



# SUSTAINABLE DEVELOPMENT THROUGH ECO-INNOVATION: DRIVERS AND BARRIERS

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## ABSTRACT

*In academic literature sustainable development through eco-innovation processes has acknowledged growing attention in recent years. Eco-innovation consist several environmental benefits and possess great significance to businesses and policy makers, as rapid industrial and economic growth posed adverse social and environmental impacts. Increased concern regarding environment protection directed firms towards environment conscious innovations to achieve sustainable development. The main focus of eco-innovation concerned with waste minimization, reduction in greenhouse gases, efficient use of energy and resources, eco-friendly design, reuse and recycled products etc. This study focuses on drivers, barriers and benefits of eco-innovation for the accomplishment of sustainable development goals so that the firms and organisations can concentrate on these factors to gain competitiveness. This study will benefit policy makers to leverage the comprehensive competitiveness with effective implementation of eco-innovation processes.*

**KEYWORDS:** *eco-innovation; environment; green business; sustainability; sustainable development*

## 1. Introduction

Currently, world is undergoing rapid changes like globalization and internationalization, technological advancements, upgraded communication and information system, big data analytics, innovative financial and economic system. The challenges ahead are particularly compelled by increasing population of the world, changes in living standards, adverse environmental impact of human activities, scarcity of natural resources [1]. It is clear that production system of industries plays a significant role because it consume around one third of the primary energy of the world [2]. Hence, there is a need of changing present socio-economic development with more sustainable development which is raised by the change in the micro and macro environment of the businesses, customer needs and wants, increasing awareness and increase in environmental constraints [5].

The efficient implementation of sustainable development is linked with significant modification in economic activity, in respect of more integrated and systemic interdisciplinary approach [3, 4]. Furthermore, well established partaking processes needed to enable the implementation of long term and short objectives for social, economic and environmental concerns [8]. It is to be taken into consideration that sustainable development is a multifaceted and multidimensional notion, which covers the inter-dependence of social, economic and environmental order, in socio-economic development, also for the necessity to reserve resources so that future generations can use them[9, 10].

Recently there is a growing political and social awareness regarding the advancement of sustainable innovations. For instance, in December 2011, Eco-Innovation Action Plan (EcoAP) was launched by European Commission, in order to accelerate European Union to move beyond green technologies and to implement comprehensive eco-innovative products, processes and services [11]. Likewise, firms and businesses are becoming more concerned about the consequences of their actions



and trying to become more socially responsible, as environmental concerns for innovation gained importance. Firms and companies are growing their investments in environment protection issues and hence becoming more environmentally oriented [7].

The main drivers of environmental concern for innovation are either external pressure like firm government regulation or to improve reputation by achieving competitive advantage and increase in production performance with reduction in cost. Moreover, evidences have proven that eco-innovations do not destabilize economic performance in short run or regarding global financial crisis[6].

This objective of this paper is to examine how eco-innovation or environment friendly innovation can help in the development of the firm or economy as a whole, also to achieve sustainable development goals. The study will also focus on drivers and barriers in the way of sustainable development through eco-innovation. The study will address the advantages or benefits of eco-innovations for the firm or company and for the consumers as well. The research questions that are answered in this study are, how eco-innovations can help achieve sustainable development and what will be the drivers and barriers in the application of eco-innovation.

## 2. Methodology

This paper is based on narrative literature study and review, in this method researcher for the better understanding of the topic, looked at multiple studies and made comprehensive interpretation of the study based on researcher's experiences [44]. Or in some reference there is another definition for narrative literature study; which it is helping the researches to define and determine the research question, hypotheses and or research questions, it is also helpful to develop theoretical or conceptual frameworks [45,46].

