.091$); 28.1% of variation in environmental performance ($Q^2 = 0.177$); and 17% of variation in environmental product innovation ($Q^2 = 0.093$). Based on the research model, a few conclusions are established: (1) the environmental product innovation, environmental process innovation and competitive advantage could explain 47.8% of variances in financial performance; (2) environmental product innovation explains 20% of variances in competitive advantage; (3) environmental process innovation explains 28.1% of variances in environmental innovation; and (4) environmental process innovation explains 17% of variances in environmental product innovation.

Table VI: Results of structural model predictive assessment

| | $R^2$ | Standard error | t-value | $Q^2$ |
|---|---|---|---|---|
| FP | 0.478 | 0.088 | 5.418*** | 0.322 |
| CA | 0.200 | 0.090 | 2.223* | 0.091 |
| EP | 0.281 | 0.088 | 3.182** | 0.177 |
| ENP | 0.170 | 0.082 | 3.182** | 0.096 |

* $p \leq 0.05$; **$p \leq 0.01$., ***$p<0.0001$

ENP = environmental product innovation; EP = environmental performance; CA = competitive advantage; and FP = financial performance.

### C. Findings and Discussion

The objective of this research is to inspect the relative role of each construct: environmental product innovation, environmental process innovation, environmental performance; on competitive advantage and financial performance of environmentally proactive manufacturing firms in Malaysia. A few important findings were drawn from the results of structural equation modelling analysis as presented in section 4.2, and interpreted below.

First, competitive advantage has a significant positive effects on financial performance (standardised beta = 0.299, $p \leq 0.01$). H1 was supported. This indicates that environmentally derived competitive advantage contributes to financial performance of environmentally proactive manufacturing firms in Malaysia. Thus, these firms are more likely gaining superior financial performance when their environmental activities result in lower cost relative to competitors, improved products quality, strengthened reputation, market leader position, and lucrative new market entries. This finding is in line with several studies [34], [54], [57], [58] which asserts that competitive advantage is distinct from financial performance, and competitive advantage would be significantly predictive of financial performance. As such, environmentally proactive manufacturers need to understand how their environmental actions create competitive advantage, in line with eco-efficiency concept which asserts an integration of environmental and economic goals concurrently [17], [18], [28].

Second, environmental process innovation (standardised beta = 0.309, $p \leq 0.01$) and environmental product innovation (standardised beta = 0.305, $p \leq 0.01$) both have a strong significant positive effect on financial performance. H2a and H2b were supported. The path coefficients show that both have approximately similar contribution to financial performance of environmentally proactive manufacturing firms in Malaysia. Thus, these firms are more likely gaining superior financial performance when their environmental activities incorporate redesign of processes and products for environmental improvements, which form the biggest scope for achieving eco-efficiency [25], [33]. Fundamental change in resource productivities is likely to be gained through process redesign for lower pollution, solid waste, energies, materials use; and for enable recycle, reuse, remanufacture of parts, thus leading to lower cost and superior financial performance. Likewise, market differentiation is likely to be gained through fundamental change in products designs for environmental improvements in terms of use of non-toxic materials, eco-friendly packaging, eco-labelling, least materials use, low energies consumption, as well as design for recycle and decompose. These green products designs and materials choices lead to improved green product features and functionality. These findings indicate both dimensions of environmental innovation are the dominant drivers of financial performance among environmentally proactive manufacturers in Malaysia. The findings are consistent with previous studies [43]-[47], [62] which assert that environmental innovation significantly enhances financial performance. As such, environmentally proactive manufacturers need to prioritise their environmental actions for enhancing environmental process innovation and environmental products innovation that creates economic value concurrently with environmental value, such strategy reflects the highest level of eco-efficiency value [17, 30, 31, 33], [42].

