Editorial

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In the last few years, many companies and governments in the world have begun promoting eco-innovation, or similar terms, as a way of supporting sustainable development objectives while keeping industry and the economy competitive. In addition, Aghion et al. (2009) emphasise that there will be no green growth without innovation.

Although the promotion of eco-innovation has so far focused mainly on the development of environmental technologies, there is today a growing understanding of the non-technological aspects of innovation, which reflects the fact that the focus of innovation on sustainable development demands broad structural changes in society.

The term eco-innovation first appeared in Fussler and James' book *Driving Eco-Innovation* in 1996. The concept was defined in James (1997) as "new products and processes that provide customer and business value while significantly decreasing environmental impacts".

Various publications have highlighted the characteristics of either innovation targets or kinds of impacts.

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Regarding targets, Kemp and Arundel (1998) point out that they are "new or changed procedures, techniques, systems or products to reduce or avoid environmental damage". For a description of impacts, Hemmelskamp (1997) argues that "environmental innovations serve to: avoid or reduce emissions caused by the production, use or consumption and disposal of goods, reduce resource input, environmental cleanup damage done in the past, identify and control pollution".

Over time, the literature has used related concepts interchangeably such as 'environmental innovation', 'cleaner technology', 'green innovation', 'innovation for sustainable development' or 'sustainable innovation'.

According to the Oslo Manual (OECD and Eurostat, 2005)[1], innovation is defined as "the implementation of new, or significantly improved, products (goods or services) or processes, marketing methods, or organisational methods in business practices, workplace organisation or external relations".

Gradually, this definition has been expanded to take into account various concerns of an innovation supporting sustainable development. In 2008, the OECD proposed the following definition of eco-innovation: "the *creation* of new, or significantly improved, products (goods and services) processes, marketing methods, organisational structures and institutional arrangements which – with or without intent – lead to environmental improvements compared to relevant alternatives" [OECD, (2008) p.19].

This advanced OECD definition has the merit of pointing out a number of specific features of eco-innovation:

- What is the mission of the organisation relative to novelty: should it develop, create and/or implement innovation? [For a description of drivers of eco-innovation, see Markusson and Olofsdotter (2001)].

- The nature of targets: from classic products and processes to institutional arrangements? [See debates in Malaman (1996), James (1997), Kemp and Arundel (1998), Rennings (2000) and Oltra (2008)]. Thus, we have to promote a definition of eco-innovation that encompasses the broader societal sphere (Reid and Miedzinski, 2008).

- The integration of the environmental dimension: does innovation emphasise more environmentally benign solutions than relevant alternatives? (Hemmelskamp, 1997).

- Is the environmental definition of innovation focused on the intention or the effects of innovations? [As described in Markusson and Olofsdotter (2001)].

Therefore, we suggest Kemp and Pearson's (2008) definition that gives a particular environmental identity to innovations: "Eco-innovation is the production, assimilation or exploitation of a product, production process, service or management or business method that is novel to the organisation (developing or adopting it) and which results, throughout its life cycle, in a reduction of environmental risk, pollution and other negative impacts of resources use (including energy use) compared to relevant alternatives".

To improve the conceptual understanding of eco-innovation and to facilitate the construction of an analytical framework that combines eco-innovation with sustainable growth, this special issue attempts to draw together a conceptual and typological overview of eco-innovation and its determinants and drivers.

In the innovation literature (Charter and Clark, 2007; Reid and Miedzinski, 2008) it is proposed that an eco-innovation can be understood on the basis of three key axes: its target, its mechanism and its impact.

For the *target*, the basic focus of eco-innovation can be categorised under:

- Products and processes, which are closely related to technological advances [as mentioned in Beise and Rennings (2005)].
- Marketing methods and organisational structures whose mechanisms tend to be associated with non-technological changes (such as the question of responsible governance or operational practices).
- Institutions, which include wider societal areas beyond a single company's control such as broader institutional arrangements as well as social norms and cultural values (Rennings, 2000). In Japan, for example, the government's Industrial Science Technology Policy Committee proposes promoting the construction of 'zero emission-based' infrastructures in transport development, as well as sustainable lifestyles by selling services instead of products and by promoting environmental and sensitivity values (METI, 2007).