## 3. Eco-innovation and Sustainable development

The idea of 'sustainable development' was first addressed in Brundtland Report World Commission on Environment and Development from the United Nations in 1987. According to the Brundtland Report, the definition of sustainable development is "...the development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs". The concept of sustainable development has two main fundamental elements, i.e. sustainability and development which leads to the formation of the concept itself [12]. However, sustainability and development could be in contrast connection, and both could possess potential counterproductive effects [13]. Although, neoclassical economists highlight that there is no contradiction in development and sustainability [14]. In regard to this, Sachs (2008) proposes that, there is no development without sustainability and no sustainability without development [15].

Eco-innovation or in other words sustainable innovation is also defined as the process of evolving innovative products, ideas, processes and behaviour that will contribute in reducing adverse environmental impacts or to environmentally identified sustainability goals [16]. Moreover, innovation in respect to sustainable society can be comprehended on three extensive levels such as social, institutional and technological. Also, it is believed that evolution in social and institutional structure should support corresponding technological innovation [17]. Likewise, according to Eurostat, innovation is described as the implementation of an innovative or significantly enhanced product or service, enhanced method for marketing, correspondingly developed process, or a new method of organization related to business practices, external affairs or workplace association [18, 19].

Although, eco-innovation is not only restricted to environmentally inspired innovations but could include unintentional environmental innovations, and the environmental benefits of any innovation could be the result of other goals, like recycling of heavy metals to reduce cost. Also, the



organizational innovations like changes in beliefs, norms, values, knowledge, and organizational acts are included, as changes in organisation, management, laws of governance can help in reducing environmental effects [20]. A varied number of definitions of eco-innovation was addresses and among those definitions, according to the definition described by European Commission is, eco-innovation is considered as each and every kind of innovation that can be sustained by the reduction of effects on the environment and obtaining the use of present natural resources, which includes energy, more efficiently and effectively, and that aims at the demonstrative and significant advancement on the way to development [21]. Eco-innovation is also defined as the creation of novel and competitively goods and services, processes, procedure and systems to satisfy human needs and provide a better quality of life for everyone with a life-cycle minimal use of natural resources per unit output and minimal release of toxic substances in environment [23].

Hence, in order to reduce the adverse environmental effects caused by an increasing global population that demands more products and services, eco-innovations are important, along with competitive technologies and competitive valued products with improved environmental performance in contrast with other alternatives [22]. To solve the present challenges of this century, significant efforts are needed at all levels of development.

#### **4. Advantages of Eco-innovation**

Eco-innovation possesses tremendous benefits in its processes. It is regarded as the change in the activities of an economy which improves both the environmental and economic performance of the society [26]. Also, it can be said that on the basis of enhanced environmental and economic performance it can be judged that whether eco-innovation has taken place or not [25]. Eco-innovations can help in reducing environmental burden and also to reduce costs of doing so, but there is no guarantee that by using eco-innovations the quality of the water, soil or air will improve. So, absolute decoupling shows improved environment quality and deterioration of water and air quality in spite of usage of green technologies showed by relative decoupling. Hence, there are both indirect and direct benefits for eco-innovator [24].

The operational advantages like cost saving with better resource productivity, improved logistics and sales with commercialization comes under direct benefits. In contrast, better reputation, improved relations with suppliers, authorities and customers and improved innovation competence comes under indirect benefits. The advantages of eco-innovation can be classified under advantage for the manufacturer and advantages for the consumer.

##### ***4.1 Advantages of Eco-innovations for manufacturers***

The eco-innovations have various positive impacts on environment. But it is not possible to determine the relation between eco-innovations and economic standard of the country. Although, it is assumed that some impacts of eco-innovations is in relation with country's economic level. Nevertheless, in some studies it is shown that there exist correlation between country's economic level and advantages of eco-innovations for manufacturers [24].

##### ***4.2 Advantages of Eco-innovations for consumers***

In some studies it is stated that there exist a relation between economic level of the country and benefits of eco-innovations for the consumers. But, it is not possible to estimate the relation between the economic level of country and effects of eco-innovations for consumers. According to a study it is indicated that measure to analyse or to reduce the ecological impacts are more frequently used in developed nations as compare to under developed nations [19]. Also, consumers be directly or



indirectly get effected by the inappropriate or non-ecological measures used by the firms and companies in its production processes. Nevertheless, in some studies it is shown that there exists correlation between advantages of eco-innovations and present processes used by the firms and companies [24].

