

On the drivers of Eco-innovation: insights from a systematic literature review

Mounir DROUZI, (PhD candidate)

*Faculty of Law, Economics and Social Sciences of Tetouan
Abdelmalek Essaadi University, Morocco*

Mohammed RAJAA, (associate professor)

*Faculty of Law, Economics and Social Sciences of Tetouan
Abdelmalek Essaadi University, Morocco*

Correspondence address :	Faculté des sciences juridiques , économiques et sociales de Tétouan Route de Martil, Tétouan Université Abdelmalek Essaâdi - Tétouan Email : info@fsjete.ma Tel :05-39-68-70-86 / 05- 39- 68-70-86
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Abstract:

Discussions over environmental matters are gaining momentum in both academic and professional spheres. Subsequently, Much ink has been spilled over climate change concerns urgency and ways to mitigate its side effects. Amongst solutions to such pressing problems, Environmental innovations (EI) are new options recently explored to hinder detrimental effects of economic activity and combat its negative impact on the environment. To spell out such a special kind of innovation to a full extent, research on its motivations through a systematic literature review is conducted and a conceptual framework is provided analysing each factor involved in motivating decisions to EI. The aim of the study is to delineate different aspects in relation with EI drivers and delimit all facets related to what really drives firms' intentions. The literature review is carried out on recent articles published in a decade span between 2011-2021, and discussing EI and its various drivers leading to its wider adoption. The main findings are (1) EI are still in infancy stage needing more researches to fully understand them , and (2) that factors pushing toward embracing EI are both internal and external to companies. They include: government policies, collaboration with external partners, customers demand, internal capabilities, efficiency, Size/sector, other stakeholders' pressure, style of leadership.

Keywords : Eco-innovation, environmental innovation ,drivers, systematic literature review

JEL Classification : M10

Paper type: Theoretical Research

1. Introduction

There is a growing global awareness of sustainability issues that pose a great risk to our current generation and threaten the near future of our planet (WCED, 1987). In 2015, in response to such concerns, the intergovernmental panel on climate change (IPCC) made an engagement (Paris agreement) to limit the average warming in global temperature to well under 2°C (no more than 1,5 °C above pre-industrial levels). Such endeavours aim to curb climate change impacts and contain ensuing damages (The Economist ,2022).

Achieving that ambitious goal is possible through many initiatives. One of the main levers is neutral carbon policy (IPCC, 2019). Neutrality is a planetary objective set by the UN to run national economies without burning fossil fuel energy. To do so, greenhouse gas (GHG) emissions need to be halved by 2030, eliminated by 2050 and replaced by greener net-zero emissions (IPCC ,2019). Thus, striking a balance between economy and environment is essential. Green economy through the promotion of decarbonisation technologies and environmental innovations (EI) is viewed as proper mitigation strategy to achieve net-zero transition and ensure long lasting prosperity (EIO 2013, Machiba 2010, , McKinsey 2022). This emphasises the leading role that could be played by EI in the development of a sustained future that benefits the economy, societies, and the environment(Araújo et al., 2022 , Costa 2021).

In the literature, the terms “green”, “eco”, “environmental”, and “sustainable” added to innovation describe the same type of innovation; they are used interchangeably. They refer to a specific type of innovation that aims to reduce detrimental impact on environment through novel and complex products and services, process or new management method. It is noteworthy to indicate that it is difficult to build a holistic view on the subject, due to its scope vastness and dissemination of papers across too many journals and many fields of research (Díaz-García et al., 2015, Dewangan et al., 2017).

According to a widespread definition of Eco-innovation, EI is “ *the production ,assimilation , or exploitation of a novelty in products ,production process ,services or in management and business methods which aims throughout its life cycle to prevent or sustainably reduce environmental risk ,pollution and other negative impact of resource use*” (OECD, 2009). Also, Eco-innovation can be defined 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 life-cycle*” (EIO , 2013).

All definitions point out to the fact that EI is a transformative process that converts inputs into outputs that are new or relatively new while minimising environmental burdens of such process throughout the entire life cycle of products from sourcing, transforming, and exploiting until disposal. EI can take many forms: product innovation, process innovation, marketing and organisational innovation, and social innovation (Oslo manual Guide for innovation). The field of EI is still a young area of research that needs more investigation to fully understand its determinants, barriers and aspects (Díaz-García et al., 2015, Klewitz & Hansen, 2013).

The rationale behind the adoption of eco innovation is contributing to abate negative impacts on environment caused by production activities and energy consumption, as well as, reduction cost and gaining market shares (Horbach et al., 2013). Implementing EI in firms results in many benefits :increase of environmental materials, effectiveness through reduction in use of resources(energy, water, mineral), increasing productivity via reducing costs and better use of inputs, improved brand name and increase market share (Fernando et al., 2016).

Compared to conventional innovation, Environmental innovation seems different in terms of process, resources required and objectives pursued (Messeni Petruzzelli et al., 2011). It shows the particularity of aiming both environmental and business performance as described by

Rennings in his theory of double externality (De Marchi, 2012, Rennings, 2000). This renders EI riskier, uncertain, and more complex and needs additional resources commitment (Cainelli et al., 2015; Zhang and Walton, 2017).

EI can be, by essence, *radical* if it seeks to disrupt existing products and processes, or *incremental EI* when it makes products greener in a gradual way or enhances efficient resources consumption. Incremental innovations enhancing production process are the predominant modes of EI (Taddeo et al., 2017).

EI is a peculiar type of innovation distinguished by its own externalities and drivers promoting its development (De Marchi, 2012). In addition, a study based on a cross-country comparison led in two nations (France and Germany) highlights specificities of EI as opposed to traditional innovation (Horbach et al., 2013). The results show that EIs are mostly characterised by higher degree of novelty bringing in “never seen before” innovations, requiring R&D capabilities normally not present internally and call for more external knowledge sharing and information exchange. Such characteristics help companies to realise environmental innovations more efficiently and in shorter period.

