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From ecodesign to responsible eco-innovation
A comprehensive investigation of responsible innovation in practice

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Abstract

Responsible innovation (RI) has been introduced as a normative concept that can be defined on the basis of three norms: avoiding harm, do good and coordinate for the sake of protecting the people and the planet (Voegtlin and Scherer, 2017). If the ostensive aspects of responsible innovation have been developed, their performative aspects remain understudied. In order to understand the challenges and issues of RI in practice, we propose to study the field and practices of ecodesign and eco-innovation. Often designated as a crucial lever to tackle environmental Grand Challenges, their diffusion is still limited. The aim is to understand how the initial techno-scientific framing of ecodesign helps to explain these mixed results, and under what conditions ecodesign could be integrated in a more pragmatic responsible eco-innovation strategies, oriented toward stakeholders aimed at producing positive legitimacy judgments. Through a comprehensive analysis of the literature and the conduct of 27 semi-directive interviews, we highlight the coexistence of two regimes - a techno-centric regime, and a still emerging responsible eco-innovation regime – of which we discuss the characteristics, promises and limits.

Keywords : Responsible innovation, ecodesign, eco-innovation, responsible ecodesign

THEORETICAL BACKGROUND AND RESEARCH QUESTIONS

Responsible innovation (RI) for corporations has been recently introduced in the literature as a normative concept that can be defined on the basis of three norms: avoiding harm, do good and coordinate with others for the sake of protecting the people and the planet (Voegtlin and Scherer, 2017). Tackling Grand Challenges, i.e. massive social and environmental challenges that have important negative effects on people and the planet (Ferraro et al., 2015), is often presented as being the purpose of RI. Thus, responsible innovation seeks to contribute to the achievement of the UN's sustainable development goals (SDGs). In that respect, RI differs from traditional Innovation (TI) which is generally focused on customer value, reduction of private production costs, and profit maximization (Berkhout, 2014).

But, the difference between RI and TI is not only about the intents and outcomes of innovation, it is first and foremost about processes, and especially about the governance of innovation. Definitions of RI emphasize the importance of governance structures and processes opened up to stakeholder involvement as in the seminal definition proposed by Von Schomberg (2012): RI is « a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products ». In line with this definition, Stilgoe et al. (2013) have proposed four dimensions of responsible innovation processes: anticipation, reflexivity, inclusion and responsiveness. They suggest that these four dimensions should be integrated and embedded in governance to enable the implementation of responsible innovation processes. Similarly, but at the corporate level, Scherer and Voegtlin (2018) argue that « corporate governance should influence the corporate innovation process so that the outcomes are socially acceptable (legitimacy), meet sustainable development goals (effectiveness) and use appropriate means (efficiency) so that the resulting innovations avoid harm and do good to society and the planet » (ibid p10). From their perspective, responsible innovation can be seen as a meta-framework whereas organizational innovations that avoid harm/do good are the outcomes of responsible governance.

However, if the ostensive aspects of responsible innovation have been developed – how RI should be conducted in principle -, their performative aspects - how RI are conducted in practice in companies - are still understudied (see Latour for the distinction between ostensive and performative, 1984). In other words, there is a need for empirical studies to better understand the challenges and obstacles of RI in corporations, large or small. In particular, we need to

understand in greater details how RI are organized, instrumented and governed in practice, and the difficulties that are encountered concretely to materialize the principles of RI.

In this communication, we propose to study the field and practices of ecodesign and eco-innovation, which can be considered as a relevant domain of investigation for the study of RI. Ecodesign consists in a purposeful strategy to integrate environmental criteria in the design of a product or service, taking into account all the stages of its life cycle: extraction of resources and materials, energy used during the manufacturing process, logistics, use phase, recycling or disposal. The aim of this proactive approach is to develop eco-innovations, i.e. products that not only have a reduced environmental impact compared to conventional products, but which are also commercially successful, thus contributing to an ecological transition (Pigosso et al., 2010). Ecodesign is often designated as a crucial lever to tackle environmental Grand Challenges such as global warming, resource depletion or waste accumulation. Ecodesign has emerged as a new corporate practice in the 90's, supported by the development of a new expert community around Life Cycle Assessment (LCA) and by public authorities by means of different incentives (ecolabelling schemes, public green procurement policies, subsidies, regulations including ecodesign requirements, etc.). However, more than twenty years later, the results are quite disappointing (Bey et al., 2013). The diffusion of these practices is still limited and its recognition by customers and the public is also modest. This apparent lack of effectiveness is quite paradoxical as ecodesign is a major lever of sustainability public policies and as many companies pretend to conduct such strategies. If the drivers and best practices for ecodesign implementation have been investigated, few analyses have tried to understand the obstacles encountered by companies having deployed ecodesign (Dekoninck et al., 2016 ; Johansson, 2002). However, several studies have highlighted the fact that, historically, emphasis was placed on the development of technical tools to the detriment of its integration into the organization and strategic decision-making process (Boks, 2006 ; Baumann et al., 2002). What is more, for a long time, ecodesign has been approached from the strict company scope, and not from a broader value chain or ecosystem perspective. These elements reflect the fact that ecodesign has long remained a technical subject, lacking openness to other parts of the organization and to stakeholders at large, suggesting legitimacy and efficiency issues.

