

Identifying Research Gaps and Developing a Nomological Framework on Green Innovation and Competitive Advantage

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ABSTRACT

The main objectives of the article are to identify research gaps on green innovation and competitive advantage and develop a nomological framework. The desk research strategy used to achieve the objectives. The literature survey was based on the articles which were found in databases such as Emerald, JSTOR, Scopus, EBSCO Host, Oxford University Press, Sage, Research Gate, and Wiley Online Library, from the year 2000 to 2022. 500 articles were rejected grounding that those are not directly relevant to the field of green innovation, available without full text, and not scientific. 84 articles were selected as the sample of the study. 10 research gaps were identified and among them, two gaps (1 and 2) were considered as empirical gaps while the other five gaps (3,4,5,6,and 7) were theoretical gaps. The last three gaps (8, 9, 10) were contextual gaps, sector-wise (service sector) gaps, and methodological gaps. Based on the identified research gaps, a nomological network was developed for further empirical studies. This study is limited to conceptual model development; however, shade a new light on green innovation by injecting a theoretical perspective into the emerging field of green innovation. This study donates an important contribution to the body of knowledge on green innovation because it addresses significant knowledge gaps amongst relationships and the effects of identified variables, which have not been previously discovered. Further, it has presented vibrant contributions to managers of the apparel industry and policymakers to depth-understanding of the concept of green innovation and competitive advantage.

Keywords – Competitive Advantage, Desk research, Green Innovation, Nomological Framework, Research Gaps.

INTRODUCTION

Way to achieve the development aims of the firms, the different economic development activities of human beings create many environmental problems. When environmental degradation becomes one of the severe threats to people survival in the future, an increasing number of organizations have identified green innovations as a way to achieve both environmental consideration and economic growth. Green innovation is the new or modified products and processes, including technology, managerial, and organizational innovations, which help sustain the surrounding environment [1],[2].Further, green innovation is defined as the hardware or software innovation related to green products or processes [3] and some others suggest that green innovation consists of technical improvements or new administrative practices that improve the environmental performance and the competitive advantage of an organization[4],[5].

On the other hand, green innovation courses firms to gain competitive advantages in different aspects

through product differentiation, cost reduction, and product customization. According to [6] the competitive advantage of a firm is generally known by its advantages of low cost, the superiority of managerial capability, profitability, and a first mover advantage. Moreover, being a pioneer in green innovation enjoy better performance and first-mover advantages while charging a higher price, enhancing their corporate image, and expanding into new markets [3],[7].

However, not enough theoretical and empirical arguments in the field of green innovations and still it is an emerging field. Specially, in the Sri Lankan context, only a few studies were done by the researchers. Therefore, the authors intended to do this study with the main objectives of identifying research gaps in the literature on green innovation and competitive advantage and developing a nomological framework. It will motivate future researchers to carry out their research studies so that the existing body of knowledge of green innovations and competitive advantage gets expanded significantly.

OBJECTIVES OF THE PAPER

Specifically, this paper attempts to achieve the following four objectives:

- To identify the literature on concepts of green innovation and competitive advantage.
- To review the relationship between green innovations and competitive advantage.
- To identify research gaps in green innovation and competitive advantage.
- To develop a nomological framework to present the relationship between green innovations and competitive advantage.

METHOD

The desk research strategy was used for the study since it is the most suitable method for this sort of study to achieve objectives. An extensive literature survey was carried out to achieve the first, second, and third objectives. The literature review is the strongest foundation of research that can be built in the mind of the researcher [8].

This study has followed a three-step process. 1. The review was planned; 2. The screening criteria were set out and 3. The data were extracted. In the first steps, articles were collected using the search strings “green innovation”, “eco- innovation”, and “environmental innovation” in the title and keywords of the articles. Based on the above key terms, articles were downloaded from the year 2000 to 2022. The downloaded publication types include journals, and conference proceedings. Articles were found in databases such as Emerald, JSTOR, Scopus, EBSCO Host, Oxford University Press, Sage, Research Gate, and Wiley Online Library.

In the second step, criteria were specified to screen the data.; (A) the articles published from 2000 to 2022, (B) the articles in the English language, and (C) articles with a primary focus on green innovation. In the Third step, 500 articles were rejected grounding that those are not directly relevant to the field of green innovation, available without full text, and not scientific. Finally, 84 articles were selected as the sample of the study.