Mechanism relates to the method by which the change in the eco-innovation target takes place. Depending on whether the nature of the change is technological or non-technological, the literature identifies the following mechanisms for eco-innovation [for a description, see Faucheux and Nicolaï (2015)]:

- Modification referring to the innovation intensity [incremental/radical change as in Freeman and Soete's definition developed in De Marchi (2012)].
- Redesign, referring to the scope of innovation [end-of-pipe/integrated environmental technologies as described by Hemmelskamp (1997)].
- Alternatives, referring to eco-innovation support (such as the service economy) or new production methods [as represented by industrial symbiosis in Erkman (1998)]. The substitution of raw materials in the use of renewable energies could also be mentioned (Polimeni et al., 2008).
- Creation, comprising the design of new products, processes, procedures, and institutional settings (Rennings, 2000).

Impacts refer to the eco-innovation's effects on environmental conditions, throughout its complete life cycle. For eco-innovation, environmental damage could be evaluated on its technological performance with respect to energy and resource efficiency [measured on the environmental effects as in Weizsacker et al. (1998)] and with regard to avoiding pollution.

In this perspective, we adopt the following definition of eco-innovation given by the Eco-Innovation Observatory [EIO, (2012) pp.8]: "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". Thus, eco-innovation encompasses technical, social, economic, governance, and environmental dimensions.

Clearly, these eco-innovations need investment and time to mature. Thus, a transition period has begun during which organisations must be supported and encouraged in their efforts to promote eco-innovation. Like all potentially disruptive innovations in their emerging phase, they are inherently less efficient and less profitable than *dominant designs* (Christensen, 1997). Moreover, although embarking on the eco-innovation pathway may lead to profits in the long-term (Rockström et al., 2009), it is often a decision accompanied by a loss of competitivity in the short-term. This is where targeted and temporary policies with an environmental objective can 'bridge the gap' (Moore, 1991).

In other words, 'bridging the gap' is the prerogative of innovators who mange to transform a 'technology push' dynamic into an adoption movement of the 'demand-pull' type. Eco-innovation is no exception (Costantini et al., 2015). However, for it to be adopted by the mass market, it must be visible and accepted.

In this respect, the case of electric mobility is particularly enlightening. In fact, the experiment of Hidrue et al. (2011) shows that, in the current state of the technology, there is no willingness to pay for an electric vehicle because the potential clients perceive a net disutility in it compared to a combustion-powered vehicle. Such a disutility can be compensated in two ways: by government incentives to purchase, of the bonus-penalty type, which support the disruptive innovation until the performance of the new technology exceeds that of the *dominant design*; or by the constitution of a complete ecosystem around this new technology (Pillot, 2013; Faucheux and Nicolaï, 2016). For electric mobility to have a future, i.e., for potential consumers to become actual clients (or users) its access and use must be simplified: the charging stations must be installed and visible throughout the territory, particularly at modal hubs; priority lanes and some parking spaces must be reserved for this type of vehicle; or the vehicle should even be able to communicate with domestic electrical equipment.

In a way, this is the message that we want to deliver in this special issue of the *International Journal of Sustainable Development*: the effective and responsible use of primary resources is a source of tangible economic benefits in the long-term, provided we understand how to use them best throughout their lifecycle and work towards setting up incentive mechanisms to accelerate this 'eco-logical' transition.

This special issue addresses various questions related to the determinants of eco-innovations and how to interpret new innovation patterns and manage their implementation in organisations.

The article by Céline Michaud, Iragaël Joly, Daniel Llerena and Valeriia Lobasenko presents an original experimental approach to demonstrate the willingness to pay for upgradable products, the well-known product service systems (PSS) which show real promise in terms of more responsible consumption. The results are particularly encouraging in that they reveal a preference by consumers for these types of goods, provided that they can make substantial savings by using them, especially in energy. The reluctance of some consumers to upgrade the products themselves is a positive sign for companies working to provide complete service packages, from sales to maintenance and including advice and upgrading. It would thus be possible to recreate the lost value by decreasing the renewal (and planned obsolescence) of equipment downstream in the value chain.

