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The role of Environmental Innovation in enhancing the firm performance

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ABSTRACT--*Company environmental practices are able to create competitive advantage, which in turn enhances their performance. However, environmental practices are expensive and complex to realise the expected benefits, and require effective implementation, thus making them a risky proposition with high failure rate. Thus, it is essential for the company to identify the truly environmental capabilities, for enhancing the company environmental competitive and financial performance. This research aims*
To capitalize the role of Environmental Innovation in enhancing the firm performance. In this study, a total of 124 responses were collected from managers of EMS14001 certified manufacturers in Malaysia, and data was subjected to a structural equation analysis using the Smart PLS version 3.2.7 software. Results endorse environmental innovation as the key enabler for the creation of economic values from environmental management i.e. environmental performance. This is owing to its function as the sole factor that directly contributes to firm performance. Moreover, environmental innovation is also found to be the full mediator that translates benefits of environmental performance into financial performance.

Keywords: *Environmental performance, environmental innovation, financial performance, Malaysia.*

I INTRODUCTION

Business firms are increasingly adopting proactive environmental management as business strategy to address environmental challenges and enable the shift to green market competition. In doing so, it is crucial for these firms to be equipped with environmental capabilities for sustaining firms' competitive capabilities in terms of environmental performance and innovation, which would eventually lead to superior firm performance. However, to date businesses are still uncertain about what kind of environmental capabilities could enhance firm performance. This is because extant empirical research had largely focused on examining direct effects of proactive environmental management on firm performance. Thus, this study examined how dynamic capabilities emerged from proactive environmental practices foster the creation of environmental capabilities that in turn enhances firms' competitiveness and financial performance. Further, the natural resource-based theories have clearly specified innovation as the core factor enabling superior firm performance from environmental management. In view of limited empirical studies in this perspective, this study examined the mediating role of environmental innovation. Literature showed environmental innovation as a robust predictor of firm performance (Chang, 2011; Chen et al., 2006; Chiou et al., 2011; Forsman, 2013; Liao, 2016; Peattie, 2001; Porter & Van der Linde, 1995; Wagner, 2009), and it is taking a mainstream role in literature examining firm competitiveness and firm performance (Dangelico & Pujari, 2010). Likewise, environmental studies also

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concluded a positive correlation between environmental performance and firm performance (Chan, 2005; Clarkson, Li, Richardson, & Vasvari, 2011; Dowell, Hart, & Yeung, 2000; Hart & Ahuja, 1996; Klassen & McLaughlin, 1996; Konar & Cohen, 2001; Russo & Fouts, 1997). As such, environmental innovation and environmental performance constitute environmental competitive capabilities of firms. This is owing to the reason that both the constructs are firm specific, rare, valuable and difficult to be imitated by competitors, thus served as sources of competitive advantage, which in turn enhances firm performance (Hart, 1995; Hart & Dowell, 2011). This study aims to investigate the relationship between firms' environmental performance, environmental innovation and financial performance.

II LITERATURE REVIEW

Effects of Environmental Performance on Environmental Innovation

Environmental performance reflects firms' environmental capabilities generated from environmental strategies implementation as underpinned by the dynamic capabilities theory (Eisenhardt & Martin, 2000; Helfat & Peteraf, 2003; Teece, 2007; Teece et al., 1997). Likewise, Crossan and Apaydin (2010) confirm the role of organizational capabilities as the determinants of innovation. This is due to the fact that environmental performance represents firms' success in implementing environmental mission and strategies, structure and systems, which forms the basis for innovation practices (Crossan & Apaydin, 2010). These environmental routines and processes provide basis for continuous innovations in products designs and production processes targeted at environmental improvements. Further, environmental performance also reflects firms' absorptive capacity (Cohen & Levinthal, 1990; Delmas et al., 2011) as it represents strengths gained by firms from adoptions of environmental practices. Superior environmental performance reflects firms' ability to identify new environmental knowledge, and successfully apply it to improve products and processes.

