

# Incorporating Green Innovation to Enhance Environmental Sustainability

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*Abstract:* - Green innovation has become a key environmental topic in modern business practice around the globe. Green innovation generates new market prospects, products, services and processes that refine and conserve the environment. This study sought to identify the link and the influence of green innovation elements in term of enhancing environmental sustainability in the dairy products sector in Syria. The study attempts to answer the following question: Does green innovation elements have an impact on enhancing environmental sustainability in Syrian dairy products Companies. The researcher proposed two hypotheses to establish the association between the variables of the study. A practical survey sought the opinions of 60 skilled and knowledgeable personnel from three Syrian Dairy Products Companies on the subject matter.

The results showed a significant correlation between the elements of green innovation combined and the enhancement of environmental sustainability in the surveyed companies. This indicates an increasing interest in the management of companies with green innovation, which will contribute to environmental sustainability. The researcher suggested that companies should collaborate with academic institutions in conducting training courses for the employees in order to raise awareness of the importance of green innovation and training them in a way that helps the company to become a green company.

*Key-Words:* - Green Innovation, Environmental Sustainability, Green Product, Green Process, Organizational Innovation.

## 1 Introduction

The protection of the earth from the pollution is of utmost importance due to the great effects that humans are causing on the planet [1]. Environmental protection organizations have begun to identify the great danger that man causes and the result of industrial development that has been reflected negatively on the natural environment of the Earth [2]. At this point, companies started to focus on the development of their products in a way that has a weak impact on the environment and did not stop at this level only but pushed the manufacture of products to contribute to improving the environment on earth [3]. As a result, the idea of "green innovation" emerged as a new trend to encourage companies to provide green products that are environmentally friendly. Not just products, but the processes and machines that produce these products. Companies can reduce the pollution level by energy saving, recycling of waste, and adhere to government regulations and environmental laws [4]. To conform to the new environmental laws, organizations must embrace environmentally friendly practices to progress their environmental reputation and image [5]. These practices can

sustain the environment and refine their status in the market [4]. This was the result of increased awareness of customers as they began to focus on accessing products that protect the environment in addition to social responsibility felt by companies toward community and thus maintaining their fair share of environmental sustainability.

Given the limited studies that dealt with the subject of this research in Syria, it was found appropriate to address these variables within a comprehensive framework especially after the Syrian Crisis of 2011. Green innovation is a relatively recent issue that has received increasing interest from industrial companies in Syria due to its role in environmental conservation. In view of the limited studies that dealt with this subject in Syria, the researcher conducted an empirical survey about the implementation of green innovation in three famous dairy companies operating in Syria (Syrian-Finnish Dairy Company, MidaOrient Trading Company, and Syrian Arab Dairy Company). In addition, extensive interviews with some managers and their staff has been done and to be able to determine the practical dimensions of the problem of this research. The humble efforts of the

administrative authorities to reduce the level of pollution by focusing on conformity with environmental specifications. In addition to the limited knowledge of managers and employees of companies surveyed about the nature of the relationship between the elements of green innovation and the promotion of environmental sustainability.

This research was a modest attempt to study correlation and influence between two variables of increasing importance: the green innovation and the promotion of environmental sustainability.

This study aims to provide a theoretical and practical framework that links the elements of green innovation (green product, green process, organizational innovation) with environmental sustainability. Also, to explore the role of green innovation in influencing environmental sustainability. Finally, to discover if there is any correlation between green innovation in enhancing environmental sustainability.

## 2 Literature Review

### 2.1 The Concept of Green Innovation

Green innovation means the making of products or production function designed to address the environmental problems resulting from the product life cycle [6]. Weag, et al., [7] stated that new or customized products and procedures include technical, managerial and regulatory innovations that help preserve the surrounding environment. Stenbrink and Westerberg [8] showed that innovation was linked with green products and production, including the technological innovation that leads to preventing pollution, energy conservation, and waste recycling. Ma, et al., [9] explained that new procedures, methods, schemes, and products were invented or modified to avoid or minimize environmental damage. Li, et al., [10] stated that innovation in technologies, products, services, organizational structures or management practices adopted by companies to achieve sustainable development. Consistent with the above, the researcher believes that green innovation refers to the creation of methods, techniques, and procedures that contribute to reducing the dire outcome of production course and products on the environment to ensure the sustainability of the environment and its resources to the benefit of current generations and future generations.