Then, our research questions are the following: How to explain the lack of legitimacy, effectiveness and efficiency of ecodesign practices? How have these practices evolved over time and how could the problems encountered be related to the historical framing of the issue?

What are the conditions according to which ecodesign strategies could change into responsible innovations?

To answer these questions, we propose to analyze how companies and experts of the ecodesign field have framed this issue historically and why this dominant problematization could explain a lack of legitimacy, effectiveness and efficiency.

To analyze the forms of problematization that are dominant at a certain period of time, we drew upon the concept of regime, in the sense proposed by Foucault (1980; 1991). For Foucault, the ways new issues are made governable, and may thus become objects of government, are historical constructs which are based on power/knowledge relationships, on specific instruments and governmental doctrines. The notion of regime captures an historical dominant problematization of an issue at a certain period of time, how this issue is framed, through which techniques, instruments and programs the issue is made visible and governable (Foucault, 1991).

In that respect, we will show how ecodesign and eco-innovation have been framed initially as a techno-scientific issue built on mediating instruments (Miller and O'Leary, 2007; Chiapello and Gilbert, 2019; Labatut, Aggeri & Girard, 2012) and dedicated expertise (implementing LCA tools and using ecolabels) (Berkhout and Howes, 1997), with little considerations to stakeholders, governance and value for customers (Delmas and Colgan, 2018). We will call this regime a *« techno-centric ecodesign regime*. This regime refers to a form of rational-legal legitimacy (Weber, 1978), built on techno-scientific calculations (LCA) on the one hand (rational tools) and quasi-legal mechanisms (ecolabels) on the other hand. We will explain why such strategies failed to attract the attention of customers, of the public, and why it did not spread as expected within companies.

We will then analyze recent trends where ecodesign is integrated as part as a broader approach, that we will call *responsible eco-innovation*. Responsible eco-innovation is not only about designing new products and services based on environmental assessment tools, but also to develop sustainability business models, conduct a responsible governance of innovation with stakeholders, both external (customers, NGO's, suppliers, etc.), and internal (key departments and top management), connect product strategy with corporate sustainability and CSR commitments, build responsible global value chains and structure ecosystems consistent with this approach. Thus, as a process, eco-innovation is framed differently than ecodesign; more

attention is paid to governance issues, to open forms of innovation, with a broader concern about co-benefits beyond strict environmental performance, encompassing other Grand Challenges issues such as health, poverty or local production. According to a comprehensive approach, we will present the different methods, organization and governance mechanisms that are experimented at the moment within companies and discuss to what extent the principles of RI could resonate with these practices and may provide new directions for this emerging « *responsible eco-innovation regime* ». We will then discuss how this regime widely differs from the techno-centric ecodesign regime as legitimacy, effectiveness and efficiency of innovation are not so much based on rational techniques or legal mechanisms but merely on interactive and more transparent governance processes with a wide range of stakeholders. In the latter regime, legitimacy is inherently pragmatic and processual, based on judgments by stakeholders produced along the process of design and marketization of responsible products (Tost, 2011).

METHODOLOGY

To grasp how organizations have taken up and framed initially the issue of ecodesign, and to account for the evolution of organizations' ways of thinking and acting, we have mobilized a Foucaldian genealogical approach (Foucault, 1980 ; 1991). In order to understand the different problematizations of ecodesign that have successively emerged, their influence on organizations' practices and conversely, a systematic analysis of academic articles and grey literature on ecodesign was conducted.

To analyze the obstacles that organizations have had to overcome over time, and to analyze the past and current methods, organizations and governance mechanisms experimented by companies with regard to ecodesign, a series of 27 semi-structured interviews. Initially, these interviews were carried out with agencies specialized in environment -ADEME -French Environment and Energy Management Agency and eco-organizations. Then, pioneering companies from various business areas i.e. companies giving strategic priority to ecodesign and recognized for their actions in this area for several years by these agencies were surveyed, as well as organizations supporting the development of the approach such as private consulting firms.

By interviewing pioneering companies and experts of the field, and conducting a content analysis, we have seeked to identify changes in the way ecodesign was apprehended and implemented, and the future agenda to make these practices more legitimate, effective and efficient. To complete the interviews, secondary data such as environmental activity reports or ecodesign best practice guides drafted by these companies were also used.

Concerning the intents of ecodesign and eco-innovation, we have relied on Voegtlin and Scherer's (2017) responsible framework to identify how eco-innovations are intended to avoid harm or do good. Concerning the governance of innovation, we have seeked to identify how actors were supposed and did actually coordinate with each other responsibly (responsible governance). More specifically, as our aim was to observe if ecodesign practices were socially acceptable, could contribute to the achievement of several sustainable development goals through appropriate means and would be considered legitimate by different stakeholders, we drew upon the framework proposed by Scherer and Voegtlin (2018).

