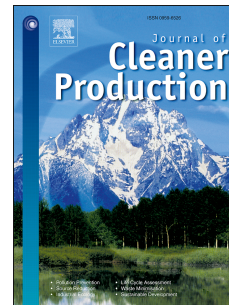


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ECO-LABELS AS A MULTIDIMENSIONAL RESEARCH TOPIC: TRENDS AND OPPORTUNITIES

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Abstract

This study analyzes the importance of ecolabels as an eco-innovation tool that can contribute to the sustainable design, production and consumption of products. Our research has a dual objective. The first is to build a theoretical framework that explains the relationship between ecolabels and eco-innovation, their determinants (demand, supply, and institutional and political influences) and the dimensions that arise from them. Second, according to this framework, a systematic literature review was carried out to identify the trends and opportunities in ecolabeling as a multidimensional topic, from empirical, geographical and sectorial perspective. The main contributions of this paper are a proposal for cyclical ecolabeling innovation process, an understanding of the ecolabeling dimensions according to the studies analyzed, and ecolabel performance in the market. Additionally, the systematic literature review revealed that ecolabels have been mainly explored in food sectors and, developed countries, and researchers tend to assess their performance from the dimension of market dynamics.

Keywords: Ecolabels, eco-innovation cyclical process, environmental certificates, environmental management, systematic literature review.

1. Introduction

In recent years, many modern consumers tend to be concerned about green products and ways to identify them. This trend is supported by personal values and the wealthy amount of positive feelings that people have when they choose products with an environmental label (Hamilton and Zilberman, 2006; Loureiro and Lotade, 2005). At the same time, people seem to expect higher quality from these kinds of products (Bougherara and Combris, 2009; Zanolli and Naspetti, 2002).

This need to develop and to identify sustainable products led the Federal Republic of Germany (Labandeira Villot et al., 2007; Reisch, 2001) to launch the Blue Angel ecolabel scheme in 1978. Later, environmental labels schemes were strengthened by reports by the United Nations. The UN's first approach was *Our Common Future*, which provided the first definition of sustainable development as well as a section that described the role of labels in electrical appliances in order to encourage energy savings and to limit the use of chemicals (WCED, 1987). Later, the Agenda 21 report made a greater advance in enhancing environmental labeling programs as a tool to encourage sustainable consumer behavior and suggested that labels be used to support cleaner production in different sectors of the market (UNCED, 1992). Following the advancement made by multiple governments and institutions, labeling initiatives were taken up by other countries such as the US, Japan and France (Hemmelskamp and Brockmann, 1997; Salzhauer, 1991; Salzman, 1991).

From a business point of view, ecolabels are an environmental management tool that can inform customers of products' new green features in a visual way (Thøgersen et al., 2010). However, when a firm can attain positive results and gain consumer acceptance through implementing ecolabeling, it serves as an incentive to design and improve products with higher environmental performance to replicate this success (Wagner, 2008). In this sense, ecolabeling can be seen as an eco-innovation process and product result (Dangelico and Pujari, 2010; Wagner, 2008) because it furthers the emergence of new green products (Van Hal, 2007), new cleaner methods of production, green supply sources and combinations (Hellström, 2007). Therefore, consumer awareness pushes companies to differentiate continuously their sustainable products or the ones that have been environmentally improved. Working in parallel, governments and institutions try to guarantee transparency in the markets and encourage the responsible consumption of goods and services. This creates a cyclical dynamic between three levels: consumers, firms, and governments and institutions.

This situation shows that the relevance of the increase in ecolabel use lies in three significant facts: (1) the effective ecological role of ecolabels in society, (2) the breadth and depth of their propagation by governments and institutions, and (3) the strategic and innovative value of ecolabeling to the companies that adopt them. The first fact reflects the effective role that ecolabeling has in contributing to the protection of the environment (Gutierrez et al., 2012) and its influence on achieving sustainable development. This claim is attributed to the positive influence that ecolabeling has had in reducing the volume and toxicity of pollutants that are released, such as the amount of laundry detergent, soap, or shampoo that escapes down drains (Eiderstrom, 1993; Naturvårdsverket, 1997).

Concerning the second fact, there has been an increase and spread in ecolabel certifications. Starting in 1990 there were only about a dozen, but currently, there are over 435 (Big Room, 2014; Delmas et al., 2013). The ecolabeling phenomenon can also be seen in the products labeled: In Germany, there were fewer than 100 products labeled by Blue Angel in 1979, but in 1994 there were 4,271 labeled products (Hemmelskamp and Brockmann, 1997) and today there are about 12,000 Blue Angel products (Global Ecolabeling Network, 2013). In a similar trend, the European Union launched the EU Ecolabel scheme in 1992 (Loureiro et al., 2001). According to the latest report, the EU label has granted 2,010 licenses to cover 44,051 products and services from different sectors in 2015 (European Union, 2015).

Consequently, the diversity of ecolabels fostered the institutional standardization of the principles of ecolabeling in ISO 14020:2002. ISO later proposed three categories of environmental labels according to the aspects covered and the rigor required to award the seal: type I in ISO 14024; type II in ISO 14021; and type III in ISO 14025. Additionally, a different category called “Type I – like” is present in the literature, which represents environmental labels focused on just one environmental or social aspect; these labels have been launched by independent organizations (Leire and Thidell, 2005; Panainte et al., 2014).

Turning to the third fact, companies that adopt ecolabels and other kinds of environmental management strategies create value through the eco-innovation process because they have to improve their products and services to get an ecolabel of whatever kind (Monteiro, 2010; Rex and Baumann, 2007). Evidence of this value creation is the growing group of consumers who are willing to pay more for ecolabeled products (Loureiro and Lotade, 2005). As a result, this product differentiation can relax price competition (Nadaï, 1998). On the other hand, ecolabeling indicates that a company has a long-term vision, is flexible, anticipates market

expectations, and creates sustainable value for its products (Hart, 1995), all of which contributes to a company's sustained presence in the market and the increase of its financial value (Epstein and Roy, 1998; Klassen and McLaughlin, 1996).

Given the growing influence that ecolabeling has on environmental protection, the welfare of society, governmental and institutional strategies, eco-innovation, and company strategy, it is necessary to develop academic research that is focused on ecolabeling as an eco-innovation process and the future usefulness of ecolabeling for regions and economic sectors. Existing literature reviews are mainly focused on descriptive analyses of institutional concepts and emerging ecolabel typologies (Mungkung et al., 2006), institutional awareness in regulating ecolabels (Ball, 2002; Ponte, 2008), the effectiveness of ecolabels for environmental conservation (De Snoo and Van de Ven, 1999; Kaiser and Edwards-Jones, 2006), and the propagation of ecolabeling in terms of number and marketing use (Buckley, 2002; Rex and Baumann, 2007). Nonetheless, to the best of our knowledge, we have not identified articles that describe the current situation of ecolabeling from an eco-innovation approach, the determinants and dimensions involved in ecolabeling, or the economic sectors and geographical regions affected.

The previous gap recognized in the literature and the value of ecolabels from an eco-innovation approach motivated a dual objective for this research: first, to build a theoretical framework that explain the relationship and dynamic between ecolabels and eco-innovation, their determinants and the dimensions that arise from them. Second, undertake a systematic literature review to determine the current situation of academic research on ecolabels and thereby identifying trends and opportunities for future explorations.