LITERATURE REVIEW

In this section first, review the concepts of green innovation and competitive advantage. Then, intended to review the relationship between these two concepts.

1. Concept of Green Innovation

Currently, than the early couple of decades, organizations started to pay attention to regarding the environmental impact of their organizational activities. As reference [9] mentioned that, “nowadays, it is widely recognized that integrating environmental and sustainable practices into a firm’s competitive strategy represents a crucial issue due to the increasing pressure from social, environmental and political forces”.

According to the literature the meaning of the term “Green” or “Greening” has four aspects: (1) the natural environment is to be conserved, (2) the natural environment is to be preserved (3) the pollution of the natural environment is to be avoided or minimized, and (4) gardens and looking-like natural places are to be created [10]. Green innovation is often referred to as environmental innovation, eco-innovation, and sustainable innovation. Green innovation is defined as the hardware or software innovation related to green products or processes [3] and some others suggest that green innovation consists of technical improvements or new administrative practices that improve the environmental performance and the competitive advantage of an organization [4],[5]. To adapt to the environmental practices, organizations design new processes, products, develop new technologies, and management strategies that are aimed to increase effectiveness. While some authors mentioned that green innovation contained green product innovation and green process innovation [11], others included managerial innovation too [12].

Green product innovation is the production of a new product or service that causes no negative impact on the environment or less than the current or competing product [13]. As, reference [3] mentioned, many studies on green product innovations focus due to many reasons as, most manufacturers have adopted the concept of green to reduce undesired waste in the production process, increase input efficiency, and be more competitive. Green product innovations come out with some big improvements to current products or changes in materials, components, and other characteristics that better the performance. As a result of it, decrease of toxic components within products, decrease of emissions and energy consumption during product usage, increase of the useful life of products, including recycling schemes for products[14]. Moreover, green product innovations help to differentiate firms from their rival’s products [15].

Green process innovation is the improvement of existing production processes and the use of environmentally friendly technologies to produce goods and provide services that impose no or reduced negative impact on the environment [13]. Some other scholars supported this idea by mentioning as green process innovation activities help companies to reduce environmental effects with the development of current production facilities or by adding some new processes [16].Consequences of green process innovation, can be achieved in energy saving, pollution prevention, waste recycling, or hazardous materials prevention in the production process [3].

Managerial innovation is the “formulation of green objectives and strategies for achieving green innovation should be aligned with daily operations and a specific budget for green innovative thinking.” [17]. Further, they explained managerial innovation is signifying a firm’s ability to formulate green projects and all the green projects with suitable programming and resources of budget allocation such as redefining operation and production processes to ensure internal efficiency that can help to implement green supply chain management and re-designing and improving product or service to obtain new environmental criteria or directives.

Table I Definitions for the Concept of Green Innovation

Author(s) and year	Definitions	Common characteristics
Chen et al., (2006, p.534)	“As hardware or software innovation that is related to green products or processes, including the innovation in technologies that are involved in energy-saving, pollution-prevention, waste recycling, green product designs, or corporate environmental management.”	-green products or processes innovation. -negative environmental impact.
Arundel et al., (2009,p.5)	“Innovations with lower negative environmental impact than relevant alternatives. The innovations may be technological or non-technological (organizational, institutional, or marketing-based)”.	-negative environmental impact. -technological and organizational, institutional, or marketing-based innovation.
Conding et al., (2013)	The innovation that an industry carries out and involved in energy-saving, pollution, prevention, waste recycling, green product, and process designs, and corporate environmental management	– green product, and process designs. -corporate environmental management
Weng et al., (2015)	Green innovation is the new or modified products and processes, including technology, managerial, and organizational innovations, which help sustain the surrounding environment.	-products and processes, technology, managerial, and organizational innovations.
Song and Yu, (2018)	The hardware or software innovation related to green products or processes.	Green products and processes.
Ilvitskaya and Prihodko,(2018).	The new or modified products and processes, including technology, managerial, and organizational innovations, which helps to sustain the surrounding environment.	Products and processes, including technology, managerial, and organizational innovations.
Wong et al., (2013); Lin et al., (2014) cited in Soewarno,et al., (2018)	Green innovations refer to various innovations that allow the reduction of adverse impacts on the environment so as to provide a great opportunity for firms to achieve environmental performance targets and benefits.	-Reduction of impacts on the environment. -achieve environmental performance.
Russo (2003); WCED (1987) cited in Galbreath (2017)	An effort to reduce the impacts of business activity on the natural environment, in order to protect and preserve natural capital for current and future generations.	-reduce the impacts on the natural environment. – protect natural capital.
Wang (2019)	Green innovation includes the development of green products and green processes that modify an existing product design to reduce any negative impact on the environment during any stage of a product’s life cycle	-green products and green processes. – reduce any negative impact on the environment.

