CAN
environmental product standards enable eco - innovation?

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Outlook 12

Environmental product standards and eco-innovation – a review.

By Albert Roger, ZEW

Key messages

Effectiveness of environmental product standards (environmental labels) gearing consumers towards environmentally-friendly consumption depends on consumers' trust. Multiplication of labels can negatively affect the credibility and effectiveness of environmental product standards.

Providing consumers with an overview of labels that could help them distinguish between those having a third-party certified environmental attribute and those who don't could help them choosing a more sustainable consumption behaviour.

Identifying the environmental effectiveness communicated by labels need to be based on solid evidence. We recommend the use of quasi-experimental methods for a more thorough analysis of the impacts of environmental product standards.

Case study evidence suggests that environmental labels enhance the diffusion of already existing innovations rather than incentivizing the creation of additional innovations.

Firms behave strategically with the introduction of new labels (e.g.: by bunching on the notches, introducing price premiums for some price-bands...). Accounting for firms' reaction to labels could help improving their effectiveness.

Key messages

Market surveillance (i.e.: verifying that mandatory environmental labels are enforced and self-claimed labels are truly environmentally-friendly) is key for a successful implementation of environmental labels.

From a global perspective there is a need to understand possible implications (e.g.: barriers to trade) of eco-labels in developing and developed countries (i.e.: producers from developing countries might face higher costs to access developed economies' markets, many ecolabels maintain a monopoly over the right to certify).

Providing support for firms that want to implement a label (i.e.: reducing "red tape" documentation and providing financial support for the implementation costs) can increase the adoption of eco-labels.

Including new insights from behavioural economics (e.g.: consumers' in attention to physical quantifiers such as energy consumption, improving labels' designs to enhance consumers' attention) can help improving the effectiveness of environmental product standards.

1 INTRODUCTION

Environmental product standards (EpS) certifying environmental product attributes are key for fostering sustainable consumption[1], which is an essential measure for achieving the Sustainable Development Goals (SDGs)adopted by the United Nations. EpS, also called environmental labels or eco-labels, are intended to describe environmental features of consumer goods and raise consumers' awareness about sustainability. By fostering sustainable consumption they can become one of the main policy instruments for tackling climate change. They can be mandatory (i.e. providing such information is compulsory for producers or sellers) or voluntary.

EpS aim at reducing the information asymmetry between consumers and providers. Evidence shows that demand-pull is a decisive factor for firms to voluntarily provide environmental product information. By enhancing consumers' awareness, product standards can spur eco-innovation. Nevertheless, they have also raised some concerns about barriers to trade and "greenwashing". The recent rapid spreadof EpS has fostered label competition, confusing consumers and thus endangering potential sustainability benefits resulting from EpS.

The aim of this outlook is to provide policymakers with an overview on how EpS can support eco-innovation. For this purpose we first describe the different types of labels and review evidence on the different impacts of EpS. Later on, we analyse drivers, benefits and barriers of adoption ofEpSand their relation to eco-innovation and environmental performance. Finally, we provide an overview on new behavioural insights to EpS.

2 WHAT IS THE SUSTAINABILITY CHALLENGE THAT ENVIRONMENTAL PRODUCT STANDARDS CAN RESPOND TO?

What is the sustainability challenge that environmental product standards can respond to?

Environmental Product Standards can become a cornerstone on the journey towards achieving the Sustainable Development Goals (SDG). The SDGs were defined by the United Nations as part of the new sustainable agenda. As we have seen in the previous section, EpS can go beyond pure environmental issues. Many NGO-backed product standards involve some kind of social criteria for their certification besides the environmental attributes. Well-known examples can be found among food labels such as the “Fairtrade” or the “UTZ” label. The connection between EpS and the SDGs reaches beyond solely environmentally-related SDGs like n°6 (Clean water and sanitation), n°7 (Affordable and Clean Energy), n°9 (Industry, innovation and infrastructure), n°12 (Responsible Consumption and Production), n°13 (Climate action) or n°14 (Life Below Water). EpS also contribute to SDGs n°8 (Decent Work and Economic Growth), n°10 (Reduced Inequalities) and n°15 (Life on Land).

3 WHAT ARE ENVIRONMENTAL PRODUCT STANDARDS?

Environmental labels have become increasingly present in our daily lives. According to a report from the OECD, the total number of environmental labelling schemes quintupled from 1988 to 2009 (Gruère, 2013). Environmental standards aim at providing information to consumers on the environmental quality of a given good (product standards) or process (process standard). When related to products, as is the case with environmental labels, the so-called Environmental Product Standards (EpS)[2] are aimed at rectifying the asymmetry between consumers and firms regarding the information about the environmental effects of good's consumption[3] (Fuerst, 2011;Galarraga, 2002). The labelled products are called "credence goods" since the consumer cannot evaluate the quality signalled by the label, not even after its purchase. Therefore trustfulness is key for the effectiveness of EpS (Prag et al., 2016).

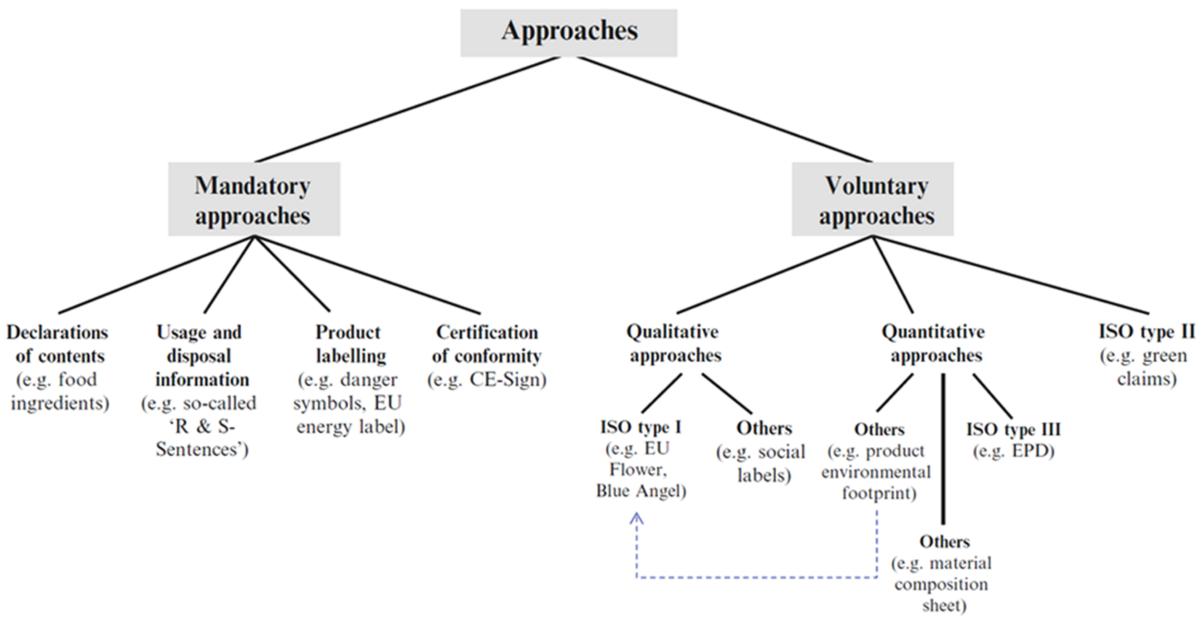
3.1. Different Labelling Taxonomies

Despite the variety of EpS, we can distinguish between mandatory and voluntary product standards. As shown in Figure 1, we can find different types of mandatory/voluntary information on a product's label.

