ECO-Innovation as a Catalyst for Sustainable Business Growth

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Abstract

This article conducts a comprehensive review of 12 prominent scientific papers in the emerging domain of eco-innovation literature, offering a robust foundation for scholars, industry professionals, and policymakers.

The review aims to enhance eco-innovative practices that are crucial for achieving sustainable development and maintaining business competitiveness in the 21st century. Furthermore, the article identifies new directions for future research in the field of eco-innovation.

Keywords: *eco, innovation, eco-innovation, open eco-innovation.*

JEL classification: Q55, O31, M14

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1. Introduction

In recent years, the continuous focus on sustainable management and innovation has given rise to a new discipline known as eco-innovation. This field has garnered significant attention over the past decade, becoming a prominent topic in the scientific community. Positioned at the intersection of ecology and innovation, eco-innovation introduces a new dimension to the discussion, prompting debates about the overlapping areas and the comprehensive nature of this emerging discipline. The present research involves an in-depth literature review aimed at elucidating the main concepts associated with eco-innovation. It seeks to clarify definitions and explore their implications for achieving sustainable management in everyday life. By examining the confluence of ecological principles and innovative practices, this study aims to thoroughly understand how eco-innovation can contribute to sustainable development and business competitiveness.

2. Definitions of eco-innovation

Nowadays, small and medium enterprises (SMEs) are at the forefront of the global economy, striving to gain a competitive advantage. Technological capability, commitment to sustainability, ecological innovation, eco-innovative

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processes and open-innovation are crucial in helping businesses thrive (Valdez-Juárez & Castillo-Vergara, 2021).

A company's industry competitiveness can stem from process or product innovations and can be given by competitor knowledge, price competition, and the rapid adoption of cutting-edge technology that can reflect in production rates and increases in output. It can include short-term market analysis of profitability key performance indicators, such as income, return on investment (ROI) and comparative net profit growth, and long-term growth potential metrics, like enhanced cash flow, sales, revenue growth, and market share (Dong et al., 2014).

Widely acknowledged, technological capability contributes to eco-innovation to a great extent. It refers to a company's competence in designing and developing new processes and products, enhancing the skills of its human capital, and converting knowledge into valuable outputs, such as products and services, thereby boosting the organisation's performance. It entails a combination of financial and human resources to enhance efficiency, including the practical and theoretical knowledge necessary for a company to refine existing products and innovate new ones (Valdez-Juárez & Castillo-Vergara, 2021).

Moreover, eco-innovation and sustainable management have become a constant preoccupation during the past decades, introducing the environmental aspect in managerial practices; however, innovation has recently become a subject of study. One of the first prominent writers to clarify this concept is Schumpeter, in his study called "Theory of Economical Development", first published in 1911 in Austria. The word "sustainability" is even more recent and was first implied at the United Nations Conference on Human Development in Stockholm (Mendonça apud Pacheco et al.) in 1972.

Whereas commonly associated with general innovation, eco-innovation is a particular type of innovation that requires special attention. Therefore, although policies that promote general innovation also contribute to eco-innovation, they possess unique and additional characteristics, primarily tied to the double externality issue and the prominent role of public policies in propelling these innovative practices (Del Río, Peñasco, & Romero-Jordán, 2016).

The term "eco-innovation" was introduced even more recently by Fussler and James in the book entitled "Driving Eco-Innovation", where it is defined as a new product or process that creates value by decreasing environmental impact. In Kemp's and Foxon's views, eco-innovation is the creation, adoption or exploration of a product, manufacturing process, service, management practice or business that is new to the organisation (either by developing or adopting it) and which results during its life cycle in fewer environmental risks, less pollution and other negative impacts resulted from the use of resources, power inclusive, in comparison with alternatives (Pacheco et al., 2017).

The Eco-Innovation Observatory describes eco-innovation as the launch of any novel or significantly enhanced product, process, organisational change, or marketing strategy that minimises the consumption of natural resources (such as materials, energy, water, and land) and reduces the emission of harmful substances

throughout its entire lifecycle (Eco-Innovation Observatory apud Hojnik & Ruzzier, 2016).