This paper is structured as follows. Section 2 describes the systematic literature review method undertaken and the results of this study. Then, in Section 3 the results and discussion are examined in three steps: the theoretical framework developed to undertake the systematic literature review (Section 3.1), the descriptive analysis of the findings from the review (Section 3.2), and the ecolabeling opportunities and trends that emerged from the systematic literature review (Section 3.3). Finally, conclusions are presented in Section 4.

2. Research Method

In an attempt to discover research gaps and select the most relevant studies from which to infer the current state of ecolabels in academia, authors chose the systematic literature review as an appropriate method for carrying out this study. The systematic literature review is a replicable, scientific and transparent method for defining the field of study, and it allows readers to understand the path researchers take to arrive at their findings (Tranfield et al., 2003).

Following, Tranfield et al. (2003), the systematic literature review includes three phases: planning, execution and reporting (Table 1). The planning phase defines the framework, the keywords to be used in the search, and a protocol for conducting the search. Included in this phase is the selection of an accessible and reliable academic database. In the execution phase, the protocol defined in the planning phase is used to conduct the search and classify the identified articles in a systematic way. The reporting phase synthesizes the findings and proposes research trends and opportunities for future studies.

Table 1. Phases of the systematic literature review.

Phases	Section	Description	Output
Planning	2.1.	Method description	Protocol, database selection
Execution	2.2.	Execution of systematic search	152 academic articles identified and classified
Reporting	3.1.	Ecolabeling theoretical framework	Ecolabeling innovation cycle Ecolabel determinants Ecolabel dimensions for classifying articles
	3.2.	Descriptive analysis	Analysis of bibliographic data and methodologies
	3.3.	Focus and content of the publications	The most developed dimensions Ecolabel performance in the market Joint analysis to find research gaps

2.1. Planning

In the first phase, the interdisciplinary research group consisting of members from two research groups at the University of Navarra— Innovation Decisions in the Business Environment and Sustainable Improvement—defined each research step. First, a theoretical framework that includes the relationship between ecolabels and eco-innovation, ecolabeling determinants and their related dimensions was developed.

Additionally, the framework facilitated the selection of relevant keywords to identify papers that had ecolabeling as the main research topic. Consequently, the research team considered any variation on the terms given to ecolabels in the title of these articles. Moreover, to guarantee the

quality of the literature review, the research group selected the Web of Science (WoS) database because it includes the most highly cited scientific papers from different fields of study (Hirsch, 2005). Another benefit of WoS is that it provides different levels and categories for searching within a precise collection of indexed articles in the business and management fields (Shepherd and Günter, 2006; Taticchi et al., 2014; Whitaker et al., 2010).

According to the above, a protocol was designed based on Stechemesser and Guenther (2012), which recorded all the information we gathered in a systematic way (see Table 2). The items in the first column of Table 2 are the criteria used to conduct a content analysis method (Krippendorff, 1989), which means drawing out the most relevant aspects of the bibliographic data and background based on.

Table 2. Review protocol.

Bibliographic data	Description	Example (Teisl et al., 2002)
Title	What is the title of the publication?	Can eco-labels tune a market? Evidence from dolphin-safe labeling
Author	Who is the author of the publication?	Teisl, MF; Roe, B; Hicks, RL
Journal name	What journal published the paper?	Journal of Environmental Economics and Management
Journal Category	How was the journal ranked in 2014?	Q1
Year of Publication	When was the article published?	2002
WOS citations	How many other authors have cited the paper in Web of Science?	153
Publication background		
Methodology used in the paper	What methods are used to develop the research?	Modeling
Country	Which country is the subject of the paper?	US
Industry Sector	Which industry sector is the subject of the paper?	Fish
Dimension	What is the main dimension developed in the study?	Market dynamics

Adapted from Stechemesser and Guenther (2012).

All the bibliographic data fields were recorded according to the information downloaded from Web of Science on June 03, 2015. Then, each paper was recorded according to methodology, country, industry sector and dimension explored. However, dissimilar data like the types of ecolabeling or the kinds of firms present in some empirical analyses was not included. Therefore, the sectorial and geographic characteristics of the studies are appropriate to this research because sectorial information may indicate the ecolabels' spread in the market and the geographical context provides relevant information about consumers' exposure to ecolabeling schemes (Thøgersen et al., 2010). With regard to ecolabel dimensions, it is possible to say that this aspect is one of the most relevant aspects of our review, given that we have not found any previous studies that have characterized knowledge of ecolabels in terms of dimensions or fields

of study. Additionally, the dimensions give an idea of the determinants that are most affected by each one of the articles analyzed.

2.2. Execution of systematic search

In the second phase, the systematic review was conducted taking into account the objectives set in Section 2.1. First, the search focused on words selected in the planning stage, terms such as “ecolabel*”, “eco-label*” and “environmental label*” that appeared in publication titles, and the 303 results included documents such as articles, books, and reviews, among others. In the second search, we selected only academic articles and obtained 190 results. Afterward, the team selected only papers from academic fields like economics, business, management, environmental sciences, environmental engineering, ecology, sociology, food science, agriculture, multidisciplinary studies and international relations, among others. As a result, 155 academic papers were obtained. Finally, the search yielded 152 articles after three papers were discounted because they were written in German or due to the discontinuation of sources and

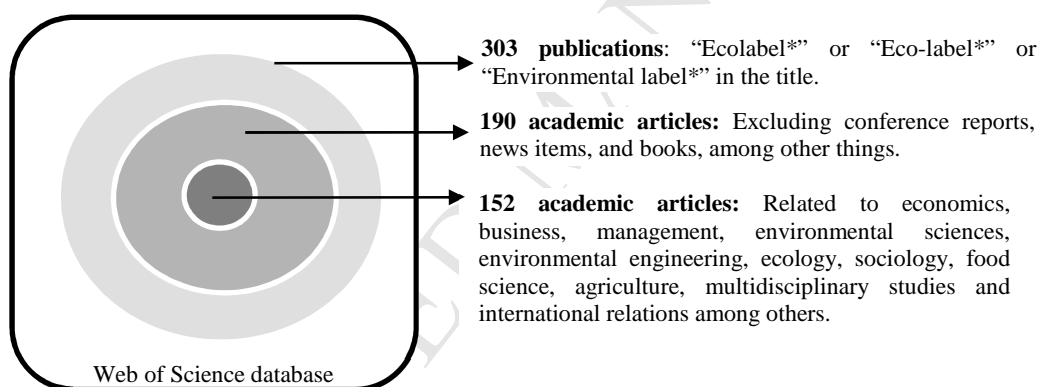


Figure 1. Research Execution in Web of Science.

URL link errors (see Figure 1).

The next step was to apply the review protocol to each article in order to build the database that would allow us to analyze the papers’ content in a systematic way.

3. Results and discussion

In order to address the main objectives of this paper, this section presents an ecolabeling theoretical framework based on the relationship between ecolabeling and eco-innovation (see section 3.1). This effort provided the foundation for defining the categories used to explore the selected academic papers. Moreover, section 3.2 includes a descriptive analysis of these 152 papers and recorded them according to the protocol (see Table 2). Finally section 3.3. presents the analysis of the trends and research gaps in the ecolabeling literature selected for this study.

3.1. Theoretical framework

According to our dual objective, the first step of this research was to develop a theoretical framework that explains the relationship and dynamic between ecolabels and eco-innovation, their determinants (demand, supply, and institutional and political influences) and the dimensions that arise from them.