This paper’s goal is twofold. First, it aims to delineate reasons that drive companies to environmentally innovate and discuss each factors behind the decision to undertake EI. Second, we propose a theoretical framework that summarises different factors according to available literature on the subject. Concretely, understanding those incentives gives firms necessary knowledge to overcome challenges when embarking on this journey. Also, the results benefit decision-makers who can learn much from being aware of motivators, as well as their real impact on the decision to adopt EI. Such an effort might provide policy-makers with a useful tool to keep in mind while revamping existing laws or introducing new ones that promote innovation for both novice firms and those which are actively involved in EI.

To do so, the remainder of the article is organised as follows: Section 2 proposes a literature review in relation of the field of EI of and its motivations; the section 3 explicit the methodology and articles from which information has been drawn then, the results are presented and discussed; and lastly, conclusions, limitations, and policy implications are presented.

2. Eco-innovation as a nascent field of research

The integration of ecological issues in the development of products from the early stage of design till delivery to end-users turn out to be a lasting trend to support product/ process innovation (Sorli and Stokic, 2011, Sumrin et al., 2021).

EI can be reached through two types of solutions (Carillo-hermosilla et al., 2009). The first ones are called “End-of-pipe solutions” which consist of the design of a new products and components aiming at improving environmental outcomes or repairing detrimental effect secondary to its use. The second ones are based on a “preventive approach” or using cleaner technologies (Hart, 1995; Triguero et al., 2013). They can be either, incremental and consist in the design of subsystems which result in new or improved products or processes utilising fewer resources, impacting less the environment and producing less waste, or disruptive that come up with new solutions that replace old ones (Nasrollahi et al., 2020). End-of-pipe solutions are reactive answers as they deal with consequences after they materialise while the latter are more proactive and recognise the urgency to tackle problems before, while and after they take place (Carillo-hermosilla et al., 2009).

Existent studies on EI can be categorised into six mainstreams (Díaz-García et al., 2015):

Performance: this group is focused on the outcomes of implementing EI such as environmental performance, financial performance, economic performance or increased competitiveness (Frenz & Ietto-Gillies, 2009, Zhang & Walton, 2017, Zaman et al., 2021, Araújo et al., 2022; Nasrollahi et al., 2020).

Drivers: articles dealing with incentives that push firms to innovate ecologically internally or external drivers (Walker et al. 2008; Costantini & Mazzanti, 2012; Zhu et al. 2012, Inoue et al. 2013, Triguero et al., 2013, Ford et al. 2014, Marin, 2014, Fernando et al., 2016, Soewarno et al., 2019, Wang et al. 2020, Kalthaus & Sun 2021, Carvache-Franco et al., 2022).

Process: this group tries to spell out processes behind EI adoption like patents, R&D research (Messeni et al., 2011; Costantini & Mazzanti, 2012, De Marchi 2012, Scarpellini et al., 2012; Cecere et al., 2014; Costantini et al., 2017; Scarpellini, Portillo-Tarragona et al., 2019; Lipieta & Malawski, 2021, Song et al., 2021).

Types: a category that discusses EI through its different forms. Notably, it specifies differences between product, process and method innovations, radical and incremental EI (Sorli & Stokic, 2011, Galliano & Nadel, 2013; Horbach et al., 2013; Del Río et al., 2015; Mele & Russo-Spena, 2015; Weigt-Rohrbeck & Linneberg, 2019, Wang et al., 2020; Naruetharadhol et al., 2021).

Policy: made of set of articles that delve into multiple policies carried out by governmental or corporations, and discussing multiple decision-making initiatives promoting EI (Porter and Linde, 1995; Popp et al., 2007, Brad et al., 2011, Berrone et al., 2013, Kijek, 2015, Hermann et al., 2016, Lewandowska 2016, Scarpellini et al., 2016, Zhang & Walton, 2017, Bitat, 2018, Soewarno, Tjahjadi et al., 2019, Kesidou & Wu, 2020).

Context: related to given territories, specific groups or industries, and performing comparative studies between sets : small vs. large corporations (Triguero et al., 2013), developed vs. developing, service industry vs. Manufacturing sector...) (Cheng and Shiu, 2020; Civelek et al., 2020; Sumrin et al., 2021)

A literature review has been conducted on existing articles published between 2000 and 2013 and focusing on Eco-innovation (Díaz-García et al., 2015). The main findings are that papers trying to explain the drivers behind its adoption dominate research on the subject. In addition, it establishes that EI is a novel area of study that requires further investigation.

Some researchers tried to establish potential effects that innovations in environment have on managerial and economic outcomes (Nasrollahi et al., 2020). Indeed, on a sample of 202 listed companies in Latino-American capital markets (Brazil, Argentina, Chile, Mexico), a study investigated the potential correlation that exists between corporate sustainability (environmental, social, governance or ESG) and EI. The results suggest that there is a positive and significant relationship between green innovations and organisations ESG overall score. EI influence positively organisational outcomes of companies (Shahzad et al., 2020; Nasrollahi et al., 2020), nonetheless, for each component of ESG the outcome remains different. Only governance pillar is affected by EI, whilst economic and social components stayed neutral to the effect. EI can , also, be a powerful engine providing cost and differentiation competitive advantage to companies responding to environmentally sensitive customers (Wang et al., 2020), foster a reputed brand image (Yao et al., 2021).

EI contribute positively to business performance notably in green-oriented firms (Zhang and Walton, 2017), nevertheless, the effect remains unimportant unless it is moderated by environmental orientation and resources commitment of companies. Environmental orientation designates strategic level composed of entrepreneurship, corporate social responsibility, and engagement to environmental issues. Resources commitment, contingent to an organisation's portfolio of resources, describes the process of allocating organisational resources to address environmental burdens effectively and efficiently. Fostering committed environmental orientation and environmental organisational culture (Ooi et al., 2020) enhance the relationship between EI and business performance. Besides, green SMEs that commit more resources to EI reap more benefits reflected on improved business performance (Del Río et al., 2015).