Mandatory Environmental Product Standards (MEpS)

Mandatory environmental product standards require every firm that is willing to introduce products in the market to provide certain information about the characteristics of the product (e.g.: information on health impacts, safety, etc.).

Figure1. Classification of Different Information Transmission Approaches in EpS



Source: Rubik, (2015)

Two prominent examples of MEpS are the European Energy Labelling Directive, epitomized the EU "Energy Label", and the Ecodesign Directive. The former focusses on the consumption of energy and other resources (e.g.: water) during the usage of the product. The latter, instead, extends specific "Ecodesign requirements" to the whole life cycle of the product (i.e. including recycling or disposal of the product after the usage phase). These environmental requirements concern one of the following five aspects, namely: resource consumption, waste, emissions, hazardous substances and physical impacts in the use phase (Molenbroek et al., 2014).

Voluntary Environmental Product Standards (VEpS)

Voluntary environmental product standards (VEpS) constitute a different approach, leaving the decision whether to perform more environmentally-friendly (and signal it with a label) or not (Rubik, 2015) to market players.The International Organization for Standardization (ISO) has developed an own taxonomy to classify VEpS. This classification follows the ISO 14020 series and distinguishes between three types of VEpS (Gruère, 2013):

- Type I (ISO 14024) – Eco-labels:"Voluntary, multiple criteria-based third party programs that award a licence authorising the use of environmental labels on products. These labels provide qualitative environmental information" (ISO 2000: 1). They are covered by ISO 14024 published in April 1999, last reviewed and confirmed in 2009 (Rubik, 2015). Examples of Type I labels include: German "Blue Angel", "Nordic Swan", European "EcoLabel" and Canadian Environmental Choice.

- Type II (ISO 14021) – Self-declared Environmental Claims: "Self-declared environmental claim made by manufacturers, importers, distributors, retailers, or anyone else likely to benefit from such a claim without independent third-party certification (ISO 1999 : 3). They are covered by ISO 14021 published in 1999."(Rubik, 2015) Examples include: Recycled content and Biodegradable.

- Type III (ISO 14025) – Environmental Declarations: "Quantified environmental data using predetermined parameters and, where relevant, additional environmental information. (ISO 2006: 2). They are covered by ISO 14025 published in 2006." (Rubik, 2015) Examples of Type II labels are among others: "Eco-Leaf" and Korean Environmental Declaration of Products.

The main differences between these three types are:

- Type I and III cover multiple criteria whereas Type II covers only a single area.

- Similarly Type I and III are life-cycle based, which is not the case for Type II.

- Type II labels do not need to be third-party certified whereas it is compulsory for Type I and III.

- Type I labels are selective, namely the symbol of the label allows to differentiate between products with and without that label.

This taxonomy does not gather the full diversity of VEpS. It fails to include mixed labels (i.e. quantitative or qualitative labels that don't fall into the ISO categories), such as the "Fairtrade" label or some other quantitative labels like the carbon footprint.

The above classification can be complemented with the one proposed by Rubik (2015), which also includes the three ISO types (see Figure 1). The classification distinguishes between quantitative and qualitative labels, and so-called Type II labels:

Qualitative Labels

- Type I ISO Labels: Eco-labels are voluntary product standards that consider the entire life-cycle of the product. Their approach is to label the products with the best above-average environmental performance to set them apart. The first eco-label was introduced in Germany in 1978, the German

"Blue Angel". It was followed by the "Nordic Swan" and the Japanese "Eco-Mark" in 1989 (Rubik, 2015).

- Social Labels and Standards: These product standards aim at covering social features such as social rights, child labour or minimum wages, e.g.: the former "Rugmark" label now "GoodWeave International" or the "Fairtrade" label among others (Potts et al., 2014; Rubik, 2015).

- Certificates of Conformity: These certificates might address diverse issues (i.e. not only one single environmental characteristic), but they generally certify the fulfilment of certain environmental requirements and are often concerned with upstream resource extraction. Three well-known examples are the "FSC" (Forest Stewardship Council) label, the "MSC" (Marine Stewardship Council), and the "Rainforest Alliance" label. The FSC is a scheme created in 1992 under an NGO (Forest Stewardship Council), which certifies that companies fulfil a number of forestry requirements (Prag et al., 2016; Rubik, 2015).

Quantitative Labels

- Type III ISO Labels: Also referred to as "Environmental product declarations", are a type of standards mainly oriented towards business partners (e.g. public procurers or retailers). They provide quantified environmental data for a product, given certain parameters. The data provided should be based on life-cycle assessment tools and calculations should consider supply chains (Rubik, 2015). e.g.: Japanese "Eco-Leaf" and "International EPD® System".

- Product Footprint: The environmental issues addressed depend on the type of footprint (e.g.: ecological, water, carbon, land, etc.). An example of one of these footprints is the "Product Environmental Footprint" (PEF) created by the European Commission under the "Single Market for Green Products Initiative". The PEF measures the environmental performance of products throughout their entire life cycle (i.e. including recycling and disposal after usage phase), considering relevant environmental impacts of all steps needed to get the product to the consumer. The PEF has been tested from 2013 to 2017 with the collaboration of more than 280 companies and organizations[4] (Rubik, 2015).

- Material Composition: Without any reference to ISO standards, suppliers might be willing to give consumers information on the composition of their products. Two prominent examples are the electronics and the car industry, where global players ask their suppliers to deliver information on the composition of the products and pre-products. E.g.: "Material Composition Declaration for Electrotechnical Products" of the Consumer Electronics Association (CEA) (Rubik, 2015).

Type II Labels

This type of labels refer to self-declared environmental claims, which do not undergo an audit process. These kind of labels have raised some issues referring to their trustfulness, which might affect other EpS. A recent study of the OECD gives a first insight on the different types of environmental claims and the possibilities to punish misleading claims (Klintman, 2016).

Others

Some of the most extended standards, which are third-party certified but neither life-cycle-based nor multi-criteria standards do not fall within these three types. Prominent examples are organic certified products, the "Energy Star" label or third-party certified labels, which are not life-cycle based, such as energy performance or fuel efficiency labels (Gruère, 2013).

3.2. Classification by Sector

Besides the above mentioned extended-ISO classification, it is possible to take a sectoral approach to study EpS. In a study published in 2016, the OECD differentiates between four main sectors in which environmental labels are used, namely seafood; coffee, fruits and vegetables; forest products; and appliances (Prag et al., 2016).

Seafood

This sector includes one of the most well-known environmental labels, the "dolphin safe" tuna. The consequences of the implementation of this label have been broadly analysed among others in Teislet al. (2002). Introduced in the 1990s, its aim is to reduce the dolphin mortality rate. By focussing on a single issue, it contrasts with other labels that address the sustainability of capture fisheries, such as the "Marine Stewardship Council" (MSC) or "Friends of the Sea" (FOS).