Empirical studies reported evidences to support contributing effects of environmental performance on environmental innovation. Wagner (2009) conducted a survey based on approximately 2,000 manufacturing firms in Europe and reported a positive association between environmental performance and environmental innovation, both in terms of products innovation and process innovation. Likewise, environmental innovation measured as environmental patents is found to be associated with environmental performance in terms of reductions in toxic pollution (Carrión-Flores & Innes, 2010). In addition, green product innovation was reported to be correlated positively to environmental performance in Taiwanese manufacturing sector (Chiou et al., 2011); and green process innovation was reported to be positvely associated with environmental performance among manufacturing firms in Taiwan (Chen, 2006) and Turkey (Sezen & Çankaya, 2013).

Taken together, this research posits that the greater environmental performance, the better environmental innovation at firm level. On top of existing empirical literature studies are needed to gain evidence across different countries and industries. Accordingly, the following hypothesis is proposed:

H1: Environmental performance is positively related to environmental innovation.

Environmental Performance and Financial Performance

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Underpinned by the NRBV theories (Hart, 1995; Hart & Dowell, 2011), the implementation of environmental strategies results in enhanced resource productivities and lower operational costs as a result of innovations in environmental protections, which in turn enhance financial performance. Numerous empirical studies reported a positive relationship between environmental performance and firm performance (Clarkson et al., 2011; Dowell et al., 2000; Eltayeb et al., 2011; Iwata & Okada, 2011; Long, Chen, Du, Oh, & Han, 2017; Wagner & Schaltegger, 2004; Yang, Hong, & Modi, 2011). Similarly, longitudinal design studies concluded that environmental performance was positively associated with financial performance (Clarkson et al., 2011; Delmas, Nairn-Birch, & Lim, 2015). Empirical studies in Malaysia have also reported evidences for the positive link between environmental initiatives and financial performance (Eltayeb et al., 2011; Lee et al., 2013). On the contrary, numerous empirical studies (Cordeiro & Sarkis, 1997; Rassier & Earnhart, 2010; Sarkis & Cordeiro, 2001; Wagner, Van Phu, Azomahou, & Wehrmeyer, 2002) found a negative relationship between environmental performance and financial performance. In addition, some researchers found no relationship (Iwata & Okada,

2011; Wagner et al., 2002) between environmental performance and financial performance.

Accordingly, despite a small number of studies have reported contrary evidences, the positive link between environmental performance and financial performance at firm level has been validated by a large number of empirical studies including those studies performed based on manufacturing firms in Malaysia. Thus, underpinned by the NRBV, this research posits a positive link between environmental performance and financial performance. However, limited empirical studies have linked environmental performance to firm performance within an integrated model involving environmental innovation simultaneously, thus allowing concurrently testing the effects of both environmental competitive capabilities on financial performance. Accordingly, the following hypothesis is proposed:

H2: Environmental performance is positively related to financial performance.

Environmental Innovation and Financial Performance

Innovation research studies have largely postulated environmental innovation as a core antecedent of firms' financial performance (Chen, 2006; Cheng et al., 2014; Chiou et al., 2011; Cortez & Cudia, 2010; Forsman, 2013; Long et al., 2017; Rennings et al., 2006). 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 (Ambec & Lanoie, 2008; Porter & Van der Linde, 1995); and (2) these firms can differentiate themselves from their competitors, create legitimacy and reputation, thereby increase their total revenues (Ambec & Lanoie, 2008; Porter & Van der Linde, 1995). Empirical studies have reported a positive relationship between environmental innovation and various aspects of financial performance including: turnover and export (Rennings et al., 2006); return on investment, profits, market share and sales (Cheng et al., 2014); changes in return on assets (Aguilera-Caracuel & Ortiz-de-Mandojana, 2013).

As such, underpinned by the natural resource based view (NRBV), this research posits a positive association between environmental innovation and financial performance at firm level. However, limited empirical studies have linked environmental innovation to firm performance within an integrated model

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involving environmental performance simultaneously, thus allowing concurrently testing the effects of both environmental competitive capabilities on financial performance. Furthermore, empirical studies are needed to gain further evidence across different countries and industries as majority of the current studies were conducted based on firms in Taiwan and Western Countries. Accordingly, the following hypothesis is proposed:

H3: Environmental innovation is positively related to financial performance.