Third, environmental product innovation has a strong significant positive effects on competitive advantage (standardised beta = 0.439, $p \leq 0.001$), but environmental process innovation has no influence on competitive advantage (standardised beta = -0.059, $p > 0.01$). H2b was supported and H3b was unsupported. In addition, environmental process innovation has a strong significant effect on environmental product innovation (standardised beta = 0.412, $p \leq 0.001$). H5a was supported. The results as above indicate environmentally proactive manufacturing firms in Malaysia are leveraging on green product design innovation for competitiveness, whereas green process design innovation does not form the locus of competitiveness among these firms. Furthermore, the strong path coefficient of environmental product innovation reflects its robust predictive role of competitive advantage. Thus, these firms are more likely remain competitive when their environmental activities incorporate green products design innovation, which serve as dominant source of competitive advantage [25], [33]. Market differentiation is likely to be gained through fundamental change in products designs for environmental improvements in terms of non-toxic materials use, eco-friendly packaging,

eco-labelling, least materials use, low energies features, as well as design for recycle and decompose. Based on green product features and functionality, these firms are implementing eco-branding as their strategy for competitive positioning. Thus, environmental product innovation strategy serve as central source of competitiveness among environmentally proactive manufacturers as consumers are increasing recognising environmental value through their shopping behaviours [36]. This finding is consistent with Orsato [25] which found evidences a predictive role of environmental product innovation and competitive advantage. Likewise, also in line with previous researches [6], [43], [45], [93], which had postulated that environmental innovation significantly enhances competitive advantage. On the contrary, environmental process innovation for lower pollution, solid waste, energies, materials use; and for enable recycle, reuse, remanufacture of parts, are shown to be non-predictive of competitive advantage. This indicates strategy for green process design improvements does not form locus for competitive advantage of environmentally proactive manufacturers in Malaysia.

One possible explanation is, unlike green products features that directly observable by customers, environmental value through green process innovation is indirectly related to consumers through their concerns for environmental protection [25], [33]. Despite increasing awareness of environmental concerns among consumer market, however, findings of this study suggests inherent environmental value within green processes has not become sources of competitive advantage among environmentally proactive manufacturer in Malaysia. In addition, findings reported a predictive role of environmental process innovation on environmental product innovation. This indicates that process re-designs for environmental improvements supports enhanced green features and functionality in products, which eventually creates competitive advantage. As such, green process innovation could potentially serve as an indirect source of competitive advantage when benefits of process improvements are effectively incorporated as products features and functionality directly observable by customers.

Fourth, environmental process innovation has a strong significant positive effects on environmental performance (standardised beta = 0.439, $p \leq 0.001$). H5a was supported. This indicates that process re-designs for environmental improvements supports environmental achievements in mitigating adverse environmental impact. Environmental innovation reflects firms' environmental capabilities generated from their environmental strategies implementation. Underpinned by the dynamic capabilities theory [94], environmental innovation reflects a firm's ability to implement effective routines and processes related to environmental protections that facilitates continuous improvements in its products and processes. Further, environmental innovation also reflects a firm's absorptive capacity as it serves as an outcome achieves by a firm from its adoptions of innovative environmental practices. Superior environmental innovation reflects a firm's ability to identify new environmental knowledge, and successfully apply it to improve its products and processes, thus contributes to better environmental solutions of a firm. These findings are consistent with several studies [43], [79] which found evidences that environmental process innovation significantly enhances environmental performance. On the contrary, environmental product innovation was found to have no influence on environmental performance (standardised beta = 0.113, $p > 0.01$). H5b was unsupported. This indicates products innovation for environmental improvements was non-predictive of environmental performance. This result is inconsistent with Chiou, Chan [45] which reported a positive correlation between environmental product innovation and environmental performance. One possible explanation is due to a relatively smaller size of environmental damages arising from products use compare to those damages caused by manufacturing and distribution processes.