Besides these kind of labels, an OECD study (OECD, 2011) noted that many retailers are introducing self-declared environmental claims. In 2011, ClientEarth (a non-profit environmental law organization) found out that 32 out of 100 products examined in UK supermarkets carried misleading, unverified or unverifiable claims (ClientEarth, 2011). According to Prag et al. (2016) the introduction of Type II labels has contributed to increase consumer confusion in this sector. One of the reasons stated is that Type I labels find low recognition among consumers compared to self-declared claims.

Coffee, Fruits and Vegetables

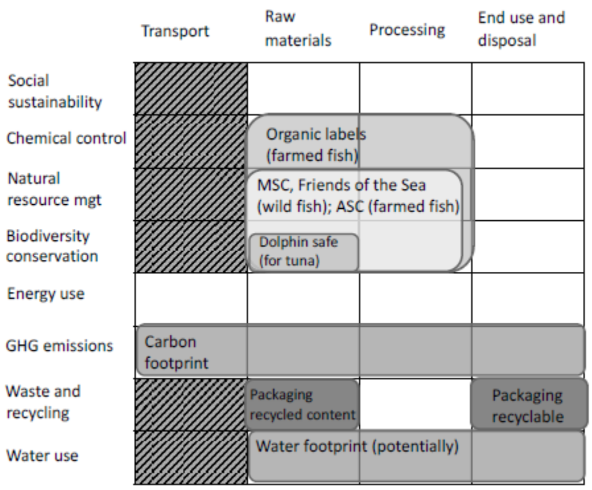
This sector is characterized not only by the variety of labels but also by their co-existence (e.g.: multiple certification). The variety of EpS makes it possible to observe both a horizontal and vertical differentiation. The horizontal differentiation occurs in terms of the variety of environmental attributes certified (e.g.: organic, fair trade, bird-friendly, etc.) whereas the vertical differentiation takes place on the quality ladder in terms of environmental stringency (Prag et al., 2016). An empirical field study, realized in 12 countries[5] based on a control group, found evidence that on average certified farms had higher yields and that double certification significantly increased yields by a substantial amount (COSA, 2013).

Forest Products

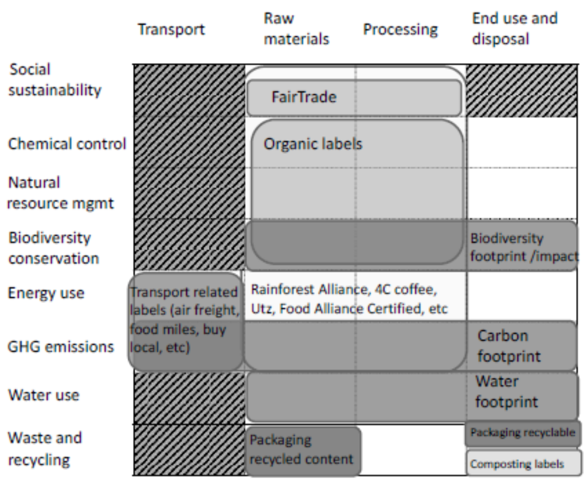
There are two main consolidated and internationally recognised EpS, namely the "Forest Stewardship Council" (FSC) and the "Programme for the Endorsement of Forest Certification" (PEFC)[6]. Both were created in the early 1990s. They primarily focus on environmental performance, but they also address other social issues like workers' safety or community relationships. Nevertheless, one of the main criticisms of workers' safety or community relationships. Nevertheless, one of the main criticisms of these labels is that while they are present in 80 countries, they heavily focus on OECD countries. Together they achieve a coverage in Europe and North America of 88% of the forested area, globally, however, this percentage shrinks to a 9.1% (Prag et al., 2016).

Figure 2. Types of EpS by Sector

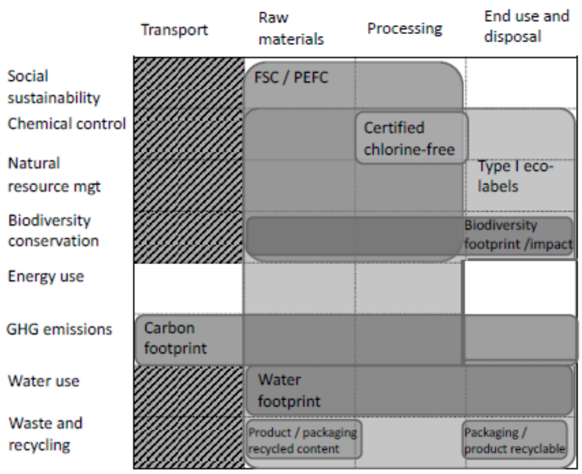
Mapping EpS for seafood



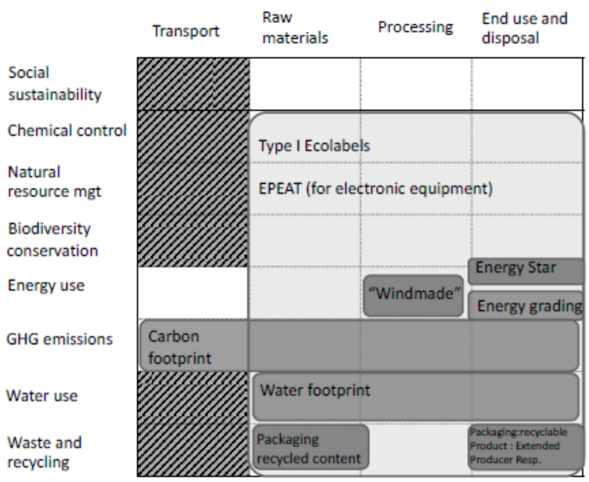
Mapping EpS for coffee, fruits and vegetables



Mapping EpS for forest products



Mapping EpS for appliances



Source: Prag et al. 2016

Appliances

In this sector, two well-known labels related to products' energy consumption are competing with other EpS. These two labels use different incentive mechanisms. The "Energy Star", a US government-backed label, is a seal-type certification attributed to the top performers within a product category. The European Union "Energy Label", in contrast, is a type of mandatory grading scheme that covers large household appliances (the so-called white goods e.g.: washing machines, refrigerators,…). Going from A (most efficient) to G (least efficient), it assigns every device a corresponding energy efficiency level (see Box 1 for more details).

Grading schemes have become mandatory in OECD countries and often include minimum performance standards. The main asymmetry between the US and EU for mandatory energy efficiency grading schemes lies in their coverage. Whilst both are mandatory for white appliances, it is only the US scheme that is mandatory for office equipment. These two labels coexist with other EpS like the multi-attribute label on electronics (EPEAT), the "Windmade" label (certifies manufacturers purchasing renewable energy) or "Extended Producer Responsibility" (EPR) (a waste-related label) (Prag et al., 2016).

Although the revision of the Energy Labelling regulation to replace Directive 2010/30/EU has taken into account the critique concerning the existence of the A+,++,+++ classes, it still lacks information on absolute energy use. Furthermore, label enforcement (market surveillance) is still weak under the new revision (ECOS 2017).

Box 1 – Energy Labels in the Appliances' Sector: The Case of the European Energy Efficiency Label and the "Energy Star"

The EU "Energy Label" has received much criticism since its modification in 2010 (Arditi et al., 2013). Most of it was related to the introduction of the additional A+, ++ and +++ categories, claiming that providing the A class too easily would undermine consumers' incentives to purchase high-efficient devices. Nevertheless, a recent study has added new critique to the list. The report, signed by four NGOs, intended to scrutinize the testing procedures for the EU "Energy Label" categories.