Environmental Innovation as a Mediator between Environmental Performance and Financial Performance

Environmental strategies guided by eco-efficiency concept define environmental actions that pay-off financially, thus linking environmental performance to firm performance (Figge & Hahn, 2012; Orsato, 2006; Reinhardt, 1998). According to eco-efficiency concept, firms seeking for economic benefits must operate at an optimum level of environmental performance; and implement their environmental activities in the most efficient manner, with the lowest costs possible, thereby achieving eco-efficiency (Schaltegger & Synnestvedt, 2002; Wagner & Schaltegger,

2004). Underpinned by value based eco-management literature (Figge, 2005; Hart & Milstein, 2003; Reinhardt, 1998; Schaltegger & Figge, 2000; Wagner & Schaltegger,

2004), environmental performance reflects a 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. Whereas, environmental innovation reflects a higher level of eco-efficiency, as its presence indicates firms' focus on market and product development within their environmental management that would likely bring about economic benefits. This is because firms equipped with a high level of environmental innovation are more likely to be able to create market differentiation through innovative products, thereby increasing total revenues (Ambec & Lanoie, 2008; Porter & Van der Linde, 1995). Likewise, green process improvements also contributed to reduction in operation costs resulting from lowered waste from manufacturing activities. Consequentially, firms would need to extend the capabilities generated from their environmental processes and routines into environmental innovation for the benefits of gaining superior financial performance. Accordingly, firms could gain superior financial performance when they take advantage of their strengths in environmental performance and convert the strengths into improved green products design and green processes. Thus, this research proposes the following hypothesis:

H4: Environmental innovation mediates the effects of environmental performance on financial performance.

III Methodology

Based on the discussion above a conceptual framework (Figure 1) connecting the research constructs is developed as below. In addition, Table 1 indicate the research constructs and the operationalization of the constructs based on the past studies.

Research Framework

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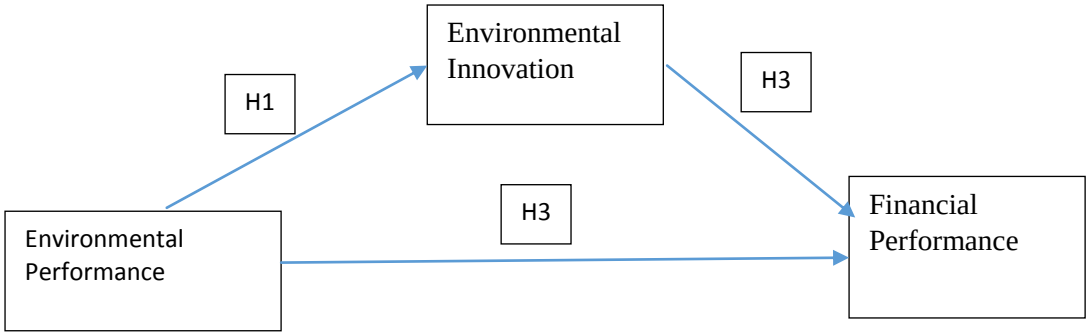

Table 1: Operationalization of Research Constructs and Sources of References

Construct	**Operationalization**	**Source of references**
Financial performance	1. Increases in profit margin 2. Increases in market share 3. Increase in sales revenues 4. Increase in return on investment 5. New market opportunities 6. Increase in overall financial performance	adapted from scales of several authors (Karagozoglu & Lindell, 2000; Rao & Holt, 2005; Rao, 2002)
Environmental performance	1. Reduction of air emission 2. Reduction of waste water 3. Reduction of solid waste 4. Decrease consumption for hazardous / harmful / toxic materials 5. Decrease frequency of environmental accidents 6. Improved environmental situation.	Adapted from the scale developed by Zhu and Sarkis (2004)
Environmental Innovation	Environmental product innovation dimension: 1. Use non-polluting or non-toxic materials 2. Design for recycling, reuse, and decomposition 3. Collect back products after end-of-life for recycling 4. Use environmental friendly packaging for existing and new products	Adapted from scales of several authors: (Chen et al., 2006; Chen, 2008; Chiou

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Construct	Operationalization	Source of references
	5. Use materials that consume lower energies 6. Use materials to the least amount possible 7. Use eco-labeling. Environmental process innovation dimension: 1. Carried out recycle, reuse, and remanufacturing of materials or parts 2. Redesign manufacturing process to lower pollution (air, water, noise) 3. Redesign manufacturing process to lower solid waste 4. Redesign manufacturing process to lower energies consumption (water, electricity, gas, petrol) 5. Redesign manufacturing process to lower material use 6. Use cleaner technologies to make savings (e.g. Energy, water, waste).	et al., 2011; Lin, Tan, & Geng, 2013; Rao & Holt, 2005; Rao, 2002)
Control variable: Firm size	Number of employees of a firm	(Eltayeb et al., 2011; González-Benito & González-Benito, 2005)