3.1.1. Relation between Ecolabeling and Eco-Innovation

Taking into account the growing importance of ecolabels, as noted in the introduction, and their relevance for eco-innovation, this study started developing a framework for understanding the relationship between ecolabels and eco-innovation. According to Dangelico and Pujari (2010) and Wagner (2008), ecolabeling is conceived as an eco-innovation process because it promotes the emergence of new green products and it improves production methods, supply sources and combinations (Hellström, 2007). It is important to note that this is an effect at the organizational level and along the value chain. However, as we also noted in the introduction, the impact of ecolabeling goes beyond organizational borders and affects consumer awareness and governmental and institutional regulations in an interactive way, in which each agent influences the others, creating a virtuous circle.

To better understand this cyclical process, it is possible argue that companies that reach an eco-innovative maturity level will be ready to improve their processes or materials in order to meet consumers' and institutions' environmental expectations (Ormazabal et al., 2016). Additionally, at the governmental and institutional level, ecolabeling becomes an innovation in and of itself because the creation of each new ecolabel scheme is a new practice (Thøgersen et al., 2010). It also involves the societal level in that many consumers know the concept and each new ecolabel

will be at least an incremental innovation that competes in a context with other schemes (Rogers, 2003).

Likewise, this perspective on ecolabeling is related to the concept of eco-innovation, because its characteristics, scope and objectives are similar. A good example of the eco-innovation concept is the one released as part of the EU project Measuring Eco-Innovation (Kemp and Pearson, 2007), which explains that: “*Eco-innovation is the production, application or exploitation of a good, service, production process, organizational structure, or management or business method that is novel to the firm or user and which results, throughout its life cycle, in a reduction of environmental risk, pollution and the negative impacts of resource use (including energy use) compared to relevant alternatives*”.

To understand the eco-innovation as a cyclical process, we can start with consumers’ need to buy environmentally friendly products. Firms may hear and respond by starting innovation processes, even though companies may or may not improve their goods and services. Then, governments and institutions, after interpreting their needs, procure to develop tools to identify and certify those sustainable goods and services in order to encourage cleaner production and consumption. In the market, traditional products or services with added value are going to compete with ecolabeled products and services with greater added value. In this way, ecolabels emerged as a managerial solution for communicating to consumers the high environmental performance and remarkable features of green products (Figure 2).

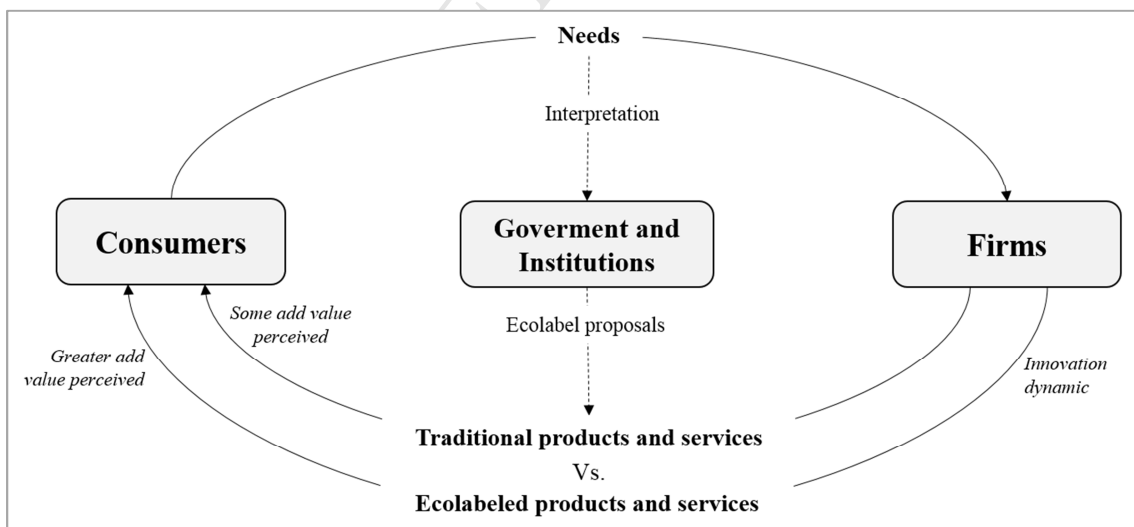


Figure 2. Ecolabeling innovation cycle.

To close the process, as soon as the ecolabeled products are inserted into the market, the cycle may start again with feedback from consumers and institutions (Figure 2). For example, the ecolabeling scheme known as EU Ecolabel is being improved to develop its potential to achieve regenerative or radical innovations in encouraging the conservation and cyclical use of natural resources (European Union, 2014). In this last feedback step, there are many tools (one such example being the Life Cycle Assessment (LCA)) that improve the ecolabeling process, identify the relevant environmental impacts of any product and guarantee the transparency of an ecolabeling process (Mungkung et al., 2006).

Finally, time is a factor that should be taken into account in assessing sustainable initiatives in the short and long term (Lozano, 2008). First, improvements made inside organizations in order to develop an ecolabeled product or service tend to promote restorative or incremental innovation in the short term (Hofstra and Huisingsh, 2014) rather than radical change (Figure 3), since an ecolabel is awarded after comparing the performance of the green product with traditional products. Nonetheless, the incremental innovation process of ecolabeling is one of the best and most feasible efforts that established firms could undertake to improve the environmental performance of their products and services (Carrillo-Hermosilla et al., 2010). Second, the constant repetition of the ecolabeling innovation cycle may cause radical innovation in the long term because continuous innovation by companies and the pressure from consumer demand would lead to a blossoming of inventions, designs, and new solutions in order to fulfil the needs of humans and nature (Hofstra and Huisingsh, 2014). To summarize, ecolabeling is an innovative process that arises from cyclical interaction (Berkhout et al., 2006), which permits, in the short term, products and services with more value to be delivered by developing better organizational routines (Winter and Nelson, 1982). Likewise, in the long term, this evolutionary behavior could meet the needs of humans and nature's.

3.1.2. Ecolabeling determinants and their dimensions

As the previous section illustrated, ecolabeling is a cyclical eco-innovation process, in which the interaction of different agents influence its performance. In this sense, Horbach (2008), Oltra, (2008) and (Horbach et al., 2013) agree that there are three determinants of eco-innovation: 1) supply side 2) demand side, and 3) institutional and political influences. These determinants are based on multiple empirical studies, and they represent a systemic view of this topic (e.g. (Florida, 1996; Green et al., 1994; Rehfeld et al., 2007).

In applying eco-innovation determinants to ecolabeling performance, it is possible to argue that they also serve as determinants of ecolabeling phenomenon. For example, from the supply side, an ecolabel is understood by various authors as a visible and voluntary instrument for communicating the environmental performance of products or services, which facilitates consumers' decision-making process (Rex and Baumann, 2007; Thøgersen et al., 2010). Hence, ecolabeling programs can create market-based incentives that improve the management of environment resources (Roheim et al., 2011). On the other hand, the demand side is closely associated with the "green" consumers who demand sustainable products (Zanoli and Naspetti, 2002), and ecolabels are an easy way to identify such products. Finally, in terms of institutional and political influences, there are some standardizing institutions such as ISO that procure to guide the relationship between companies and consumers, such that an ecolabel is a "claim which indicates the environmental aspects of a product or service" according to the clause 2.1 in ISO 14020 (ISO and ICONTEC, 2002). This straightforward description is consistent with the original basic concept first developed by the German Institute for Quality Assurance and Certification, which stated that "environmental labels inform consumers about the positive environmental aspects of a product" (Hemmelskamp and Brockmann, 1997, p. 67). From the perspective of governmental organizations, an ecolabel is defined as a tool that is dedicated to influencing demand (Salzman, 1994) by informing consumers about the environmental implications associated with all elements in the product's life cycle (Global Ecolabeling Network, 2007).

