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**ECO-INNOVATION AND FIRM PERFORMANCE: IS
LEADERSHIP THE GAME CHANGER?**

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Abstract

Environmental concerns have become more prominent than ever. There is a strong need for organizations to immediately shift from the current business as usual attitude. Organizations, as the driving vehicles of economic growth, are expected to lead this new era. Eco-innovations were identified as one of the pillars of change towards sustainable development. The application of eco-innovation will be a crucial factor in achieving sustainable development. Eco-innovation has the ability to help organizations tackle rising environmental issues. Despite the increased popularity of eco-innovation, there is a lack of literature that considers the management's role in the eco-innovation and firm performance relationship. How firms might develop and embed eco-innovations has received little attention. As research concerning eco-innovation converges, there is a need to develop eco-innovation and firm performance models that can be related to organizational factors. Models that deal with strategic, structural and management factors are needed. Most of the current developed models are highly generalized and only few have been adapted to specific markets, segments or industries. Furthermore, models should examine the interaction of internal and external variables in the context of eco-innovation and firm performance. Hence, this paper aims to highlight the gaps in current eco-innovation and firm performance literature. Furthermore, this paper discusses future directions regarding eco-innovation and firm performance model development.

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Keywords: Eco-innovation, firm performance, environmental sustainability, board characteristics, sustainable development. ”

1. Introduction

There are growing concerns over the medium to long term health of the natural environment. For the ten year period, covering 2007 through to 2017, concerns have been raised over the deteriorating natural environment, and finite resource depletion (World Economic Forum, 2015; 2017). The Global Risk Report of 2016 highlighted the evolution of global risks as a result of deterioration of the natural environment. It was found that there is a connection between the increase in global risks and depletion of natural resources (World Economic Forum, 2016). Such is the magnitude of environmental risks, that it is strongly interconnected to a host of other risks such as conflict and migration (World Economic Forum, 2015). Global concerns for the environment also stood out at World Economic Fora (World Economic Forum, 2017). In order to effectively address the concerns raised about the deteriorating environment, there is need for participation from various stakeholders (Seliger, 2007). Examples of stakeholders that would be involved include society, governments (regulators), and management (leadership of organizations) (Joris-Johann et al., 2014). Failure to collectively address and mitigate climate change issues could result in dire consequences to the world population according to the Food and Agricultural Organization (2017).

In order to find solutions towards the deteriorating natural environment and mitigate the induced risks, solutions need to be found by the stakeholders' involved (Rajala et al., 2016). Finding solutions towards arresting the deteriorating natural environment and rapid depletion of finite natural resources presents significant challenges for the various stakeholders involved (Mohsen et al., 2014). Apart from the significance of challenges posed by environmental issues, it has been observed that the stakeholders involved, such as governments and corporates, are failing to reach a consensus towards environmental risk mitigation (Schaltegger et al., 2016). Natural resources, access to fresh water and food security could potentially be compromised for future generations if alterations are not made (Rasul & Sharma, 2016). According to Nidumolu et al. (2009), innovation with sustainability in mind can catalyze changes in technology, organizational structures and enterprise systems. These changes can help to lower organizations' and industry CO₂ footprints, as well as improve social and economic efficiencies (Nidumolu et al., 2009). Another terminology to describe this type of innovation is eco-innovation (Machiba, 2010). Eco-innovation has the potential ability to help organizations tackle rising environmental and ecological issues (Sarkar & Pansera, 2017). Hence, innovation with sustainability in mind (eco-innovation) can potentially mitigate the environmental, economic and social concerns emanating from man-made activities (Dangelico, 2017).

Eco-innovation has been gaining prominence in academia as well as industry, due to its potential (Tariq et al., 2017). Change is needed in order to transform organizations, governments and industries towards sustainability, and the "business as usual" attitude needs to be disposed (Arundel & Kemp, 2009). The emergence of different sets of enablers has also seen eco-innovation rising to prominence. Fragmented niches such as renewable energy policy and carbon trading are buttressing eco-innovations (Zhang et al., 2017). To better understand the eco-innovation, research has focused on identifying the drivers (Doran & Ryan, 2016) as well model these drivers (Tariq et al., 2017). As a result, most models that investigate eco-innovation seek to understand the relationship between drivers of eco-innovation and a proposed outcome, such as performance (Fernando & Wah, 2016). Whilst identifying drivers of eco-innovation is useful, however, the role played by organizational factors such as management has been largely left out in eco-