Questionnaire

Data gathering was conducted using questionnaire. Questionnaires were sent to respondents in the targeted firms and follow up calls to the respective managers were made for improving response rate. A survey package containing: (i) cover letter address to the targeted respondent of the sample firms, (ii) questionnaire and (iii) a post-paid self-addressed envelope, was sent to every manager in the targeted sample via postal service. In some circumstances, the questionnaire could be sent by fax or e-mail. Multiple telephone calls were made to targeted respondents who had not returned their questionnaire. Replacement questionnaire was provided to those who had missed the previous ones sent to them.

Sample

All ISO 14001 Environmental management system (EMS) certified manufacturing firms (483 to date) in Malaysia were selected as population of study. EMS represents advanced environmental practices by manufacturing firms, as its implementation consumes substantial resources of firms. A certified ISO 14001 EMS

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is not regulatory mandatory for manufacturing firms in Malaysia. However, EMS certification enables a firm to signal to its stakeholders about the quality of its environmental management as well as its commitment in environmental protection. Thus, firms equipped with ISO 14001 EMS reflect a higher level of environmental proactivity with the need to implement proactive environmental strategies.

Pilot test

The questionnaires was first pre-tested by 6 academic staff and then pilot tested by sending it to 20 companies. The questionnaire was then revised based on the feedback of the respondents. A total of 124 survey responses were collected out of 483 questionnaires distributed to all ISO 14001 EMS certified manufacturing firms in Malaysia. The response rate was 25.7%, which was comparable to other firm-based survey studies in Malaysia (Eltayeb et al., 2011; Lee et al., 2013). Further, the sample size of 124 companies is adequate for SEM-PLS analysis as it falls within the acceptable range of the sample size (Hair et al., 1998).

Common method bias and Non-response bias

Harman's single-factor test was performed on the date in order to examine the possibility of common method bias. Findings indicate that the first factor explains 36.99% of the total variance. This indicates the common method bias is not an issue in this study.

An independent t-test was conducted across all constructs in order to assess whether data collected are significantly different among early (18 responses) and late (106 responses) respondents. Results reported non-significance of Levene's values, thus risk of non-response bias is non-critical in this study.

IV Results and Discussion

Descriptive Statistics

Table 2 shows the profiles of the responding companies. Majority of the companies were from electrical and electronics sector (n = 29, 23%), followed by basic metal products, motor vehicles and transport equipment (n = 22, 18%), rubber and plastics (n = 18, 15%), chemicals and chemical products and manmade fibres (n = 16, 13%), and others (n = 39, 31%).

The number of full time employees indicates the relative size of responding companies. Majority of the companies (n = 52, 42%) are smaller in size, with total employees between 200 to 500. Second larger group comes from companies between 200 to 500 employees (n = 41, 33%). The remaining companies are larger in size with a workforce above 500 (n = 31, 25%).

Table 2: Company profiles

Description	**Frequency**	**%**
N = 124		
Sector		
Electrical machinery, radio television & communication equipment, optical equipment	29	23%
Basic metals and fabricated metal products, motor vehicles and transport equipment	22	18%

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Rubber and plastics products	18	15%
Chemicals, chemical products and man-made fibres	16	13%
Others	39	31%
Employees size		
Below 200	52	42%
Between 200 - 500	41	33%
Above 500	31	25%

Table 3 shows the descriptive statistics of measurement items. Results indicate that mean values for all items are ranging from lowest 4.84 to highest 5.15, which confirm the presence of environmental proactivity within the studied companies. All measurement items having Kurtosis and skewness within the normality range of -1.96 to +1.96 (Hair et al., 2010).