Additionally, to understand the eco-innovation determinants in detail, we propose five dimensions that arise from the determinants (see Figure 3). They are D1: social environmental awareness, D2: market dynamics (supply and demand), D3: organizational strategy (cost savings, organizational innovations, industrial relations and networking), D4: technological

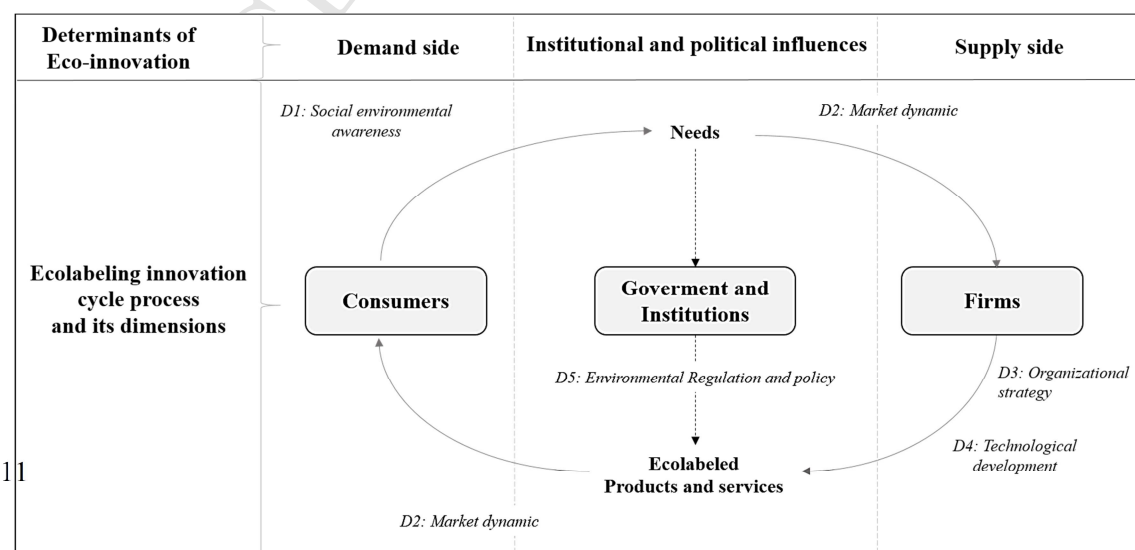


Figure 3. Ecolabeling innovation cycle, determinants and dimensions.

development, and D5: environmental regulation and policy.

If we first look at the demand side, we see that it is related to the dimension of social environmental awareness and market dynamics. Because the demand for ecolabeled products is influenced by consumers' level of involvement in environmental concerns (Ginsberg and Bloom, 2004; Kotler, 1997; Rex and Baumann, 2007) as well as the function, price, quality and other features of the products and services (Johnston and Roheim, 2006; Sedjo and Swallow, 2002; Sörqvist et al., 2013).

Turning to the supply side, it influences the dimension of market dynamics when the increase in consumer involvement and information about green products stimulates demand (Kotler, 1997) and companies are moved to change the way they produce in order to be in line with current environmental perception. The third dimension, organizational strategy, takes place when firms are designing a strategy for overcoming the market's environmental challenges. This means that organizations can evolve to improve their products or services with incremental innovations in order to take a piece of the market share and to meet stakeholder expectations (Ormazabal and Sarriegi, 2012). In this way, when a company aims to develop an environmental management strategy, the entire value chain must be involved. Consequently, a company's organizational strategy must overcome barriers such as the costs of research, changes in processes, suppliers, and investments (Horbach, 2008). The fourth dimension, technological development, is also relevant for the supply side determinant in that companies have to find ways to attain cleaner production and overcome technological challenges (Amacher et al., 2004) in order to improve or create new products that will meet consumers' environmental expectations.

Finally, institutions and political influences have the ability to catalyze the four previous dimensions through laws or norms and they can even propose voluntary strategies such as ecolabels to green the economy. First, institutions and political influences have a relevant effect on environmental conservation, given that governments can trigger environmental regulations and policies to support environmental sustainability programs and social environmental awareness (Carrillo-Hermosilla et al., 2010). Additionally, institutions can affect market dynamics by encouraging demand for and the production of sustainable goods or services (Banerjee and Solomon, 2003; Hemmelskamp and Brockmann, 1997). These challenges will boost the development of technology and new strategies in the organizations that compete in the market.

Analyzing the determinants and multiple dimensions of ecolabeling leads us to define *ecolabeling as a cyclical eco-innovation process in which consumers, firms, governments and institutions interact. Its final purpose is to contribute to the development of sustainable and ecological ways of production and consumption. In this process, consumers' environmental expectations are met; firms increase their created and captured value and enhance their sustainability, and governments and institutions foster cleaner production and consumption. Finally, this process is tangible in the products through the awarding of ecolabels, which are visibly displayed on goods and services.*

3.2. Descriptive analysis

In order to analyze the most relevant studies on ecolabels, the quality of the analyzed papers was guaranteed by the selected database, as explained in the planning section. Moreover, the articles were classified according to Journal Citation Reports (JCR) categories. Of the 152 articles, 83 are classified as Q1 in at least one category, and on average, they have an impact factor of 2.55. This result shows that knowledge about ecolabels has been well developed in top journals, which have published more than a half of the selected articles.

Second, we identified the most prominent journals in our review (Figure 4). This categorization reveals that the clearly dominant journal that focuses on aspects of the environment and sustainability is the *Journal of Cleaner Production*. This is followed by the *International Journal of Cycle Assessment* and other journals more focused on economic aspects that may affect the market, such as the *Ecological Economics*, *Environmental and Resource Economics* and the *Journal of Environmental Economics and Management*. This last journal has published

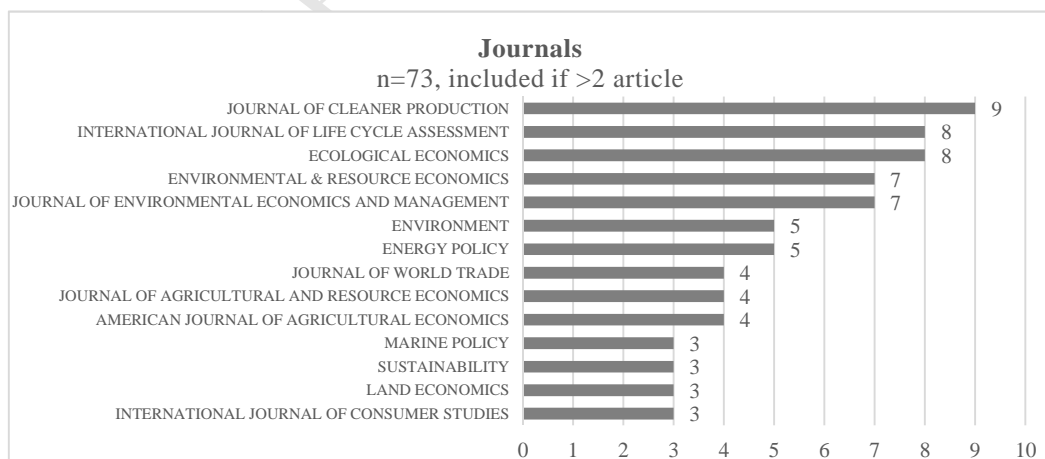


Figure 4. Most prominent journals with more than two publications.

two of the top ten most cited articles from this review (Bjørner et al., 2004; Teisl et al., 2002).