FINDINGS

Based on our genealogical analysis of ecodesign and empirical investigation, we distinguish between two historical regimes. The first, that we propose to call a *techno-centric ecodesign regime*, has been dominant in the last twenty years. While this regime is still of considerable importance, its inherent limitations have led to the development of a more responsible regime, seeking to meet legitimacy, effectiveness and efficiency that we propose to call a *responsible eco-innovation regime.*

The techno-centric ecodesign regime

The characteristics of a techno-centric regime

What are the premises of ecodesign practices and reasonings when the concept and practice emerged in the 90's? Who were its initial promoters and how did they frame the issue? Ecodesign was a term invented and promoted by environmental experts who wanted to enhance a prevention environmental strategy as a key lever to meet ambitious environmental political

targets. Its initial promoters were experts specialists of Life Cycle Assessment (LCA), a quantitative method of environmental impact assessment standardized in 1997 (ISO 14040 standard. In this initial framing, ecodesign was seen as prospective and rigorous approach aiming at assessing all the environmental impacts of a product during its life cycle so to make the adequate decisions at the design stage (selection of technologies, materials, energy, product architecture, etc.). The figure of the environmental expert, whose legitimacy was based on scientific, technical and regulatory knowledge became predominant (Korpalski, 1996), and the stakes of the approach rested on the adoption and the development of advanced environmental assessment tools such as LCA tools, and on the need to integrate them into traditional product development processes and Computer Aid Decisions (CAD) tools (Brezet and van Hemel, 1997; Baumann et al., 2002). In order to disseminate these ecodesign tools and methods, experts formed a kind of epistemic community (Amin and Cohendet, 2004), organized around networks, events, and scientific journals, like the international journal of LCA. They also diffused best practice guides intended for practitioners. More specifically, at that time, efforts were made in three directions:

- *towards regulators and policy makers* to make ecodesign a privileged method. In this perspective, ecodesign was promoted as an efficient prevention strategy aimed at reducing pollutions at the source. Legislative and regulatory initiatives were thus made at the European level in the late 1990s and early 2000s to introduce ecodesign as a condition to the marketization of new products like in the Waste Electric and Electronic Equipment (WEEE) Directive (2002) or in the End of Life vehicle (ELV) Directive (2001).

> "Among the main thrusts of our roadmap, there is work on design practices and the quantification of environmental impact, including at the end of equipment life. There is also offering reliable ecodesign tools and help companies access them, one of the biggest part being the LCA part, a very structuring tool. We realized there were significant gaps in LCA databases, and it's a big job for us." *(Technical manage - Eco-organization, electrical and electronic equipment)*

- *towards decision-makers and designers* by means of mediating instruments such as decision-aid LCA tools. To this end, they were encouraged to participate to training programs organized

with the support of public environmental agencies, supported by experts, whether they were employees of the company or external consultants called for this mission.

> " The competence has been developed in-house, benefiting from my previous experience with Renault and Volvo. A team was created and trained in environmental assessment techniques, among other things. Now in each of our design offices there is an "internal relay" for eco-design issues. The goal is to train highly skilled experts." *(Sustainability engineer - Electrical supplier)*

- *towards customers* through environmental labelling as an instrument to make the environmental performance of products visible and credible. The environment being considered as an expert good (Nadaï, 1998), an asymmetry of information between companies and customers was assumed (Akerlof, 1978). Environmental labelling (ex: ecolabels) appeared to be the best solution to inform consumers about the environmental quality of products and restore the terms of exchange.

> "Initially, the quality department was asked to develop life cycle analyses to deploy environmental signage in our store shelves, so that customers could discriminate products according to environmental criteria." *(CSR manager - Furniture retailer)*

This techno-centric strategy rests upon three underlying assumptions:

(1) The purpose of ecodesign is to improve the design of products and is the result of individual initiatives by companies in order to comply with laws or to anticipate legislative developments (product and firm-centric approach) ;

(2) Ecodesign is a technical issue that requires rigorous assessment methods so that decision-makers can make the right decisions (instrumental approach) ;

(3) The success of eco-innovation depends on information disclosure: once customers are aware of environmental impact through labelling, they make a choice consistent with their supposed preferences (asymmetry of information hypothesis).

Using Max Weber's concept, the legitimacy of this *techno-centric ecodesign* regime was based on instrumental rationality, uing scientifically grounded techniques (LCA) and quasi-legal devices (official ecolabels supported by the State like the European ecolabel) as a priori conditions for legitimacy.

The limits of the techno-centric regime

However, this strategy did not get the expected results. If policy makers introduced incentives to support this strategy, most designers, managers and customers did not adhere to it. In other words, instrumental rationality did not succeed to get positive legitimacy judgments from key stakeholders (Tost, 2011).

