Theoretical Aspects Of The Nature And Influencing Factors Of Eco-Innovations

Anita Auzina, Dr.oec., assoc. professor.;
Andra Zvirbule, Dr.oec., professor;
Karina Tihonova, Mg.oec.
Latvia University of Agriculture

Abstract

The world faces such serious environmental problems as climate change, the exhaustion of natural resources and the loss of biodiversity, which create self-destruction threats to our mankind. This situation has become so real and visible that it caused response in the form of eco-innovations. Eco-innovations are any kind of innovation that contribute to more efficient exploitation of resources or environmental protection. Eco-innovations involve the sustainable exploitation of natural resources, ensure increase in the quality of life, meet today's needs without compromising the ability of future generations to meet their own needs and contribute to the preservation of biodiversity for an unlimited period. Eco-innovations involve not only environmental gains but also provide an opportunity for entrepreneurship. Eco-innovations reduce the expenses of enterprises, help the enterprises to use new opportunities for their growth and strengthen the image of the enterprises among the public.

The eco-innovation initiative was launched in 2008, and it was part of several European Union (EU) innovation programmes. For this reason, the research problem and the research aim were determined by the necessity to identify and examine the theoretical aspects of the nature and kinds of this relatively new initiative, which are further used as a basis for empirical research.

The research aim is to characterise and examine the theoretical aspects of the nature and influencing factors of eco-innovations.

The research employed general analysis methods, logical construction, and quantitative methods: monographic, content analysis for the specific literature and research papers, a specific case study and graphical methods for data analysis and depiction.

Keywords: Green growth, environmental innovations, eco-innovations

Introduction

Green growth and a green or ecological economy are among the keywords used for the global economy in recent years. These terms refer to an economy that, with the public and private sectors cooperating, contributes to increase in incomes and employment, decrease in carbon emissions and pollution and to the rational exploitation of resources and energy efficiency, while preserving biodiversity and available ecosystem services (Graudums, 2012). Eco-innovations in particular can contribute to a green economy and ensure sustainable development.

A chronological analysis of the emergence and application of the term eco-innovation in theoretical and empirical research studies on economic and environmental protection problems reveals that the mentioned term is relatively new. In bibliographical sources, authors use various terms: eco-innovation, green innovation, environmental innovation and ecological innovation. After analysing a number of bibliographical sources in their research, Angelo et al. (Angelo et al., 2012) have concluded that the term environmental innovation was used in most of the sources examined (65%), the term eco-innovation was used in 22% and the term green innovation was referred to in 13% of the sources.

C.Fussler and P.James (Fussler, James, 1996), in their book entitled Driving Eco-innovation: a Breakthrough Discipline for Innovation and Sustainability were among the very first authors who used the term eco-innovation. In his next book published in 1997, P.James defined eco-innovation as "new products and processes which provide customer and business value but significantly decrease environmental impacts" (James, 1997). In their works, many authors use a definition by K.Renning (Renning, 2000): eco-innovation is the development process of new ideas, behaviours, products and processes that contribute to reducing burdens on the environment or promote the achievement of environmental sustainable development objectives.

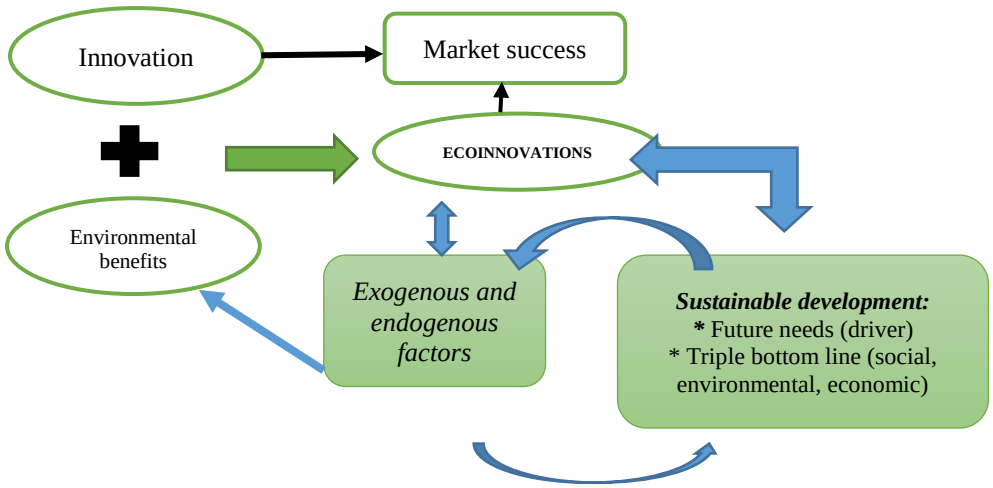
The authors of the Systematic Eco-Innovation Report (2008) define eco-innovation as follows: "Eco-innovation is "the creation of novel and competitively priced goods, processes, systems, services, and procedures designed to satisfy human needs and provide a better quality of life for everyone with a whole-life-cycle minimal use of natural resources (materials including energy and surface area) per unit output, and a minimal release of toxic substances". It follows from the definition that eco-innovation is based on the efficient exploitation of resources and energy.