Chiou et al., (2011).	Green innovation is actions regarding environmental objectives such as eco-design, prevention of pollution, energy-saving, and wasterecycling.	-actions regarding environmental objectives.
Ar (2012)	all the measures taken by relevant stakeholders to promote the development and application of improved or new, process, products, techniques and management systems that contribute to negative environmental impacts and attain specific ecological goals	-improved or new, processes, products, techniques and management systems. -negative environmental impacts.
Chen et al., (2006)	Green innovation is a novelty used in technologies that incorporate energy saving, pollution prevention, waste recycling, green product designs and corporate environmental management.	– novelty used in technologies -actions regarding environmental objectives.
European Union Environmental Innovation Observatory cited in Skordoulis (2022)	The introduction of a new or significantly improved product, service, process, organizational change or marketing solution that can reduce the use of natural resources and the release of harmful substances throughout its life cycle.	-improved product, service, process, organizational change or marketing solution. – reduce the use of natural resources. – and the release of harmful actions
Lin et al., (2014) cited in Gürlek and Tuna,(2006)	innovations in products and production processes in order to reach the environmental objectives and decrease the ecological footprint throughout the lifecycle of a product	-products and processes. -environmental objectives
Rennings (2000) cited in	Green innovation is the improvement of products or processes which reduces environmental burden or achieve sustainability targets	-improvement of products or processes. -reduces the environmental burden.
Wong et al., (2012), cited in Singh et al., 2021	Green innovation refers to improved products or processes using environmentally friendly technologies in the production processes that negatively impact the environment.	-improved products or processes. – negatively impact the environment

<p>Oduro, et al.,2021</p>	<p>as a subclass of innovation associated with green products or processes, marketing techniques, organizational structures and systems or technologies that improve not only environmental performance but also the economic performance of innovators.</p>	<p>-products or processes, marketing techniques, organizational structures and systems or technologies. -environmental performance. -economic performance.</p>
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According to the table 1, almost all definitions were discussed regarding product and process improvements. Some other definitions included technological, organizational, managerial innovations, institutional, or marketing-based innovations. Specially, 100% of the definitions highlighted the reducing negative impact on the environment while few of the definitions talked about environmental performance and reducing the use of natural resources. Accordingly, researchers identified five important aspects in the different definitions:

1. Innovation object (Product, process, technological, organizational, managerial innovations, institutional, or marketing-based innovations)
2. Environmental friendly products.
3. Pollution management.
4. Natural resource management.
5. Clean technologies.

B. Concept of Competitive Advantages

The concept of competitive advantage was started to discuss six decades ago. Ansoff (1965) was the first text to use the concept of competitive advantage on corporate strategy [18]. Competitive advantage refers to the situation whereby a firm has a superior position in the market. As [19] and [6] defined competitive advantage as “a company occupies some position where the competitors cannot copy its successful strategy and the company can gain sustainable benefits from this successful strategy”.

Competitive advantage includes the four factors: (1) the ability to create customer value, which creates real marketing potential; (2) operational scalability via business processes and firm structure; (3) business sustainability, including investing in leadership and innovation training, to mitigate risks and generate strength and (4) positive financial net performance, achieved through focusing on value and reducing complications [20]. In that sense, green innovation course firms gain competitive advantages in different aspects. For Instance, product differentiation, cost reduction, and product customization. As reference [6] explained the competitive advantage of a firm is generally known by its advantages of low cost, superiority of managerial capability, profitability, and a first mover advantage. With respect to firm differentiation, firms can add more features to the product and reduce pollution which may increase the demand for a firm’s products from environmentally sensitive consumers. “A differentiation strategy is a business strategy used to achieve competitive advantage by providing customers products or services which are unique, different and distinct from products or services of their competitors may offer in the market” [21]. Through differentiation strategy, the firm has several advantages that are helpful in developing a unique niche within an industry. However, there is less supportive literature to show that firm’s green innovations are considered as a differentiation strategy [22]. As reference [23] found that “besides reducing production costs and avoiding liability costs, green innovation may represent a source of differentiation advantage and may allow the firm to increase market share and its revenue”. With respect to low cost strategy, as shown in literature [3],[24] because of inefficient use of resources pollution happened and through green innovation, firm can increase their productivity and reduce the environmental cost [12].