innovation models (Hermann & Wigger, 2017). The embedding and development of eco-innovations has received little attention (Roscoe et al., 2016). Research needs to explore how organizations could be structured, so as to embed new knowledge into their eco-innovation processes (Watson et al., 2017). This is crucial, as firms ought to include environmental concerns in their organizational activities (Cainelli et al., 2015). Therefore, factoring in the board of directors in eco-innovation models would be useful. In addition, Marsden (2013) pointed out that reflexive corporate governance structures resulted in greater environmentalism. It would then be interesting to note if characteristics of board would influence eco-innovation through enhanced organizational capability. Hence, this paper discusses the various literatures of eco-innovation models that have presently developed. The models are evaluated. How the models attempt to address the shortfall in eco-innovation models which factor in the leadership of organizations is also discussed. Based on the findings, future areas of eco-innovation research are also presented in this paper.

This paper consists of five sections. Section 1 is the introduction. The remaining four chapters are organized as follows: Section 2 states the objectives of the research, as well as the research questions. Section 3 defines the nature of eco-innovation as well as sustainable development. This section also discusses and summarizes the various literature concerning triple bottom line sustainable development and eco-innovation, as well as the factors concerning organizational leadership. Section 4 discusses the methodology utilized by this paper. Section 5 discusses the main findings from the literature review conducted in Section 3. Section 6 then concludes the discussion, offering suggestions for future research directions concerning eco-innovation and firm performance, with suggestions on how organizational leadership plays a role in this future research.

2. Problem Statement

2.1. Definition of Eco-Innovation

From Schumpeter (1942)'s definition of innovation, it can be evident that the scope covering innovation incorporates invention commercialization as well as new combinations of ideas emanating from opportunities for development. Eco-innovation is thus, multidisciplinary, needing to be looked at from different dimensions (social, managerial, and technical). Policy makers, industry, organization leadership as well as other relevant stakeholders are also part of the eco-innovation synergy. Eco-innovation is therefore, a dynamic, interactive and complex process, featuring a number of paradoxes (Hall & Clark, 2003). The term eco-innovation has also been adopted by firms to describe contributions they are making towards sustainable development (Machiba, 2010).

Growing awareness of challenges of environmental sustainability, rising social inequalities and the challenge to be competitive in a global economy have catalyzed the need for change. The growing awareness of the issues mentioned above creates a need for innovative solutions to tackle the challenges. The successful implementation of such innovations assists society to progressively gravitate towards a more sustainable path. Improvements can be made to existing technologies, production methods, and social behavior patterns. Hence eco-innovation can be viewed as an innovation which seeks to improve environmental performance (Long et al., 2017). Such a definition of eco-innovation also makes it critical to grasp the broader context in which this innovation occurs according to Carrillo-Hermosilla (2009). Hence

it is necessary to also understand what environmental performance is, and why it is crucial to the concept of eco-innovation (Long et al., 2017).

2.2. Factors Influencing Eco-Innovation

Environmental performance is based on three categories pointed out by Delmas and Blass (2010). Firstly it's the environmental impact of organizational activities on emission and energy usage. Second is the achievement or compliance by the organization to any environmental regulations set by a regulatory body. Third is installation and usage of treatment or recycling plant by the organization. The third category can be confirmed by analyzing the organization's capital expenditure as well as organizational processes (Delmas & Blass, 2010).

The concept of linking eco-innovation to environmental performance (Delmas & Blass, 2010) was tested by Fernando and Wah (2017):