The term eco-innovation is defined also in the Eco-innovation Action Plan of the European Union (EcoAP for a..., 2008) – "any innovation that makes progress towards the goal of sustainable development by reducing

impacts on the environment, increasing resilience to environmental pressures or using natural resources more efficiently and responsibly.

However, J.Horbach et al. (Horbach et al., 2011) define eco-innovation as a product, process, marketing and organisational innovations, the performance of which considerably reduce negative environmental impacts. A positive impact on the environment might take the form of a clearly defined target as well as an innovation externality. It may emerge in the internal environment of enterprises or through consumers consuming goods or services.

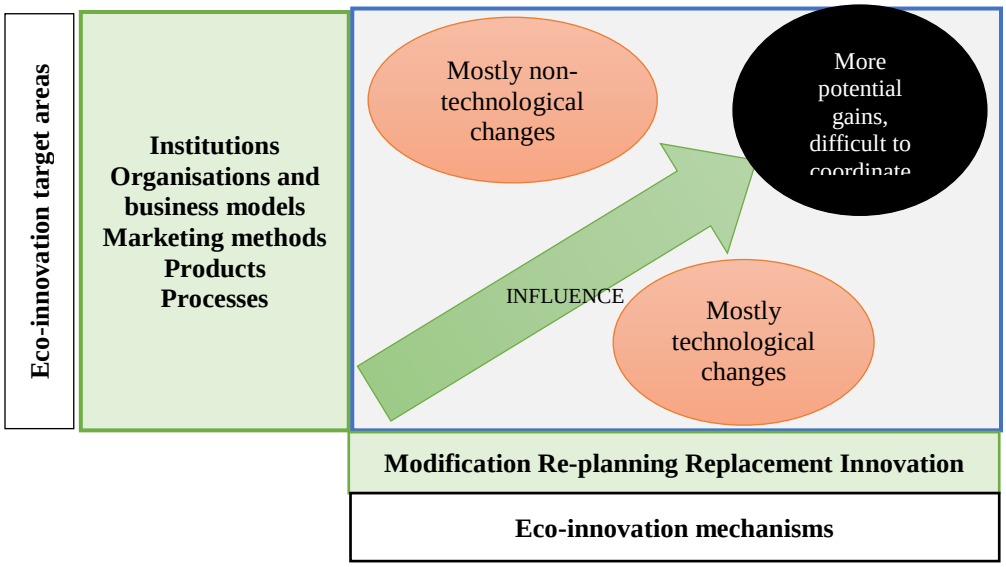
In their research, M.B.Bossle et al. (Bossle et al., 2015) consider eco-innovation as an output (not from a processual point of view, but as a goal), which can be achieved by companies, encouraged by the government, demanded by society, as a way of contributing to sustainable development (Figure 1).



Source: authors' construction based on Bossle M. et al. "The drivers for adoption of eco-innovation", 2015. g.

Fig. 1. **Drivers of eco-innovations**

The Eco-design Centre in Great Britain (2013), characterising the nature of eco-innovation, identified three eco-innovation aspects: eco-innovation-focused targets, mechanisms developed due to a change in a target area and influence as an impact of eco-innovation on the environment (Ecodesign Centre Briefing..., 2013). The interrelation of the mentioned aspects is shown in Figure 2.