On the other hand, being a pioneer in green innovation enjoy better performance and first-mover advantages while charging a higher price, enhancing their corporate image, and expanding into new markets [3], [7]. As in [25] mentioned Innovations are essential to the survival of firms and a weapon to achieve competitive advantage. Among innovations, green innovations are more critical to gain competitive advantages. In literature, green product and process innovation performance of a company have a positive effect on competitive advantage [3],[26].

According to [27], green product innovation has a statistically significant positive impact on competitive advantage. In [28] have similar findings that green innovation addresses sustainability issues (social, economic, and environmental) and enhances organizational competitive advantage. In the literature, green product and process innovation performance of a company have a positive effect on competitive advantage [3],[26].

Table II Definitions for the Concept of Competitive Advantage

Author/s and year	Definitions	Common characteristics
Barney(1991) cited in Tu and Wu (2020)	Competitive advantage means an enterprise gains more profits or benefits than its competitors in terms of cost, technology, brand, management, and so on.	– gain profits or benefits than its competitors.
Barney, (1991),cited in Cao et al., (2021)	An enterprise has a competitive advantage when it can implement a value creation strategy that other existing and potential competitors have not adopted.	-value creation strategy that competitors have not adopted.
Chen, et al., (2009, p. 334)	“a company occupies some position where the competitors cannot copy its successful strategy and the company can gain sustainable benefits from this successful strategy”	– Strategy that competitors cannot copy.
Chang (2011)	Competitive advantages is defined as a condition which competitors are not able to replicate its competitive strategies executed by the company, nor are competitors able to acquire the benefit that the company obtains by means of its competitive strategies	– Not able to replicate firm competitive strategies. – Benefits that the company obtains.
Hesterly and Barney (2008) cited in Mady et al., (2021)	Sustainable Competitive advantages defined as the ability of the firm’s resources to continue to achieve an economic value that exceeds the economic value of its rivals.	– exceeds the economic value of its rivals.
Prajogo and McDermott (2008), Kuo et al., (2022)	Competitive advantage can be defined as the ability of a company to achieve an advantage in performance or different competitive priorities (e.g. cost, quality, or flexibility).	– Ability to achieve an advantage.
Kuo et al., (2022)	Greencompetitive advantage as a leader in the hospitality industry, where environmental management, sustainability, and green innovation are at the forefront of their business models and competitors cannot successfully replicate these environmental strategies.	-Competitors cannot successfully replicate environmental strategies.
Fatoki (2021)	Competitive advantage refers to the situation whereby a firm has a superior position in the marketplace.	– A situation which is create superior position in the marketplace.

Empirical Evidence of Relationships between Green Innovation and Competitive Advantages

Innovation is a component of competitive advantage that makes exceptional and statistically significant contributions for predicting customer satisfaction [29],[27]. They found that green product innovation has a statistically significant positive impact on competitive advantage. Some other Studies show that adopting a green innovation strategy increases a firm's competitive advantage [30], [31]. Moreover, in 2006, [3], found that the performances of green product innovation and green process innovation were positively correlated to the corporate competitive advantage.

Reference [22], revealed that green product innovation and green process innovation of a firm can be considered differentiation strategy in order to achieve sustainable competitive advantage. In the recent study of [32], they discussed the concept of green competitive advantage as collective learning and abilities to innovate environmentally sustainable products for ecological management, which positively influence enterprise ability to be capable to design green products and process innovation.

As [33] found that, green innovation activities have a significant effect on a company's environmental performance and competitive advantage. According to another study, making aware of suppliers affects green innovation positively and also green innovation has an effect on environmental performance and competitive advantage [25]. Further, [34] indicate that green innovation performance mediates the effect between Green Information System and competitive advantage. Accordingly findings of early researches, there is a significant Positive Influences of Green Innovation on Company Performance. Thus, green innovation can be considered as a strategy in order to achieve sustainable competitive advantage.