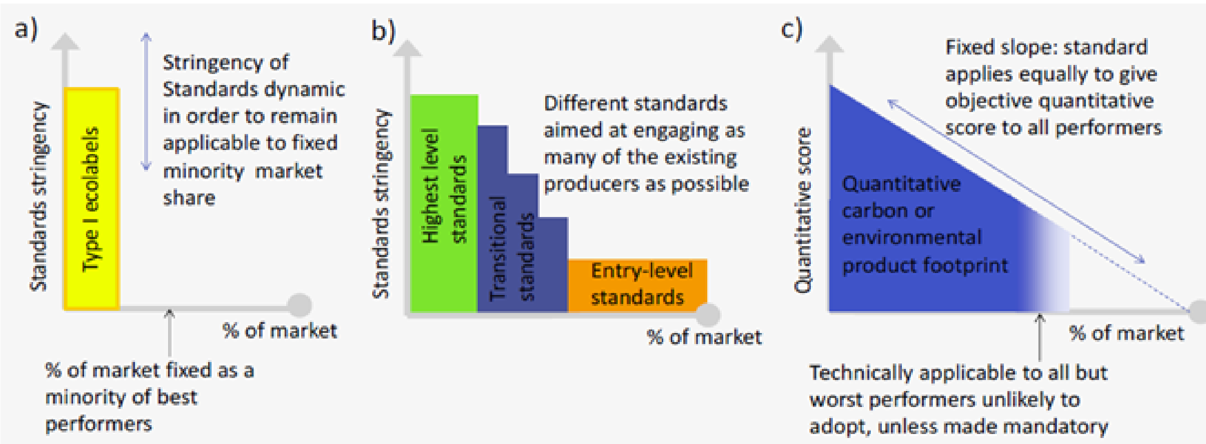
One of the main findings of the study is that there are discrepancies between the class declared by the appliances' producers and the class measured in a test. In the case of the fridges, 50% of the appliances were found to be one class less efficient than the class reported. Furthermore, they criticize the way the Energy Efficiency Index (EEI) is computed. The aim of this index is to compare the measured energy consumption of the model (kWh/year) to the standard energy consumption depending on the volume. The main drawback of this formula is that it relies heavily on the reference volume, which itself depends, among others, on the type of fridge (e.g. with or without freezer) or the climate. Since the absolute energy use is not clearly communicated to the consumer through the label, he might purchase a new appliance rated A+++, which might consume more energy than his former A+ device (CLASP et al., 2017).

3.3. Classification by Impact on the Market

EpS can be also classified depending on the market impact they want to generate. Often Type I labels (e.g.: "Energy Star") target only the products with the most environmental-friendly performance (i.e. representing 15 to 30 percent of the market), see Figure 3a. NGO-backed voluntary EpS tend to differ more in quality; thereby some of them focus on the best performers and others aim at increasing average energy performance (e.g.: food labels), see Figure 3b.

Finally, the third type of EpS rates the actual environmental performance of the product, this is the case for footprint labels (e.g.: water footprint or carbon footprint) or grading schemes (e.g.: EU "Energy Label"). The drawback of this label type is that if certification is voluntary, only good performers are willing to be certified, see Figure 3c (Prag et al., 2016).

Figure 3.Comparing Market Objectives of Different Types of EpS



Source: Prag et al. 2016

4 ECO-INNOVATION IN PRACTICE: ENVIRONMENTAL PRODUCT STANDARDS, ECO-INNOVATION AND BEHAVIOURAL ECONOMICS – EVIDENCE OF IMPACTS

4.1. Eco-innovation Impact

The effectiveness of EpS heavily relies on consumers' trust in the environmental impact of the given labels. Nevertheless, as claimed by Cohen and Vandenbergh (2012), only few studies on the effectiveness of EpS generally satisfy the standards of rigorous empirical research since they lack random assignment or quasi-experimental design. Cohen and Vandenbergh (2012) review evidence on the role of product labelling and its influence on consumer and firm behaviour. They classify the provided types of evidence (non-quasi-experimental) into two types: industry and market studies of product sales, and consumer surveys of label awareness, use and stated preferences.

Industry and Market Studies

Cohen and Vandenbergh (2012) use the environmental impact evaluation of the US Energy Star programme as an example. The estimated emission reduction benefits from the programme (U.S. EPA, 2008; Brown et al., 2002) cannot be solely attributed to the EpS' implementation. They claim that the estimation of the emission reduction is based on the market penetration of the "Energy Star" and engineering estimates. Nevertheless they claim that, as it is not possible to know whether these products would have been manufactured and purchased in absence of the label, it is hard to attribute all the estimated energy-efficiency benefits to the program itself.

Cohen and Vandenbergh (2012) analyse the market impact of the introduction of an EpS, by considering different possible impacts such as: demand rebound[7], substitution effects[8] or price-band specific impact[9]. In their paper, they discuss first an example of demand rebound, namely a case study analysing the impact of EpS, and more specifically of the "dolphin-safe tuna" label on the market. In the case of this label, public environmental concerns about dolphin killings spurred a drop in tuna demand. The introduction of the dolphin-safe label increased tuna demand (Teisl et al., 2002).

Box 2 Compiling Evidence on the Impacts of EpS is Challenging

As already mentioned, one of the cornerstones for the success of environmental labels is consumers' trust, which depends on the evaluation of a label's effectiveness. Thus providing solid evidence of the economic and environmental impact of labels should be a priority.In the RESOLVE (2012) study, a Steering Committee assessed the impacts of environmental labels in four sectors: agriculture, forestry, fisheries and aquaculture. The "impacts" they defined were the changes in the quality and resilience of ecosystems, changes in resource efficiencyand livelihoods, and changes in social welfare within the workplace and wider community.In their study, they acknowledge that the main problem in the evaluation of EpS is the identification of an appropriate counterfactual, i.e. finding an answer to the question of what would have happened in absence of the certification scheme. Nevertheless, the main barrier to providing evidence based on counterfactual settings consists in the costs and logistical challenges of experimental and quasi-experimental designs.

Environmental and Economic Impacts

One recent piece of evidence has been provided by Asensio and Delmas (2017). They scrutinize the effectiveness of U.S. energy efficiency building labels induced by three main labels, namely: the U.S. Department of Energy's Better Building Challenger, the U.S. EPA "Energy Star" program and the U.S. Green Building Council's "Leadership in Energy and Environmental Design" (LEED) program. In this case, in order to cope with the mentioned non-randomness problem, they use matching techniques to compare the performance of participating buildings with the one of similar buildings that are not part of these programs. They find energy savings of about 18% to 30%, depending on the program. Nevertheless, these programs do not substantially reduce emissions in small and medium sized buildings, which represent about two-thirds of commercial sector building emissions.