Sophie Dantan, Julie Bulteau and Isabelle Nicolaï propose an original prospective analysis consisting of establishing in advance the interest of consumers in – and ultimately their intention to pay for – a multimodal information platform to facilitate mobility. The results of their research show the prevalence of the *functional value* of the eco-innovation for the potential consumer as the first driver of its adoption, ahead of economic or ecological motives. Such a hierarchy of stated preferences seems to suggest that the acceptability of the eco-innovation increases when it is perceived as accessible and facilitating.

Like the previous article, that of Amélie Coulbaut-Lazzarini and Thibault Danteur falls within the scope of the acceptability of eco-innovation, but completes it by a sociological approach to the problem. By investigating electric mobility, they show how the installation of communicating charging infrastructures jointly developed by a consortium of operators can accelerate the spread of the electric vehicle and indirectly cause a paradigm shift. Their research reveals the socio-technical areas of use and dissemination where the stakeholders of eco-innovation can meet and/or coordinate. From an operational point of view, they help to understand better the place of the user within the innovation network. From an institutional perspective, they demonstrate the difficulty of rapidly introducing eco-innovations supported by groups whose members may be complementary at the technological level but whose organisational and strategic cultures may be very different.

The article by Christian Le Bas and Nicolas Poussing establishes a novel link between CSR and non-technological (organisational and marketing) innovations undertaken by companies and their ability and willingness to develop environmental innovations. This result questions the relevance of public policies focused only on tax incentives or restrictive regulations to stimulate eco-innovations. It would be more effective to combine these with comprehensive policies aimed at making entrepreneurs and intrapreneurs aware of the virtues of non-technological innovations.

This result has been confirmed by the research of Adeline Alonso Ugaglia and Marie Ferru on the determinants of eco-innovation. Their article states that in specific territories characterised by their small size and the preponderance of low-tech industry, the determinants of the offer, and thus the ability to gain a competitive advantage or reduce costs, have a greater influence than incentive policies on the development of eco-innovations. In such market conditions, dependence on the technological pathway is strong and can slow down the adoption of radical eco-innovations.

Lastly, the article by Babacar Dieng and Yvon Pesqueux establishes the normative nature of the concept of ‘green governance’. It should be understood as a natural resources management system, which is built around an institutional framework and managerial tools and structure that enable the coordination of actors, conflict resolution and group achievement. This is the perfect conclusion to this special issue of the *International Journal of Sustainable Development*, in that the article recalls that faced with the failures of centralised governance systems to implement decisive environmental measures, there is an absolute need to address the ‘eco-logical’ transition from a collective and collaborative angle. Governance is the fourth pillar of sustainability that should be analysed in an integrated way.

References

Aghion, P., Hemous, D. and Veugelers, R. (2009) 'No green growth without innovation', *Bruegel Policy Brief 07*.

Beise, M. and Rennings, K. (2005) 'Lead markets and regulation: a framework for analyzing the internal diffusion of environmental innovations', *Ecological Economics*, No. 52, pp.5–17.

Charter, M. and Clark, T. (2007) *Sustainable Innovation: Key Conclusions from Sustainable Innovation Conferences 2003-2006 Organised by The Centre for Sustainable Design*, The Centre of Sustainable Design, University College for the Creative Arts.

Christensen, C. (1997) *The Innovator's Dilemma: When New Technologies Cause Great Firms To Fail*, Harvard Business School Press, Boston, USA, p.336.

Costantini, V., Crespi, F., Martini, C. and Pennacchio, L. (2015) 'Demand-pull and technology-push support for eco-innovation: the case of the biofuels sector', *Research Policy*, Vol. 44, No. 3, pp.577–595.

De Marchi, V. (2012) 'Environmental innovation and R&D cooperation: empirical evidence from Spanish manufacturing firms', *Research Policy*, Vol. 41, No. 3, pp.614–623.

Eco-Innovation Observatory (EIO) (2012) *Methodological Report*, European Commission, August.

Erkman, S. (1998) *Vers une écologie industrielle*, Editions-Diffusion Charles Léopold Mayer, Paris, France, p.240.

Faucheux, S. and Nicolaï, I. (2015) 'Business models and the diffusion of eco-innovations in the eco-mobility sector', *Society and Business Review*, Col. 10, No. 3, pp.203–222.