Benefits of EI are obtained through reduction in: material use, energy use, CO₂ emissions, resource (air, soil, water) pollution, replacement of existing materials with more eco-friendly products, and recycling of used water, waste and by products (CIS ,2008¹). EI is hindered due to a lack of sufficient financial resources (, a prohibitive cost to implement pricey innovation, lack of a qualified workforce within the companies or the labour market(D'Este et al., 2012, Carvache-Franco et al., 2022). Some factors also influence negatively the tendency to innovate such as the shortage of adequate information on market, shortage of technology and the structure of market dominated by large companies (Carvache-Franco et al., 2022).

(Segarra et al.,2015) identify three types of firms in relation to commitment to a proactive environmental strategy: opponents, environmentally driven, and environmental trainers. Opponents are those firms within which stakeholders` action is opportunistic and reactive to the introduction of new environmental policies showing negative effect regarding the environmental proactivity of organisations (Ooi et al., 2020). Environmentally driven enterprises exhibit a positive effect exerted by stakeholders` undertakings and goals on environmental outcomes and they proactively run after environmental innovativeness. The last set, considered champions in ecological matters, is characterised by the commitment of all stakeholders including managers, employees, clients and public authorities to environmental subject and manifesting high degree of dedication to achieve a proactive environmental strategy (Marin et al., 2015).

3. Methodology and Data collection

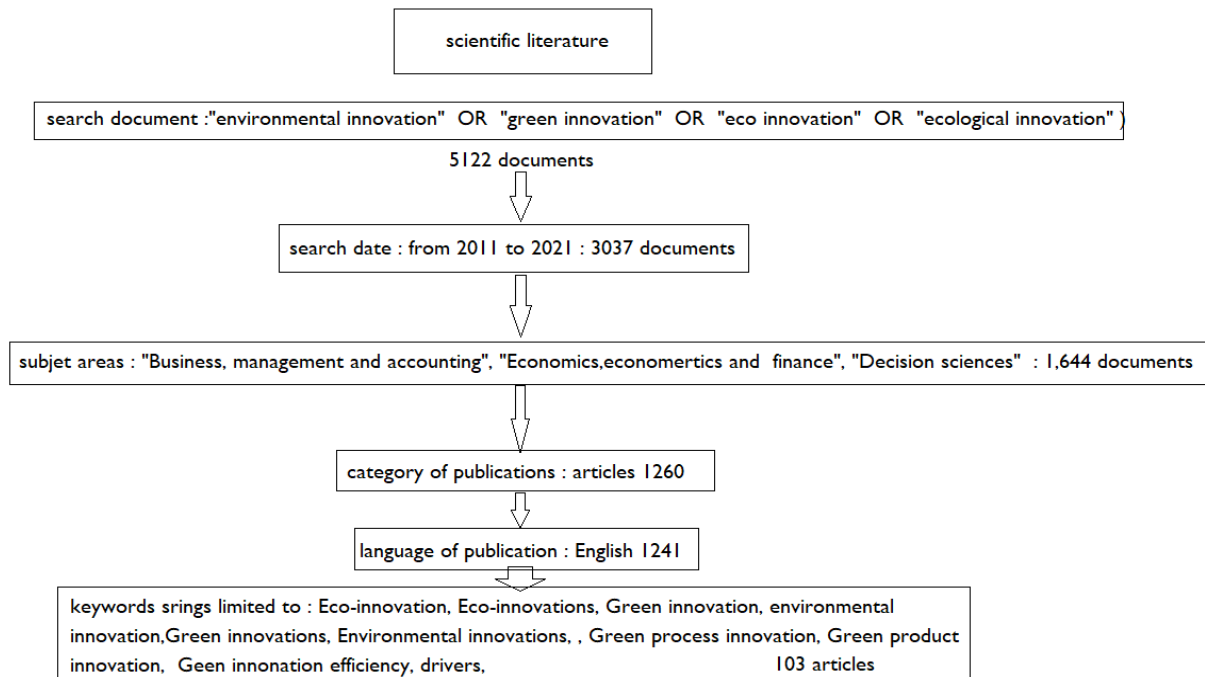
3.1. data collection

To retrieve articles on the drivers and barriers to EI, a research on Scopus database has been conducted on April 2023. Scopus database provides a scientifically recognised and wider source of knowledge(Díaz-García et al., 2015). The strategy rolled out to access the Database of previous research is as follows (fig.1).

We begin by searching for documents containing words such as "environmental innovation", "green innovation", "eco innovation" or "ecological innovation", in abstract, keywords and/or titles resulting in a total number of 5122 publications. Then, research areas were limited to documents issued between the years 2011 and 2021. Areas of research fields were limited to "business, management and accounting", "decision sciences", "economics, econometrics and finance" for publications belonging to the category of "articles". The total number of papers found after fine-tuning was 103 articles (English language only). Restricting research to time interval (2011-2021) is driven by that fact that before 2011, IE field was not popular among scholars and there were few papers treating environmental innovation.

¹ The community innovation survey (CIS) is the reference survey on innovation in enterprises.it is a questionnaire destined to the companies operating in EU-27 countries every two years .The CIS is designed to provide information on the innovativeness of business economy sectors, to enable the analysis of innovation drivers or barriers or to assess innovation outcomes. <https://ec.europa.eu/eurostat/web/microdata/community-innovation-survey>