Also, using propensity score matching to control for self-selection bias, Blackman and Naranjo (2012) find that eco-certification of coffee improves growers' environmental performance. Furthermore, they find that it significantly reduces chemical input use and increases the adoption of some environmentally friendly practices.
In the RESOLVE (2012) study as well as in the Kjeldsen et al. (2014) study, further evidence, very often survey- or case-study-based, can be found on the environmental and economic impacts of environmental labels. Additionally, the meta-study of Carlson and Palmer (2016) compiles the main case studies on the impact of two eco-labelling schemes in developing countries, namely the "Forest Stewardship Council" (FSC) and "Marine Stewardship Council" (MSC). From the case studies, they conclude that producers benefit in varied ways from certification. They do not seem to receive benefits in the form of price premiums or market access, but mainly intangible benefits, i.e. learning, governance, community empowerment, and reputational benefits.

Cohen and Vandenbergh (2012) analyse further market impacts of EpS such as the substitution effects. They discuss a study of Bjørner et al. (2004) on the "Nordic Swan". The study sheds light on the consequences of the introduction of thisEpS on the willingness to pay for certified toilet paper, which they find it increased from 13% to 18%.In the case of paper towels, however, they found few evidence. In order to explain the results, they argue that most environmentally friendly consumers are more likely to avoid buying any paper towels and would rather substitute them by cloth.

The impact of EpS can also depend on the price of the good.Authors discuss an experiment in an Australian grocery shop (Vanclay et al., 2011), where the introduction of an EpS increased the demand for the most environment-friendly products on average by 4%. Furthermore if those products had also been the cheapest, the demand would have increased by 20%. Part of the evidence on the higher willingness to pay for environmentally-certified goods comes from participation in green electricity programs in the US (Bird and Sumner, 2010; Kotchen and Moore, 2007).

Consumer Surveys

Cohen and Vandenbergh (2012) review evidence on surveys used to uncover consumers' preferences. They discuss several papers starting with a paper by Borchers et al. (2007) where they found a positive willingness to pay for green electricity among consumers, especially for solar energy, using hypothetical purchases. Then they review a work by Clark et al. (2003), which is in the same line but surveying real purchases. There they found that altruism towards the environment followed by altruism towards regional residents to be the most important factors for purchasing green electricity. They argue that there is, however, few evidence on higher willingness to pay for carbon emission reductions besides energy saving motivations or other personal benefits. They suggest that willingness to pay for green goods might depend on consumer preferences, income, taste and product category (Jacobsen et al., 2012; Wiser et al., 2000; Michaud et al., 2013)[10]. For further information on studies related to the willingness to pay see Box 3.

Finally they discuss evidence on consumers' awareness of environmental labels. They argue that while purchasers seem to know about the existence of green labels in some sectors, like energy-efficient labels in the appliances sector (Ottman, 2011), other sectoral labels attract little attention (e.g.: seafood). According to a U.S. survey, only 18% of the respondents were aware of the "Marine Stewardship Council" label on sustainable fish (Ottman, 2011). Furthermore, as shown in Murray and Mills (2011), awareness might be different across household income levels.

5 ECO-INNOVATION CHALLENGE

5.1. Drivers, Benefits and Barriers to Eco-innovation

In our review of the drivers, benefits and barriers of adoption of EpS by firms, we will build upon two main pieces of evidence namely the EVER study (2005), which evaluated the "EU Ecolabel" and a study evaluating the "Nordic Swan" (Kjeldsen et al. 2014).

Drivers of Adopting EpS

Survey results from the EVER study (2005) suggest that one of the main motivations for companies to apply for the "EU Ecolabel" scheme is to exploit business opportunities offered by higher consumer awareness of environmental issues. Different studies (Horbach et al., 2012; Wagner M., 2008; Demirel and Kesidou, 2012) suggest that firms' decision to certify their products might be due to societal pressures and market requirements, e.g.: gain access to certain markets, green procurement, green demand (Iraldo and Barberio, 2017).

A study evaluating the "Nordic Swan" (Kjeldsen et al. 2014) uses a survey to analyse the motivations behind firms' decision to obtain certification. The main reasons found were to obtain or to sustain a green profile and to increase sales. Interestingly, the source of motivation was top-managements' idea of using the "Nordic Swan"label as part of a strategical environmental focus. Besides this, other companies claim that their decision to obtain the certification was driven by the will to be at the forefront of upcoming changes in environmental regulation.

From these two studies we can conclude that motivations behind the decision to adopt an EpS are diverse and might depend on the context of the firm. Nevertheless market-related issues, e.g.: competitive pressure and demand pull, seem to have been two major drivers of this decision.

Benefits of EpS

There is few evidence from quantitative or qualitative studies on economic or environmental benefits obtained by firms due to the implementation of the "EU Ecolabel". In the case of the "EU Ecolabel", most of the evidence comes from the EVER study (2005), in which some surveyed firms state having received economic and environmental benefits. Other companies, for instance, state having experienced a modest increase in market share and sales. Besides the economic benefits, the surveyed firms also state an improvement in their environmental performance. One of the reasons mentioned for this improvement was environmental knowledge acquisition during the Ecolabel implementation process, which for some firms induced them to set environmental targets (Iraldo and Barberio, 2017).

Evidence from the "Nordic Swan" by Kjeldsen et al. (2014) suggests that some companies have gained a competitive advantage by being recognized as market leaders. Furthermore, even companies that did notice an increase in sales recognize that they would have lost their market share if they had not had adopted the "Nordic Swan" label. Firms participating in the "Nordic Swan" labelling scheme declared significant gains in resource efficiency (Iraldo and Barberio, 2017).

Barriers to EpS

The EVER study (2005) on the "EU Ecolabel"found that label holders considered the so-called "red tape /documentation"[11] and the costs of compliance with label's criteria to be the main barriers. In the same study, the non-label holders explain the main reasons why they abandoned the certification scheme or decided not to enter it.
Those can be summed up in four main types: lack of recognition by future demand, high costs of implementation, high costs of license, and lack of economic incentives.

Similarly, a study evaluating the "Nordic Swan" found that the main barriers were the overall cost of implementation and the application procedure (Kjeldsen et al., 2014). With regard to the implementation costs, the indirect costs appeared to be even higher than the direct ones (e.g.: cost of application procedure, changes in the production process, consulting costs or human capital training costs). Besides the costs, time spent in the overall application process appeared to be another barrier, namely time used to understand environmental criteria and time spent collecting documentation.

Box 3 Impact of EpS: Consumers' Willingness to Pay and Bunching Effects

Beyond the before mentioned market effects, environmental labels might not only impact consumers' willingness to pay, and thus have an effect on price premiums, but also influence firms' strategy to develop "green" product characteristics, by steering them towards a label's rating scheme.

Willingness to Pay

Evidence on price premiums and EpS is not clear. There are some studies that find higher prices for labelled products but other studies discuss whether the price premium can really be only attributed to the label.

Examples of studies finding a positive impact on price premiums are Ward et al. (2011) and Fuerst et al. (2011). Using survey results,Ward et al. (2011) find that consumers are on average willing to pay an extra $249.82-$349.30 for a fridge with the "Energy Star" label. Fuerst et al. (2011) find that eco-labels in commercial offices (LEED and "Energy Star" labels) obtain higher rental rates and an average sales premium of 18% for "Energy Star" and 25% for LEED labelled office buildings. More recent studies come to different results for other EpS. Namely,Kortelainen et al. (2016) find no evidence that carbon reduction labels have an impact on detergent prices or demand. Furthermore, scrutinizing the reasons for such results, they find the specific design of the label to be responsible for the lack of success. Park (2017) suggests in his findings that the price premium in the Korean television market does not result from the energy efficiency label itself. Energy-efficient products already had a higher price before the introduction of the label.