Furthermore, there are 73 (of 152) articles that appear in the 14 most prominent journals (of 84), meaning that almost half of the articles in this study appear in 17% of the journals analyzed. Consequently, ecolabels can be seen as an interdisciplinary topic that is considered from numerous points of view and in different kinds of journals. However, this diversity is not balanced; the most prolific journals are all related to the environment. There are articles that appear in sectorial journals, while there are very few papers published in journals focused on consumer behavior and marketing.

Third, the historical evolution of the ecolabeling shows that articles exploring ecolabels have been published since the 1990s (Figure 5). This fact is clearly associated with the ecolabel milestones, such as the launch of the first ecolabel by the German government and the first

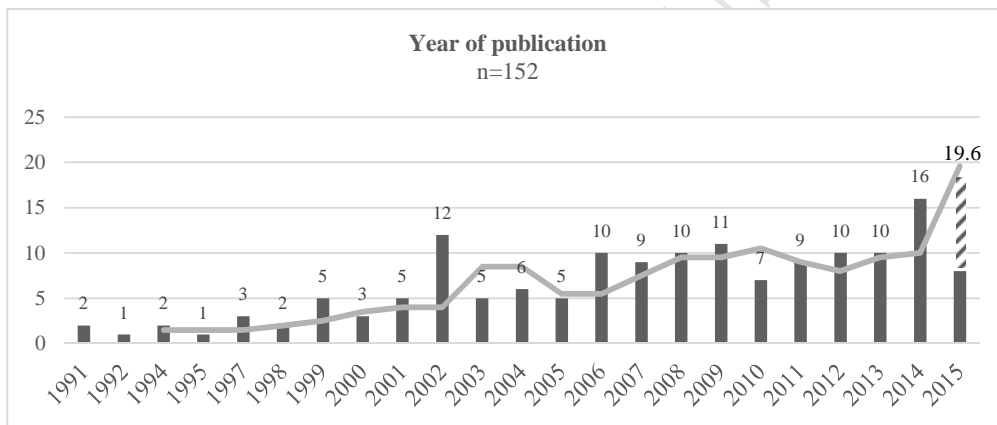


Figure 5. Number of publications by year (1991–June 2015).

definition of sustainable development, as outlined in the introduction.

The propagation of ecolabel initiatives in the global scenario and its market benefits could encourage governments and private organizations around the world to implement them. In this regard, social concern about ecolabels evidently boosted academic curiosity in this topic. Thus, according to the forecast in 2015, we expect an increase in publications by between 30% and 60%, which includes words related to ecolabels in the title. It is worth noting that in 2002 the number of papers published was much higher than in previous years. We wondered if something special had happened in that year, but to the best of our knowledge, the only event that could explain this large jump is the 2002 Earth Summit in Johannesburg, South Africa, which

established the Millennium Development Goals and it encouraged energy and chemical labeling (UN, 2002).

Fourth, we analyzed the methodologies employed in the 152 articles, finding that almost three quarters of the articles developed their analysis based on modeling (26%), empirical analysis (26%), and survey methodologies (22%) (Figure 6). In the modeling cases, the most cited articles developed utility models (Amacher et al., (2004) Loureiro et al., (2001); Teisl et al., (2002) and hedonic regression models (Nimon and Beghin, (1999); Roheim et al., (2011)

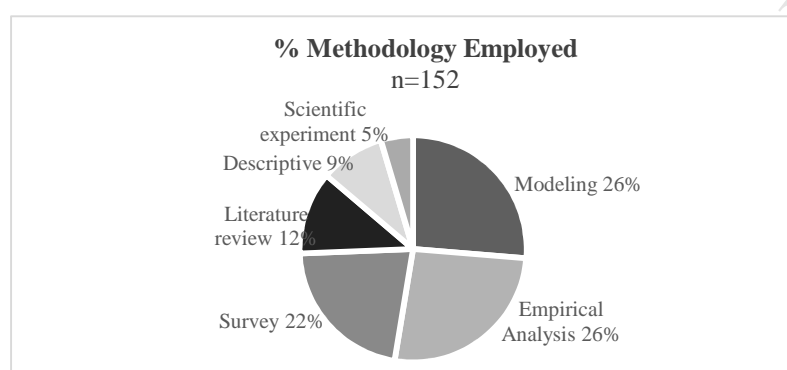


Figure 6. Methodology used in the 152 articles analyzed.

Uchida et al., (2014), although other less popular econometric techniques were also present.

The empirical analysis category includes every publication that used qualitative observation, experience and case studies primarily related to environmental management and regulation topics, such as studies by Bray et al. (2002), Gutierrez et al. (2012), Thrane et al. (2009) and Truffer et al. (2001). Moreover, survey cases are analyzed separately from empirical analyses because of their weight in statistics. In this case, the majority of the top ten cited papers tend to analyze consumer behavior and work in marketing research, as is the case in studies by Blend and Van Ravenswaay (1999), Johnston et al. (2001), Loureiro et al. (2002), Loureiro and Lotade (2005), and Wessells et al. (1999). The review of the methods used in all articles led us to identify a need for different methodologies other than modeling or surveys focused on informed populations because academics and practitioners require more information to reach traditional consumers, who are not well informed.

In terms of literature reviews, 12% of the articles are classified as studies that used structured or systematic reviews of research, such as the one by Rex and Baumann (2007). However, the articles that used descriptive analysis (9%) are mainly conceptual and present theoretical proposals. Articles that use the literature review or descriptive analysis are frequently focused

on developing the ecolabeling concept, the norms needed to implement it (Lathrop and Centner, 1998), and the traditional usage of ecolabeling from an international perspective (Bonsi et al., 2008). In this way, future descriptive analysis and literature reviews should carry out more in-depth research about the strategies that can capitalize on the value of ecolabeled products, as Rex and Baumann (2007) suggest. Finally, the scientific experiment methodology includes the studies that were carried out from the natural and applied sciences with ecolabeling applications. Examples are the small number of articles that analyze psychological reactions to ecolabeled products (Cason and Gangadharan, 2002; Sörqvist et al., 2013). Along these lines, there are ecological experiments that design or assess ecolabel schemes in the market (Olsson and Kjallstrand, 2006; Wik and Dave, 2005), but evidently there is a gap in the knowledge about the possible scientific applications that can improve ecolabeling practices in the market. Taken all together, the variety of approaches and areas shows that ecolabeling is an issue that can be studied through theoretical or empirical methodologies because of its broad applications and the need to explore this topic from different perspectives.

3.3. Focus and content of the articles

In this section, we examine how the articles let us understand the relation between ecolabel dimensions, economic sectors, and geographical regions. Some clues that speak to those relations are the presence in the articles of each of the dimensions, the involvement of sectorial journals in ecolabeling topics, and the variety of geographical locations mentioned in the studies. This cross analysis also shows how studies have examined ecolabels, how the ecolabeling innovation cycle is involved, and the research gaps that present opportunities for future research.