Cainelli et al. (2015) define eco-innovation as developing innovations that lead to environmentally sustainable products and services (Arranz et al., 2023). Similarly, Arranz et al. think that eco-innovation is the ability to alter, reconfigure, and develop products, processes, and methods to minimise environmental impact.

Eco-innovation is conceptualised as an innovation focused on reducing environmental degradation or pollution, spanning not only products and processes but also encompassing marketing techniques, organisational practices, and social and institutional changes that positively impact a firm's sustainability efforts (Puspita & Isnalita, 2020, citing OECD, 2009).

3. Categories of Eco-Innovations

Eco-innovation improves social cohesion by encouraging changes in the behaviours of individuals and businesses concerning environmental issues. A categorisation identifies four types of eco-innovation: technological, organisational, social, and those associated with business parks (Păcesilă & Ciocoiu, 2017). Other theories state that eco-innovations come in four types, with organisational eco-innovation being the most prevalent, followed by process eco-innovation, product eco-innovation and end-of-pipe eco-innovation. (Dong et al., 2014).

Rennings (Pacheco et al., 2017) suggests a typology of eco-innovation categorised into four distinct classes: technological, organisational, social, and institutional. Within the technological eco-innovations, there are further subdivisions: i) reactive technologies, which are utilised to repair existing environmental damages such as contaminated soils, and preventive technologies aimed at mitigating environmental harm; ii) end-of-pipe technologies, encompassing measures implemented consumption processes and post-production; and clean or integrated technologies, which address the root causes of emissions during production or at the product level. Organisational eco-innovations involve modifying company management practices, such as implementing eco-audits and service innovations, like managing power demand and waste transportation. These innovations necessitate the development of new infrastructures and more ample systemic changes. The category encompasses social eco-innovations centred around emerging sustainable consumption patterns. These have been gaining more attention and are viewed as shifts in people's values and lifestyles towards sustainability. Lastly, institutional eco-innovations are creative solutions to sustainability challenges facilitated by local networks and agencies, global governance structures, and international trade mechanisms.

Carrillo-Hermosilla et al. (2010) suggest methods for assessing the function and effects of eco-innovations, which include adding components to mitigate and rectify adverse effects without altering the underlying processes and systems responsible for these impacts; Modification of sub-systems focusing on

eco-efficient enhancements and the fine-tuning of sub-systems to boost their performance and lessen their negative environmental effects; transformation of systems aiming to minimise their ecological and societal impacts. Embracing systemic changes requires corporations and society to revisit and modify their production methods and behaviours. (Smith & Lee, 2020)

In addition, the open eco-innovation (OE) that has lately emerged is less scrutinised in the theoretical literature. It became widely known by various terminologies, including sustainable open innovation (SOI), open environmental innovation, the open eco-innovation mode (OEIM), and open-corporate greening, emerging from collaborations between corporations and entrepreneurs for advancing the circular economy. The concept of OE spans different studies, demonstrating its multifaceted nature and the wide range of strategies it encompasses for promoting sustainability within corporate and entrepreneurial activities. Open eco-innovation is characterised as a distributed process that relies on regulated knowledge flows beyond the organisation's confines. This process employs financial and non-financial tactics that align with the organisation's business model. The knowledge foundation of OE is categorised according to the types of external knowledge sources, analytical, synthetic, and symbolic, that companies employ separately or combined. Key sources of information for eco-innovation include patents, consultancy services, private and public research institutes, universities, conferences, trade fairs, exhibitions, scientific and trade publications, and input from suppliers, customers, competitors, industrial and eco-designers, and professional associations (Sanni & Verdolini, 2022).