Bunching Effects

As previously mentioned, EpS might not only affect firms in their pricing strategy, they can also have an influence on the "environmental" quality of the goods they provide. Shewmake and Viscusi (2015) find that firms respond to environmental label stringency by strategically incorporating green features to achieve higher ratings. Firms incorporate green attributes to the offered goods such that product bunch around notches. This appears to be a consequence of producers strategically building homes to achieve ratings, which is consistent with the absence of a price premium for points beyond rating cut-offs. Recent results by Houde (2017a) for the refrigerator market are in line with those of Shewmakeand Viscusi(2015).

5.2. Trade and EpS

A UNEP report (UNEP 2005) analyses the possible Technical Barriers to Trade (TBT) of five eco-labelling programmes ("Blue Angel" label, IFOAM accreditation, FSC and MSC, and "Fairtrade" label). Analysing the possible impact of eco-labelling on trade, it outlines some of the requirements in the TBT Agreement (particularly the Annex 3 of the TBT Agreement: Code of Good Practice "Standards Code") and the challenges associated with their application in the case of EpS.

The following list subsumes the main trade-related challenges:

▪ Article F of the Standards Code calls on standard bodies to base their work on relevant existing international standards. This presents problems in the case of ecolabels. Besides the generic ISO 14020 series of eco-labelling template standards and the generic ISO 14040 life-cycle assessment standards, there are very few international labels. Ecolabels are generally developed based on national environmental priorities and preferences.

- Since developing countries are standard takers, some in the trading community (e.g.: developing country exporters) argue that a proliferation of ecolabels can greatly increase the cost to these countries of accessing different markets.

They argue that since most ecolabels are developed by non-governmental bodies outside the traditional standards networks, it is likely that practitioners are unaware of the procedurals provisions. Thus, it is often difficult for producers in one country to obtain information on the existence or specific requirements of an ecolabel in another country.

Besides these points, they mention that it is generally accepted that conditions in developing countries are such that the certification costs are higher than in developed countries. This is mainly due to the lack of availability of domestic certification services, the size of the facilities and the gap between existing practices and the requirements of the ecolabel.

- Many ecolabels maintain a monopoly over the accreditation of conformity assessment service providers and therefore do not enter into mutual recognition agreements with other competent bodies, e.g.: FSC auditors are also forbidden from certifying to any other sustainable forest management standards.

Finally, the lack of data makes it impossible to quantify barriers to market access arising from environmental requirements. Ecolabels may impose additional burdens on companies from developing countries, but they do not necessarily impose a greater burden than any other kind of standard. Nevertheless, if ecolabel's requirements are not designed with a clear understanding of the domestic environmental, social and economic context of the developing country, adoption of the ecolabel could impose inappropriate requirements.

5.3. Eco-innovation and EpS: New Insights from Behavioural Economics

The emergence of a new field studying reaction of human behaviour to different incentives is helping to shed some light on key issues related with EpS. Behavioural economics can provide a new glance to understand the gap between provided information and the way consumers might react to it. This is key for EpS since the information on the environmental attributes is mainly proportioned through a label. Thereby the way consumers will react to a certain label will depend mainly on what kind of information is provided (i.e.: sustainability information) and how the information is provided. Behavioural economics can help enhancing the design of labels such that consumers react purchasing the most sustainable good. Hereby we summarize key insights from a literature review by Gerarden et al. (2017) as well as some main experimental results from an OECD report (OECD 2017).

Impact of Cognitive Biases on Information Perception

A major problem in the design of labels is to take into account how the consumer might react to the different types of information provided. Namely, if he will finally purchase the most sustainable product he is willing to pay for. At this stage different perception biases might prevent him from doing the right purchase. Indeed there might be some imperfect information problems happening, i.e. consumers might not be provided the right information on the potential economic savings of their energy-efficient purchase.

Box 4 Impact of EU Ecodesign and Energy Labelling on R&D and Technological Innovation

A study ordered by the European Commission in 2014 (Braungardt et al., 2014), evaluating the impact of the EU Ecodesign and the EU "Energy Label" on R&D and technological Innovation, found that the directives seemed to have stimulated innovation in some of the studied sectors. They identify a list of factors contributing to the "innovation friendliness" of policy instruments, they find that the Ecodesign and Labelling directives fulfil a number of these criteria.

Using patent data, they show that the Ecodesign directive did typically not have a significant effect on the patenting activities of the affected companies. They argue that the firms already had the necessary technologies to meet the directive's requirements but they lacked the incentives to bring them to the market. Thus, they recognize the role of the directives in the promotion of the diffusion of high-efficiency technologies.
In their case-study analysis, they observe that for the consumer market, information-related barriers to the adoption of energy efficiency innovation are predominant and are adequately addressed by the Labelling legislation for the high-efficiency segment and by the Ecodesign directive for the low-cost segment.

Policy Recommendations

As a result of their analysis, they developed a list of policy recommendations for policymakers in order to enhance the positive impact of regulations on R&D and innovation. These could be divided into six categories:

<u>Increasing stringency of regulatory requirements</u>:focus on engaging innovative manufacturers, including a stage in the "Methodology for the Ecodesign of Energy-related Products" (MEERP) to investigate innovation (best not available technology).

<u>Market surveillance and control:</u> long-term impact of the regulation can only be assured if the legislation is enforced.

<u>Recasting of the Labelling classes:</u> stakeholders highlighted that incentives to innovate are limited when the top of the classes are reached too early.

<u>Sector specific innovation dynamics:</u> the innovation dynamics might vary from sector to sector. Therefore, in order to enhance the impact of regulation on innovation, this effect should be taken into account.

<u>Consumer response to Labelling:</u> the impact of labelling on consumers' decision varies between different products, sales structure and member states. In order to enhance the impact of labelling, these kind of effects need to be taken into account.

<u>Complementary measures:</u> they recommended to use green public procurement to identify the best performing class of products and thereby incentivise energy efficient innovations.

Consumers might also be myopic, i.e. they might undervalue discount rates on their energy-efficient investments thus revealing them their discount rates might help them do more sustainable purchases. Furthermore consumers might have cognitive limitations, that is, if they are exposed to a variety of complex information they might struggle to disentangle the right one for doing the most sustainable purchase (e.g.: energy metrics are often hard to interpret in terms of economic savings). Finally consumers might have loss aversion, i.e. they might react differently depending on how the message is formulated (e.g.: people strongly prefer avoiding losses rather than acquiring gains). Further references can be found in Table 1. From these different examples we can see that the design of the label can be a key factor in the orientation of the consumer towards the most sustainable choice.

Insights from Experimental Evidence

A recent study from the OECD (2017) gathered the results of some behavioural experiments on EpS (an extended summary can be found in Tables 2a and 2b). Some of the main findings of these studies are that consumers don't give attention to the actual sustainability quantifier (e.g.: energy consumption) but rather to a provided label (e.g.: energy efficiency letter A, B…). Furthermore different energy label designs were compared to the actual design of the EU "Energy Label", they find that all alternative designs actually outperformed the current label in physical stores. Thus showing that there is still room for improvement of it. Finally information of product sustainability was compared among different food products. The results showed that in foods products more attention was given to price and nutritional information rather than to sustainability information.