Faucheux, S. and Nicolaï, I. (2016) 'Responsible innovation in mobility eco-system: what management mechanisms to address social responsibility, colloque international', *The New Frontiers of the World Automative Industry*', Monterrey, Mexique, June.

Fussler, C. and James, P. (1996) *Driving Eco-Innovation*, p.384, Financial Times/Prentice Hall.

Hemmelskamp, J. (1997) 'Environmental policy instruments and their effects on innovation', *European Planning Studies*, Vol. 5, No. 2, pp.177–194.

Hidrue, K., Parsons, G., Kempton, W. and Gardner, M. (2011) 'Willingness to pay for electric vehicles and their attributes', *Resource and Energy Economics*, Vol. 33, No. 3, pp.686–705.

James, P. (1997) 'The sustainability circle: a new tool for product development and design', *Journal of Sustainable Product Design*, No. 2, pp.52–57.

Kemp, R. and Arundel, A. (1998) *Survey Indicators for Environmental Innovation*, IDEA Paper Series, No. 8.

Kemp, R. and Pearson, P. (2008) *Measuring Eco Innovation*, Final Report of the MEI Project.

Malaman, R. (1996) *Technological Innovation for Sustainable Development: Generation and Diffusion of Industrial Cleaner Technologies*, Working Paper, Fondazione Eni Enrico Mattei.

Markusson, N. and Olofsdotter, A. (2001) *Drivers for Environmental Innovation*, VINOVA, The Swedish Agency for Innovation Systems.

Ministère de l'Economie, du Commerce et de l'Industrie (METI) (2007) *The Key to Innvoation Creation and the Promotion of Eco-Innovation*, Tokyo, Japon.

Moore G. (1991) *Crossing the Chasm – Marketing and Selling High-Tech Products to Mainstream Customers*, HarperCollins, New York, USA, p.235.

OECD (2008) *Annual Report on Sustainable Development*.

OECD and Eurostats (2005) *Manuel d'Oslo, Principes Directeurs Proposés pour le Recueil et l'Interprétation des Données sur l'Innovation*, 3rd ed.

Oltra, V. (2008) *Environmental Innovation and Industrial Dynamics: the Contributions of Evolutionary Economics*, DIME Working Paper, No. 7.

Pillot, J. (2013) *Vers Une Mobilité Décarbonée: Quels Écosystèmes D'affaires, Quels Positionnements Stratégiques?*, Rapport VeDeCoM.

Polimeni, J., Mayumi, K., Giampietro, M. and Alcott, B. (2008) *The Jevons Paradox and the Myth of Resource Efficiency Improvements*, Earthscan.

Reid, A. and Miedzinski, M (2008) *Eco-Innovation: Final Report for Sectorial Innovation Watch*, Technopolis Group.

Rennings, K. (2000) 'Redefining innovation – eco-innovation research and the contribution from ecological economics', *Ecological Economics*, Vol. 32, No. 2, pp.319–332.

Rockstrom, J., Steffen, W., Noone, K., Persson, Å., Chapin, F., Lambin, E., Lenton, T., Scheffer, M., Folke, C., Schellnhuber, H., Nykvist, B., De Wit, C, Hughes, T., Van Der Leeuw, S., Rodhe, H., Sorlin, S., Snyder, P, Costanza, R., Svedin, U., Falkenmark, M., Karlberg, L., Corell, R., Fabry, V., Hansen, J., Walker, B., Liverman, D., Richardson, K., Crutzen, P. and Foley, J. (2009) 'A safe operating space for humanity', *Nature*, No. 461, pp.472–475.

Schumpeter, J.A. (1934) *The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest and the Business Cycle*, translated form the German By Redvers Opie, New Brunswick and London, Transaction Publishers, 2008.

Weizsäcker Von, E., Lovins, A. and Lovins, H. (1998) *Factor Four: Doubling Wealth, Halving Resource Use*, Earthscan, London, GB, p.323.

Notes

1 Inspired by Schumpeter's (1934) definition "the commercial or industrial application of a new product, process or method of production; a new market or source of supply; a new form of commercial, business or financial organisation".