## 5. Drivers of Eco-innovation

Many studies suggested different drivers in the growth of eco-innovations. Thorough literature review resulted in finding out five main drivers for sustainable eco-innovation such as, consumer's demands, reduction in cost, reputation, to capture new markets, and external regulations [27, 28]. The other drivers of eco-innovation could be interrelated factors such as level of development of the firm and its position in the market. In difference with innovation, eco-innovation cannot only determine by the demand and supply determinants, rather can be measured by the environmental failure of the market [5]. According to the hypothesis of Porter, the need of innovation can result from environmental regulations that can be useful for the firms and have a potential for improvement in their business model [29]. Nevertheless, an important driver can also be qualified and experienced managers, their familiarity with green technologies and the capability to ascertain for long term benefits [5].

Although the main focus in the studies is on external regulation, and in addition many other factors regarded as impetus, for instance, technological opportunities, bases of knowledge as well as conditions of demand [30]. Hence, environmental innovation can be termed as the reactive answer to the market [31]. So, market demand and normative pressure are the most important external factors. Firms can face demands form consumers, suppliers, competitors, research centres, non-governmental organizations (NGOs), financing institutes in the implementation of eco-innovation [32, 33]. And these demands can be figured out when clients and investors require information about company's actions to reduce hazardous burden on environment [34].

Demand factors, such as the adoption of Corporate Social Responsibility (CSR) and other customer requirements, affect the decision of a company to undertake eco-innovations [35]. Given the systemic and complex characteristic of eco-innovation, the relevance of cooperation is also stressed [36, 37]. Companies need to learn how to produce without harming the environment, so cooperation and interdependency between firms [38, 39], customers, distributors, suppliers [40] and universities [41] improve the likelihood of eco-innovation. In addition to those external pressures, Arnold and Hockerts (2011) also studied company's internal factors that can trigger environmental innovation and organizational development. Company's internal factors will induce the company to evaluate costs, benefits, and risks involved in the adoption of eco-innovations. In other words, companies seek to be more efficient causing less environmental hazards, by developing higher R&D intensity, by acquiring new machinery, software or simply upgrading it [42].

## 6. Barriers in Eco-innovation

The European Commission's Environmental Technologies Action Plan identified the following barriers to eco-innovations, like economic barriers, ranging from the high cost of investment in environmental technologies to the market prices that do not replicate the external costs of services or products, initial investment size, the difficulty in transferring from traditional technology to environmental technology. In addition, established standards and regulations will also act as barriers to eco-innovation, lack of research efforts, unsuitable functioning of the research system, weak training and information, insufficient availability of the capital to use in production line, lacking market demand from consumers as well as public sector [43]. Barriers can be classified separately on following bases:



### **6.1 Financial barriers**

In literature the financial barriers are noted as, costs in relation with changes in production system, costs of research and development of technology, lacking predictability of liability costs in future like waste disposal cost, problem of competitiveness as other firms are not investing in waste reduction technologies [5]. In addition, non-comprehensive cost-benefit analysis, cost evaluation as well as calculation method, lack of capital investment in green technologies, low profit margin, economies of scale preventing small firms to invest in waste minimization technologies, operating costs etc. acts as barriers in eco-innovation for the development [48].

### **6.2 Managerial barriers**

There are several managerial barriers that come in the way of sustainable innovation, such as inadequate management, lack of cooperation in engineering cooperation in hierarchical separation of department of responsibility [43], for instance, lack of cooperation between environmental engineers and production engineers, reluctance to change according to the changing technological demand, lack of training and education, insufficient motivation, lack of expertise [11].