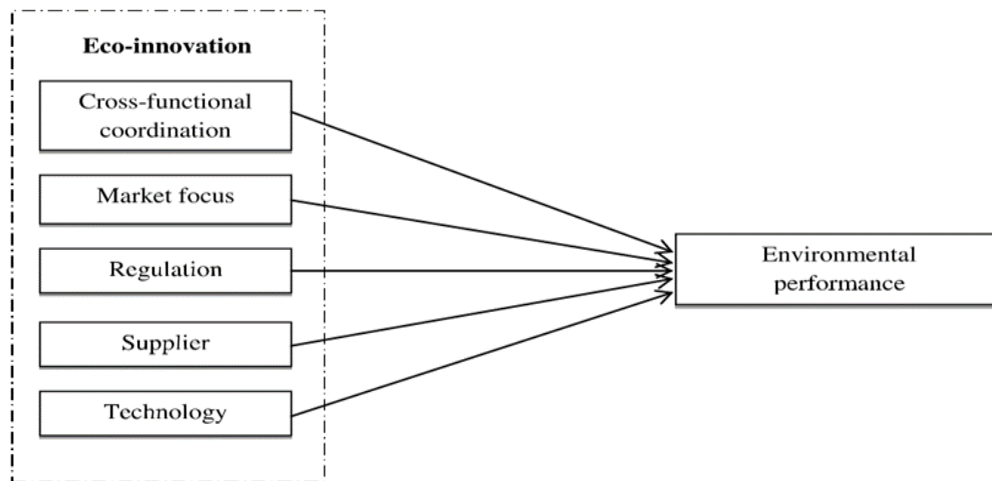


Figure 01. Eco-Innovation Drivers (Fernando & Wah, 2017)

Based on the findings from this model, eco-innovation is indispensable to both policy makers and the organization itself. Companies that adopt eco-innovation are likely to register improvements in environmental performance. However, whilst eco-innovation overall has buttressed improvements in organization's environmental performance, it appears that cross functional co-ordination in particular did not support better performance (Fernando & Wah, 2017). This was attributed to the lack of the necessary structures, management and coordination within the organization. As a result of the lack of the organizational structures, common practices towards sustainability in the organization were not developed (Fernando & Wah, 2017). Therefore, the role of management needs to be assessed, as the organization's leadership is crucial in the transformation towards sustainability (van Tulder et al., 2014).

He et al. (2018) indicated that in the development of eco-innovation, environmental as well as economic objectives are critical. Previous studies that factor in the contextual and organizational factors such as governance structures were insufficient. Eco-innovation tended to excessively focus on the technological eco-innovation aspect, yet leadership, ownership structure and market competition are also able to explain the implementation of eco-innovations. Utilization of a theoretical framework that is not supply-side focused could also explain eco innovations (He et al. 2018).

Díaz-García et al. (2015) highlighted the emergence of eco-innovation as an interesting and insightful area of research for academia. Policy makers, management and industry experts stand to benefit from the emergence and refinement of research in this budding research thrust. However the authors also pointed out that contribution towards eco-innovation studies are currently dominated by developed markets such as United States of America and the European Union. Hence there is a need for contributions from developing and emerging markets (Díaz-García et al., 2015). Contributions from newly industrialized and emerging markets could strengthen the robustness of eco-innovation research. This is because eco-innovation research from emerging markets contexts can factor in regional and location factors, allowing for comparison to take place on a cross-country or market spectrum. Also, the linkage of contexts to methodology is also an area of need for this emerging research. By including and factoring in country specific determinants and characteristics to methodology, this emerging research area is strengthened overall (Díaz-García et al., 2015). Horbach (2014) also stated that innovation is not homogenous nor is it uniformly distributed across geographic and regional contexts. Advanced market effects as well as certain regional infrastructure could influence or impede innovation success. However when it came to environmentally oriented innovations (eco-innovations), the plethora of research that identifies determinants and drivers of eco-innovation neglects regional and geographic factors. This is important as innovation activities are not homogenous in space due to market aggregation effects as well as specific infrastructure and vehicles that may encourage or impede it (Horbach, 2014). In response to these suggestions, Aloise and Macke (2017) conducted a study that sought to understand the eco-innovation drivers and determinants in the context of emerging markets. Strict regulations that sought to address environmental concerns were found to induce eco-innovation.