3.3.1. The most developed dimensions

Regarding ecolabeling theoretical framework, each paper was classified in the dimension best covered by its research. The most developed dimension observed in the articles is market dynamics in terms of supply and demand interactions (33%) (Figure 7). Furthermore, a significant number of these studies on ecolabels have been developed through the analysis of duopoly models, which are modeling techniques from microeconomics, and descriptive

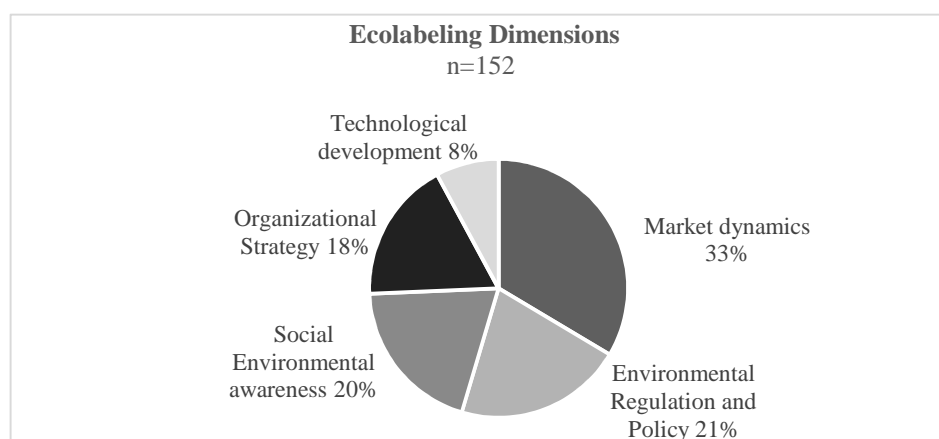


Figure 7. Ecolabeling dimensions.

analysis. Most such studies try to understand the possible results in the market when “brown” and “clean or green” firms are competing (Amacher et al., 2004; Lozano et al., 2010) and consumers’ reaction to premium prices in ecolabeled products (Bjørner et al., 2004; Nimon and Beghin, 1999; Srinivasan and Blomquist, 2009). Additionally, in marketing research some prolific authors have conducted part of their research on consumer behavior in relation to ecolabels (Johnston et al., 2001; Johnston and Roheim, 2006; Thøgersen et al., 2010) and how marketing makers may benefit from implementing ecolabels in organizations (Moon et al., 2002; Rex and Baumann, 2007; Thøgersen et al., 2012).

Some other articles in the same dimension show that although people prefer ecolabeled products in survey studies (Srinivasan and Blomquist, 2009), there are certain barriers that keep people from buying them at the end of the day. Those barriers could be price or information consumers received about the label (Rex and Baumann, 2007; Zhao and Xia, 1999). Consequently, Rex and Baumann (2007) point out that environmental tools such as ecolabels require a complete marketing strategy to communicate their meaning and their added value. The value must be obvious to the customer (Hemmelskamp and Brockmann, 1997) given that an individual’s decision-making process in a store may take about 5 seconds (Thøgersen et al., 2010) as measured in a place where ecolabeled and non-ecolabeled products compete. The relevance of marketing dynamics is also evident in the ecolabeling innovation cycle (Figure 3) because it is relative to the ecolabels’ performance as soon as they are inserted in the market.

The second most developed ecolabel dimension is environmental regulation and policy, which was dealt with in 21% of the reviewed articles (Figure 7). In this area, researchers tend to carry out literature reviews and descriptive analyses of the current policies and norms that regulate the design, use and implementation of ecolabels (Ball, 2002; Boström, 2006; Hemmelskamp and Brockmann, 1997; Horne, 2009; Lavallee and Plouffe, 2004; Ponte, 2008). From another point of view, there are authors like Truffer et al. (2001) and Riddel (2003), who have undertaken empirical analyses from the law and governmental experiences, and authors like Van Amstel et al. (2008) and others, who compare the regulation of different ecolabels implemented in a region. This is a dimension with a broad range of opportunities because of the lack of convergence regarding legal issues, which should be included in the label’s schemes locally and globally according to the ecolabels’ presence in the market.

Then there are articles that highlight the role of ecolabels in social environmental awareness (20%). These kinds of studies tend to comment on the importance of the conservation of

species, avoiding the overexploitation of resources, especially in the sea, and reducing pollution by influencing consumer decision-making (De Snoo and Van de Ven, 1999; Kaiser and Edwards-Jones, 2006; Mourato et al., 2000). This dimension includes the growing group of studies that question the transparency of the ecolabeling process, but they also tend to propose the Life Cycle Assessment be used to be honest with society and address that concern (Mungkung et al., 2006; Thrane et al., 2009). However, some other articles by researchers such as i Canals et al. (2002), Baldo et al. (2002), and Capitano et al. (2014) focus on regulation topics in order to define how to introduce Life Cycle Assessment in regional, national or transnational norms.

The organizational strategy dimension presents a gap in the literature, taking into account that it has been mainly developed in just 18% of the studies. Although the majority of them are recent publications in business and economic journals with an applied approach, such as the articles by Loureiro et al.(2001) and Sedjo and Swallow (2002). The studies related to environmental sciences, economics and environmental management that fall into the technological development dimension make up just 8% of all articles selected. The articles classified in this dimension are mainly focused on energy and construction solutions (Jeong and Kim, 2014; Olsson and Kjallstrand, 2006; Peri and Rizzo, 2012), and they usually propose ways for consumers to receive added value from greener technologies and cleaner production. Authors included in this category, such as Wik and Dave (2005), have proposed an innovative process for developing new and effective ecolabels in polluting products like car tires. Nevertheless, the low quantity of scientific experiments (Figure 6) and the low presence of papers in the technological development dimension (Figure 7) prove there is a lack of interest in the business applications of the technological tools used to develop ecolabeling. Moreover, environmental management initiatives need to be supported by the natural and applied sciences to develop effective and innovative sustainable products.

3.3.2. Ecolabel performance in the market

In order to understand the market where ecolabels are tested, this paper includes an analysis of the empirical studies from our systematic literature review that have developed their research in a specific sector. The first of the findings is that the most cited authors have researched areas related to the food sector (Blend and Van Ravenswaay, 1999; Loureiro et al., 2001; Loureiro et al., 2002). Besides, the most cited and prolific authors have focused their articles on the fishery sector (Johnston et al., 2001; Johnston and Roheim, 2006; Roheim et al., 2011; Teisl et al.,

2002; Teisl et al., 2008; Wessells et al., 1999). Moreover, the Earth Summit in 2002 gave special importance to the fishery sector due to its impact on biodiversity protection (UN, 2002). Consequently, we list fish as a separate category rather than including it with other food products (see Figure 8). Additionally, the statistical importance of fish and coffee is as high as the food sector in general.