6 WHAT CAN POLICY MAKERS DO?

In this policy outlook I have tried to provide a broad and depth picture of the landscape in which EpS and eco-innovation interact. Even if there are some clear messages that can be taken from this outlook, I would like to emphasize that often lessons can only be drawn on a case-by-case basis. Thus the main lesson to be taken is the need for quasi-experimental policy evaluation.

Besides this main point I would like to list some additional messages:

- Consumers need to be better informed to be able to disentangle between Type I and Type II labels. Furthermore information about "Self-declared environmental claims" (Type II labels) having legal implications needs to be clearly communicated to consumers.

- Policymakers should analyse the consequences of the multiplication of EpS and the possible loss in trustfulness that this might induce in already existing labels. Policymakers can play a key role for building consumer's trust on EpS.

- Providing consumers with sectoral information on the different types of labels available, the type of environmental quality that they award and their scope would help consumers to do a more rational choice according to their preferences.

- In the design or modification of future EpS, it is important to account for firms' strategic behaviour (e.g.: bunching effects, price premiums…). Furthermore it is important to make sure that the sustainability index allowing to differentiate between goods is really aligned with environmental goals (e.g.: avoid that consumers might purchase a new fridge attributed a higher energy efficiency rate than their previous one but actually consuming more energy).

- Since there are some case studies indicating that some EpS have rather enhanced the diffusion of already existing innovations rather than incentivized the creation of new innovations, this should be taken into account for the design of future EpS.

- In this outlook I have made the difference between so-called voluntary and mandatory labels. Nevertheless the mandatory character of EpS might be misleading since without proper market surveillance mechanisms it is impossible to enforce mandatory labels.

- From a more global perspective there is still a need to understand the different implications of EpS in developing and developed countries. Thereby it is important to understand to which extent these do not represent a barrier to access markets for certain countries.

- From the evaluation of two voluntary EpS we have learnt that implementation costs together with indirect adoption costs (i.e.: human capital training) are the main barriers for the EpS's adoption. Therefore providing support for the implementation might be a good policy to foster adoption of environmental labels.

- New insights from behavioural economics have taught us highly valuable lessons on not only how to design new labels but also on what kind of information we should provide through them. Future policymakers should take into account cognitive biases and consumer myopia in their design of new labels.

What can policy makers do?

Problem	Effect	Solution	Reference
Imperfect information: Consumers might not be provided with enough information on a product, or they may not pay attention to the available information or have difficulties using it.	E1.Leads to significant undervaluation of energy efficiency by the consumers E2.Firms as consumers of energy-efficiency technologies may underinvest in profitable energy-efficiency technologies E3.Providing information to consumers may lead some consumers to consume more energy. If they are informed about their own and their neighbors' energy consumption, those who are consuming below the average tend to consume more energy (Schultz et al. 2007).	S1.Providing simple information on the economic value of saving energy leads to an increase in cost-effective energy-efficiency decisions. S2.Presenting a cost and benefits analysis and additional information on projects. S3.Designing the information provision carefully, providing peer comparisons, and changing reference points. S4.Informed third parties (governments and private labelling programs) can fill the information gap.	E1-S1.Allcott&Taubinsky, 2015 E1-S1.Newell&Siikamäki, 2014 E2-S2.Anderson&Newell, 2004 2.Bloom et al., 2013 E3-S3.Schultz et al., 2007 E3-S3.Allcott&Sweeney, 2014 E3-S3.Allcott, 2011b E3-S3.Ayres, Raseman&Shih, 2013 E3-S3.Allcott&Rogers, 2014 S4.Davis&Metcalf, 2014(effects of state-specific EnergyGuide labels) S4.Sallee, 2014(effects of coarse energy-efficiency certifications) S4.Houde, 2017b(positive effects of certification program) S4.Houde, 2017a(crowding out effect of certification) S4.Eichholtz, Kok&Quigley, 2010, 2013; Brounen&Kok, 2011; Kahn&Kok, 2014; Wallls et al., 2013
Myopia: Consumers tend to minimize their costs but there might be inconsistency between cost-minimizing behaviour and the discount rates that consumers use. They may consider the upfront investment costs, and not be aware of or not pay attention to operating costs.	E4.Consumers may undervalue discount rates and energy efficiency. E5.Consumers have different individual discount rates and individual time preferences.	S5.Revealing the discount rates helps consumers with making their decisions rationally on average.	E4.Allcott&Wozny, 2014 (fuel economy) E5.Newell&Siikamäki, 2015 E5.Bradford et al., 2014 S5.Newell&Siikamäki, 2014
Cognitive Limitations: Heuristics and bounded rationality.	E6.Heuristics and bounded rationality prevents consumers from analyzing benefits and costs of investing in energy-consuming goods. E7.Consumers misperceive the information provided by fuel economy ratings (the MPG illusion). E8.Consumers preferences for cars depend on the metric and scale of information on energy labels.	S6.Consumers preferences are improved by redesigning the energy labels by adjusting the scale of energy labels based on expected lifetime, providing multiple translations of energy-efficiency metrics, comparing products, or providing environmental ratings.	E6.Gillingham,Newell&Palmer, 2009 E6.Sanstad&Howarth, 1994 E7.Larrick&Soll,2008 E7.Allcott, 2013 E8-S6.Camilleri&Larrick, 2014 E8-S6.Ungemach et al., 2017 E8-S6.US Environmental Protection Agency, 2015
Loss Aversion and Reference Points: People strongly prefer avoiding losses to acquiring gains.	E9.Consumers and firms investing in energy-efficiency are sensitive to reference points and loss aversion. E10.Every consumer has different opinions on the right level of energy efficiency (heterogeneity problem).	S7.Encouraging goal-setting programs makes consumers reduce their energy consumption to meet their own goal. S8.Different types of information on energy labels may affect individuals` reference points.	E9-S7.Harding&Hsiaw, 2014 E9-S7.Abrahamse et al., 2007 E9-S7.Carrico&Riemer, 2011 E10-S8.No reference on this point. It is stated that existing research does not provide enough evidence on it