As [35] in year 2022 did a research in Greece medium and large-sized firms and they indicated that the mediating role of firm strategies in the relationship between green entrepreneurship, green innovation, and competitive advantage is confirmed. As [36] found that green innovation acted as a full mediator of the effects of green organizational culture on competitive advantage. Reference [37] stated that in a low environmental uncertainty, dynamic capabilities play a full intermediary role between Green innovation strategy and sustainable competitive advantages. However, in a high environmental uncertainty, dynamic capabilities have no mediating effect between green innovation strategy and sustainable competitive advantages. According to [38] in year 2021, empirical results showed that both formal (e.g. government support) and informal (e.g. social legitimacy) institutions positively influenced corporate competitive advantage. Further, green innovation acted as a mediator in the relationship between external institutions and competitive advantage. The study by [26] shows its empirical results that green product innovation mediates the positive relationship between corporate environmental ethics and competitive advantage, but green process innovation does not. According to [39] the relationship between products innovation and green processes and the achievement of competitive advantage is significant, but [32] indicated that although the environmental orientation is a key factor of green innovation, its direct role toward green competitive advantage is not so strong. Accordingly, Green innovation has paid a successful mediating role between green entrepreneurship and competitive advantage, culture and competitive advantage, external institutions and competitive advantage, corporate environmental ethics and competitive advantage. Moreover, the aforementioned empirical evidence showed that, government support and social legitimacy should be promoted in order to stimulate competitive advantage.

ANALYSIS AND FINDINGS

Table III consists of two main variables including green innovation and competitive advantage. Four rows of table III indicate four types of variables independent, dependent, mediating and moderating variables. It shows how green innovation and competitive advantage have been used in previous studies.

Variables	Green innovation	Competitive advantage
Independent	Weng et al., (2015), Sezen (2013), Tang et al., (2017), Turulja and Bajgoric(2018), Tepe and Pinar (2015), Feng and Chen (2018), Asadi et al., (2020), Xue (2019), Chen et al., (2006), Chu et al., (2018), Ma et al., (2018), Lukitaruna and Sedianingsih (2018), Xie et al., (2019), Wang et al.,(2021), Somarathna (2020), Arenhardt et al., (2016), Chu et al.,(2018), Mady et al., (2021), Muangmee et al., (2021),	No one uses competitive advantage as an independent variable.
Dependent	Zhang and Zhu (2019), Soewarno (2018), Galbreath (2017), Li et al., (2017), Yousaf (2020), Huang et al., (2015), Guo et al., (2020), Zhang & Zhu (2019),	Mady et al., (2021). Kuo (2021), Ghaith (2020), Wang (2019), Chen et al., (2006), Somarathna (2020), Zameer et al., (2020), Cao et al., (2021), Conding (2012), Nanath and Pillai(2017), Skordoulis, et al., (2022), Gürlek & Tuna(2018), Ge et al., (2018), Dong et al., (2022), Arenhardt et al.(2016), Qiu et al., (2019), Mady et al., (2021), Kuo et al., (2022)
Mediating	Leonidou et al., (2015), Novitasari and Agustia (2021), Su(2020), Rossi (2020), Wang et al., (2021), Chu et al., (2018), Seman et al., (2019), Wang (2019), Huang and Li (2015), Seman et al., (2018), Chen (2008), Tjahjadi(2020), Conding et al., (2013), Zameer et al., (2020), Skordoulis, et al., (2022), Gürlek & Tuna(2018), Dong et al., (2022), Li et al., (2016), Guo et al., (2020), Abu et al., (2019), Singh et al., (2021), Kuo et al., (2022)	No one uses competitive advantage as a mediating variable.
Moderating	No one use green innovation as a moderating variable.	No one uses competitive advantage as a moderating variable.

Gap 1: According to table III, the construct of green innovations has been used by different scholars for different purposes. It means, many researchers have used green innovations as an independent variable as well as a mediating variable. But, few authors have used it as a dependent variable for their studies. The other main variable i.e. competitive advantages have been used only as the dependent variable. It means that every researcher has labelled competitive advantages as a dependent variable for their studies. Findings show that no one has used competitive advantages as an ‘independent variable’ or ‘mediating variable’.

Therefore, a research gap can be created by positioning the main variables for future studies. It highlights a lack of theoretical and empirical evidence for considering competitive advantages as a mediator.