First, the systematic use of complex environmental assessment tools undermined the internal legitimacy of the approach. Environmental experts found themselves relatively isolated, failing, in most cases, to involve other experts in the process. The complexity of LCA tools and methods was perceived as a main obstacle for these internal stakeholders whereas value for customers remained unclear for them. Only a few pioneering companies really tried to mobilize the full range of competencies, to involve the entire organization in order to build their whole brand image around the environment, ecodesigning all of their products and trying to get a specific positioning in the eyes of their customers. We can find such examples in pioneering companies in the detergent sector, like Rainett in Germany or l'Arbre Vert in France, who positioned themselves with success as leaders of "green products". In contrast, most companies only managed to generate incremental innovations such as introducing recycled plastics in the auto industry or improving energy efficiency in the white good sector (washing machine, fridge, etc.) without changing the identity of the product perceived by consumers.

> "For a long time we have given priority to the tools, but we came back from them. The tool is finally the practical refuge behind which we imagine that everything will be played out and settled. But if we want to trigger something concrete, to have a real impact on our offers, it is up to us to go to the design kingpins and the other business units to identify with them the relevant issues and to make them want to get involved, to be part of it."
> *(Ecodesign engineering manager - Aerospace and defense)*

Second, as a direct consequence, one of the main limitations of the techno-centric regime of ecodesign lies in its difficulty to make ecodesigned products visible for customers, i.e. in its ability to transform the ecodesign approach into eco-innovations characterized by a limited environmental impact and a commercial success through a discourse that makes sense to the consumer. For example, in the automotive industry, recyclability strategies were developed in response and in anticipation to regulations but car manufacturers failed to valorize them vis-à-vis customers. The excessive focus on scientific methods and complex tools explained these difficulties.

> "For 15 years, we have had a very technological and scientific approach to calculating environmental impacts. (...) Today we have a big gap to go as far as the generalization of eco-design. We're talking to a consumer and we don't have the keys to the consumer's buying decision for an ecodesigned product, not the sociological approach. We need to dig up and to disseminate that knowledge." *(Coordinator of the ecodesign centre – Environment Public Agency)*

Surveys showed that ecolabels and environmental product communication were neither easily understood nor easily adopted by consumers that could be overwhelmed with information or lack knowledge (Thøgersen, 2010). Marketing departments were then reluctant to embark in initiatives seen as creating no clear value for customers.

> "We were pioneers in environmental labelling more than a decade ago, but it fell through. It is very long, very time consuming and most of the time the display is not understood and moreover it is not even seen by the customers. It is true that it was very small and many people do not even see it. It's really complicated, and doing things that are not understood is useless and frustrating so we're not investing in it anymore." *(sustainability product manager, Home design and gardening company)*

Ecolabels now concern 26 families of products but their notoriety remains pretty low, except for few products like detergents. The complexity of the message -LCA is a multi-criteria approach through which environmental performance is measured according to 13 different environmental impacts- is a considerable obstacle, as well as the lack of visibility of the ecolabel on packages that already contain a lot of information to be read at the time of purchase. Finally, environmental labelling provides additional information to the consumer, but independently of

its affixing on the packaging or label, it does not allow the consumer to discriminate eco-designed products from traditional products by revising their identity or offering materially visible features (Le Masson et al., 2010). For instance, several car manufacturers experimented in the mid-2000 ecolabels based on self-declaration, but this did not attract the interest of customers who could not materialize the difference between so-called "green" products and traditional ones. For instance, for a specific model, a variant (with a small engine) could be labeled, whereas another, which looked identical, would not. It made it difficult for customers, even the most engaged ones, to make sense of the message related to the product.

Third, and more importantly, ecodesign strategies mainly focused on avoiding harm objectives (Scherer and Voegtlin, 2018), i.e. only on the environmental impacts avoided with reference to a business-as-usual scenario. Put differently, the techno-centric regime makes it possible to consider the reduction of certain environmental impacts in a preventive logic, but does not capture the "do good" features that could attract the attention of consumers.

From these observations, we can question the effectiveness of this technical-driven approach, especially its ability to drive concrete changes towards more responsible models of production and consumption. In other words, this approach proved to be neither effective nor efficient. With regards to governance, the process was neither interactive nor reflexive: ecodesign was essentially a confined approach, conducted by experts whose internal and external legitimacy was contested. The techno-centric ecodesign regime quickly reached its limits: the lack of perceived social legitimacy (Tost, 2011), the weak contribution to meet sustainable development goals given the difficulties for eco-innovations to find their markets, and consequently lower-than-expected diffusion of practices became manifest.

Techno-centric ecodesign regime	
Do Not Harm	
Goal	Compliance to legal rules and legislation anticipation
Practices	Classical environmental assessment (LCA and related tools)
Actors	Environmental internal and external experts

Do Good	
Goal	No direct “Do Good” will
Governance	
Legitimacy	Rational-legal
Effectiveness	Limited impact on a unique goal (responsible production)
Efficiency	Lack of interactivity, reflexivity

However, the situation was quite paradoxical: although environmental consciousness was rising in the population, ecodesign and disruptive eco-innovation still remained marginal practices.