### 2.2 Benefits of Green Innovation

The significance of green innovation is highlighted by its concern to reduce pollution, improve environmental performance, improve resource productivity, increase energy efficiency and reduce waste, as well as reduce the cost of materials produced [6]. Saunila, et al., [11] summarized the benefits of green innovation in following manner:

1. Companies can obtain incentive from establishing environmentally sustainable products.
2. Improve the performance to meet the needs of environmental laws. Green innovation has the role of mediator between environmental ethics and competitive returns.
3. It serves as the key to improving competitive advantage in an increasingly environmental-friendly world.
4. Offers a huge opportunity to satisfy customers' needs without damaging the environment.
5. Can improve company performance.
6. Efficiency in the use of resources and energy.
7. Companies can reduce costs and increase revenue

### 2.3 Objectives of Green Innovation

The implementation of green innovation achieves a number of objectives, most notably: (1) Energy conservation. (2) Reducing emissions and developing the economy at the same time. (3) Direct improvement of environmental quality. (4) Aims to reduce greenhouse gases. (5) Providing new employment opportunities for community members. (6) The implementation of green innovation helps to achieve the city's eco-friendly goal [11] and [12].

### 2.4 Elements of Green Innovation

A number of authors, including Li, et al., [10]; Ma, et al, [9]; Ganzer, et al., [18]; and Stenbrink and Westerberg, [8] agreed that the elements of green innovation are (green product, green process, organizational innovation). Here we have a brief explanation of each element of green innovation.

#### 2.4.1 Green Products

The green product is the process of altering the use of natural resources in accordance with environmental laws and standards, and modifying existing production processes mainly to reduce damage through production processes and reduce pollution levels to the lowest possible level [13].

Ma, et al., [13] stated that new or modified products aimed to minimize negative impacts on the environment. Fraccascia, et al., [14] defined green products as products that use fewer resources in their production and have less environmental impact and risk and reduce waste generation during the product life cycle. Also, Ebert, [15] indicated that the green product aims to:

1. Maintain natural resources and energy, which include products or services that preserve energy and reduce the use of fuel.
2. Decrease pollution by introducing products or services that protect the environment.

Concerning the importance of green product, Biswas, [16] clarified that green products have the ability to conserve resources, least environmental impact at the product life cycle stages, and the possibility of recycling green products.

#### 2.4.2 Green Process

Whelebrator [17] noted that the green process is the abolition of waste by redefining the accessible manufacture procedure or the existing scheme so that at the end of the production line it produces the same product as it is recycled and used again. This concept contributes to tackling the public and environmental impacts of the contamination process as well as controlling the working environment and minimizing the costs incurred due to faulty production methods. Weag, et al., [7] reported that they customized production procedures to manufacture environmentally friendly goods that meet environmental objectives like saving energy, avoid pollution and waste. Ganzer, et al., [18] explained that the invention of the process is focused on improving the efficiency and effectiveness of the production process and involves changes in the way the products are produced and delivered to customers. According to Ma, et al., [9], the following points can sum up the importance and benefits of the green process:

1. Help improve resource utilization and reduce pollution.
2. Help to achieve a significant reduction in costs.
3. Resolve environmental tribulations during the manufacturing phase.
4. A Green process is a required condition for the innovation and creation of green products.
5. Check the competitive advantage of the company.
6. Increase the revenues and returns of the company and thus increase its market share.

7. Enhancing the company's intellectual position with its customers and the market in which it operates.

#### 2.4.3 Organizational Innovation

Najem [19] noted that organizational innovation means the introduction of new concepts and applications that improve the internal environment and thus the overall performance of the company, including its environmental performance. According to Satell, [20] innovation is a lasting attempt to increase the firm's capability to resolve problems and to renovate its process through inclusive progress of the organization's climate. Special emphasis on elevating the efficiency of its working teams with the help of change consultant or professional that convinces members of new ideas, by the utilization of novel ideas completely new to the marketplace or new plans that rejuvenate operations, systems, and the organization methods of operating the business. Al-Kaabi, [21] stated that organizational innovation is an idea or a fundamental improvement by the company in order to add value to the firm either directly or indirectly. Ganzer, et al., [18] added that it means the execution of a new institutional method in the positions of the company, such as the arrangement of the workplace and external relations as well and others. As these new methods and procedures will improve the performance of the company, organizational innovation is necessary for companies that plan to pursue strategic challenges. With regard to the objective of organizational innovation, Steiber [22] noted that the objectives of organizational innovation are:

1. Increasing the long-term competitiveness of companies.
2. Organizing of the workplace and external relations of the company.
3. Increase operational efficiency and increase the satisfaction of working personnel.
4. Give competitive advantages to the company.
5. Controlling and developing operations within the company.
6. Reduce the total costs of the company.
7. Documenting an ongoing program of inventions.