Fifth, environmental performance has no effects on both financial performance (standardised beta = -0.040, $p > 0.01$) and competitive advantage (standardised beta = -0.112, $p > 0.01$). H4a and H4b were unsupported. The path coefficients show that environmental performance has a negligible influence on financial performance. Furthermore, the negative path coefficient relating to competitive advantage, despite a non-significant relationship, indicates its trade-off effects on competitive advantage. Firms' environmental achievements such as reduction in air emissions, waste water, solid waste, hazardous materials use, environmental accidents, are shown to be non-predictive of financial performance and competitive advantage. This indicates environmental strategy targeting solely at minimising adverse environmental impact does not form locus for competitive advantage, nor does it contributes to financial performance of environmentally proactive manufacturers in Malaysia. The result of this study is inconsistent with previous researches [17], [65]-[71] which indicates that environmental performance significantly enhances financial performance. Further, this finding is also inconsistent with Lee, Ooi [72], which indicates that environmental performance significantly enhances competitive advantage. However, the result is consistent with findings of several empirical studies [73]-[77]. One prospective explanation for these findings was offered by proponents of eco-efficiency [17], [28]. According to Schaltegger and Synnestvedt [28], continuous improvements in environmental performance do not bring economic success indefinitely. The authors stress that increased environmental investment will lead to a net cost when net benefits from environmental protection efforts have been exhausted. Instead, economic value of environmental performance is dependent on a firm's state of eco-efficiency. In order to benefit financially, a firm must operate at an optimum level of environmental performance; and implement its environmental activities in the most efficient manner, with the lowest costs possible, thereby achieving eco-efficiency [17], [28]. Furthermore, environmental performance is indirectly related to customers through their concerns for environmental protection [25], [33]. Despite growing green market, findings of this study suggest achievements for reduced environmental impact have not become sources of competitive advantage among environmentally proactive manufacturer in Malaysia. As such, environmentally proactive manufacturers should strategically craft their environmental strategies for maximising eco-efficiency, in order to create economic value and environmental value concurrently.

## V. CONCLUSION

An eco-efficiency approach to environmental management must emphasise concurrent creation of environmental value and economic value as the prerequisite for gaining superior economic benefits. This study calls for the recognition that to achieve superior firm performance from environmental management, attention must be emphasised on eco-efficiency that influences their market performance, cost performance, environmental performance. The research addresses the theoretical gap surrounding operationalization of eco-efficiency, for empirical testing the notion that a firm's economic performance may vary with regards to their level of eco-efficiency. Findings of this study examine the predictive role of each key construct included in the research model in an integrated perspective. Based on the preceding discussion, several conclusions are made as follows:

Economic value creation among environmentally proactive manufacturers in Malaysia was mainly sourced from their achievements in environmental innovation.

Findings of this study indicate environmental innovation serves as the most important factor contributing to economic benefits. Both environmental process innovation and environmental product innovation are equally important in their contribution to financial performance. However, each dimension has occupied a distinctive role. Environmental product innovation serves as the core predictor of competitive advantage. While environmental process innovation has no direct influence on competitive advantage, it does contribute to competitive advantage indirectly as it serves as a strong predictor of environmental product innovation. On the other hand, findings show environmental performance has no effects on both competitive advantage and financial performance. In this sense, environmental performance contributes to environmental value creation solely. In terms of integrating economic and environmental needs, findings of this study indicate that environmental process innovation functions as a connector that enables concurrent creation of economic value and environmental value, thus achieving eco-efficiency. Environmental process innovation has strongly contributed to financial performance as well as environmental product innovation, which enhances competitive advantage, and both performances create economic value. At the same time, environmental process innovation has strongly contributed to environmental performance, leading to creation of environmental value. In conclusion, this study found evidences to assert that environmental innovation is the key enabler supporting green business case. A focus on environmental innovation management brings economic benefits while concurrently enhancing environmental performance among environmentally proactive manufacturers. When these manufacturers strategize to improve their products designs and processes for environmental improvements, it is envisaged that their improvements in competitiveness, financial performance and environmental performance will occur concurrently. Theoretical implications and managerial implications are being discussed in the following paragraph.