Our study also shows that academics are interested in forestry, construction, energy, and fuels. The results in Figure 8 confirm that there is a special interest in certain types of ecolabels from specific sectors. In fact, the level of interest in those ecolabels varies according to the degree of

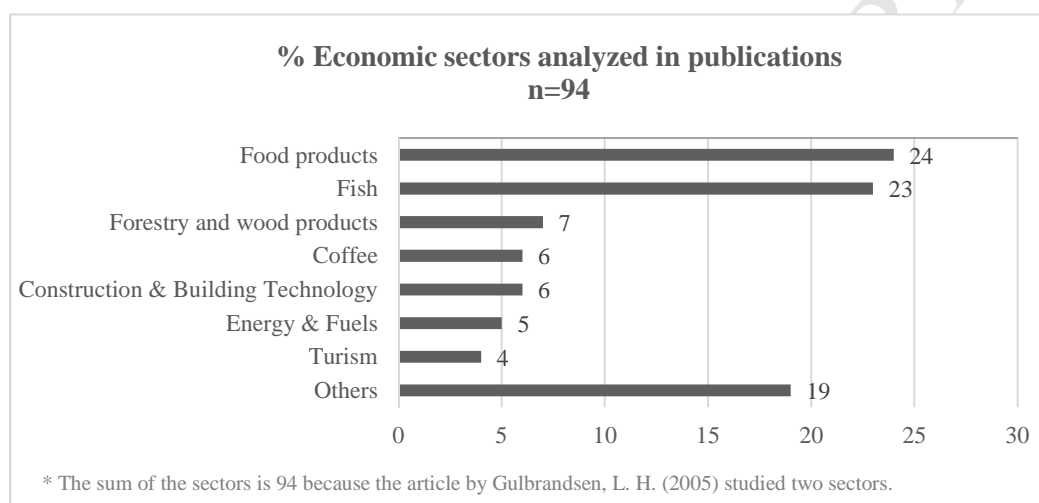


Figure 8. Economic sectors present in the review.

tangible contact between the product/service sector and users. This means that according to the literature selected, it will be more feasible for academics to measure the results of a study that analyzes an ecolabel on foodstuffs than an ecolabel that certifies services such as tourism because services cannot be touched or stocked and the perception may be very subjective. The least ecolabeled sectors can be a clue for determining the least eco-innovative producers so the demand side and institutions can influence them to develop new goods, process or sources.

Reviewing the geographical focus or location of the studies could guide academics and practitioners in the spread and implementation of ecolabels. Moreover, taking into account that not all consumers in the world have been exposed to the same ecolabels at the same time (Thøgersen et al., 2010), a geographical perspective can suggest the areas of the world where ecolabels are well known and explored.

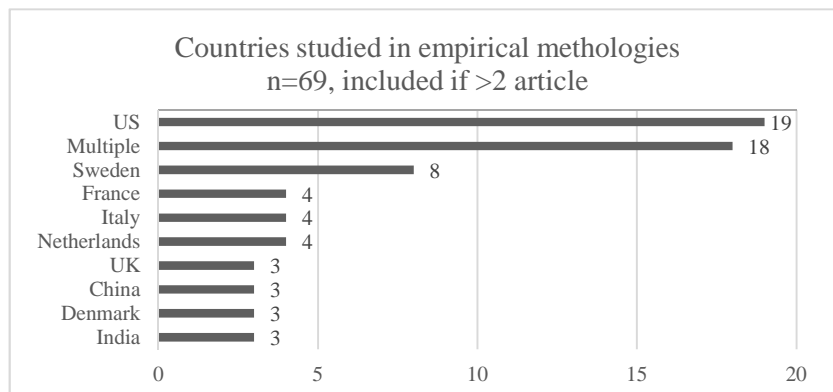


Figure 9. Geographical location of the studies reviewed.

According to our review (Figure 9), the US is the most analyzed country. Not only are there 19 studies that focus solely on the US, the US also appears in six studies that focus on multiple countries. Furthermore, the top five most cited articles (Blend and Van Ravenswaay, 1999; Loureiro et al., 2001; Loureiro and Lotade, 2005; Teisl et al., 2008; Wessells et al., 1999) have carried out their research totally or partially in the US. Meanwhile, Sweden is the second most studied country, and curiously, the majority of the research has been done in the food sector (Figure 9), reinforcing the trend that we analyzed before.

Continuing down the list, the ecolabels are widely spread in developed European countries and emerging Asian economies such as China and India. This is evidence of bias in ecolabel research and the possible existence of research gaps in developing countries. Some of them have recently implemented ecolabels due to international influence because they do not have experience in implementing them and the certification costs are too expensive, such as the case with the Colombian ecolabel (Rodríguez et al., 2014) and the MSC label in South Africa (Ponte, 2008).

3.3.3. Joint analysis

In this section, a joint analysis presents the possible relations, trends and opportunities regarding ecolabels dimensions (Figure 7) and ecolabels performance in the market. The most significant results were found by doing two cross-analyses: (1) Economic sectors versus ecolabel dimensions, and (2) economic sectors versus the geographical location of the studies. Moreover, the strongest relations are highlighted with a darker background color.

The first analysis is focused on the economic sectors given in the previous section, although it does not mean that they are the only sectors with research potential. To that point, Table 3 represents the relation between the sectors explored by the researchers and the dimensions (Figure 7). Additionally, the ecolabeling dimension that was taken into account for the chart is the one that was the primary focus in each of the articles.

Table 3. Dimension versus economic sector matrix

Sectors	Dimensions					Total
	Market dynamics	Social Environmental awareness	Environmental Regulation and Policy	Organizational Strategy	Technological development	
Food products	10	6	4	4	1	24
Fish	5	11	1	6		23
Forestry and wood products	2	1	3	1	1	7
Construction & Building Technology	1		2		3	6
Coffee	1	2	1	2		6
Energy & Fuels			1	1	3	5
Tourism	1	1		1	1	4
Others	7	2	4	3	3	19
Total	27	22	16	18	12	94

The matrix in Table 3 lets us see that the most relevant relation is between the fish and food sectors and the market dynamics dimension (Table 3). This explains researchers' interest in understanding consumer behavior and reactions to an ecolabeled product. One behavior of interest is consumer willingness to pay premium prices and the strategies that can influence the decision-making process, topics that have been studied by Roheim et al. (2011). In this case, researchers have to design ways to establish relations between consumer behavior and personal values, information, and of course, prices. In the same relation, the large number of fish studies examined from the social environmental awareness dimension is the result of the continuous ecological threats that academics report. Some of them deal with topics such as marine overfishing (Gutierrez et al., 2012; Kaiser and Edwards-Jones, 2006; Thrane et al., 2009), water eutrophication (Mungkung et al., 2006), and damage to marine ecosystems (Cooke et al., 2011).

The third most researched sector is forestry and wood products, which has been studied from different dimensions by authors like Sedjo and Swallow (2002), Boström (2006), and Veisten (2007). As the matrix shows, this sector is not dominated by any particular dimension. Additionally, there is a growing interest in construction, coffee, and energy and fuels, as the majority of these works were published in the last three years. However, so far the most studied sectors are usually studied from the environmental regulation and policy dimension, which takes

into account the technical process of production (Galinkina et al., 2012; Heinzle and Wüstenhagen, 2012; Lupu et al., 2013; Peri and Rizzo, 2012; Vinagre Diaz et al., 2013).

Regarding the environmental regulation and policy dimension, almost all sectors have been addressed; some articles are even focused on the governmental issues. This finding is coherent with the initial assumption that the “institutions and governments” determinant has an equal influence in all the eco-innovations dimensions of ecolabels and it may affect every sector too.

Secondly, the joint analysis of economic sectors versus the geographical location of the studies revealed the large presence of European countries in singular and multiple studies (Table 4). This situation can be explained by their long experience in the design and implementation of environmental management instruments (Thøgersen et al., 2010). In the Nordic countries, Germany, and Japan ecolabels may cover nearly 5%-20% of the market (Amacher et al., 2004; Zhao and Xia, 1999), which is justified by the time that these countries and regions have taken in adopting an environmentally friendly philosophy. Indeed, as we described in the introduction, some of those countries were pioneers of ecolabeling schemes starting in the 1970s, and they have promoted regional schemes such as the EU Ecolabel and the Scandinavian White Swan.