Gap 2: Generally, the moderating variable influences the strength of the relationship between two other variables. Besides independent, dependent, and mediating relationships, there may be another kind of moderating variable between these two variables. According to the Resource-based view, competitive

advantages can be gained with unique and non-imitable resources. Therefore, it is wise to see firm resources as a moderator between green innovations and competitive advantages. As [27] found in their study on the topic “Green product innovation and competitive advantage: an empirical study of chemical industrial plants in Jordanian qualified industrial zones”, that “firm resources” has a statistically significant positive moderation effect on the relationship between green product innovation and competitive advantage.

It seems that there is a lack of theoretical argument and empirical evidence with regard to firm resources as a moderating relationship between green innovations and competitive advantage. Therefore, it is worth studying this kind of relationship in different country contexts and different industries.

Gap 3: According to the review of seminal papers (table IV), previous researchers have not focused on moderating the effects of green innovations on the relationships between firm resources and competitive advantages. No theoretical arguments exist with regard to the moderating effects of green innovations on firm resources and competitive advantages. Moreover, no empirical evidence is available in existing literature with regard that green innovation moderates the relationships between firm resources and competitive advantage.

Therefore, it can be identified as another research gap, i.e. moderating the relationship of green innovations between firm resources and competitive advantages.

Gap 4: There is no theoretical argument as well as empirical evidence in the existing literature with regard to the mediating effects of competitive advantages. Available studies have used competitive advantages only as the defendant variable.

Therefore, future studies can build a theoretical argument by taking competitive advantages as mediating variable between green innovation and firm performance. Further, they can empirically test the relationship locally and internationally as well.

Gap 5: Empirical evidence lacking in the past studies done locally and perhaps internationally too, with regard to the mediating variable between green innovation and competitive advantages. Past literature seems to say that a green image accelerates competitive advantage. As [40], mentioned green image generates a positive organizational reputation and as a consequence of it, increases a firm’s sales and opens a new market. In this regard, from firms’ green innovation firms have a better green image and it can lead to more economic benefits to the firms. Moreover, existing literature proved that customer loyalty and corporate reputation are crucial factors for influencing potential return [41],[42].

The above findings have highlighted the necessity of the “firm green Image” as a mediating variable between the variables i. e. green innovation and competitive advantage in different Industries and different country contexts. Hence, the authors suggest doing future studies by considering this kind of relationship.

Gap 6:As [43] found that a firm’s green image moderates the relationship between green product innovation and financial performance. Further, [15] found the importance of efficiently managing the green image of a firm. But there are not enough literature.

Due to the lack of adequate empirical evidence showing the moderating relationship of the firm green image between green innovation and competitive advantage. It is worth finding empirical evidence of the moderating relationship of “firm green image” between green innovation and competitive advantage.

Gap 7: Common sense seems to say that with unique and non-imitable resources firms can adopt to green innovation activities and then can compete with the competitors. According to the innovation theory, firm resources are important for a firm to engage in innovation activities.

Past empirical studies did not focus on firm resources as an independent variable in green innovation research. According to the above argument, it can be presented as another research gap, to find out the impact of a firm’s resources on green innovations.

2) Number of studies with a focus on different countries: Figure 1 reports the countries where the reviewed studies have been conducted. Most studies have been conducted in China and the next top three most represented countries are Taiwan, Malaysia, and Indonesia. Accordingly, among the south Asian countries, Pakistan has four studies, Sri Lanka has two studies, India has only one study and other countries (Afghanistan, Bangladesh, Bhutan, Maldives and Nepal) don’t have a single study. However, there is a growing trend of green studies in southeast countries (Indonesia, Malaysia, and Thailand).

Gap 8: It is evidence that (see figure 1), there are very limited studies in the Sri Lankan context. Among 84 studies, only two studies are conducted in Sri Lankan Context. Hence, the authors identified this as a contextual gap that needs to address in future research.

3) Sector-wise distribution of Green Innovation Studies: According to figure 2, most of the green innovation studies (78% of studies) have been conducted in the manufacturing sector and 22% of studies have been done in the service sector. Hence, it is noted that there is a lack of empirical evidence in the service sector with regard to green innovation studies.

Gap 9: it can be seen as another research gap and it is worth conducting green innovation studies in the service sector to fill this gap.