Figure 1: Research strategy

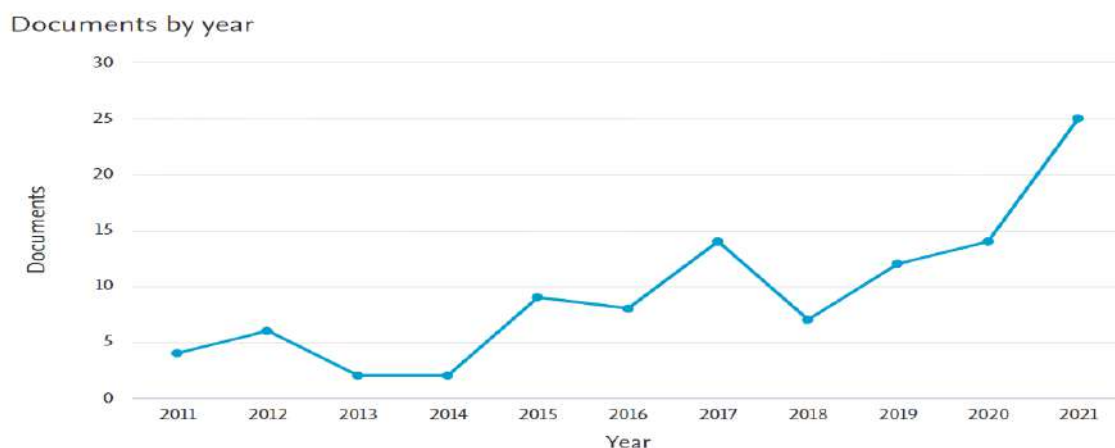


Source : authors

3.2. Bibliometric characteristics of publications

From 2011 to 2014, papers focusing on EI motivations were less than five per year. From 2015 onwards, we witness an increase in the number of studies discussing this nascent area of research with more than 10 papers published annually indicating a growing interest among scholars in EI and hinting to its exponential development and adoption in business. We started with few papers less than 10 on 2011 to a period when more than 20 articles are published annually (25 articles in 2021). Figure 2 stresses the increasing trend the topic is showing throughout the years.

Fig.2 number of publications on IE during 2011-2021

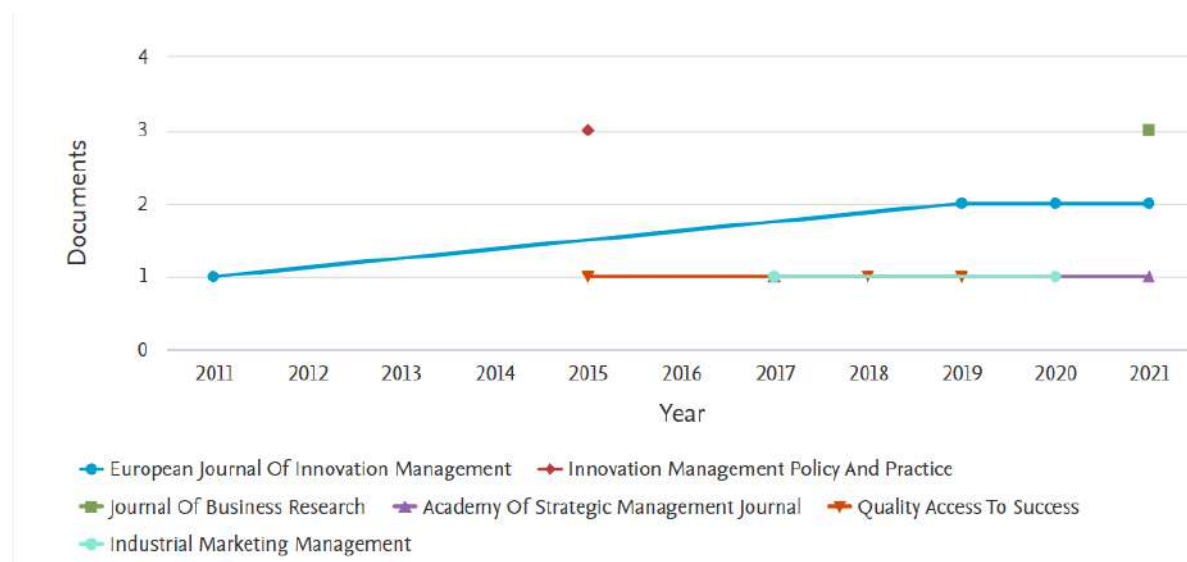


Source: author

Regarding publishing journals, we notice that articles are scattered among a wide number of journals. Our data-set of 103 papers is spread in 81 magazines. The primary sources of the material are “European journal of innovation management” with 07 publications, “Innovation

Management Policy And Practice” with 03 articles,” Journal Of Business Research” issuing 03 articles,” Quality Access To Success” with 03 articles, and ”Academy Of Strategic Management Journal”, ”Administrative Sciences”, ”Comparative Economic Research”, ”Industrial Marketing Management ” each publishing two articles (fig.3).

Figure 3. documents by source per year



Source: authors

4. Results and discussion

We identify three types of firms in relation to commitment to a proactive environmental strategy: opponents, environmentally driven, and environmental trainers (Segarra et al. ,2015). *Opponents* are those firms within which stakeholders` action is opportunistic and reactive to the introduction of new environmental policies showing negative effect regarding the environmental proactivity of organisations. *Environmentally-driven* enterprises exhibit a positive effect exerted by stakeholders` undertakings and goals on environmental outcomes and they proactively run after environmental innovativeness. The last set, considered as the leading group in ecological matters, is characterised by the commitment of all stakeholders including managers, employees, clients and public authorities to environmental subjects and manifesting high degree of dedication to achieve a proactive environmental strategy.

4.1 . Motivations for Eco-innovation

There is not a consensus neither on the number, the nature or the intensity of influences regarding motivators of EI. Some scholars establish groupings (two or three groups) of them while others consider them separately. We will develop findings according to such classification.

4.1.1. Miscellaneous drivers behind EI

A previous research have established through a parsimonious conceptual framework five main determinants of EI adoption(Fernando et al., 2016). The constructs are regulation, technology, cross functional coordination, supplier involvement, and market focus. Regulation refers to the adoption or anticipation of stringent laws aiming to induce compliance of companies regarding environmental problems (Kesidou and Wu, 2020 ,Park et al., 2017). Technology can be either curative aspiring to repair damages caused to nature or preventive dealing with ecological issues from the start of new product development process (Rennings ,1998). In order to innovate environmentally, cross-functional teams composed of committed to environmental issues,

autonomous members and responsible leaders are a lynchpin to the matter (Park et al., 2017). They ensure an effective knowledge transfer, solid collaboration among its members, and fluid information exchange across departments. Involving suppliers is important to acquire quality components and raw material, lower product development cost, minimise production time, and engage them in collaborative approach to reap benefits from increased productivity and achieve high levels of environmental performance. The last element pertains to market focus that enable firms to understand customers' eco-friendly need for green products and services and provide them with adequate solutions. Scholars have highlighted the existence of an inextricable link that bonds market orientation of organisations and propensity to EI to introduce new and successful products and services (Carillo-Hermosilla et al., 2010).