From techno-centric ecodesign to responsible eco-innovation regime

In the last ten years, companies that have implemented a techno-centric ecodesign approach have progressively come to realize the discrepancy between rising expectations about sustainability among customers and the general public at large and the shortcomings of their product portfolio offer. In certain sectors, like the food sector, cosmetics, automobile, electronic products, increasing pressures from consumer associations, NGO’s and the media on environmental and social impacts have become so prominent that status quo is no longer possible. In certain cases, scandals or external events have played a key role in the regime change.

An interesting example of such external jolt that led to a shift in company’s strategies is the example of Yuka, a free application for smartphones developed in France by social entrepreneurs for customers to calculate a score (from 0 to 100, with four categories from green (good) to red (bad)) for health and environmental impacts of a product based on an open database. The principle is simple: when a consumer is in a store, he can scan the barcode of the product and gets, with the app, a score of the product with detailed environmental and health information. This app has met a great success with more than 15 million downloads in Europe (January 2020), mostly in France, with 5,5 regular users. According to experts, the success of this app reflects regular health, social or environmental scandals that affect the credibility of

corporate discourses and the confidence in corporate labelling. Initially focused on food products, the app has been extended to cosmetics in 2019 to evaluate health impacts in particular. The result was terrible for most producers, especially large companies dominating the market, who received very bad scores (red). This rating raised immediate controversies about their product's impacts. Brutally caught in a turmoil, companies organized crises meetings one after the other. As the perceived legitimacy of their products and brands is traditionally based on a positive image of quality, health and transparency, the controversies were potentially devastating for them. Consequently, the agenda of responsible innovation and eco-innovation has come to the front of their strategy since then. Similar examples can be found in other sectors, like the auto industry, where the dieselgate had a significant impact on speeding up the transition towards electric mobility and the decline of diesel engines.

Within this background, more and more top managers have become aware of the need to go further in terms of environmental and social commitments but also to integrate, more concretely, these commitments to product and service portfolio in a coherent setting, and thus avoid the criticisms of "greenwashing", i.e. the purposeful decoupling of claims and realizations. To align corporate commitments with product portfolio, top managers have encouraged the initiatives of other actors, including designers, marketers, stylists, production staff or CSR managers, who questioned an overly technical and rational approach that missed its target.

Meanwhile, public agencies and other support organizations (trading associations, producer responsibility organizations, consulting companies…) came to similar conclusions. The techno-centric and company-centric approach was not enough and there was a need to develop an entire ecodesign ecosystem to create the conditions according to which ecodesign and eco-innovation might become effective. This desire to move towards collective action resulted on the one hand in the organization of meetings and exchanges through networks and clubs, and on the other hand in a pooling of resources through the development and provision of case studies, and the building of platforms.

Different producers and retailers started to frame the issue differently, integrating various internal and external stakeholders into the process, paying particular attention to customers and society as a whole, thus favoring interactivity, reflexivity and transparency. In this new approach, three critical issues have become salient.

First, based on our interviews, we have observed that more and more companies use ecodesign approaches to meet commitments that go beyond a simple target to reduce the environmental footprint of their products. They realize they have a responsibility towards the planet and towards people, who now expect strong commitments to be reflected in product and service offers. As a result, companies move beyond legislative requirements, committing to voluntary labels and norms to “do not harm”, and, above all, demonstrate a growing willingness to "do good" by participating in the achievement of several sustainable development goals, directly - climate, protection of aquatic life, biodiversity conservation- or indirectly linked to the environment -reducing poverty through local production, fair trade and healthy living conditions. It can be said that companies want to be part of the solution to Grand Challenges and that they use ecodesign to incorporate these “do good strategies” into their product offering. In this perspective, changes in consulting offerings represent a good “marker” of these on-going transformations.

> For me, that's what ecodesign is all about today, working with the company on the commitments it has made. And these commitments are much more ambitious today, with the 1.5 degree target trajectory, science-based targets, sometimes global emissions across the entire value chain. Ecodesign approaches are taking their full place in a context where companies are making strong commitments for the climate, biodiversity and even other causes that go beyond. In this context, we are more and more called by top managers to accompany a global transformation of the company toward transparent and responsive green strategies in which ecodesign is issue among others, alongside with green corporate strategy, green corporate communication, corporate reporting and auditability *(Director, consulting firm specialized in sustainable transformation)*

Within this framing, eco-innovation makes it possible to establish a link between the company or brand major commitments at a strategic level and the products put on the market, to ensure overall consistency between commitments and products at an operational level. However, companies are also fully aware of the difficulties to provide consumers with products that make sense to them through conventional assessment tools. In order to develop a product offer with positive value for customers, and consistent with their “do good” strategies, they have engaged in an interactive and reflexive governance with stakeholders, both internally and externally, from the start of the design process. A greater importance is now attached to the stakeholders’

viewpoints and, more broadly, to society's claims. This strategy is materialized in the development of participative ecodesign projects with both internal stakeholders who did not have a voice in the previous regime (ex : production, CSR, marketing departments) and external stakeholders (ex : consumer organizations, consulting firms specialized in eco-responsibility or eco-innovation) who act as spokespersons for the new expectations of consumers and society. Concretely, this can lead to discussions on existing mediating instruments in order to make them take into account dimensions hitherto overlooked, for instance, critical LCA reviews which consists in involving different stakeholders in the LCA process to increase its social legitimacy. Besides, companies tend also to diversify the techniques used to promote stakeholder involvement.