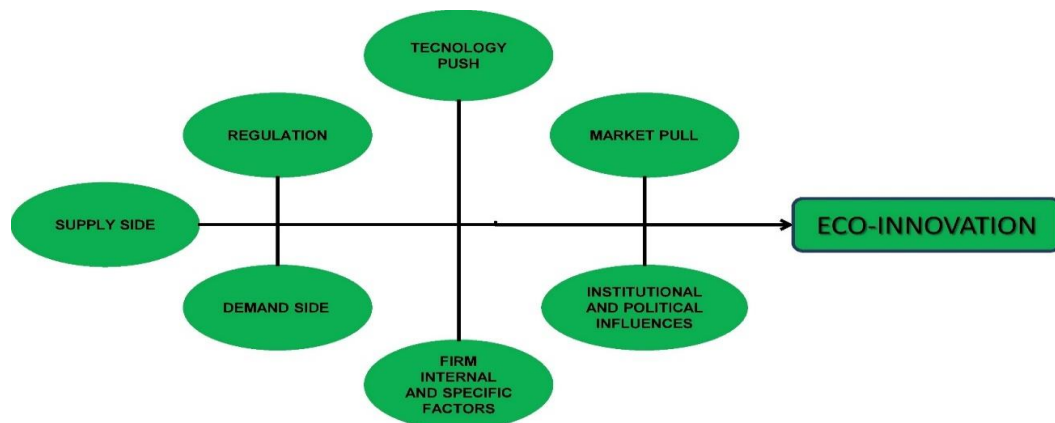


Figure 02. Eco-Innovation Drivers (Aloise & Macke, 2017)

Environment regulation helps to encourage eco-innovations. The encouragement of eco-innovation results in the generation of innovative, environmentally friendly products (Horbach, 2014). Recycling and utilization of wastes from one industry as inputs for another also buttress eco-innovation (Horbach, 2014; Seliger, 2007). However, organizational management and structural factors appeared to impede eco-innovation. This is because where management lacked the necessary capability to eco-innovate, eco-innovation became difficult for organizations (Aloise & Macke, 2017).

The lack of clear corporate governance, and organizational structures that create bureaucratic processes created barriers for eco-innovation. In addition, having management that does not support and

incentivize eco-innovation also impedes organizations from eco-innovating (Aloise & Macke, 2017). Also, bureaucracy harms eco-innovations. This is because decisions need to go through various departments before authorization. A lack of orientation towards innovation also reduces eco-innovation for organizations. Managers, policy makers and academics ought to define and operationalize strategies that aim to induce eco-innovations (Aloise & Macke, 2017). These eco-innovations contribute towards the triple bottom line of sustainability i.e. economic, environmental, and social positive impacts (Aloise & Macke, 2017; Elkington, 1994, 2004).

Doran and Ryan (2016) investigated whether eco-innovation is able to assist firms to create competitive advantages that are sustainable, given the ultra-competitive business environment of modern markets. The investigation was done through identification of key eco-innovation drivers. In particular it was of interest to the investigators to understand how these drivers individually influence the performance of the firms. Internal, as well as external factors exert an influence on the firm's strategic decisions to eco-innovate. Integrating environmental aspects into the business strategy of firms extended benefits to the firm's financial, market as well as manufacturing performance (Doran & Ryan, 2016). Paying attention to the type of eco-innovation is key for a firm's leadership, as it will allow them to align and adapt their organization to their environmental strategies. Future research looking into eco-innovation should consider the internal and external factors. Internal factors, such as capabilities and skills such as management, can be complemented with external factors through organization to organization cooperation (Doran & Ryan, 2016).

For organizations to integrate sustainability drivers such as eco-innovations into their practices, the organizations have to change i.e. the organizational culture. Organizational culture must be changed and geared towards achieving sustainability (Baumgartner, 2009). How organizational culture relates to the sustainable development of organizations has not received the attention it needs. It is important to incorporate sustainability elements such as eco-innovation in the organizational culture. This would assist organizations to successfully develop in a sustainable manner. For environmental innovations and other sustainable development tools to be adopted within the organization's culture, it has to be a part of the leadership's mind-set (Baumgartner, 2009).

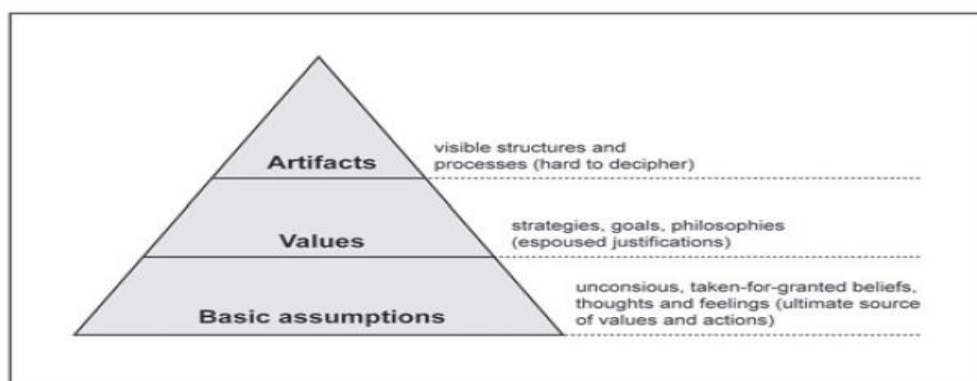


Figure 03. Organizational Culture and leadership (Baumgartner, 2009)