### **6.3 Supplier related barriers**

Company require support from dealers in relation to new innovative product adjustment. Hence, lack of support from suppliers with regard to product marketing and advertising, maintenance facility, lack of expertise in product adjustments act as barriers in eco-innovation from supplier side [48].

### **6.4 Regulatory barriers**

Some of the regulatory barriers are depreciation tax laws, uncertainty about future environmental technology [5], waivers from Resource Conservation and Recovery Act (RCRA) available only for hazardous waste treatment technology, RCRA permit requirements in addition to compliance requirements made it difficult to invest in reuse and recycle technologies [48]. Furthermore, lack of incentive provided by the regulatory bodies to invest in waste reduction and green technologies acts as a barrier.

### **6.5 Technological barriers**

Technological barriers are addressed as the most important barrier for sustainable innovation, for instance, lack of availability of technology for precise applications, inadequate performance ability of technology for certain economic requirements and design standards of processes [5], lack of substitute substances for the hazardous constituents. Similarly, inflexibility in processes and high level of uncertainty in performance of new technologies made firms reluctant to invest [24, 11].

### **6.6 Lack of significant labour force**

For innovative sustainable technologies particular labour force is required who possess substantial expertise in the specific technological advancement. Therefore, lack of specific labour force, lack of management in charge to implement and control waste reduction technology became barriers in eco-innovation [43, 48]. Furthermore, reluctance of firms to employ trained engineers for new technologies, inability to manage waste reduction program and growing management requirements to deal with waste reduction technologies are some of the barriers in regards to labour force [5, 43].



The summarised list of drivers and barriers in the development of eco-innovation are shown below in the following table.

<b>Drivers</b>	<b>Barriers</b>
Consumer's demands, reduction in cost, reputation, to capture new markets, and external regulations	Regulatory barriers like permit requirements lack of incentive provided by the regulatory bodies
Level of development of the firm and its position in the market	Lack of availability of technology for precise applications
Technological opportunities, bases of knowledge the adoption of Corporate Social Responsibility (CSR)	Costs in relation with changes in production system costs of research and development of technology
Pressure from non-governmental organizations (NGOs) and financing institutes	Inadequate management, lack of cooperation in engineering cooperation
Company's internal factors can trigger environmental innovation	Lack of specific labour force, lack of management in charge

*Table 1: Drivers and Barriers in the development of eco-innovation*

## 7. Conclusion

As stated in this paper that the eco-innovations are basically innovative methods to achieve sustainable development and to gain potential advantage by such industries that are environment friendly and makes better use of present natural resources without posing any hazardous impact on environment. Through eco-innovations firms and companies can use waste reduction technology and also can make best use of waste generated by industries in order to conserve and protect ecology. Eco-innovations encourages the production of environment friendly products to create a market niche for products termed as green products and marketed with eco-labelling and green branding. This will create new opportunities for businesses for environment conscious companies. The main findings of the paper proposed that there are many drivers of eco-innovations that will offer growth and potential to green technologies and eco-friendly businesses. The internal and external factors act as drivers or determinants for eco-innovation, for instance, companies are now focusing on corporate social responsibility and pressure from environment conscious consumers made firms to act accordingly. Among these drivers, regulation is termed as the most important factor along with external and internal pressure and the need of efficient and cost reducing production.

Findings of this study suggested that apart from the drivers that leads to the growth of eco-innovations there exists many barriers in eco-innovations that demotivate firms and companies to adopt such innovative methods. The results also focus on awareness and education for both consumers as well as companies regarding sustainability and environmental responsibilities. To efficiently support eco-innovations, it is necessary to get access of various incentives and new diversified instruments to stimulate the demand of eco-friendly services and products, which will directly effects the processes of firms and companies to change their production processes and produce in a more sustainable way.

Future studies can analyse in more detailed manner about the drivers and barriers in eco-innovations and sustainable development. A case study can also give proper information of the barriers and determinants it faced in the adoption of eco-innovation.

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