Table 3: Data statistics

Constructs	Item code	Mean	SD	Kurtosis	Skewness
Financial performance (FP)	FP1	4.85	0.67	0.489	0.516
	FP2	4.89	0.74	(0.360)	0.425
	FP3	5.07	0.97	(0.789)	0.507
	FP4	4.95	0.91	(0.319)	0.690
	FP5	5.11	0.87	(0.546)	0.391
Environmental performance (EP)	EP1	4.97	0.78	(0.007)	0.159
	EP2	4.96	0.78	0.362	0.280
	EP3	4.85	0.87	0.440	0.750
	EP4	4.94	0.90	(0.077)	0.537
	EP5	4.92	0.85	(0.214)	0.236
Environmental product innovation (ENP)	ENP1	5.05	0.68	(0.419)	0.093
	ENP2	5.15	0.71	0.686	0.599
	ENP3	5.02	0.83	0.255	0.733
	ENP4	4.98	0.93	(0.302)	0.721
	ENP5	5.03	0.88	(0.620)	0.441
	ENP6	5.05	0.74	0.056	0.408
	ENP7	5.07	0.73	(0.155)	0.283
Environmental process innovation (ENC)	ENC1	4.98	0.73	(1.117)	0.025
	ENC2	4.99	0.76	(0.005)	0.466
	ENC3	4.95	0.74	0.318	0.563
	ENC4	4.99	0.93	(0.354)	0.688
	ENC5	4.84	0.79	(0.989)	0.397
	ENC6	4.88	0.85	(0.860)	0.476

Table 4 represents the convergent validity of the research constructs. The factor loadings for all measurement items are ranging from the lowest at 0.731 to the highest at 0.897. Composite reliability values range from 0.877 to 0.920. Average variances extracted range from 0.561 to 0.699. Cronbach's Alpha values range from 0.738 to 0.892. All the three criteria have fulfilled the threshold required for robustness of the structural relationship before further analysis (Hair et al., 2013).

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Table 4: Convergent Validity

Items	Loadings	Constructs	AVE	CR	CA
FP1	0.787	Financial performance (FP)	0.588	0.877	0.826
FP2	0.732				
FP3	0.763				
FP4	0.794				
FP5	0.755				
EP1	0.897	Environmental Performance (EP)	0.616	0.888	0.841
EP2	0.830				
EP3	0.603				
EP4	0.773				
EP5	0.791				
ECS2	0.837				
ECS4	0.790				
ECS5	0.834				
ENC1	0.855	Environmental Process Innovation (ENC)	0.699	0.920	0.892
ENC2	0.806				
ENC4	0.796				
ENC5	0.868				
ENC6	0.853				
ENP1	0.820	Environmental Product Innovation (ENP)	0.561	0.836	0.738
ENP2	0.705				
ENP4	0.737				
ENP7	0.731				

Notes: CR = Composite reliability; AVE = Average variance extracted; CA = Cronbach's Alpha

Table 5 shows the factor loadings and reliability of seconder-order constructs. In this case, environmental process innovation and product innovation are grouped as one constructs namely environmental innovation. Highers loadings were generated that ENC=0.928 and ENP = 0.923. All the three criteria threshold were fulfilled such as AVE = 0.856; CR=0.923 and CA = 0.832.

Table 5: Second order Constructs

First-order constructs	Loadings	Second-order constructs	AVE	CR	CA
ENC	0.928	EN	0.856	0.923	0.832
ENP	0.923				

Notes: CR = Composite reliability; AVE = Average variance extracted; AC = Cronbach's Alpha

Results presented in Table 6 support the establishment of discriminant validity of the constructs. All the constructs have achieved adequate threshold criteria at below 1 (Henseler et al., 2016). This indicates that each construct reflects distinctive concept on its own.

Table 6: Discriminant Validity Analysis

	FP	EP	ECS	ECC	ECM

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FP	**0.767**				
EP	0.458	**0.785**			
EN	0.495	0.558	**0.813**		

Table 7 presents the VIF values generated which were ranging from 1.885 to 2.335. All VIF values fall below threshold value at 5, suggesting no threat of multi-collinearity among constructs (Ringle et al., 2015).

Table 7: Inter-constructs VIF values

	EN	EP	FP
EN		2.335	
EP	2.218		1.885

Results in Table 8 provides the simultaneous testing of structural model. Environmental performance was found to have a positive significant association with environmental innovation (β=, p<). Environmental performance was found to be not significantly associated to financial performance (β=, p<). Environmental innovation was found to have positive and significant relationship with financial performance (β=, p<). In terms of control variables (company size), findings reported that no significant association between financial performance and natural logarithm of number of employees. Findings reported that all paths with above small effect with f^2 effect size > 0.02 (Cohen, 1988). This shows all independents variables (EP, EN and EY) have small contribution toward dependent variables (EN and FP).