#### 2.5 Environmental Sustainability

The interest in environmental sustainability has been implicit in the need for sustainable development based on three pillars: economic, society and the environment. An environmentally sustainable system should maintain a stable base of natural resources and avoid excessive depletion of

renewable resources, including agricultural productivity and air balance, and environmental sustainability was in the heart of sustainable development [23].

Yuan, [24] defined environmental sustainability as making decisions and minimizing the negative effects of human activities, as well as taking measures to use non-renewable resources wisely, fairly, and equitably for present and future generations. Morelli, [25] identified it as a state of equilibrium, flexibility and consistency that are provided to fulfill the wants of society, provided that these needs do not exceed the capability of the sustaining ecosystems and continue to renew products to satisfy those wants.

In the same context, Moldan, et al., [26] noted that environmental sustainability is the preservation of natural services at the required levels because of the relationship between these services and human well-being. Moreover, the nature of this relationship is the essential feature of supporting and maintaining environmental systems, these natural services involve the care of life-supporting ecosystems globally (concern for the services provided by nature, meaning care for nature itself). Therefore, environmental sustainability is dependent on the responsible management of natural and human resources that sustain the needs of current generations and safeguard the interests of subsequent generations. This is the challenge for individuals and societies and requires considerable efforts to educate the population about this problem. Sustainability means protecting natural resources from human pressures, non-excessive use of fertilizers and pesticides that contaminate surface and groundwater, and over-exploitation of forests and fisheries at unsustainable levels [27]. In line with the above, the environment is one of the priorities of the business in all activities and events carried out by society and companies to achieve the optimum use of environmental resources and ensure their sustainability for the benefit of future generations.

Companies participate in maintaining the integrity of the environment by reducing resource consumption, reducing pollution and waste, in addition to their effect on ecosystems, soil, and atmosphere. These processes have a helpful effect on the company's reputation and optimization. The importance of environmental sustainability is highlighted in the maintaining of the ordinary resources necessary to ensure the safety of human beings. Also, the protection of water resources, soil, and biodiversity so they do not lead to their significant degradation through pollution, carbon

dioxide accumulation, the elimination of the ozone layer and the elimination of natural habitats that allow biodiversity to be safeguarded by combating pollution reducing energy consumption and protecting non-renewable resources. This dimension translates into the concept of caring for or caring for the environment. This was attributed to the achievement of so-called environmental efficiency, which leads to value creation, quality of life, environmental care and improved quality.

According to Khadri, [28] there are many requirements for achieving environmental sustainability, they are:

1. The use of non-renewable resources should be paid for increasing renewable resources.
2. The rate of growth should exceed the rate of consumption for non-renewable resources.
3. The rate of consumption of non-renewable resources should not exceed the capacity to replace them with new materials.
4. Pollution rate must be less than the capacity of the environment in dealing with pollution.
5. Inorganic substances whose rate of production should not exceed the capacity of nature to dissolve them.

### 3 Methodology

The study relied on descriptive and analytical approach in describing the population and sample of the research, as well as studying and analyzing the correlation and effect between the research variables and reaching conclusions and recommendations for the surveyed companies.

The researcher used multiple methods in data collection, including Arabic and foreign references, periodicals, university thesis, and websites to cover the theoretical aspect of the research. In addition, a questionnaire was established to examine the suggested model. The questionnaire included four constructs (green product, green process, organizational innovation, and environmental sustainability). The data and information related to innovation were cited from (Medina, et al., [29]; Kesra and Najeeb [30]; Weag, et al., [7]; and Ganzer, et.al, [18]. The terms of environmental sustainability have been cited from the views of the following authors: Moldan, et al., [26]; Yuan, [24]; Khadri, [28]; and Muhammad et al., [27]. A five-dimensions Likert scales was used (1 = strongly disagree, 5 = strongly agree) to measure the variables.