An example is the growing success of design thinking techniques (Jones et al., 2001) that are based on users needs and prototyping. Contrary to scientific techniques, they represent a pragmatic approach of design, built on collective *bricolage,* where is the ultimate goal is to generate ideas, concepts and prototypes that "work", i.e. which are valued by users and stakeholders, regardless of their scientific validity.

Second, in this new frame, the selection of the issues at stake in ecodesign practices have become of crucial importance. In the previous regime, the criteria that matter for customers were supposed to be those included in LCA. Looking at what consumers and the society at large valued most, companies and stakeholders have found out that environmental criteria covered by LCA were not necessarily the criteria that mattered to them.

In the new regime, issues that matter are pragmatically identified in the course of interaction between companies, customers and other stakeholders. In this stakeholder-centric approach, other environmental issues, like microplastics that end up in oceans (crucial in the clothing industry), protecting biodiversity (an important issue for cosmetics), reparability and durability (key element in the electric and electronic appliances), or other social issues like health issues, bio origin, fair trade or local origin have been identified as highly valued criteria depending on the products concerned. In light of these trends, it has become salient that the vast majority of consumers were not buying ecodesigned products solely for their environmental characteristics, but were increasingly looking for "co-benefits" like price, status, emotions, health, security, etc. (Delmas and Colgan, 2018). In this perspective, the issue for companies is to identify, for each product, the relevant "green bundle" (Delmas and Colgan, 2018), i.e. the association of co-benefits that best satisfy the customer, and the society at large. More broadly, consumers do

not only buy a product, they also buy a brand, more precisely the social reputation attached to a brand. Consequently, the companies do not only seek a greater effectiveness and efficiency, they look for a license to innovate, i.e. a greater social legitimacy (Sachs and Rühli, 2011) and therefore give a specific importance to legitimacy judgments produced by stakeholders.

> "We decided to organize a series of workshops with everyone around the table, so that everyone feels concerned and everyone brings their ideas, with the help and guidance of people with experience in materials, recycling and the market, in order to explore new avenues and go much further than our old LCAs that no one understood us or our clients *(Chief commercial officer, furniture retailer)*

The new wording associated to these eco-innovations reveals this change in the approach. More and more companies talk about "eco-responsible" products and claim to develop products with "positive impact", i.e. with a purpose to do good, the will to act responsibly towards the planet and people. This language is, of course, blurry and vague but shows the intention to find, for each product or family of products, the relevant bundle for customers and society.

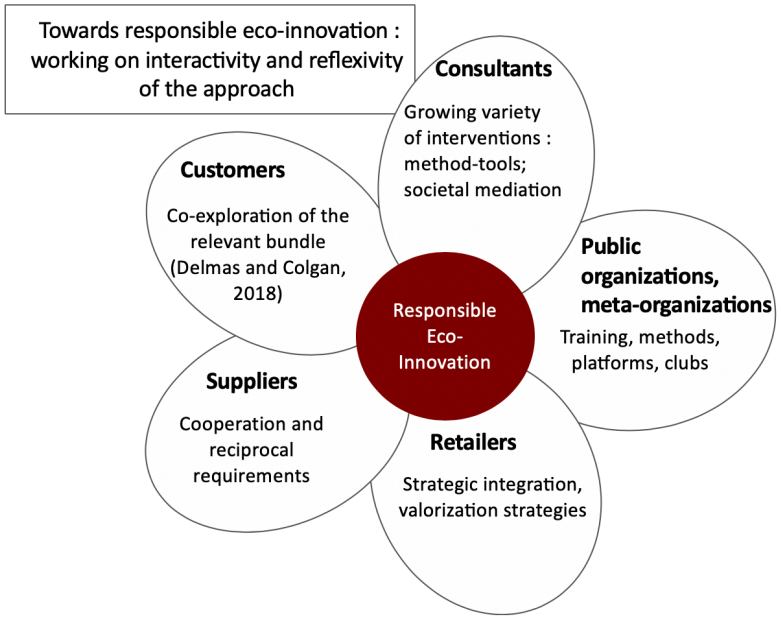
For instance, at Decathlon, a major international sport and leisure retailer and producer, a well-known internal stylist convinced the top management to experiment the development of "positive impact" products with local subsidiaries instead of traditional centralized product developments for worldwide markets. They experimented such strategies in India where the "bundle" proposed to customers revolved around three main values: local production and supply, reduced environmental impacts and affordable products for people with limited financial resources. However, when we asked this stylist manager about the credibility of this communication, he recognized that a pending problem was to find the adequate metrics and reporting system that could support the message and provide credibility for customers.