Source: authors' construction based on Ecodesign Centre Briefing..., 2013

Fig. 2. **Interrelation of the aspects of eco-innovation**

However, regardless of differences in the formulations, all the definitions comprise an environmental component and reflect two key eco-innovation outcomes: fewer negative impacts on the environment and more efficient use of resources. Accordingly, one can conclude that eco-innovation relates to all the kinds of innovation: technological, non-technological as well as those related to goods, services and new practices in entrepreneurship, which create opportunities for business and benefit the environment, avoid or reduce environmental impacts or optimise the use of resources.

The first empirical research studies that aimed to identify factors hindering and driving eco-innovation were done in the 1990s. These first research studies were heterogeneous in methodology and outcomes, as one of the key problems was to find adequate, appropriate data and indicators on eco-innovation. Even though there were discussions among the researchers of that period on the strong effect of environmental regulation on innovation and the most effective policy instruments as stimuli, many authors stressed the positive correlation between the innovation and the environmental regulation in their works (Belin et al., 2011). Their research results supported the so-called Porter hypothesis; according to it, correctly developed environmental standards can trigger innovations and partly or even more that fully offset the costs incurred due to support for the innovations (Porter, van der Linde, 1995a). This indicates that eco-innovation measures are not the outcome of optimisation.

At the initial period of research on eco-innovation, researchers pointed out that one of the hindering factors was the fact that enterprises did not disclose and fully assess the potential of eco-innovation, as they lacked long-term creative experience in environmental matters (Belin et al., 2011). Ecologically and economically "fruitful" eco-innovations were not implemented owing to the lack of information as well as because of organisational and coordination problems (Porter, van der Linde, 1995b). Enterprises could not identify the potential of economies (e.g. savings on energy or materials) that was ensured by eco-innovations. For this reason, environmental regulation could encourage enterprises to introduce economically efficient ecological innovations – eco-innovations. However, despite the incentive role of regulation, eco-innovations may not be considered to be only a systematic response to and the outcome of the regulation. There are other market factors and technological opportunities for an enterprise that determine the enterprise's technological response to eco-innovation (Kammerer, 2009).

In fact, an eco-innovation is an innovation that depends on a number of factors. Many factors influence the innovation process, not only exogenous but also endogenous: resources of all kinds (technological, human) that are available to an enterprise and, in particular, its experience, knowledge base and technological capabilities for the creation of eco-innovations (Belin et al., 2011). J.Belin classified the influencing factors into three categories: policy and regulatory determinants, traditional demand side determinants and traditional supply side determinants (Table 1).

Table 1 **Determinants of eco-innovation**

Policy and regulatory determinants	Implementation and institutionalisation of environmental policy instruments: economic and regulatory instruments. Regulatory design: stringency, flexibility, time frame. Anticipation of future environmental regulations.
Traditional demand side determinants	Technological capabilities: knowledge bases, R&D activities, human capital endowment. Cost savings, productivity improvements. Appropriability conditions, market structure. Organizational innovations: environmental management systems, extended producer responsibility. Industrial relationships, supply chain pressure, networking activities.
Traditional supply side determinants	Environmental consciousness and consumers' preferences for environmentally friendly products. Expected increase in the market share or penetration of new market segments.

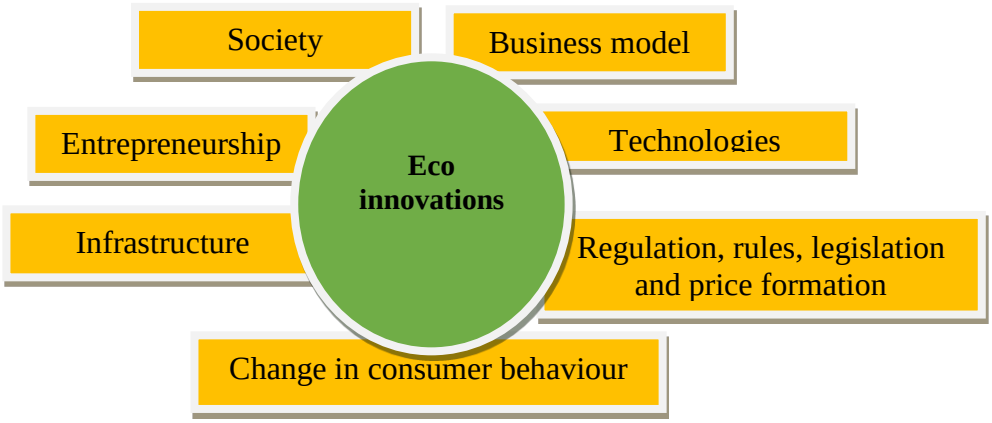
Source: authors' construction based on Belin et al., 2016