Three dairy companies from the private and public sector in Syria have been selected as the field

of study. These companies are (Syrian-Finnish Dairy Company, MidaOrient Trading Company, and Syrian Arab Dairy Company). Perhaps the most important reasons for choosing these companies, because they are equipped with administrative and technical specialties with the appropriate expertise and skill in their field of specialization. Thus, the study variable clear to all respondents. Secondly, the excellent customer service of these companies in responding to the needs of their customers and customers' interest in the products of these companies. Finally, the continuous production of these companies during the Syrian crisis of 2011 despite the difficult circumstances they faced during the war.

The research sample consisted of individuals who have the expertise and knowledge of the company's activities and operations in order to ensure the benefit of the accurate and useful data and information provided by them. The researcher distributed (75) questionnaire form to respondents in the three companies (60) valid and complete forms were returned.

To determine the correlation and influence between the research variables, Statistical Package for Social Science (SPSS 20) were applied in order to reach proper conclusion including frequencies and percentages to describe the occupational status of respondents. Also, simple and multiple correlation coefficient to get the maximum degree of linear relationship variables. Finally, multiple linear regression to clarify the connection between one dependent and two or more independent variables. The outline of the study is illustrated in Fig. 1 below.

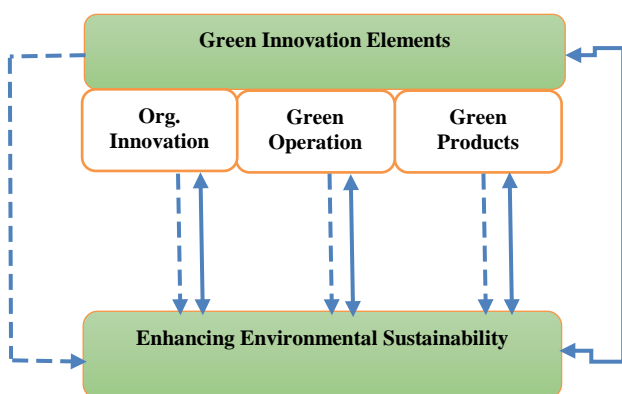


Fig.1: Elements of Green Innovation

In this outline, the dotted arrow indicates the correlation between the variables and the straight arrow indicates the effect. From this outline, the researcher formulated the hypothesis:

*First hypothesis:* There is a significant correlation between the elements of green innovation and the enhancement of environmental sustainability at the surveyed companies.

The following sub-hypothesis has emerged from the first hypothesis: There is a significant correlation between each element of green innovation in enhancing the environmental sustainability at the surveyed companies.

*The second hypothesis:* There is a significant effect between green innovation elements and the enhancement of environmental sustainability at the surveyed companies.

The following sub-hypothesis has emerged from the second hypothesis: There is a significant effect for each element of green innovation in enhancing environmental sustainability at the surveyed companies.

#### 4 Research Analysis and Finding

Table (1) shows the occupational status of the respondents. It was found that the senior management of the company represents (17.7%) while the middle management and the lower management constituted (83.3%) of the total sample. This is a good indicator that the questionnaire is not limited to an administrative level, opinions were obtained from various administrative levels. Concerning education, (41.76%) have University degree, (40%) had high school diploma. Finally, it is also evident that 90% of the respondents have service in the company for five years or more, which contributed to improving their experience and knowledge of the company's work and has a great impact in dealing with the questionnaire.

Table 1. Occupational status of the respondents

Job Position											
Lower Management				Middle Management				Top Management			
N		%		N		%		N		%	
30		50		20		33.3		10		17.7	
Education											
Elementary		High School		Bachelor		Master		PhDs			
N	%	N	%	N	%	N	%	N	%		
11	18.33	24	40	23	38.33	2	3.34	0	0		
Work Experience											
0-4		5-10		10-15		15-20		20-25		Over 25	
N	%	N	%	N	%	N	%	N	%	N	%
6	10	13	21.66	14	23.33	9	15	8	13.33	10	16.66

### 4.1 Testing the Hypothesis

#### 4.1.1 Testing the First Hypothesis

Table 2. Correlation between green innovation elements combined and environmental sustainability

Independent Variable	Elements of Green Innovation
Dependent variable	
Enhancing Environmental Sustainability	0.781*

Table 2 shows a significant correlation between the elements of green innovation combined and the enhancement of environmental sustainability at the surveyed companies. The total index of correlation coefficient was (0.781) at a significant level (0.05), this finding suggests that the more the departments of the three companies are interested in elements of green innovation of combined, the more the environmental sustainability will be enhanced. This finding is consistent with Li et al., (2017), in which they noted that the application of green innovation factors reduces the negative impacts on the environment and promotes environmental sustainability. Based on the above, the first major hypothesis is accepted at the level of the surveyed companies.