Finally, a third critical issue is the simplification of the message to customers, attached to the product. This is still a major challenge, particularly for the B2C sector. How to find to find a coherent and catchy product communication, especially when multiple issues have been identified in the green bundle? Among the reflections carried out by companies, we find the idea of developing very simple and easily identifiable logos affixed to products complying with the criteria laid down (a synthetic and simple indicator, an easily understandable color coding) ; but also playful and gaming logics featuring characters that tell the story of the products. There is a willingness to be transparent, to transcribe the results of a more interactive and reflexive

approach into an easily appropriable mediation mechanism. In the interviews, this issue of developing a coherent and comprehensive storytelling has been put forward.

> "Customer communication is still a major issue. Globally, environmental labelling has not worked very well and new logics are being studied by companies, in particular the articulation between synthetic information directly on the product and more information provided in digital version to ensure greater transparency. » *(Manager, eco-innovation consultancy)*

These strategies belong to what we propose to call an emerging "*responsible eco-innovation* " regime where interactivity, reflexivity, and responsibility towards stakeholders are claimed to be core values for the company, materialized in the product portfolio.



While the techno-centric regime was confined, and imposed a certain vision of what ecodesign and ecodesigned products should be, the responsible eco-innovation regime establishes an open and interactive process for building ecodesign with a multiplicity of internal and external stakeholders with a goal to produce effective and impactful eco-innovations. This collective process comes through a new value proposition built around "bundles" adapted to specific customers and situations.

DISCUSSION AND CONCLUSION

The aim of this communication was to study the challenges and issues of managing responsible innovation in practice. For that purpose, we have taken the field of ecodesign and eco-

innovation where a change has occurred from a traditional rational-legal approach based on techniques and expertise, focusing on avoiding harm, toward a more responsible and open approach based on an interactive and reflexive governance with stakeholders, what is more directed toward "do good" objectives. Based on a genealogical approach, and an empirical exploration, we have identified two regimes that we propose to call *techno-centric ecodesign regime* and *responsible eco-innovation regime*, based on Voegtlin and Scherer (2017) and Scherer and Voegtlin (2018).

	Techno-centric ecodesign	**Responsible eco-innovation regime**
Do Not Harm		
Goal	▪ Compliance to legal rules and legislation anticipation,	▪ Compliance to legal rules and legislation anticipation ▪ Commitment through voluntary labels, norms
Practices	▪ Classical environmental assessment (LCA and related tools)	▪ Extended environmental assessment (LCA + others)
Actors	▪ Environmental internal and external experts	▪ Environmental internal and external experts
Do Good		
Goal	▪ No direct "Do Good" will	▪ Contribute to the achievement of SDGs ▪ Be part of the solution to Grand Challenges
Practices		▪ Definition of corporate vision ▪ Co-benefice offers
Actors		▪ Organization members from design to marketing ▪ Various stakeholders acting as consumer and society intermediaries

Governance		
Legitimacy	▪ Rational and pragmatic	▪ Social
Effectiveness	▪ Limited impact on a unique goal (responsible production)	▪ Stronger impact on several SDGs (No poverty, Good health and well-being, Responsible production and consumption
Efficiency	▪ Lack of interactivity, reflexivity	▪ Interactive and reflexive forms ▪ Participatory processes

In the latter regime, companies extend their ecodesign practices beyond reducing harm, committing to "do good" by participating in the achievement of several SDGs and taking part in the resolution of Grand Challenges. More importantly, they implement governance mechanisms that reflect a willingness to move towards greater responsibility. These mechanisms, participative and reflexive, provide a social legitimacy to this new approach, responding to the limits of the previous and suggesting promising results in terms of effectiveness and efficiency.

Rigor vs relevance debate

If it is still too early to assess the real impacts and effects of this emergent regime on sustainability transitions, it looks a priori more in line with societal evolutions. However, unexpected problems, obstacles or limits could hinder its development. In particular, even if the approach seems more relevant vis-à-vis customers and society, the rigor of the method to evaluate the benefits of eco-innovation is questionable. The strength of the techno-centric regime lied in the robustness of the environmental performance measure through the use of standardized science-based methods. In the new pragmatic approach, sustainability issues are broader, sometimes blurry, their scope varying across time and space. Beyond environmental aspects taken into account in LCA, other environmental issues have emerged -e.g. biodiversity, micro-plastics, etc. – as well as other co-benefits like health, local origin, bio or fair products

that matter for consumer and the public. The vagueness of certain statements used by companies, such as positive innovation or responsible product, goes along with difficulties in constructing measurement systems based on solid grounds. This is problem insofar as perceived social legitimacy also depends on the credibility and transparency of green products claims. Likewise, the desire to clarify the message to the consumer generates a tension between the simplicity and accuracy of the information provided. The risk is that such approaches will be seen as a new greenwashing avatar where the materiality of the environmental and societal value of products is questionable. To put it simply, the techno-centric approach was rigorous but lacked relevance; on the contrary, the responsible stakeholder-centric approach may be more relevant but is in search of rigorous methods. The challenge for the future is to find an appropriate balance between these issues and, therefore, to put strong efforts on the development and legitimation of certifiable and auditable methods for social and environmental performance measurements.