Table 8: Results of Hypothesis Testing

Hypothesis	Path	Standard beta	Standard error	t value	p value	Results	f^2	R^2
H1	EP>EN	0.198	0.105	1.881*	0.060	Supported	0.035	0.500
H2	EP>FP	0.256	0.108	2.370**	0.018	Supported	0.063	
H3	EN>FP	0.347	0.092	3.778^{***}	0.000	Supported	0.116	
Control Variable	Log EY>FP	-0.003	0.073	0.345^{NS}	0.965	Unsupported	0.000	0.213

Note: NS= non-significant; *p≤0.1,**p≤0.05, ***p≤0.0001

f^2 or effect size is a measure used to assess the relative impact of a predictor construct on an endogenous construct.

R^2 or coefficient of determination is a measure of the model's predictive accuracy and is calculated as the squared correlation between a specific endogenous construct's actual and predicted values.

The procedures of bootstrapping with 5,000 sub-samples were executed to determine the significant level of hypothesised mediator path (Hair et al., 2013). Table 9 shows that for the path relation EP, EN and FP, EP has a positive association on FP

Table 9: Extracted results of hypothesis testing for indirect effects

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Path	Hypothesis	Indirect effects			Direct effects		Results
		Beta	Standard error	t-value	Beta	t-value	
EP to FP mediated by	H4	0.091	0.044	2.074*	0.057	0.520 NS	Supported

Notes: NS = insignificant; * p < 0.05; FP = financial performance; EP = environmental performance; and EN = environmental innovation.

Environmental Performance and Environmental Innovation

Finding presented in Table 5.9 (xi) provides strong support for H3 (standardised beta = 0.227, p < 0.01). As anticipated, firms' environmental innovation is positively predicted by their achievements in environmental performance through effective environmental protection routines and processes. This result is in agreement to past empirical studies (Chen, 2006; Chiou et al., 2011; Sezen & Çankaya, 2013; Wagner, 2009), which reported a positive association between environmental performance and environmental innovation in terms of products and process innovation Additionally, others reported a positive association between environmental patents and reductions in toxic pollution (Carrión-Flores & Innes, 2010); as well as between environmental responsive behaviour and developments of new products (Pujari et al., 2004)

This result endorses environmental performance as a predictor for environmental innovation. These firms are more likely to be better in environmental innovations when they achieve a high level of environmental performance such as achievements in reducing air emissions, waste water, solid waste, hazardous materials use, and environmental accidents. This is mainly due to the fact that environmental performance reflects strengths in environmental capabilities, such as effective environmental protection routines and processes, superior environmental knowledge, committed environmental goals; that form the resources needed for supporting continuous environmental innovations in products designs and production processes (Crossan & Apaydin, 2010). Furthermore, these firms could have developed a higher level of absorptive capability as superior environmental performance reflects a firm's ability to identify new environmental knowledge, and successfully apply it to improve its green products and green processes (Delmas et al., 2011). As such, achieving superior environmental performance is crucial to the manufacturing firms as it represents key sources of environmental capabilities needed for improving environment innovation. Moreover, the path coefficient shows that environmental performance has a moderately strong driving effect on environmental innovation among environmentally proactive manufacturing firms in Malaysia.

Accordingly, it appears that manufacturing firms with a high level of environmental performance are more likely to achieve superior environmental innovation. In line with dynamic capabilities view (Eisenhardt & Martin, 2000; Helfat & Peteraf, 2003; Teece, 2007; Teece et al., 1997), the reported positive role of environmental performance on environmental innovation provides evidence to validate environmental performance as environmental capabilities among environmentally proactive manufacturers in Malaysia. These

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environmental capabilities eventually form basis of dynamic capabilities that strengthen firms' competitive capabilities in the form of environmental innovation.

Environmental performance and financial performance

H5a: Environmental performance (EP) is positively related to financial performance (FP).

Finding reported in Table 5.9 (xiv) shows that environmental performance has no effects on financial performance (standardised beta = 0.057, $p > 0.05$), and H5a was unsupported. In contrast to prediction, finding of this study discovers that environmental performance does not act as a contributing factor towards financial performance among environmentally proactive manufacturers. These firms are unlikely to gain financial performance directly from their environmental performance such as reduction in air emissions, waste water, solid waste, hazardous materials used, and environmental accidents.