### A. Theoretical Implications

Results of this study clarify theoretical relationships among key constructs of "it pays to be green" literature and provide insights on "when it pays to be green". Firstly, this study validated the concept of eco-efficiency which asserts the need for keeping a value-based eco-environmental approach for concurrent achievement of environmental value and economic value. Based on data collected from ISO 14001 EMS certified manufacturers in Malaysia, this study performed a simultaneous equation analysis on two dimensions of environmental innovation i.e. environmental process innovation, environmental product innovation; environmental performance, competitive advantage and financial performance, in order to clarify distinctive role played by each construct in supports of a green business case. Findings of this study provide evidences that both environmental product innovation and environmental process innovation are dominant predictors of financial performance and competitive advantage in a developing economy such as Malaysia. In addition, environmental process innovation was found to be a strong predictor of environmental performance. On the contrary, environmental performance was found to be non-predictive of firm performance both in terms of competitive advantage and financial performance. In line with eco-efficiency perspective, environmental innovation plays a duality role in enhancing economic performance as well as fulfilling environmental accountability of firms. Secondly, this research justified distinctiveness of two economic performance constructs: competitive advantage and financial performance, which are regularly modelled as equivalent outcome variables in empirical studies on environmental management. Findings of this study differentiate the two constructs as distinctive, and found evidences that competitive advantage plays a predictive role that affects positively on financial performance. Consequentially, it adds theoretical understanding to the construct of economic performance.

### B. Methodological Implications

The research model was evaluated using SEM via Smart PLS 3. PLS-SEM is highly suitable for studies of exploratory nature where measurements are less established and theory is more tentative. PLS-SEM estimation technique is ordinary least squares regression-based, it estimates path relationships from the available data on the basis of maximising the $R^2$ value of the targeted construct [87]. This statistical property of PLS-SEM is highly relevant to the current research which aims is to explore the role played by each environmental related construct in predicting firm performance, environmental innovation, environmental performance, competitive advantage, and financial performance. Furthermore, according to Hair, Hult [87], due to the predictive-oriented statistical property, PLS-SEM is particularly suitable for studies on sources of competitive advantage as well as drivers of firm performance as modelled in this study.

### C. Managerial Implications

Following findings of this study, several managerial implications could be advanced which particularly relevant to manufacturers in Malaysia. First,

the validated positive relationship between environmental innovation and firm performance, endorsed the potential of gaining economics benefits from environmental management, thus managers could facilitate environmental management with a view towards fostering economic benefits. Second, the results clarify and provide evidences on the predictive role of environmental innovation on financial performance and competitive advantage. Reflecting on this, manufacturers can more readily prioritise their environment activities at enhancing the innovation outcomes. This strategic orientation ought to be integrated within the environmental strategies of the manufacturing companies. Third, results also provide evidences on the predictive role of environmental process innovation on environmental performance, indicating while managers focus their environmental efforts on generating environmental innovation, the aspect of environmental process innovation would concurrently lead to enhancement of environmental performance. This further justifies the adoption of environmental innovation strategy focusing at constant improvements in green products designs and green processes, as these practices are strongly link to achievement in environmental performance.

In conclusion, environmental innovation and environmentally derived competitive advantage plays a central role in the model which can be helpful for managers. Managers could capitalise on green design and green processes for its market segmentation strategy, for achieving its financial goals; and at the same time, the resultant environmental performance fulfil its environmental accountability obligations.

### D. Limitations and Future Research

A few limitations of this research are recognised. First, a total of 86 questionnaires were collected from 483 companies. Despite the sample size which is adequate for SEM analysis via Smart PLS 3 software, the response rate is at a relatively low rate which may affect representativeness of environmentally proactive firms in Malaysia. Second, this research employed a survey study that collects perceptual data from managers of targeted companies; hence data collection may possibly subject to common method bias. Future studies could work on triangulate data by using secondary data source to validate the research model included in this study. For example, data could be sourced from environmental reports or websites information of the targeted population. Third, this study implemented a cross sectional survey, however, to evaluate a longer term effects of the proposed research model, further studies could embark on a longitudinal approach. Lastly, this study has taken ISO 14001 certification as proxy of high environmental proactivity and included only ISO 14001 certified manufacturers as population of study. However, following such proxy could have excluded firms which are environmentally proactive but without ISO 14001 certification. Future studies could broaden the population base by employing other methods of identifying respondent companies, for example via examining companies' environmental reports to assess the level of environmental proactivity of firms.

## VI. ACKNOWLEDGEMENT:

This research work is supported by UTAR research fund (IPSR/RMC/UTARRF/2017-C1/L04) supported by Universiti Tunku Abdul Rahman and Putra Research Grant (GP-IPS/2013/9392000) supported by Universiti Putra Malaysia.

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