By adopting the above model, Baumgartner (2009) sought to address the shortfall in literature by assessing how organizational leadership, organizational culture and corporate sustainability are related. The

above model enables the use of organizational culture to create corporate sustainability strategies. The model, consisting of three levels, evaluates each strategy. Each strategy is then categorized based on how it relates and integrates to the three levels. For instance, conservative sustainability strategies focus on greening production processes, infusing with the “values” level (Baumgartner, 2009; Baumgartner & Ebner, 2010). Conservative strategies that integrate with the values should minimize waste and emissions; hence they mirror efficient and effective utilization of resources. When these aspects are a part of the corporate philosophy, the mind-set of the leadership should reflect these views (Baumgartner & Ebner, 2010). Hence companies willing to configure themselves towards sustainable innovations and activities need to be aware of their current organizational culture and optimize themselves for eco-innovations accordingly.

Aligning organizational leadership, organizational culture and sustainability strategies helps organizations to minimize greenwashing and hijacked environmentalism. It is also then pointed out that, more attention needs to be addressed towards understanding if sustainable development can catalyze organizational and leadership restructuring i.e. if leadership and organizational culture be aligned towards achieving sustainable development (Baumgartner, 2009). Fernando and Hor (2017) identified deficiencies in models that highlighted the role of management in achieving better environmental performance i.e. lower CO₂ emissions. Amongst the findings of the research, the commitment of the organization’s leadership was one of the identified barriers towards reducing carbon emission from the developing market context. Another barrier was identified as lack of knowledge as well as a lack of awareness towards environmental issues (Fernando & Hor, 2017). This is concerning, as management’s knowledge, awareness and commitment to environmental issues is essential to firms adopting eco-innovations such as improved energy management, which itself assists in lowering CO₂ output.

There appears to be a lag in the adoption of eco-innovations by industry, with a number of organizations displaying a lethargic stance towards eco-innovation. Leadership and organizational commitment to investing into and supporting eco-innovations appeared to be low (Fernando & Hor, 2017). This lack of action by the decision makers needs more investigation. It is recommended by Fernando and Hor (2017) that management fully grasp the importance and value of environmental issues, and conceptualize ways in which they may leverage the firms’ capabilities to eco-innovate. In cases where an organization’s resources are limited, the management ought to at least be trained to be aware of the emerging environmental needs of the markets. Whilst reducing CO₂ emissions is beneficial for the environment, there is also need for models that consider the organization’s decision makers. They are key stakeholders and they can be pivotal in economic and competitive outcomes, making eco-innovations beneficial to other stakeholders such as shareholders (Fernando & Hor, 2017; Shrivastava, 2013).

Doran and Ryan (2016) investigated whether eco-innovation is able to assist firms to create competitive advantages that are sustainable, given the ultra-competitive business environment of modern markets. The investigation was done through identification of key drivers’ product and process eco-innovations. In particular it was of interest to the investigators to understand how these drivers individually influence the performance of the firms. Internal, as well as external factors, exert an influence on the firm’s strategic decisions to eco-innovate. Integrating environmental aspects into the business strategy of firms extended benefits to the firm’s financial, market as well as manufacturing performance (Doran & Ryan,

2016). Paying attention to the type of eco-innovation is key for a firm's leadership, as it will allow them to align and adapt their organization to their environmental strategies. Future research looking into eco-innovation factor in internal capabilities and skills such as management, as these can be complemented with external factors through organization to organization cooperation (Doran & Ryan, 2016).

3. Research Questions

1. What are the models of eco-innovation and firm performance?
2. What research gaps exist in the models of eco-innovation and firm performance?