Table 4. Sector versus continent matrix.

Sector	Continent Studied						Total
	Europe	North America	Asia	Africa	Central America	South America	
Food products	17	6	2				25
Fish	7	6	4	1			18
Others	7	6	1				14
Forestry and wood products	6	5	1				12
Energy & Fuels	3	1	2				6
Coffee	1	2	1		1		5
Construction & Building Technology		1	1				2
Tourism	1						1
Total	42	27	12	1	1	0	83

Other countries, such as Spain, are experiencing the first phase of this phenomenon (Dekhili and Achabou, 2014). However, those countries are rapidly evolving; for example, within the European Union, Spain has the third highest number of ecolabeled products with EU Flower in 2015 (European Union, 2015). In what follows, in order to find representative results we performed the cross-analysis comparing sectors and geographical regions by grouping countries into continents (Table 4).

This cross-analysis of all economic sectors and the continents that were examined with empirical methodologies also suggests that the most developed economies conduct research in almost all industries (Table 4); however, a world of opportunities remains to be discovered. This analysis provides a strong clue, pointing to the potential areas of study in the emerging markets of Asia, Latin America and Africa. This gap in the ecolabel literature invites researchers to figure out the barriers that developing economies must overcome.

Additionally, future research could evaluate strategies for adopting ecolabel initiatives or study how developing countries view these environmental management tools. Finally, it is necessary to design strategies that will bridge the distance between the heavily researched food product sector and the less examined sectors. This is relevant because it could expand the impact of ecolabeling in the sustainable consumption and effective production.

4. Conclusions

This paper enriches the literature on environmental management and eco-innovation through the exploration of ecolabeling. This contribution is made in two ways, by providing a theoretical framework and conducting a systematic literature review.

The theoretical framework covers the first objective of this paper: it revealed that ecolabeling necessarily involves a cyclic innovation process with interaction between consumers, firms, governments and institutions. In this way, this paper also proposes a wider ecolabeling definition from eco-innovation, which can be addressed according to three eco-innovation determinants: supply, demand, and institutional influences.

The ecolabeling innovation cycle starts when consumers express their environmental expectations. Then, the most eco-innovative companies try to satisfy those expectations by improving their existing products, processes or suppliers. The objective of these actions is to offer more value added to consumers than their competitors. After that, consumers increase their environmental expectations and the process starts again. In middle of this process, the governments and institutions promote sustainable consumption and production through tools like ecolabels because they can give information about the environmental aspects of a product or service in a visual way. According to this view, the innovations developed within ecolabeling process tend to be incremental by the short term results. However, in the long term, the constant repetition of the cycle will contribute to develop radical innovations in coherence with the

environment. The complexity of this process will require an exploration with greater depth in future studies.

The ecolabeling cycle presented here is also multidimensional, as it is based in the fact that detailed dimensions make up each determinant. To the best of our knowledge, the ecolabeling dimensions identified in the cycle are: 1) social environmental awareness, 2) market dynamics (supply and demand), 3) technological development, 4) organizational strategy (cost savings, organizational innovations, industrial relations and networking), and 5) environmental regulation and policy.

Regarding our second objective, our research developed a broad systematic literature review to identify ecolabel performance, academic interest in this topic, and how researchers have explored the ecolabeling dimensions in theoretical and empirical studies.

The bibliographical data proved the growing interest in ecolabels starting in the 1990s and the apparent influence of international conferences that take an environmental approach. We saw that research methods are mostly oriented toward the modeling of “green” and “brown” markets and surveys that analyze consumers’ behavior in the market instead of analyzing the environmental management strategies in the organizations. In the subsequent cross-analysis of the systematic literature review, there is an apparent relation between certain ecolabel dimensions and economic sectors. This analysis showed that academics are more interested in the analysis of market dynamics in productive sectors instead of services. This finding also implies that there is a need to conduct new research on ecolabels in other dimensions, such as environmental regulation and policy, organizational strategy, and technological development. For example, the implementation and management of new technologies that improve processes or products that could be ecolabeled are worth investigating.

Moreover, the cross-analysis relating economic sectors and geographical regions showed that the message of sustainability has not been transmitted equally in all economic sectors around the world. One of the biggest challenges for researchers and practitioners is to look for the best way to make ecolabels visible and useful to all consumers across economic sectors, not only to the “greener customers” of the most developed regions. However, it is not a surprise because the ecolabeling practice has been undertaken by developed regions, such as Germany, Japan, the US, and the Nordic countries; as a result, their population has been exposed to the ecolabels concept for a longer time.

Table 5 summarizes the trends that have been identified throughout this paper. The following research gaps can be seen as research opportunities for scholars who are interested in this topic.

Table 5. Summary of notable trends and future research opportunities.

Topic	Trends	Research gaps
Ecolabel framework	The development of the ecolabel concept regarding eco-innovation.	There is an opportunity to explore in greater depth the ecolabels from each of the eco-innovation determinants and dimensions, and their interaction in the cyclic innovation process.
Ways of publishing	Ecolabeling is an interesting issue for top journals, and it can be studied from theoretical and empirical approaches.	There is an opportunity to study the boost of radical innovation that may be achieved in society and environmental management strategy through the ecolabeling process. It means that an analysis of long term ecolabeling experiences should be developed. There is a lack of information about the behavior of uninformed consumers' in duopoly models. The journals less focused on the environment have not published enough articles about ecolabels, even though it can be a relevant tool to differentiate goods and services in the market. The natural and environmental sciences should be incorporated in the study of ecolabels to enrich the innovation process.
Sectors of interest	Food and fish are the sectors most studied via empirical analysis. There is also growing interest in ecolabeling in the construction and energy sectors.	There is a lack of knowledge about the influence of ecolabels in the service economy sectors, such as tourism.
Ways to explore ecolabel dimensions and sectors	There is a clear trend to study the food, fish and forestry sectors from the market dynamics and social environmental awareness dimensions. Sector studies are mainly focused on the demand side determinant.	From a managerial viewpoint, there is a gap in the literature regarding the influence of ecolabels on technological development. The most studied sectors have not been studied enough from the viewpoint of the supply and institutional sides. This could be a key element in improving ecolabel insertion in the market.
Geographical analysis	The message of sustainability has been transmitted mainly to "greener customers" in the most developed regions, who have been widely exposed to the concept.	Research opportunities exist in the emerging markets of Asia, Latin America and Africa, which have to meet the worldwide environmental expectations in every economic sector.

Additionally, some limitations of this study should be recognized. First, the focus of our research and the breadth of the subject required that articles be selected only according to their title. A second limitation of the research lies in the subjective assessment of the dimension that is most developed in each article, even though some articles may develop another dimension to a lesser degree.

Thus, future studies should propose strategies for overcoming the barriers to extending ecolabeling in emerging economies, considering local factors like ecolabeling implementation costs, the culture and social features. Furthermore, future research in developing countries could help encourage eco-innovation processes through ecolabeling in order to meet worldwide environmental expectations.

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Highlights

- * Ecolabeling drives eco-innovation processes in cycle.
- * Ecolabeling triggers incremental eco-innovation in short term.
- * Ecolabeling triggers radical eco-innovation in long term.
- * Ecolabels is a multidimensional topic.
- * Ecolabels' research opportunities exist in the emerging markets and service sectors.