In their study, scholars have established the existence of 11 enablers linked to the development of EI (Dewangan et al., 2017). Ranked according to their importance these factors are: regulation, knowledge transfers, network, energy efficiency, product quality, green capabilities, material efficiency, market share, labour cost, competition, top management commitment (Dewangan et al., 2017).

Different types of innovation (product, process, method) have different motivations (demand-side, supply-side, environmental regulation) (Triguero et al., 2013). Eco-Product innovation is mainly motivated by demand side drivers (market share increase, green product offering), the need to exploit external knowledge and expertise provided by universities and research centres and compliance to actual regulation and standard (Triguero et al., 2013). Regarding eco-process innovation, supply-side factors (technological capabilities, R&D, access to information knowledge), cooperation with external partners (networking) are considered the most important drivers. Besides, seeking to reduce energy use and responding to increasing demand for green product are also among those drivers (Triguero et al., 2013). For organisational innovation, existing regulation and both arguments (supply-side and demand-side) are equally pivotal to introduce improvements to environment-related practises. Tax relief and financial incentives play no important role in the introduction of environmental innovation to the markets (Triguero et al., 2013).

- **Three groups behind EI**

A recent study tries to determine circumstances under which companies opt for EI (Cainelli et al., 2015). Based on RBV theory, the authors conducted an analysis on Spanish firms using the Spanish technological innovation panel (PITEC)². The resources considered are divided into internal, external and hybrid. It is considered one of the few studies which made such distinction among resources. Internal resources are: R&D efforts, employees' training toward technological innovation, highly skilled personnel and investment made to introduce newly devised innovation to market. External resources entail cooperation with supply chain partners, collaboration with knowledge-intensive business services (KIBS) and universities in order to share risk and get access to external capabilities and knowledge not present internally. The third category is named hybrid due to the fact that they are acquired from external partner but embodied in the company stock of resources such as patents, external R&D services, or machines and equipment. Following the study, internal resources are pivotal in determining decision to embrace EI. Especially, consistent R&D structure, and training staff as it is a

2. PITEC (Technological Innovation Panel) is a questionnaire administered on a regular basis to Spanish companies from different industries to deepen knowledge about mechanisms, determinants and outcomes of innovation process adoption and development. PITEC is issued by the national institute of statistics in Spain.

privileged vehicle to transmit knowledge and increase awareness to environmental issues. By the same mean, having a skilled workforce is not a must to be environmentally innovative. Regarding external factors, researchers came to the conclusion that nurturing intra-organisational relationships through cooperation, establishing clusters with KIBS, think tanks, and universities and setting up networks with external parties to access external capabilities is central to developing EI even more than in the case of other form of innovations. As for hybrid resources, they prove to be effective in promoting EI. Importantly, procuring equipment and external R&D services are highly correlated with EI, while at the same time resorting to patents acquisition, extrinsic knowledge and inventions turned out to be insignificant to prod companies into developing EI (Cainelli et al., 2015).

Scholars have proposed a multilevel framework of Eco innovation drivers divided into three levels: macro, meso and micro (Díaz-García et al., 2015). The macro level highlights the significance of policy instruments and semi-autonomous transition regions in fostering a favourable stance for environmental initiatives and encouraging climate change countermeasures. The meso level is an intermediate one, which emphasises the role played by market dynamics, pressure groups and networking in development of EI. Lastly, at the micro level some drivers as managers' values set, commitment to environmental issues, managerial vision and the mix of capabilities and resources that a firm has is of utmost importance (Klewitz & Hansen ,2013). The biggest share of researches, so far, concentrates on the drivers behind EI adoption and development (Pinget et al., 2015).

- **Two groups behind EI**

An empirical study on 1566 UK firms from industrial sectors (mining, F&B, textiles, wood, pulp & paper, chemicals, machinery, OEM, transport equipment, energy production) was conducted with the goal to unveil drivers that push organisations to EI (Kesidou & Demirel, 2012). The main findings of the paper are that EI is spurred by internal and external factors. The demand side factors such as corporate social responsibility (CSR), customers demand for eco-friendly products are important to invest in EI solutions, especially in the preliminary phase of introduction, although their influences do not extend into deeper level where greater effort in investment is required. Furthermore, leveraging organisational capabilities in relation in relation with environmental management systems is critical to ensure successful implementation of EI. As for external elements, the stringency of environmental regulation and compliance to environmental law remain the main driver for companies. Such force exerts its influence on both types of companies: first movers to green technology markets and laggards striving to close the gap between them and early adopters (Kesidou & Demirel ,2012).

The decision to implement environmental innovation is driven by both external and internal drivers (Fig.4). Nonetheless, each factor does not exert the same influence with the same intensity. The factors found are government policies, collaboration with external partners, customers demand, internal capabilities, efficiency, Size/sector, other stakeholders' pressure, style of leadership. Based on RVB, the paper using cross-country comparison (Ireland & Canada) points out that engaging in EI could be traced back to a mixture of internal and external factors (Kelliher et al., 2020). Environmental orientation of managers, collaboration with external partners, green knowledge identification and capture, potential gains in productivity and economic outcomes, regulation (green policies), communication strategies on green initiatives are essential enablers to engage in green initiatives in micro firms' sector (Kelliher et al., 2020).