Does it pay to be green? Rather than asking if being environmentally friendly is financially beneficial, the more pertinent questions are when and for whom it pays to be green. Ghisetti (2014) addresses these questions by examining the relationship between environmental innovation (EI) and competitiveness and environmental performance. He identifies two kinds of environmental innovation: those aimed at reducing negative external impacts and those focused on improving efficiency and cutting costs. The research reveals that innovations reducing energy or material usage positively influence a firm's competitiveness. However, innovations that primarily aim to reduce externalities may have a neutral or even negative impact on competitive advantage. A key obstacle in adopting eco-innovation is its underestimation by managers, often due to the anticipation of low returns on equity (ROE). The authors suggest that a green investment strategy enhances productive efficiency only when investments in cleaner production technologies simultaneously aim to reduce externalities and use raw materials.

4. Eco-Innovation implementing factors

Implementing eco-innovation dissolves internal boundaries and includes the participation of all stakeholders within the organisation, such as managers, employees, clients, suppliers, and the broader society, thus maintaining long-term competitive advantages (Valdez-Juárez & Castillo-Vergara, 2021). Eco-innovation

acts as a mediator between a firm's capability and its performance. Thus, as a firm's ability to manage its resources improves, its eco-innovation efforts enhance, leading to better firm performance. Additionally, the study shows that eco-innovation can mediate the impact of market pressure on firm performance. This means that the more the market pressures a firm, the more it invests in eco-innovation, boosting its performance. (Puspita & Isnalita, 2020).

Therefore, multiple factors influence eco-innovation, including the company's structural variables, research and development aimed at sustainability, adherence to environmental policy mandates, previous performance, and the quality and nature of labour relations (Păcesilă & Ciocoiu, 2017).

The impact of corporate strategies and external factors (including public policies and stakeholder effects) on the innovation activities within companies are widely studied; however, equally important are the factors internal to the company, like resources, capabilities, and competencies (RCCs), that play a crucial role in shaping business strategies and enhancing innovation outcomes (Smith & Lee, 2020). Factors influencing the innovation include regulatory and policy frameworks, determinants from the supply side (such as technological capabilities, opportunities for cost reduction, and conditions for securing benefits), and determinants from the demand side, such as consumer demand for eco-friendly products (Smith & Lee, 2020, citing Horbach, 2008).

5. Eco-Innovation in SMEs

Various factors influence the eco-innovation processes in SMEs acting in the manufacturing sector, such as the external and the internal context, the strategies, the learning, the structure, operations, and the results that lead to one another, and finally, the drive to results. The surrounding external factors comprise supportive eco-innovation policies from the government and an equitable regulatory environment for both SMEs and large corporations. Meanwhile, the internal environment is distinguished by the presence of essential resources like human capital and technology, along with the capability to implement and scale up innovative strategies. Strategies emphasise the long-term commitment to eco-innovation and its strategic relevance. Learning covers technological advisories of the environment, environmental training, and cooperative programs with external stakeholders. Structure refers to eco-innovation in products and processes, the organisational support for innovation, the role of the R&D department in sustainability, and risk management. Operations focus on cooperation within supply networks, recycling practices, and energy efficiency improvements. The results manifest as enhanced reputation, brand image, profitability, continual environmental performance improvement capabilities, attractiveness to employees and customers, and the capacity for organisational learning on eco-innovation. This systemic approach highlights the interconnectedness of various organisational facets that collectively contribute to eco-innovation. (Pacheco et al., 2017, p. 2284)

The Eco-Innovation process in SMEs focuses on services, production and commerce are highly influenced by factors like 1) governmental policies, 2) access to resources (personnel, technology, knowhow), 3) perception of the strategic importance, 4) environmental focus in technological consulting, 5) approaches in product and process development, and 6) collaborative efforts and partnerships in supply networks (Pacheco et al., 2017).