TABLE 2a*

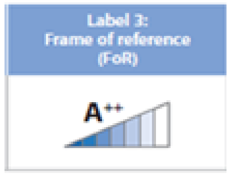
	Detection of an Energy Efficiency Fallacy	Energy Efficiency Labelling for Online Retail	Drivers of the purchase of energy efficient durables	Energy Efficiency Labelling and Consumer Behaviour
	In this experiment they aimatanalysing how consumers interpret information provided on energy labels. They observed that consumers tend to estimate rather lower energy consumption for high energy efficiency labels (A-label) than for low energy efficiency labels (B-label) although both labels state the same level of energy consumption. In other words, consumers make their decision based on energy efficiency information rather than on annual electricity consumption information.	The aim of this study is to measure what is the most effective way to provide information on energy efficiency labels to increase sales of energy efficient products on online retail platforms. They use four labels with different designs in different appliances: refrigerators, televisions, washing machines and light bulbs. They found out that Label 3 is the most effective one and that even the least effective label is better than the no information scenario to increase online sales. In physical stores, all four labels outperformed the standard EU energy label. 	Consumers make their purchasing decisions considering upfront capital costs and operating costs. However, it is not easy to calculate the accurate discount rate and this creates an energy efficiency gap. The study conducted in Switzerland aimed to observe whether and to what extend there is an energy efficiency gap using two different labels: the EU energy label and a new monetary costs and lifetime-oriented label displaying the information on annual electricity costs and lifetime energy costs of a product. Their sample includes freezers, vacuum cleaners, tumble dryers and televisions. Both labels increase the share of energy efficient products sold. In terms of reduction in average annual energy consumption, the new label leads to a higher decrease (9.6%) in tumble dryers' energy consumption compared to the EU energy label (8%). Both labels are inefficient in increasing the sales of energy efficient freezers. Besides this, the new label is less effective for products with low annual energy costs (vacuum cleaners). Since those products already consume low level of energy, the improvement in their energy efficiency displayed by the new label can be neglected by the consumers.	One of the main factors that affects the impact of energy labels is their design and consumers` comprehension of the information provided. The experiment supported by the European Commission on televisions, washing machines and light bulbs with different energy efficiency labels reveals that letter-based scales are better understood by consumers than numerical scales. They also find that, among letter-base labels, consumers tend to choose products with labels scaled from A to D, rather than those ranged from A+++ to D.
Env. Obj.	A	A	A	A
Beh. Iss.	C	C	C	C
Ref.	Wächter et al., 2016; Wächter et al., 2015a.	ECORYS et al., 2014.	Schubert and Stadelmann, 2016.	London Economics and IPSOS, 2014.

TABLE 2b**

Study	Description	Env. Obj.	Beh. Iss.	Ref.
Consumer Use of Sustainability Information	In this study it is aimed to observe consumers` reactions to sustainability-related information on the food they purchase. According to the results, consumers pay more attention on information about price, nutritional value and origin of raw materials than sustainability information and they think that sustainability is less important than the other attributes. However, they also found out that consumers pay more attention to sustainability information than information on the other components in the future.	B	F	ECORYS et al., 2015.
Testing CO2 / Car Labelling Options and Consumer Information	The objective of this study is to observe the effectiveness of different car eco-labels and that of mandatory information on fuel efficiency and CO2 emissions. They found out that it is more easily processed if a car is rated compared with cars from all classes (absolute format) rather than if it is rated compared with cars in the same class (relative format) or than the combination of both formats. Besides, it is revealed that providing information on fuel economy is more effective than providing information on CO2 emissions.	A	E	Codagnone et al., 2013.
Environmental Footprint Labelling and Consumer Behaviour	While designing a label it is important to provide informative and simple information. In this study, consumers are exposed to two different designs of labels, environmental footprint label and carbon footprint label, and their willingness to pay for environmentally friendly products is measured. According to the results, consumers are willing to pay more for environmentally friendly products (washing machines and televisions; not light bulbs) if these are provided with labels regardless of the design. Besides this, they also found out that if consumers are exposed to explanatory information on the label, their understanding of the label is higher and they tend to purchase the better performing product. In addition, consumers focus more on standard indicators than environmental or carbon footprint indicators. In other words, they pay more attention on the simple information.	A + B	C	Ipsos MORI et al., 2012.
Understanding Consumer Perception of Energy Labels	While designing a label it is important to measure how consumers react to the information provided on it. This experiment emphasizes the importance of the effect of the EU Energy Label on consumers` purchasing decision. According to the result, consumers pay more attention on energy-related information if they are provided with energy labels. Energy efficiency ratings are processed faster via labels. However, the current format of the label makes consumers pay more attention on energy-efficiency information rather than the actual energy consumption. Therefore, it might increase the energy consumption as high energy efficiency does not directly imply low energy consumption.	A	D	Wächter et al. 2016. Wächter et al., 2015b.

*Legend of Tables 2a and 2b: Behavioural Lever: Simplification and framing. Environmental Objective (A & B):A: Promote private investment in more efficient technologies; B: Incentivise environmentally sustainable consumption patterns. Behavioural Issues (C, D, E & F):C: Attitude-behaviour gap; status-quo bias; myopic preferences. A relatively small number of purchases of energy efficient appliances underline a discrepancy between consumers` stated intentions to reduce expenditures on energy and their behaviour at the moment of the purchase, where energy efficiency is only one among various product attributes under scrutiny.

**Legend of Tables 2a and 2b (continue):D: Attitude-behaviour gap; myopic preferences. A relatively small number of purchases of energy efficient appliances underline a discrepancy between consumers' stated intentions to reduce expenditures on energy and their behaviour at the moment of the purchase, where energy efficiency is only one among various product attributes under scrutiny; E: Lack of understanding of indicators of environmental impact and fuel efficiency of cars. Attitude-behaviour gaps: consumers may be aware of the environmental impact of cars – e.g. air pollution, greenhouse gas emissions – but this may not necessarily translate into the purchase of more fuel efficient and environmentally friendly cars. This is also due to myopia in intertemporal choices; F: Consumer use of sustainability information in the context of food choice.

[1] Sustainable consumption here understood as a consumption that is less harmful for the environment.

[2] Environmental product standards can be also referred to as Environmental Labelling and Information Schemes (ELIS) (Gruère, 2013;Klintman, 2016; Prag et al., 2016).

[3] The effects of a goods consumption imply not only the environmental effects of the consumption of the good itself also of its production.

[4] Further information about the PEF, the pilot studies and the different types of products involved in them can be found under: http://ec.europa.eu/environment/eussd/smgp/ef_pilots.htm#pef

[5] Mexico, Guatemala, Nicaragua, Costa Rica, Colombia, Peru, Côted´Ivoire, Ghana, Tanzania, Vietnam, Indonesia, Papua New Guinea

[6] The difference between the two schemes is that one is a chain-of-custody certification (therefore strictly related to products) and the other is related to a forest certification system.

[7] Demand rebound, i.e. by introducing a policy with the aim of reducing the demand of some good finally the opposite effect is achieved (e.g.: people consume more tuna).

[8] Substitution effects, i.e. consumers substitute the consumption of one good by another which might also have harmful consequences for the environment.

[9] Price-band specific impacts, i.e. label is only effective in directing consumers towards more environmentally friendly products for low price goods (e.g.: toilet paper).

[10] Another interesting survey on the topic is the EU Flash Eurobarometer survey: "Attitudes of Europeans towards building the single market for green products", available at: http://ec.europa.eu/commfrontoffice/publicopinion/flash/fl_367_en.pdf

[11] Red tape is the term used to define the bureaucratic process that companies need to fulfil including documentation of the compliance with the criteria to adopt the label.

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The Inno4SD Policy Outlooks series focuses on the horizontal policy issues or transversal topics relevant for public policy supporting innovation for sustainable development. The selected topics are based on questions and issues raised by policy makers and stakeholders active in the Innovation for Sustainable Development (Inno4SD) network.

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The Innovation for Sustainable Development Network (inno4sd.net®) brings together networks dedicated to innovation for sustainable development with the aim of reducing fragmentation and supporting collaboration, whilst engaging policy-makers, research & development, and businesses to achieve the sustainable development goals.

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