4) Research Methods deployed: In terms of the methodology used, reviewed papers were categorized into three basic groups as Qualitative, Quantitative, and Literature Reviews. According to table 05, the majority (58 papers) of studies, are quantitative coming under three different categories; survey questionnaire, e-mail, and semi-structured interview. Even with quantitative research as the dominant research methodology, survey questionnaire has been applied extensively in 56 studies.

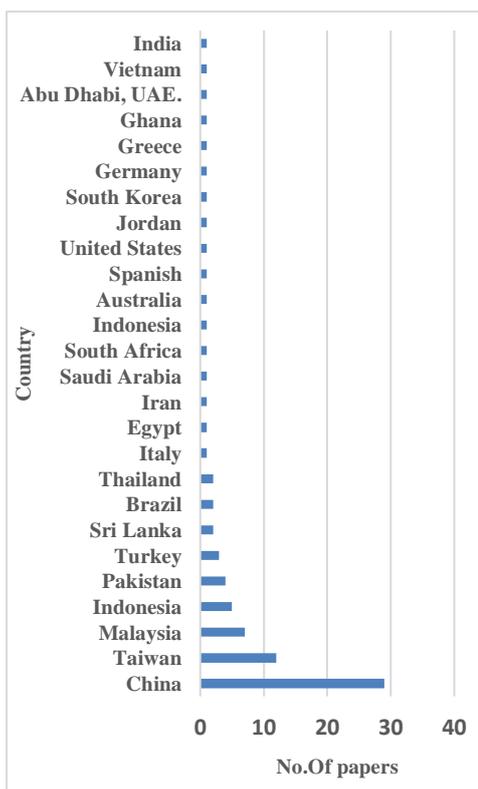


Fig. 1 Number of studies with a focus on different countries

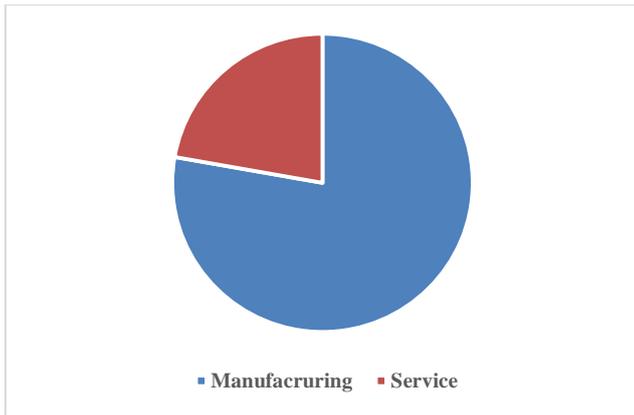


Fig. 2 Sector-wise distribution of Green Innovation Studies

E-mail has been applied in one study and semi-structured interview methods were deployed on the same number of paper (1 paper each). In terms of data collection methodology in qualitative studies, 03 study used content analysis, whereas four of them used (2 papers each) case study, and discourse analysis. The next set of 6 papers includes 03 Systematic literature reviews and 03 comprehensive literature reviews.

Gap 10: Accordingly, it is to be noted that methodological gaps can be identified as important research gaps. Use of a Survey based questionnaire is the dominantly applied quantitative data collection method in the majority of selected studies. In addition to that, e-mail, telephone surveys, and semi-structured interviews can be applied in future green innovation studies. Moreover, qualitative research method and literature reviews were deployed in relatively few studies. Hence, future studies can conduct qualitative studies in order to collect non-numerical data to understand concepts of green innovation and literature review method to develop current body of knowledge.