A recent study conducted in developing country on a low-technology-intensity sector (i.e. agriculture) focusing on external factors (regulatory pressure, competition pressure, and consumer pressure) and internal factors (technological competition, research for efficiency) and the potential relationship with EI as well as the mediating effect of EI strategy on enterprise

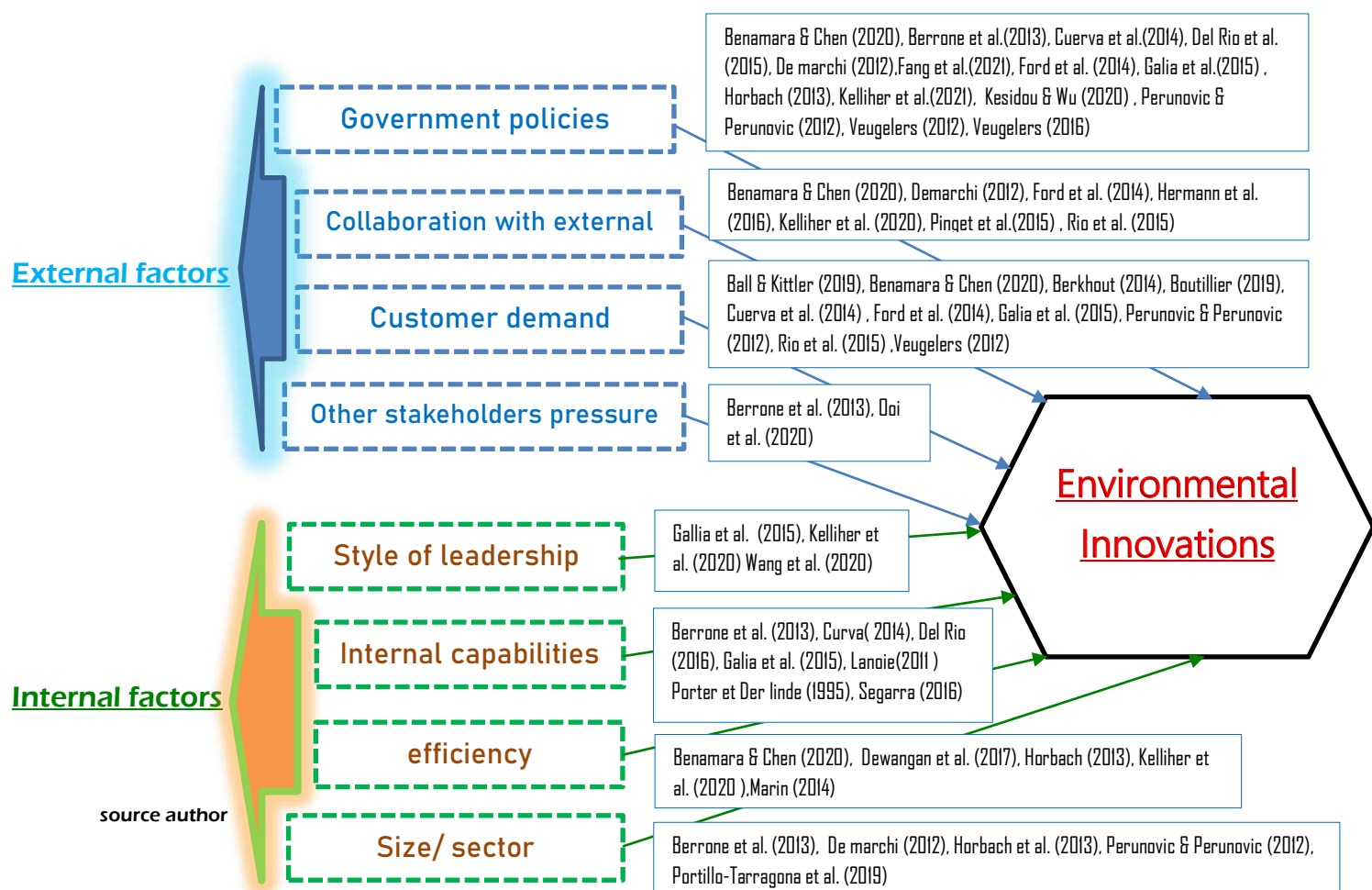
sustainable business growth (Díaz-García et al., 2015, Ben Amara & Chen, 2021). The main findings are that all aforementioned drivers are inextricably linked to a company's willingness to adopt green strategies and their joint actions push managers to foster environmental projects. EI adoption also enhances sustainable business growth.

In service sector, motivations to EI are driven by several factors: internal and external to organisation (Legrand et al., 2013). Specifically, internal motivations to EI encompass cost reduction, internal motivation of managers and employees' motivation. External drivers are market share increase, organizational image in the eyes of customers (Mahabubur Rahman et al., 2021), competitive advantage maintenance, market demand for EI, and advice from external professionals (Kesidou & Demirel, 2012, Legrand et al., 2013). In a case study conducted on major operator in Brazilian hospitality sector, we find that EI is mainly motivated by the organisation internal willingness to become green and that EIs are for larger part end-of-pipe innovations (De-Oliviera et al., 2018). To attain such goal, they adopted many initiatives in a large area throughout the facility: water resource management (monitoring, collecting, disinfecting of used water before disposing, redesign of sewage water, treatment and reuse of recycled water for irrigation), air emissions (use of solar panels, use of renewable energy, replacement of diesel generators with electric powered ones, electric bus and locomotion devices), natural resource management (monitoring of local fauna, less usage of pesticide, LED lamps, garden maintenance), construction management (collect of rainfall, reuse of construction waste), waste management (reuse of organic waste as fertilisers, composting), and social responsibility (employees empowerment, leadership support for development, competence assessment, education, awareness, philanthropist initiatives) (De-Oliviera et al., 2018).

4.1.2. Framework of EI drivers

In the following, we present each of the motivators for IE from most to lesser influent factor according to the proposition that these can be categorised into two major groups. We propose a theoretical framework encompassing EI in relation to different drivers (figure 4).

Figure 4 framework of the drivers to IE



EXTERNAL DRIVERS

➤ Government policies

Governmental policies on protecting environmental milieu are instrumental in promoting green (Costa 2021, Fang et al., 2021 ,Veugelers, 2012).Government policies are crucial to engage organisations in EI through so called “regulatory push-pull effect”. It has a leading role to induce adoption of cleaner technologies as well as development of existing technologies. A wide array of eco-policy interventions are involved: regulations, tax incentives, and financials subsidies (Veugelers 2012, Vengeler 2016).

