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SMecoMP

WP3 Eco-Entrepreneurial Surveys and Network Development

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Eco-Innovation: Definitions, Typology and Taxonomy

Introduction

Europe's and worldwide economy and citizens will have to confront a number of challenges in the decades to come. Many of these challenges are related to the environment and economic competitiveness. Both the environment and the economy matter, yet historically it has proved difficult to reconcile growth with protecting the environment. This is why the European Union (EU) has set out a new strategy for smart, sustainable and inclusive growth, known as the Europe 2020 strategy. In this strategy, eco-innovation – in combining environmental and competitiveness challenges - plays a central role. Eco-industries and eco-innovation are an emerging market which, by offering the prospect of reconciling profitable investment, job creation and environmental sustainability, is increasingly attracting the interest of businesses and policymakers alike.

Eco-innovation is not limited to a sector or a mere synonym for environmental technologies, goods or services, rather, it is cross-cutting. The pervasive nature of eco-innovation makes it challenging to capture its full scale and scope, as well as to measure it with existing statistical indicators.

Small and Medium sized Enterprises (SMEs) represent a key vector to introduce and diffuse eco-innovation in the market, because of their relevance to both the environment and the European gross domestic product. As they are often focused on continuous and incremental innovation of their products, the optimization of product eco-innovation paths can be considered a central aspect of their business. Eco-innovation is increasingly seen as an answer to the environmental and economic challenges that many business sectors and countries are facing. It offers viable economic development opportunities both for companies and countries and also promises to create jobs while at the same time preserving the environment.

However eco-innovation seems still to be a complex and not easily understood concept. In this article Eco-innovation definition, typology and taxonomy is presented in order to make it easier for the existing and future eco-entrepreneurs, companies' staff to comprehend what eco-innovation stands for. It can be considered as the first step, for eco-entrepreneurs and stakeholders both to public and private sectors, to realize what can be the benefits eco-innovation can bring to their business, the difficulties and obstacles may face towards its implementation, the existing tools they may need and look for to support their efforts and investment to integrate the eco-innovation concept into their business policy and sustainable development.

The Eco-innovation Definition

The EU Eco-innovation Action Plan defines eco-innovation as, *“any form of innovation resulting in or aiming at significant and demonstrable progress towards the goal of sustainable development, through reducing impacts on the environment, enhancing resilience to environmental pressures, or achieving a more efficient and responsible use of natural resources”*. [1]

The Eco-Innovation Observatory (EIO) defines eco-innovation as, *“the introduction of any new or significantly improved product (good or service), process, organisational change or marketing solution that reduces the use of natural resources (including materials, energy, water and land) and decreases the release of harmful substances across the whole life-cycle”* [1]. EIO also recognizes systemic eco-innovations, which can lead to systemic changes in both social (values, regulations, attitudes etc.) and technical (infrastructure, technology, tools, production processes etc.) spheres and, most importantly, in the relationships between them.

Eco-innovation is about reducing our environmental impact and making better use of resources. This means developing products, techniques, services and processes that reduce CO₂ emissions, use resources efficiently, promote recycling and so on. There are five main strands to this initiative:

- Materials recycling and recycling processes;
- Sustainable building products;
- Food and drink sector;
- Water efficiency, treatment and distribution;
- Greening business.

Environmental technologies are also considered to have promise for improving environmental conditions without impeding economic growth in the United States, where they are promoted through various public-private partnership programmes and tax credits [2].

The EU is looking to maximise the impact of Eco-innovation and make every euro go as far as possible. The best Eco-innovation projects are those that can be replicated across the EU.

The Organisation for Economic Co-Operation and Development (OECD) *Oslo Manual* (2018) for the collection and interpretation of innovation data describes innovation as *“the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organization or external relations”*. Although this definition generally applies to eco-innovation, eco-innovation has two further significant, distinguishing characteristics:

- A. It is innovation that reflects the concept’s explicit emphasis on a reduction of environmental impact, whether such an effect is intended or not.
- B. It is not limited to innovation in products, processes, marketing methods and organizational methods, but also includes innovation in social and institutional structures (Rennings, 2000).

Eco-innovation and its environmental benefits go beyond the conventional organizational boundaries of the innovator to enter the broader societal context through changes in social norms, cultural values and institutional structures.

The Eco-innovation Typology [2].

Building upon existing innovation and eco-innovation literature, eco-innovation can be understood and analysed in terms of an innovation’s

- **Target,**
- **Mechanism,** and
- **Impact.**

Target refers to the basic focus of eco-innovation. Following the *Oslo Manual*, the target of an eco-innovation may be:

- a. **Products**, involving both goods and services.
- b. **Processes**, such as a production method or procedure.
- c. **Marketing methods**, for the promotion and pricing of products, and other market oriented strategies.
- d. **Organisations**, such as the structure of management and the distribution of responsibilities.
- e. **Institutions**, which include the broader societal area beyond a single organisation’s control, such as institutional arrangements, social norms and cultural values.

The target of the eco-innovation can be technological or non-technological in nature. Eco-innovation in products and processes tends to rely heavily on technological development; eco-innovation in marketing, organisations and institutions relies more on non-technological changes.

Mechanism relates to the method by which the change in the eco-innovation target takes place or is introduced. It is also associated with the underlying nature of the eco-innovation – whether the change is of a technological or non-technological character. Four basic mechanisms are identified:

- a. **Modification**, such as small, progressive product and process adjustments.