The insignificant result could be attributed to the mediating effects of environmental innovation. According to proponents of value-based eco-management (Figge, 2005; Hart & Milstein, 2003; Reinhardt, 1998; Schaltegger & Figge, 2000; Wagner & Schaltegger, 2004), in most cases, firms with ability to integrate their environmental performance and economic performance are more likely to benefits financially from their environmental activities. This is because continuous improvements in environmental performance do not bring economic success indefinitely (Schaltegger & Synnestvedt, 2002). Environmental investment will lead to a net cost when net benefits from environmental protection efforts have been exhausted. As such, firms' performance is dependent on their ability to generate eco-efficiency, where environmental value and economic value are created concurrently. Environmental performance reflects a 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. In contrast, environmental innovation reflects high level of eco- efficiency, as it indicates a firm's focus on market and product development within its environmental management. As such, firms' financial performance could be enhanced as a result of market differentiation or cost advantage generated through environmental innovation. Consequentially, it matters for firms to convert environmental performance into environmental innovation which serves as a predictor of financial performance.

Finding of this study contradicts with previous researches (Clarkson et al., 2011; Dowell et al., 2000; Eltayeb et al., 2011; Iwata & Okada, 2011; Long et al., 2017; Wagner & Schaltegger, 2004; Yang et al., 2011) who concluded that environmental performance enhances financial performance. Likewise the result is also contradicting with findings of others, who reported a negative association between environmental performance and financial performance (Cordeiro & Sarkis, 1997; Hassel, Nilsson, & Nyquist, 2005; Rassier & Earnhart, 2010; Sarkis & Cordeiro, 2001; Wagner et al., 2002). Nevertheless, despite conflicting results, the studies described have not included environmental innovation construct into their research model. As such, empirical studies so far have not evaluated mediating effects of environmental innovation on the influence of environmental performance on financial performance, thus, could probably subject to deficiency of omitted variable. Mediation analysis presented in Table 5.11, Section 5.5 shows that environmental innovation exerts a full mediation effect on the influence of environmental performance on financial performance. Discussion of mediation effect is presented in Section 5.5.2.

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Accordingly, finding of this study reveals that environmental performance does not directly contribute to financial performance of environmentally proactive manufacturers in Malaysia. The reported non-predictive role of environmental performance on financial performance fails to provide evidence to validate environmental performance as competitive capabilities which enhances financial performance among environmentally proactive manufacturers in Malaysia, as underpinned by the natural resource-based theory of firm performance (Barney, 1991; Peteraf & Barney, 2003).

Environmental innovation and financial performance

Finding presented in Table 5.9 (xv) provides strong support for H5b (standardised beta = 0.400, $p < 0.01$). As anticipated, firms' financial performance is positively predicted by their achievements in environmental innovation. This finding is consistent with previous studies (Chen, 2006; Cheng et al., 2014; Chiou et al., 2011; Cortez & Cudia, 2010; Forsman, 2013; Long et al., 2017; Rennings et al., 2006) which assert that environmental innovation significantly enhances financial performance.

This result confirms that environmental innovation in terms of product innovations and process innovations serve as a dominant contributing factor to financial performance among environmentally proactive manufacturing firms. These firms are more likely to gain superior financial performance when their environmental activities incorporate redesign of processes and products for environmental improvements. This is mainly due to the reason that environmental innovation provides biggest scope for gaining competitive capabilities among environmentally proactive manufacturers. Fundamental change in resource productivities is likely to be gained through process redesign for lower pollution, solid waste, energies, materials used. As well as process improvements for enabling recycle, reuse, remanufacture of parts. These process enhancements in turn bring about lower cost and superior financial performance. Likewise, market differentiation is likely to be gained through fundamental change in product designs for environmental improvements in terms of use of non-toxic materials, eco-friendly packaging, eco- labelling, least materials used, low energy consumption, as well as design for recycling and decomposition. These green product designs and material choices lead to improved green product features and functionality. Improved market differentiation and resource productivity enable these firms to gain superior financial performance. As such, attaining superior environmental innovation is crucial to the manufacturing firms as it represents core sources of competitive capabilities needed for realising eco-efficiency (Orsato, 2006; Reinhardt, 1998), whereby firms could concurrently create environmental value and financial performance. The importance is further manifested by the large positive path coefficient between environmental innovation and financial performance among environmentally proactive Malaysian manufacturers, as reported in this study.