In regard to the correlation between each element of green innovation alone and the enhancement of environmental sustainability, Table 3 presents

the correlation between each element of green innovation alone and the enhancement of environmental sustainability at the level of the surveyed companies and according to the sub-hypothesis emerged from the first main hypothesis.

Table 3. Correlation between each component of green innovation and the enhancement of environmental sustainability

Independent Variable	Green Innovation Elements		
	Green Product	Green Process	Organizational Innovation
Dependent Variable			
Enhancing Environmental Sustainability	*0.853	*0.722	*0.713

The result of table (3) showed that there is a correlation between each element of green innovation alone and the enhancement of environmental sustainability at the level of companies surveyed.

1. The relationship between the green product and the enhancement of environmental sustainability was illustrated in table (3) where a positive correlation between the green product element as an independent variable and the enhancement of environmental sustainability as a dependent

variable. The correlation coefficient (\*0.853) was significant at a significant level (0.05). This shows that the management interest in the surveyed companies with their green product element will contribute to enhancing of environmental sustainability.

2. The relationship between the green process and the enhancement of environmental sustainability was illustrated in table (3) where a positive correlation between the green process as an independent variable and the enhancement of environmental sustainability as a dependent variable. The correlation coefficient (\*0.722) was significant at a significant level (0.05). Indicates that the interest of management with the green process component will contribute to enhancing environmental sustainability.
3. The relationship between organizational innovation and the enhancement of environmental sustainability was illustrated in table (3) indicates a positive correlation between organizational innovation as an independent variable and the promotion of environmental sustainability as a dependent variable. The correlation coefficient was (\*0.7013) at a significant level (0.05). Indicates that the interest of management with organizational innovation elements will contribute to enhancing environmental sustainability.

Table 4. Impact of green innovation components combined on environmental sustainability

Independent Dependent	Elements of Green Innovation		R <sup>2</sup>	F	
	B <sub>0</sub>	B <sub>1</sub>		Calculate	Tabular
Enhancing Environmental Sustainability	0.534	0.712 *(11.134)	0.769	*129.582	4.02

Based on the above, the sub-hypothesis that was generated from the first hypothesis is accepted at the level of the surveyed companies.

#### 4.1.2 Testing the Second Hypothesis

For the researcher to determine the effect of the elements of green innovation in enhancing the environmental sustainability in the surveyed companies, this section was designed to verify the possibility of accepting or rejecting the second main hypothesis and the sub-hypothesis derive from it.

Table (4) presents the results of the impact relationships of green innovation elements combined in enhancing environmental sustainability in the surveyed companies.

The Regression analysis confirms a significant effect of the elements of green innovation (combined) in enhancing environmental sustainability. The calculated value of (F) is (\*129.582), which is higher than the scale value of (4.02) at the level of (0.05). And the coefficient (R<sup>2</sup>) equal (0.769) which means that (79.6%) of the differences explained in enhancing environmental sustainability are due to the influence of green innovation elements combined and the rest are related to random variables that cannot be controlled or already not included in the regression model. And by following the coefficients of (B) and (T), it showed that the value of (T) calculated \*11,134 is significant and higher than the tabular value of (1.766) at a significant level (0.05) and the degree of freedom (1, 58).

This result conforms with (Medina, et.al, [29] in which they pointed out that the application of the elements of green innovation in companies contributes to reducing environmental burdens in general and achieving the objectives of environmental sustainability and thus improving the state of the natural environment. Therefore, we accept the second main hypothesis.

In order to clarify the detailed impact relationships of the green innovation elements alone in enhancing environmental sustainability at the surveyed companies.

In light of the sub-hypothesis that emerged from the second main hypothesis, Table (5) show the impact of each element of green innovation alone on enhancing environmental sustainability in the surveyed companies.