- b. **Re-design**, referring to significant changes in existing products, processes, organizational structures, etc.
- c. **Alternatives**, such as the introduction of goods and services that can fulfil the same functional need and operate as substitutes for other products.
- d. **Creation**, the design and introduction of entirely new products, processes, procedures, organisations and institutions.

Impact refers to the eco-innovation’s effect on the environment, across its lifecycle or some other focus area. Potential environmental impacts stem from the eco-innovation’s target and mechanism and their interplay with its socio-technical surroundings. Given a specific target, the potential magnitude of the environmental benefit tends to depend on the eco-innovation’s mechanism, as more systemic changes, such as alternatives and creation, generally embody higher potential benefits than modification and re-design

The Eco-innovation Taxonomy [3].

As mentioned above, sometimes it is difficult to clearly define eco-innovation because of the complexity of the subject and because greening is a moving target. Eco-innovation, or as it has been referred to hitherto as environmental technologies or the environmental sector, has been defined with very different purposes, e.g. as an object for environmental regulation or administration or as an industrial growth area. The concept of environmental technologies has changed and is still changing, considerably, in time with the changing environmental agenda. With a still more preventive approach to environmental issues innovation and eco-innovation is becoming still more entangled, none the least for the companies.

The way we understand eco-innovation has major influences on the nature of empirical and other case studies undertaken and the policy measures and business strategies undertaken. And the way we understand eco-innovation depends highly on how we understand innovation.

An operational taxonomy that entails key types of eco-innovations reflecting their different roles on a (greening) market is needed. Five categories of eco-innovations are suggested:

1. Add-on eco-innovations
2. Integrated eco-innovations
3. Alternative product eco-innovations
4. Macro-organizational eco-innovations
5. General purpose eco-innovations

Add-on eco-innovations (pollution- and resource handling technologies and services)

This group is the most well-defined. These are products (artifacts or services) that improve the environmental performance of the customer. The product in itself need not be environmentally friendly.

They deal with environmental solutions at the sink side (the many technologies and services which clean up, dilute, recycle, measure, control and transport emissions) and the source side (extraction and supply of natural resources and energy). Nature conservation, influenced by both sink and source activities, should be included here. These technologies and services are developed by what is generally understood as the environmental industry. The technologies and services typically have limited systemic effect as they generally are added-on to existing production and consumption practices (which is cost effective) without influencing these significantly. Very radical add-on technologies could, however, have wider systemic effects but the incentives for developing such are small.

Integrated eco-innovations (cleaner technological processes and cleaner products)

These are integrated innovations, which make either the production process or the product more eco-efficient (“cleaner”) than *similar* processes or products. Hence companies who have invested in integrated innovations (by buying and/or developing these) aim to appear more eco-efficient than similar competitors, either in the overall environmental performance of the company or in the environmental impact of the given product. They may, however, also have been introduced for other purposes, such as productivity aims.

They contribute to the solutions of environmental problems of the organization *within* the company or other organizations (public institutions, families..), in this sense they are integrated. They are the innovations which contribute to changing production and consumption practices in organizations, most importantly in companies.

The innovations enable energy and resource efficiency, enhance recycling or enable the substitutions of toxic materials. The innovations are mainly technical, but can also be organizational, i.e. changes in the organization of production and management within an organisation. The “greenness” of these products is relative (to the greenness of other similar products) and may therefore change over time. This category stresses greening as a moving target. They represent a technological continuity.

3. Alternative product eco-innovations (new technological paths)

These are innovations that represent a radical technological discontinuity. They are not cleaner than similar products but rather offer very different (a new technological trajectory) more environmentally benign solutions to existing products.

These radical product innovations have wide systemic effects; they built on new theories, capabilities and practices and may demand a change of both production and consumption patterns.

The environmental dimension lies in the production/product design alone, which is (supposedly) per se greener than the (dissimilar) alternative. The production method itself need not be clean, and in some cases attract little attention. Examples are renewable energy technologies (as opposed to fossil fuel based technologies) and organic farming (as opposed to conventional farming).

Macro-organizational eco-innovations (new organizational structures)

These innovations entail new solutions for an eco-efficient way of organizing society. This means new ways of organizing our production and consumption at the more systemic level, entailing new functional interplays between organizations, e.g. between companies (“industrial symbiosis”), between families and workplaces, and new ways of organising cities and their technical infrastructure (“urban ecology”).

These innovations imply changes in the regional and physical planning and technical infrastructure in varies ways. Many of such innovations are currently discussed within the so called “sustainable consumption and production” approach.

The innovations are organizational but may include technical innovations. They may be conceptually very radical hence representing a search discontinuity, but not necessarily technically radical. They emphasize the importance of the spatial dimension for eco-innovation and the need for organisational and institutional change. These innovations are often to a large degree within the domain of public authorities, who need to cooperate with companies to develop such novel solutions.

5. General purpose eco-innovations

Certain general purpose technologies affect the economy profoundly and the innovation process more specifically as they lie behind and feed into a range of other technological innovations.

Innovation researchers refer to how these technologies define the dominating technoeconomic paradigm at any given time. Changes in the general purpose technologies are so fundamental that they will have major effect on eco-innovations and special attention should therefore be given to developments within these. The enabling (derived rather than direct) negative and positive effects technologies such as ICT, biotechnology, and lately nanotechnology may have on eco-innovations is in need of special scrutiny.

The above categorisation is helpful in understanding the complexity of eco-innovation dynamics.

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