As the problem of environmental pollution became urgent, which naturally pointed to the need and development of eco-innovations, many researchers did their research with the purpose of identifying the factors

influencing eco-innovation (Kammerer, 2009). A number of econometric research studies analysed eco-innovations as a whole, and only a few ones distinguished innovation chain stages (Horbach et al., 2011). A number of authors have pointed out that the development of eco-innovation is determined, more or less, by the legislation and legal regulation. A number of research investigations also stress the positive role of cost savings. It is an encouraging motive and a stimulus for the introduction of eco-innovations, particularly cleaner production technologies (Horbach, 2008, Frondel et al., 2007).

However, in their work, J.Horbach, C.Rammer and K.Rennings distinguish as many as four factors influencing eco-innovation: legal regulation, technology, an enterprise's strategy and the market. Just like many other researchers, they too consider the regulatory push/pull effect to be an important factor influencing eco-innovation. According to the mentioned authors, particularly the national legislation and legal regulation are the driver for enterprises to make innovation decisions.

The Organisation for Economic Cooperation and Development (OECD) distinguishes seven factors influencing eco-innovation, beginning with a business model chosen by an enterprise through to change in consumer behaviour (The future of..., 2012, ASEM Eco-Innovation Index..., 2012). All the factors interact and develop eco-innovations (Figure 3).



Source: authors' construction based on research papers published by ESAO, 2015.
Fig. 3. **Influence of various factors on eco-innovations**

In its study entitled the Future of Eco-innovation: the Role of Business Models in Green Transformation, the Organisation for Economic Cooperation and Development (The future of eco-innovation..., 2012) has identified the key factors negatively influencing eco-innovation or barriers to it. They are divided into endogenous and exogenous factors.
Internal barriers to eco-innovation are as follows:

- a traditional mindset among producers and the lack of knowledge on sustainability issues;
- insufficient reference cases on new models and approaches;
- lack of knowledge on new possibilities among the management;
- lack of horizontality among different functions in an enterprise;
- increased development and production cost;
- lack of competencies in research and development.

External barriers to eco-innovation are as follows:

- lack of market-pull forces and their influence, the lack of consumer subsidies or the lacking implementation of green public procurement, and a general lack of governmental action and commitment for reform towards green growth. The lack of such actions in the country creates real barriers to the development and introduction of eco-innovations;
- lack of capital for initial investment. Often new projects are perceived to be too risky or lacking knowledge among stakeholders on the potential economic benefits of investment (*Green Servicizing: Building…, 2009*);
- difficulty of new business models in fitting in the existing systems as well as their need for supporting infrastructures and technological changes (Martin, 2009; Meenakshisundaram, Shankar, 2010);
- regulatory barriers that may prevent enterprises from taking certain new approaches to eco-innovation (Towards Green Growth, 2011; Fostering Innovation for…,2011);
- lack of consumer readiness on which the adoption of eco-innovations heavily depends. For example, it is difficult to change the attitudes of consumers who are used to the luxury and convenience of big, high-powered vehicles in adopting electric cars or sharing schemes (Martin, 2009; Meenakshisundaram, Shankar, 2010).

Conclusion

Owing to increasing environmental problems as well as the constrained factors of production, the global economy does not have another option but to adapt to limitations regarding the natural environment and resources, the tackling of which requires eco-innovations. Therefore, the demand for ecological innovations, goods and services is expected to increase, thereby promoting the emergence of environment-friendly industries. The faster adoption and spread of eco-innovations in the market will enhance the environmental performance and resilience of the national economy; besides, it is financially beneficial and useful for entrepreneurship and the entire society. It can also create jobs, stimulate economic growth and competitiveness, as well as it is important for environmental protection.

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