Moreover, Environmental Management Systems (EMS) and cost savings appear to motivate product, process and organisational eco-innovation and investments in environmental research and development (R&D). Furthermore, there seems to be a positive correlation between these types of eco-innovation and the company's size. The drivers that stimulate the R&D and the broad adoption of eco-innovations can be either a motivational element (such as regulatory requirements, anticipated benefits of adoption, positioning the company as environmentally conscious, pressure from competitors, or consumer demand) or an enabling element, for example, EMS, financial assets, or technological expertise (Hojnik & Ruzzier, 2016).

Environmental governmental strategies play an important role and encompass a variety of tools and approaches, such as regulatory and control measures, market-oriented policies and mechanisms, informational tools and methods, management systems, voluntary agreements, subsidies, and the rigour of policies. These elements influence a firm's eco-innovation performance and determine the specific type of eco-innovation that the firm adopts. Substantial effects can arise from various administrative control measures, including quotas and restrictive policies like technical standards and policy admittance. Market policies, such as tariffs, adjustments in water usage and taxes, adjustments in resource exports and tax rebates, and emissions trading, play a significant role. (Dong, Wang, Jin, Qiao, & Shi, 2014)

Additionally, subsidy policies like accelerated depreciation of fixed assets, tax incentives for imported equipment, and technical assistance are influential. Furthermore, voluntary actions, such as collaborating with the government on emissions determinations, are also impactful. Information policies, including environmental bulletins, the disclosure of inventories, and the publicising of pollution levels, are also key factors influencing the eco-innovation process. In evaluating an organisation's eco-innovation, attention can be given to the detection tools employed for environmental monitoring within plants. This includes examining the management of pollutants and waste (solid or hazardous) and the availability and effectiveness of facilities, projects, and equipment used for biological, physical, and chemical water and air treatment (Dong et al., & Shi, 2014).

Moreover, governmental intervention and involvement in society under uncertainty positively stimulate the entrepreneurial eco-innovation processes, which is seen as an encouragement for such tactics. In conclusion, when entrepreneurs experience heightened perceptions of environmental uncertainty, it can bolster the dynamic capabilities of SMEs, subsequently yielding a beneficial effect on the firm's eco-innovation, despite the general perception that it postpones the innovative decisions (Han et al., 2023, p. 15).

6. Adoption of Eco-Innovation

Managers consider Perceived Environmental Uncertainty (PEU) as a key factor in innovation. PEU highlights the entrepreneur's lack of vital information about external conditions. It is categorised into three types: state uncertainty, effect uncertainty, and response uncertainty. State uncertainty indicates the challenge in forecasting the likelihood or alteration of an event. Effect uncertainty pertains to the difficulty in predicting how external environmental changes affect the firm. Finally, response uncertainty involves the unpredictability of the outcomes of strategic choices in uncertain situations. Market uncertainty acts as a dual-edged sword: while it compels SMEs, known for their adaptability and flexibility compared to larger corporations, to scale back investment in new products on the one hand, it also motivates these enterprises to increase their involvement in research and development activities on the other. The PEU stimulates the entrepreneurs' dynamic capabilities and catalyses eco-innovation activities (Han et al., 2023, p. 5).

By adopting innovation, companies can gain a significant competitive edge, boost their innovativeness, and enhance their corporate performance outcomes: (1) increasing their engagement in open innovation activities by interacting more frequently with stakeholders; (2) utilising disruptive technologies and open-source software to refine their processes; (3) forming partnerships with research institutions and universities to work on technological, innovative, and ecological projects; (4) obtaining support from national or international agencies for technological and innovation-driven projects; (5) implementing continuous training programs for their organisation's members; (6) acquiring certifications that emphasise ecological or green practices in product development (Valdez-Juárez & Castillo-Vergara, 2021).

However, SMEs in emerging regions face internal challenges, including a short-term outlook, an inadequately skilled workforce, reliance on traditional technologies, and a tendency towards insular innovation processes. Additionally, they encounter external hurdles like intense competition, the global expansion of multinational corporations, and fluctuations in economic cycles. These aspects make it difficult to adopt innovation due to the R&D difficulties. It seems that SMEs in manufacturing are more prone to adopt certifications than other sectors (Valdez-Juárez & Castillo-Vergara, 2021).