Regulatory pressure is conducive to EI since any violation of existent laws can lead to legal liabilities. Authorities can make periodic on-site inspection to put under scrutiny firm’s environmental practises (Berrone et al., 2013 , Kelliher et al. 2020).The importance of environmental regulation as the main driver of EI (Dewangan et al. ,2017), has been emphasised in Porter hypothesis in which prodding corporations to adopt EI is considered one main strategy to attain sustainable growth on a long-term perspective (Porter & Linde, 1995).Therefore, policy-making decisions such as laws and regulation are ,therefore, powerful enablers to embrace EI , they can shift firms attention to produce more green patents and increase environment-related stock of knowledge (Galia et al.2015, Kesidou & Wu, 2020 ,Porter 1991). Environmental regulation stringency is conducive of EI by companies interested in an efficient use or resources (energy, water, material, land) (Ford et al., 2014 , Lanoie et al., 2011). For industrial firms, gauging regulatory push-pull effect is important while considering the possibility to implement new eco-friendly product, process or method (Horbach 2013).

Firms dealing with draconian levels of regulatory laws are more predisposed to introduce EI in the market such as products and service innovations that are novel to the firm or the line of business (Berrone 2013, Ford et al., 2014). Among international drivers of EI, we found that those type of drivers have a lighter influence to local drivers, and that supranational regulation imposed on industries such as the EU emission trading scheme have deep impact on organisations when it comes to the decision to environmentally innovate (Del Río et al., 2015). Yet, firms abide by law enforcement out of necessity in order to comply with regulation (reactive attitude) rather than intending to reach environmentally sustainable objectives (proactive stand) which proved to be more rewarding and offering a long-term competitive edge (Ben Amara & Chen 2021).

Public intervention such as grants and supervision affect positively carrying out EI. Subsidies push companies to innovate more in ecological fields than it does in the case of traditional innovation (Horbach 2012, Rio et al., 2015). It triggers development of firm strategies to become green and remain green as well (De Marchi, 2012). The effect is accentuated in the case when firms are private-owned, small and generating low profits (Fang et al., 2021).

The joint action of policy mix (regulations, tax incentives, and financials subsidies) drives migration of organisations toward EI in a more accentuated manner than individually, and because private sector left alone is not up to the task which require governmental intervention (Veugelers 2012). Inter sectoral practises related to environment emanating from agreements made between organisations are a powerful incentive to EI (Veugelers 2016). Conversely, some researchers found that relationship between regulation instruments and EI is weak and that they are insufficient to incentivise environmental behaviour of firms (Bitat, 2018). In addition, while there is no evident relationship linking EI and public support or subsidies (Cuerva et al., 2014). The stringency of regulation pushes firms to adopt green innovation initiatives especially in polluting industries (Perunovic & Perunovic 2012). Compliance to environmental laws allows for more transparency in information disclosure, which reflects trust and support for stakeholders bolstering heightened assurance in green initiatives (Fang et al., 2021).

➤ **Collaboration with external partners**

Giving the fact that eco-innovation is extremely knowledge-intensive and inextricably linked to managers' perceptions requiring specific skills set, knowledge barriers are considered a major constraint for SMEs to innovate (Pinget et al., 2015). Such shortcomings can be surmounted through the implementation of a clear environmental strategy that establishes R&D collaborations with peers, forming clusters and networks to monitor environmental aspects of activities. Maintaining external collaboration with partners paves the way for innovate ideas to materialise and enables collaborators through R&D sharing, collaboration activities to come up with new products and services that reduce environmental threats (Ford et al., 2014). Partnership with peers can be analysed by the degree of participation, the scope it reaches and the division of roles and responsibilities between partners. Furthermore, it breeds a constant interaction between suppliers and end-users and helps create innovation platforms to implement new environmental technologies (Hermann et al., 2016).

Collaboration and cooperation with international entities is particularly a good incentive for local companies to EI implementation (Rio et al., 2015). Due to its complex nature, the degree of novelty it brings, and subsequent need for involvement of external knowledge, EI requires deeper collaboration with different partners. Leveraging supplier involvement is important to share knowledge, technical capabilities, and resources to eco-innovate (Kelliher et al., 2020). KIBS, universities, and consultancy offices play an extremely important role in EI compared to traditional innovation. Insights gained from customers, nevertheless, prove to be relevant in spurring EI because customers are unequipped with sufficient knowledge regarding environmental solutions to be put into practise. R&D expenditures are a crucial enabler to take

into account while carrying out EI as for all other types of innovation (De Marchi 2012). Technological competition built upon R&D cooperation and collaboration with partners (suppliers, distributors, customers, scientific centres) is essential for adopting EI (Ben Amara & Chen 2021).

➤ **Customers demand**

Consumer behaviour affects positively environmental endeavour's implementation since consumers demand for green products is on the rise and the awareness toward product's nature, quality and respect to environment is increasingly decisive parameter in the choice for products and services (Boutillier, 2019 , Ben Amara & Chen 2021). Sustaining a competitive advantage and nurturing a "green" brand is of central interest for firms to environmentally innovate (Ford et al. 2014, Berkhout 2014). Firms, in that case, go beyond compliance to regulation to a bottom-up approach to shore up its market position, maintain a green corporate image, attract a more eco-sensitive customer base (RIO et al., 2015). Some initiatives like Eco- labels increases demand for eco-friendly products which is reflected in revenues increase and possible bigger market shares (Kijek 2015).

In an attempt to put forward innovative offerings, to propose greener products, and to diffuse green brand name among customers, firms follow environmental strategy to set apart themselves from rivals effortfully to increase market share and use efficiently energy and other available resources (Ben Amara & Chen 2021). Sometimes, entrepreneurs are facing the problem of environmental market failure where there is a customers' perception of no real value to be extracted from environmental solutions, this can be solved by integrating governmental support mechanisms to incentivise customers to adopt environmental innovations (Ball & Kittler, 2019).

Therefore, pursuing a differentiation strategy as a response to demand pull and market dynamic by developing green products is significantly and positively affecting the propensity of firms to adopt EI and prove unarguably the strength of the private sector (Cuerva et al. 2014, Galia et al., 2015, Perunovic & Perunovic 2012, veugleres 2012).