4. Purpose of the Study

The purpose of the paper was to explore literature that focuses on the eco-innovation and firm performance relationship. The paper analysed models of eco-innovation and firm performance. The paper also sought to identify areas that can be applied in future eco-innovation and firm performance relationship studies.

5. Research Methods

This paper explores the emerging topic of eco-innovation. This paper conducts exploration of eco-innovation through a literature review process. The literature review for this paper was sourced from Science Direct, Wiley, Web of Science, Springer and Google Scholar databases. The use of these databases ensured that the literature review included studies that are relevant. These databases provide a trusted and reliable foundation to conduct literature review as recommended by Xavier et al. (2017). Utilizing this procedure to conduct literature review was also recommended by Diaz-Garcia et al. (2015), Dahan et al. (2017), as well as Watson et al. (2017). Search keywords employed by this paper included "eco-innovation" OR "green innovation" OR "sustainable innovation" OR "environmental innovation" AND "firm performance". The search strings were employed so as to assist in the selection of topics to review by having the above mentioned strings in the title, abstract or keywords. The literature, having been compiled, was assessed and literature that did not feature or discuss models of eco-innovation was filtered out. The included literature featured full text accessibility, and discussed eco-innovation, and firm performance from an empirical study perspective.

6. Findings

A total of 25 papers that mentioned or factored in the role of leadership were extracted from various databases as indicated by the table below:

Table 01. Literature Database

Database	Number
Science Direct	9
Web of Science	2
Springer	3
Google Scholar	6
<u>Scopus</u>	<u>5</u>
Total	25

This paper identified 25 models of eco-innovation. The search of the models was conducted through the above stated databases. The publication dates ranged from the year 1994 to the year 2017. The first mention of eco-innovation can be traced to the year of 1994 viz-a-viz environmental or “green” innovations, as a result of the research by Green et al. (1994), Hart (1995) as well as Porter and Van der Linde (1995). Eco-innovation itself as a main concept begins to gain traction in the 2000’s with research coming from Rennings (2000). Science Direct as well as Google Scholar provided the majority of eco-innovation papers analyzed by this paper. Papers from Scopus journals also featured prominently in this paper. The number of papers analyzed is due to the limited number of eco-innovation papers that discuss or factor in the role played by the organization’s leadership. Most papers on the above stated databases discuss drivers of eco-innovation. Most literature also look to investigate how eco-innovation relates to the environmental performance of the firm. Therefore there is an abundance of literature that seeks to establish a linkage on the direct relationship between eco-innovation and environmental performance of the firm. For instance studies conducted by Fernando and Wah (2017) as well as by Long et al. (2017) found that eco-innovation was a sufficient predictor of the firm’s environmental performance. The driving factors of this prediction were influenced by a number of “drivers” of eco-innovation such as regulation, market focus, and technology. Hence, regulation, market focus and technology are key to firms’ eco-innovating, leading to better environmental performance (Fernando & Wah, 2017). However, whilst Fernando and Wah (2017)’s research as well as research by other scholars (Chen & Holden, 2017; Long et al., 2017) establish clear relationships between eco-innovation and firm performance, much of the research does this linearly. The researchers also point out the dearth of literature that investigates the effects of other variables, especially during predictive relationships (Hair et al., 2016).

In terms of the keywords employed for this paper, the table below highlights the number of journal publications matching these research keywords

Table 02. Search Keywords

Database	Number
“Eco-Innovation”	11
“Green Innovation”	1
“Environmental Innovation”	5
“Sustainable Innovation”	8

A key characteristic for classifying the literature of this paper was that the research keywords had to be linked to firm performance. This was necessitated as Briner and Denyer (2012) stated that evaluating literature is a useful step when conducting a literature review. Evaluation of prior literature can be done on a number of bases such as criteria, study types, and frameworks adopted (Briner & Denyer, 2012).

One of the most contentious issues in the research concerning eco-innovation is how to define this very concept (Carrillo-Hermosilla et al., 2009). This situation has arisen as interest, attention and focus begins to be directed towards eco-innovation (Kiefer et al., 2017). Eco-innovation and environmentally inclined research is fragmented in terms of a universal definition of the innovations that tackle environmental issues (Karakaya et al., 2014). As eco-innovation research gains ground, a more holistic definition of eco-innovation will suffice, due to convergence of terminologies (Faria & Andersen, 2017).