Table 5. The impact of each element of green innovation alone in promoting environmental sustainability in the surveyed companies

Independent Variable Dependent Variable	B <sub>0</sub>	Elements of Green Innovation			R <sup>2</sup>	F	
		Green Product	Innovation Process	Organizational Innovation		Calculate	Tabular
		B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>			
Enhancing Environmental Sustainability	0.329	0.511 *3.341	0.465 3.122	0.311 *2.291	*0.842	*42.234	2.82

Table (5) illustrates a significant effect of the elements of green innovation as independent variables in enhancing environmental sustainability, which is a dependent variable. This effect is supported by the calculated value of F (\*42.234),

which is greater than the tabular value of (2.82). And within a significant level (0.05). The value of  $R^2$  is \*0.842. This means that 84.2% of the explanatory differences in enhancing environmental sustainability are explained by green innovation elements. The rest is due to random variables that are uncontrollable or excluded in the regression analysis. Also, by following the coefficient values of the (B) and (T) tests, it was found that there is a significant effect of each element of green innovation alone in enhancing environmental sustainability. The sequence of priority of this effect can be determined by the following:

1. The effect of green product on enhancing environmental sustainability: Table (5) shows that the highest effect of green innovation elements is the green product, which came first in terms of impact with a value of  $B_1$  (0.511) (\*3,341), which is a level (3, 56) at the significant level of (0.05).
2. The effect of the green process in enhancing environmental sustainability came second in terms of impact, with  $B_2$  value of (0.465) while the T calculated value was (\*3.122) which was significant, and more than its tabular value of (1.677) at the degree of freedom level (3, 56) at the significant level of (0.05).
3. The effect of organizational innovation in enhancing environmental sustainability was ranked third in terms of impact, with the  $B_3$  value of (0.311), while the T calculated value of (\*2.291) which is significant and greater than its tabular value of (1.677) at the freedom level (3, 56) at the significant level of (0.05). Based on the foregoing, we accept the sub-hypothesis, which was generated from the second main hypothesis.

## 5 Conclusions and Suggestions

### 5.1 Conclusions

Form the research finding, we can conclude that the respondents involved in this study have good experience and knowledge of the company's work, and most of them have a good scientific qualification that enables them to understand and handle the questionnaire correctly. The majority of respondents have work experience in the company (5) years and more, which indicates the acquisition of experience and maturity in the work of the company and in answering the questionnaire correctly and accurately. There is a significant

correlation between the elements of green innovation combined and enhancing environmental sustainability in the surveyed companies. This indicates an increased interest of management of the companies with green innovation, which will contribute to environmental sustainability. There is a significant correlation between each element of green innovation alone and enhancing environmental sustainability in the surveyed companies. This is an indication of an increased interest of management of the surveyed companies with each element of green innovation alone which will contribute to enhancing environmental sustainability. There is a significant effect of the elements of green innovation combined in enhancing the environmental sustainability of the surveyed companies. This indicates that the green innovation elements combined can contribute to enhancing the environmental sustainability of the surveyed companies. There is significant effect for each element of green innovation in enhancing environmental sustainability in the surveyed companies. The most influential element in promoting environmental sustainability was the green product, and the least was organizational innovation, this was the results of our statistical analysis.

### 5.2 Suggestions

The management of the surveyed companies should cooperate with the specialized academic institutions in conducting training courses for the employees in order to raise awareness of the significance of green innovation and training them in a way that helps the company to become a green company. In addition, management of the surveyed companies must be concerned with the environment in parallel with the other competitive priorities because they are no less important. This can be implemented by increasing the interest in studying the social and environmental benefits that will be generated when applying green innovation, and by providing an appropriate standard to identify the pollution levels of the environment caused by the company's production and operations, and then conducting the necessary treatments related to providing the appropriate means by which to reduce the pollution of the environment. Finally, the surveyed companies must focus on the use of recyclable materials, as well as attention to the various manufacturing processes to produce environmentally friendly products. This can be achieved by expanding the horizons of managers and employees on environmental sustainability by providing what is new in this field especially the



diligent pursuit of the ISO 14001 environmental certification to keep abreast of developments.

### 5.3 Limitations and Future Research

Results in this study point to providing a theoretical and practical framework that links the elements of green innovation (green product, green process, organizational innovation) with environmental sustainability. This study focused on exploring the role of green innovation in influencing environmental sustainability. Limitations of this study are associated with the total samples used which were only 60 respondents. From statistical analysis view, the samples had assembled the minimum samples requirement, however, on a study about environmental sustainability, a larger sum of samples are required.

The upcoming research agenda need to add other variables to achieve better results. Some of the determinant variables that can be added are green packaging and promotion.

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