Table IV Research Methods Deployed

Method	Data collection technique	Source	No of papers
Quantitative	1.Survey Questionnaire	Weng et al., (2015), Tang et al.,(2017), Novitasari and Agustia (2021), Tariq et al., (2018), Su et al., (2020), Zhang and Zhu (2019),Wang et al., (2021), Chu et al., (2018), Soewarno et al., (2018), Galbreath (2017), Lin, and Chen(2014), Chan et al., (2016), Feng et al., (2018), Zhang et al., (2020), Cao and Chen(2018), Yusr et al., (2020), Seman et al., (2019), Asadi et al., (2020), Sellitto et al., (2020), Ma et al., (2017), Amores-Salvadó et al., (2014), Ghaith et al., (2020), Lee et al., (2016), Wang (2019), Huang and Li (2015), Yousaf(2021), Ar(2012), Lin et al., (2013), Xue et al., (2019), Tang et al., (2017),Chen et al., (2006), Chan et al., (2015), Tjahjadi (2020), Ma (2018), Conding et al., (2013), Chang and Chen (2013), Zameer et al., (2020), Cao et al., (2021), Conding et al., (2012), Chandi (2017), Skordoulis (2022), Ge (2018), Dong(2022), Chang(2011), Arenhardt et al., (2016), Ardyan et al., (2017), Huang et al., (2015), Guo, Wang et al., (2020), Guo et al., (2020), Qiu et al., (3019), Dangelico et al., (2017), Famiyeh et al., (2018), Shubham et al., (2018), Singh et al., (2021), Zhang and Zhu (2019), Mady et al., (2021),Kuo and LePage(2022), Widiyati and Murwaningsari (2021), Juniati et al., (2019), Fatoki(2021),Hossain et al., (2020), Lin and Chen(2016), Chang (2011).	56
	2.E-mail	Nasrollahi et al., (2020)	1
	3.semi-structured interview	Chu et al., (2019),	1

	2.E-mail	Nasrollahi et al., (2020)	1
	3.semi-structured interview	Chu et al., (2019),	1
Qualitative	1. content Analysis	Somarathna(2020), Leitner et al., (2010),Xie et al., (2019)	3
	2. Case study	Triebswetter and Wackerbauer (2007)	2
	3.Discourse Analysis	Tseng et al., (2013), Chien et al., (2021)	2
Literature review	1. .Systematic Literature review	Khan et al., (2021), Takalo et al., (2021), Dangelico (2015)	3
	2.comprehensive literature review	Schiederig et al., (2011), Leitner et al., (2010), Khanra et al., (2021)	3

5 Future Implications: In order to address future studies, 10 research gaps were identified in this study. Two gaps numbered 2 and 5 can be considered as empirical gaps while numbers 1, 2,3, 4, 6, and 7 are theoretical as well as empirical gaps. Furthermore, contextual gap (gap 8), sectorial (manufacturing/service) gap (gap 9) and methodological gaps (gap 10) were identified. Based on the identified research gaps, a nomological network developed for further empirical studies. The developed nomological network is presented in Figure 3.

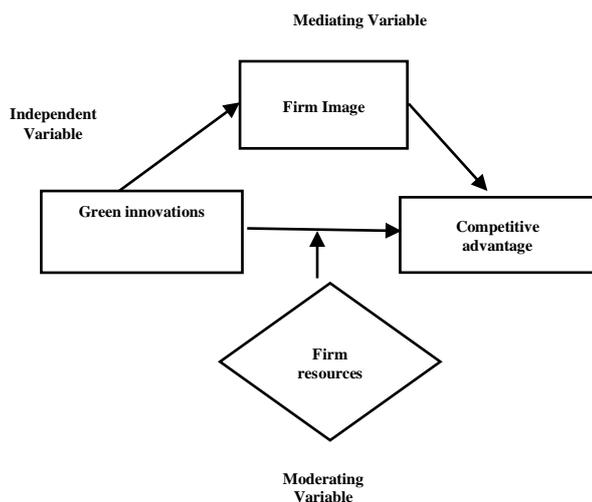


Fig. 3 Nomological Network

Figure3 illustrates the two main variables i.e., green innovations and competitive advantages. It is considered as the main variable of this framework. They are considered as the independent and dependent variables respectively. Firm resources work as the moderator and the green image identifies as the mediator of this model. Resource-based view theory provides strong support for the above framework. Indeed this framework needs to be tested in the future in the Sri Lanka context or worldwide, so as to contribute to the existing body of knowledge of green innovation.

CONCLUSION

Green innovation has great potential to reduce the environmental degradation of firms’ activities. The objectives were this study to identify the literature on concepts of green innovation and competitive advantage, to review the relationship between green innovations and competitive advantage, to identify research gaps in green innovation and competitive advantage, and to develop a nomological framework to present the relationship between green innovations and competitive advantage. Ten research gaps were identified under the desk research strategy. Two of them were empirical gaps, five of them were theoretical

gaps, while the others were contextual gap, sector-wise (manufacturing/service) gap, and methodological gaps. The contribution of this study is to show a new avenue for future researchers in the field of green innovation. Future researchers can address these identified research gaps and shed new light on green innovations. Further, this paper provides valuable insight into policymakers. Policymakers should promote the entrepreneurial culture through green innovation.

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