Eco-innovation dominated the keywords search for the literature analyzed by this paper, followed by sustainable innovation and environmental innovation. A number of scholars have also come across different terminologies concerning innovations that address environmental concerns according to Prieto-Sandoval et al. (2016) and Iñigo and Albareda (2016). This difference in terminologies can be explained by the fact that research concerning environmentally oriented innovations has proposed several models. These models, although carrying different terminologies, have helped enhance a deeper understanding of the dynamics involved in eco-innovations. As the need for organizations to be more sustainable increases, it becomes increasingly critical for organizations to understand eco-innovations more efficiently and define them accordingly (Xavier et al., 2015). A recurring theme across the various literature is the lack of models including leadership, as it could potentially be the difference maker in eco-innovation as was partially discussed by Reyes-Santiago (2017), Peng and Liu (2016) as well as Fernando and Hor (2017).

7. Conclusion

Firms need to devote more attention to issues of eco-innovation. This paper identified and analyzed 25 eco-innovation and firm performance models through a literature review. Models that did not consider the organization management and structures were excluded. Based on the analysis conducted on the models several gaps were identified. Firstly, despite the increase in popularity on eco-innovation, most of the published models still exclusively investigate eco-innovation and firm performance linearly. Eco-innovation drivers and how they impact firm performance dominates much of research (Hojnik et al., 2017; Tariq et al., 2017). Identification of eco-innovative drivers is helpful in explaining firm performance (Lee & Min, 2015). However identifying the role played by organizational factors such as management would enable researchers to further explain the eco-innovation and firm performance relationship (Huang & Li, 2017).

Secondly, management commitment is critical towards firms achieving the desired results from firm performance (Fernando & Hor, 2017). Management, at the very least, needs to be aware of environmental issues so as to optimize firm performance. Therefore, it would be interesting for future research to develop eco-innovation and firm performance models that measure the commitment of the organization's leadership to environmental sustainability.

Thirdly, research on eco-innovation continues to be dominated by contributions from developed markets such as the European Union and United States (Chareonpanich et al., 2017). Eco-innovation

models and results cannot be generalized. There is need to consider geographic and regional factors when developing eco-innovation research in different contexts (Del Río et al., 2016). Therefore, it would be interesting to develop models that are specific to the local and regional factors. It would also be interesting to compare and contrast the differences and/or similarities between models developed in highly industrialized contexts vs those developed in the developing world.

Fourthly, organizational processes and behaviors reflect the nature and culture of the leadership (Baumgartner, 2009). The degree to which environmental sustainability such as recycling is practiced in the organization depends upon the culture established by the leadership of the organization (Baumgartner & Ebner, 2010). The need for an organization to infuse corporate sustainability is key for its survival in the modern business environment (Engert et al., 2016). Therefore, future research could also investigate the key factors that management can utilize to drive the integration of eco-innovation and environmental sustainability within the organization's culture. This research can be done qualitatively so as to identify some of the tools and communication processes used as suggested by (Engert et al., 2016).

Lastly, Hair et al., (2016) indicated that in most model relationships, researchers investigate linear independent/dependent variable relationships. However, theory indicates that model relationships are far more complex. Independent/dependent variable relationships often involve some degree of intervention or moderation, viz-a-viz mediating and moderating variables. The inclusion of management decision parameters might assist organizations to understand how eco-innovation could provide better financial success. For instance (Severo et al., 2017) found that the relationship between eco-innovation and firm performance was moderated by the size of the organization. Therefore, developing models of eco-innovation that integrate leadership understanding and perspectives would be useful towards understanding eco-innovations. The inclusion of an organization's board of directors as a moderating variable would be interesting.

As the movement towards sustainable markets becomes inevitable (Ghisetti & Rennings, 2014), firms need to orient themselves towards eco-innovation. Eco-innovation could be a difference maker and even be a strategic tool that yields firms a competitive advantage in the increasingly ultra-competitive markets (He et al., 2018). Firms should prepare themselves by transitioning to sustainability oriented enterprises (van Tulder et al., 2014). Hence, it would be interesting if future research could incorporate leadership of organizations as interaction variables in developing eco-innovation models. This would be interesting as eco-innovation business models design and management has been stated as being crucial in allowing sustainable development.

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