For SMEs, certifications in social responsibility, such as those provided by ISO 14000 and 26000, are crucial. In the management aspect, the ISO 14001 environmental management certification, along with other environmental certifications and the ISO 9001 quality management certification, indicate a higher interest in eco-innovation. It is mandatory for suppliers of raw materials to either hold the ISO 14001 certification or show evidence of strong environmental performance. Concerning products or services, the environmental impact of products is consistently assessed. These products are promoted as eco-friendly or green and have been certified for their environmental, energy-efficient, or water-saving attributes. Labels such as Energy Efficiency Grade or recyclable are affixed to products, emphasising their environmental credentials. Moreover, the development of new products prioritises specific environmental performance

targets. Additionally, the packaging of these products is designed to convey information about their environmental performance. (Dong et al., 2014)

Closely linked to the eco-innovation process is the environmental performance, which can be assessed by examining reductions in the use of materials, energy, and water per product unit, as well as by decreasing emissions of pollutants in liquid, gas, or solid form or substituting materials with safer or less harmful options. A firm's overall competitiveness can be evaluated based on its standing in the specific industry through metrics such as the number of patent applications and its expenditure on research and development. Environmental performance can be viewed from both a micro and macro perspective. At the micro level, it is concerned with adherence to specific and standardised environmental regulations and the measurement of tangible environmental factors such as water quality, air pollutant emissions, solid waste production, and noise level indices (Boons & Wagner, 2009, as cited in Dong et al., 2014). Evaluating eco-innovation performance at this level focuses on ensuring a firm's compliance with legal standards and comparing it with other companies (Lázaro et al., 2007, as cited in Dong et al., 2014). From the macro perspective, environmental performance reflects a firm's broader achievements in pollution control, natural resource conservation, and ecological restoration (Ofezu, 2006, as cited in Dong et al., 2014). Tools such as environmental management performance systems and green innovation accounting systems are used for assessing a firm's eco-innovation performance at this level (Chen & Xue, 2006, as cited in Dong et al., 2014), which includes both the micro-level performance indicators and the wider benefits from ongoing environmental improvements, especially in terms of economic performance and competitive advantages (Boons & Wagner, 2009, as cited in Dong et al., 2014).

In this context, considerable attention is paid to waste treatment methods when outsourcing to another company. Additionally, a dedicated department for environmental protection and safety that has been established to oversee these initiatives is an important aspect of eco-consciousness. Lastly, being identified as a pilot enterprise for cleaner production is notable. Hence, a broad assessment of the initiatives undertaken to rehabilitate ecosystems within plants that have been degraded, damaged, or destroyed is also essential. Regarding cleaner manufacturing methods, evaluating whether new production lines or essential equipment have been introduced and if the primary equipment has been technically upgraded to include expanded capacity is important. Furthermore, there should be an assessment of whether process routes have been enhanced or substituted, raw materials replaced, and energy systems upgraded or changed, for instance, transitioning from oil to gas. Replacing or discontinuing toxic raw materials and recycling main waste, either on-site or through external companies, are also key factors in these cleaner manufacturing practices (Dong et al., 2014).

7. Conclusions

To summarise, eco-innovation and allied disciplines are essential for fostering economic growth and enhancing well-being through sustainable practices. Focusing on environmental health elevates the living standards and cultivates a

more robust economic landscape. Promoting eco-innovation offers extensive benefits influenced by both external and internal factors. However, adapting frameworks to suit the specific requirements of both small and medium-sized enterprises (SMEs) and large corporations across the manufacturing and service sectors is necessary. Despite its acknowledged economic significance and environmental impact, research on environmental sustainability within the service sector remains comparatively scarce, particularly against the backdrop of a more substantial research foundation in manufacturing (Doran & Ryan, 2012; Dumitrescu et al., 2015; Horbach, 2008 as cited in Arranz et al., 2023), indicating opportunities for further investigation.

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