In conclusion, result of this study confirms environmental innovation is a strong predictor of financial performance among environmentally proactive manufacturing firms in Malaysia. Following the resource-based theory of firm performance (Barney, 1991; Peteraf & Barney, 2003), the reported predictor role of environmental innovation on financial performance provides evidence to validate environmental innovation as competitive capabilities which enhances financial performance among environmentally proactive manufacturers in Malaysia.

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Mediation Effect of Environmental innovation between Environmental Performance and financial performance

Table 5.11 presents results of hypothesis testing for the indirect path. For the path relating EP, EN and FP, the findings reported no significant direct association between EP and FP. However, the insignificant relationship is probably due to mediating role of EN, as EP has a positive significant association with EN, and EN has a positive significant association with FP. Findings in table 5.11 concluded a significant indirect effect of EN on the relationship between EP and CA (β=0.121, $p<0.05$), and a significant indirect effect of EN on the relationship between EP and FP (β=0.091, $p<0.05$). The results confirmed the fact that EN is a mediator that fully mediates the effects of EP on CA, and EP on EN, thus providing supports for H6a and H6b.

Environmental innovation as a mediator between environmental performance and financial performance

Findings of mediation analysis presented in Table 5.11 provides strong support for H6b (β=0.091 $p<0.05$). As foreseen, results of this study indicate that environmental innovation exerts a full mediation effect on the relationship between environmental performance and financial performance. This finding is consistent with the proponents of eco-efficiency (Schaltegger & Synnestvedt, 2002; Wagner & Schaltegger, 2004), which posit that environmental performance did not directly influence financial performance. Instead, indirectly channel its influence through environmental innovation, where economic value and environmental value are concurrently created.

Finding of this study shows that environmental innovation functions as a complete mediator that transfers achievements in environmental performance into financial performance among environmentally proactive manufacturing firms. Environmental performance represents firms' successes in reducing environmental impact such as reduction in air emissions, waste water, solid waste, hazardous materials used, and environmental accidents (Chow & Chen, 2012; Delmas et al., 2013). However, 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 (Schaltegger & Synnestvedt, 2002). By transferring strengths in achieving environmental performance into environmental innovation, these firms could probably charge higher price premium for their products with superior green features, thus enhances total revenues (Ambec & Lanoie, 2008; Porter & Van der Linde, 1995). Likewise green process innovation via improved manufacturing and operational processes could probably lower operational costs (Ambec & Lanoie, 2008; Porter & Van der Linde, 1995), thus enhances profitability of these firms. As such, achieving superior environmental innovation is of high importance to manufacturing firms as it functions as a complete mediator that translates capabilities embedded in environmental performance into financial performance.

Accordingly, it appears that manufacturing firms with a higher level of environmental innovation are more likely to gain superior financial performance from its environmental performance. Following the resource-based theory of firm performance (Hart, 1995; Hart & Dowell, 2011; Sharma & Vredenburg, 1998), the reported mediating role of environmental innovation provides evidence to validate environmental innovation as the competitive capabilities derived from environmental management. Further,

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following eco-efficiency concept (Figge & Hahn, 2012; Schaltegger & Synnestvedt, 2002; Wagner & Schaltegger, 2004), finding of this study similarly validated environmental innovation as the enabler of value-based environmental management. These competitive capabilities eventually enhance financial performance among environmentally proactive manufacturers in Malaysia.

Findings included in Table 5.14 showed that the modelled constructs explain substantially variances in endogenous constructs with good predictive relevance. R^2 values were found to be at substantial level for all endogenous constructs: FP (R^2=42%); CA (R^2=36.2%); EP (R^2=54.9%) and EN (R^2=71.2%) (Cohen,1988). Similarly, all values of Q^2 for endogenous constructs were positive, which supported the predictive relevance of the structural model (Chin, 2010). Large predictive relevance was indicated by Q^2 value of each of the endogenous constructs: FP (Q^2 =0.393), CA (Q^2 = 0.320), EP Q^2 = 0.491), and EN (Q^2 = 0.653) (Hair et al., 2013).

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