➤ **Other Stakeholders pressure**

Stakeholder pressure can influence firm's inclination to environment preservation in several ways. NGOs can play a "cheerleading" role in heightening environmental activities led by companies in their pursuit of social recognition. Thanks to their extensive knowledge on environment, they are uninterested in trivial actions (green washing for example) , but instead focusing on long lasting projects with deeper impact. They can influence public opinion about practises and perform critical examinations to firms' sites. Organisations can use them as a reliable source of information to come up with disruptive innovative ideas (Berrone 2013, Ooi et al., 2020). Suppliers are salient stakeholders of the businesses, hence, businesses ought to invoke cooperation with them and consider their contribution from early stages of operations and processes (Ooi at al., 2020).

• **INTERNAL DRIVERS**

➤ **Internal capabilities**

Companies' intention to innovate is enhanced when enjoying a congruent fit between internal capabilities (patents, R&D activities, environment specific assets, firm size) (Berrone 2013). Organisation's set of internal factors such as Resources, capabilities and competences (RCC) are important drivers to business environmental strategies and instrumental in driving change in business. Those RCC, in which intensity levels vary according to the degree of disruption of innovations, include internal knowledge inherent to firms, workforce skills set, management commitment, financial assets and capacity to networking (DEL RÍO et al. ,2016).

SMEs firms leveraging internal capabilities such as environmental management system (EMS), quality management systems (QMS), corporate social responsibility (CSR) and environmental strategies are more stimulated to implement EI and more environmentally conscious (, Cuerva et al. 2014, Galia et al.2015, Ben Amara & Chen 2021, Ooi et al., 2020, Porter & Van der Linde 1995). Investing in environmental R&D affects significantly both business and environmental performance (Lanoie et al., 2011). The growing perception of barriers to environmental action hinder the firm orientation to commit adequate resources to embark on a journey of greening its products, processes and organisational methods and prevent them from being environmentally innovative (Segarra et al., 2015). According to (Galia et al., 2015), the decision to invest in EI is driven by the weighing of benefits vs. cost, in case when the latter outweigh the former, organisations are less inclined to pursue EI.

➤ **Efficiency**

On the one hand, the quest for efficiency in production process through rational material, energy and resources use affects positively propensity of organisations to EI (Kelliher et al., 2020). Ameliorating operational efficiency levels and potential gains in productivity while lessening environmental burdens of activities through cost savings, economies in resources and energy use (Dewangan et al., 2017) are of utmost consideration, for the reason they allow productivity enhancements, reduction in cost and increased flexibility gains (Ben Amara & Chen 2021, Horbach 2013). On the other hand, compared with regular innovations, EI are less procuring returns resulting on a lower productivity. Adding to that constraints on budget devoted to R&D, firms are compelled to turn to crowdsourcing to fund newly environmental endeavours (Marin 2014).

➤ **Size/sector**

The size and nature of an organisation`s activities are correlated with EI. Some scholars point out that age, size variables are significant as determinants of eco-innovation (Portillo-Tarragona et al., 2019). The more sizeable a company is and operating in international markets, the more chances they are that is inclined to take environmental initiatives(Costa 2021, De Marchi 2012).Some industries are more pressed to consider natural milieu more than others, especially while considering their less impressive environmental performance (Berrone et al., 2013). Surprisingly, Companies active in polluting sectors are more inclined to EI than those operating in cleaner sectors (Horbach et al., 2013). A research undertaken in a ‘dirty sector’ i.e. oil tanker segment of maritime transport, shows a strong linkage that exists between the sector inclination to embed green innovation and tough environmental policies resulting from both intense public pressure and governmental coercion (Perunovic & Perunovic 2012).

➤ **Style of leadership**

It exists a link between environmental responsible style of leadership and EI. Environmentally engaged CEOs allocate resources and support ecological initiatives seeking to make greener products and develop EMS. Environmental orientation of TMTs(top managers teams) is Diffused to middle managers throughout green initiatives that are adopted and translated into concrete plans through the process of collective organisational identification (Kelliher et al. 2020 ,Wang et al., 2020). Various aspects of diversity in board composition (gender, age, employees’ directors) are related with EI (Galia et al., 2015). Companies composed of diverse board members are more inclined to EI. Specifically, presence of women might spur decisions to pursue EI, age diversity is significantly correlated with the intensity of EI, whereas board harbouring employees’ directors are less concerned about long-term EI and value more short-term benefits such as social innovation.

5. Conclusion

The objective of this paper was to illustrate various factors that spur the decision taken by companies to adopt environmental innovations. We provided a framework that explicit each factor involved in that process. This was made possible by conducting a literature review on recent articles published between 2011-2021, in order to delineate different aspects related to EI drivers and circumscribe all facets related to what really drive firms' intentions.

The results have shown that motivators can be divided into two categories: internal and external. Internal drivers are internal capabilities, efficiency, Size/sector, style of leadership.

The external ones are government policies, collaboration with external partners, customers demand, and other stakeholder's pressure.

We found that not all factors exert the same influence. For example, we establish that government intervention is considered, by far, decisive and accounted for the most important variable when it comes to develop the intention to implement EI. By the same account, there is not unanimity among scholars regarding the nature, number, and the degree of importance of those variables.

Our findings have implications for both managers and decision makers. Managers have to consider encouraging long-term collaboration and establish partnerships with different stakeholders the reap the benefits of EI. Considering the nature of EI and its level of complexity, sharing knowledge and R&D capabilities prove to be rewarding and lead to shorten time-to-market for innovations. Besides, leaders' attitude toward preserving environment is important to instil an eco-friendly culture in the companies and among employees with the aim to favour their engagement in promoting ecological projects, technologies and solutions. Policy makers, for their part, are called to foster a supportive legal framework and introduce new regulation assuring progress toward a more sustainable future. The ultimate goal is to channel businesses, consumers, and every stakeholder behaviour into considering effects of their activities on the well-being of the natural milieu.

As any research, this work has several limitations. First, this work remains theoretical lacking validation and endorsement from empirical data, which opens the way for future research to test its validity and accuracy. Second, the taxonomy followed for classification is largely used but still does not situate precisely all factors, since some of them relate to both camps. Lastly, papers were drawn from only one database and need further investigation including other databases to enlarge source of information and presumably adding other factors that might have been overlooked.

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