Through this genealogical and empirical investigation, we contribute to understand how responsible innovations are conducted in organizations, and more specifically the way responsible innovations are organized, instrumented and governed in practice. We also provide a better understanding of the challenges of responsible practices. In particular, we stress the importance of building co- benefits beyond standard environmental performance per se and the techniques to produce legitimacy related to innovations.

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APPENDIX A. PEOPLE INTERVIEWED

Name	Institution	Area	Position	Date
EcoTLC	Eco-organization	Clothing	R&D Director Eco-design	04/12/18
ecosystem	Eco-organization	Electrical and electronic equipment	Technical director	14/12/18
ecosystem	Eco-organization	Electrical and electronic equipment	Head of Studies & Ecodesign	16/01/19
ADEME	Environmental agency	All areas	Coordinator of the Eco-design department	21/01/19
Citeo	Eco-organization	Packaging	Circular economy director	22/02/19
Decathlon	Company	Sport and leisure	Sustainability Leader in Design and offer	20/03/19
Nespresso	Company	Agribusiness		10/05/19
Decathlon	Company	Sport and leisure	Leader Positiv' Impact Product	17/05/19
Hager	Company	Electrical equipment		27/05/19
Thales	Company	Aerospace and defense	Ecodesign engineering manager	11/06/19
Conforama	Company	Furniture retail	CSR Director	14/06/19
Novamex – L'arbre Vert	Company	Cleaning products	Marketing director	30/09/19
Signify	Company	Lighting	Marketing manager	16/10/19
Orange	Company	Telecommunications	life cycle analyst and eco-design expert	18/11/19
Galeries Lafayette	Company	Clothing	Sustainable development project manager	25/11/19
Fnac Darty	Company	Leisure, technical products, household appliances	Chief service officer	11/12/19
ADEME	Environmental agency	All areas	Engineer, Product Service and Material Efficiency	17/12/19
Brandt	Company	Home appliances	Products Environment Manager	04/02/20
Leroy Merlin	Company	Home design and gardening company	Sustainability product manager	22/02/20
Quantis	Consulting firm	All areas	Director	26/02/20
Gingko 21	Consulting firm	All areas	Eco-innovation consultant	28/02/20
Schneider	Company	Energy and automation	Ecodesign - LCA leader	29/05/20
Amis de la Terre	NGO	All areas	Overproduction manager	29/05/20
Deloitte	Consulting firm	All areas	Circular Economy Manager	04/06/20
Casino	Company	Food retail	Director, Quality Commitments Division	10/06/20
BSH Group	Company	Home appliances	Sustainability Manager	19/06/20
Greenflex	Consulting firm	All areas	Project manager	20/06/20

APPENDIX B. INTERVIEW GUIDE

The questions were adjusted according to the type of actor surveyed and the nature of the activity. The main themes addressed were the following:

Implementation of ecodesign (history)

- Time experience in ecodesign. Initiator, triggering event.

- When did the ecodesign approach start, why, with whom and how?

- Motivations (e.g. competitive pressure, customer demand, choice of manager…)

- Environmental issues internal organization ? Environmental department ? Integration of ecodesign = change in the internal organization ? Integration of new skills and new professions ?

- Help of support organizations (ADEME, eco-organizations, consulting firms, …) ? For which aspects ?

- Impact of the approach: internal reactions ? Easy to involve employees ? Reluctance ? Commercial success (niche or not)?

Current ecodesign projects and strategy

- On what scale ecodesign has been deployed ? (few products, product lines, whole company…)

- Use of specific methods ? That mobilize which actors ? How ?

- Use of certain tools ?

- Degree of internalization of required skills ? Outside involvement ? On which aspects ?

- Obstacles met, difficulties (internal/external ; technical or managerial, resistance to change…) ?

- Changes since the beginning of the implementation ?

- Impact on supplier relations ? New requirements, skill development… ?

- Objectives set (qualitative, quantitative) ? Specific indicators to monitor their achievement ?

- New ambitions, new areas of reflection ? (process / topics)

Customer and other stakeholder relationships: governance of eco-innovation

- Change in customer expectations ? Sensitivity to the environment ? Homogeneity across all product types ?

- How to get customers' attention ? Ecodesigned products promotion : difficulties, challenge ?

- Experimentations conducted ? (valorization strategies, involvement in the ecodesign process…) With which stakeholders?

- Beyond customers, how do you work with other stakeholders (suppliers, professional unions, NGO's, consumer associations, etc.)?

- How are these different stakeholders involved in the governance of eco-innovation processes?

- How do you call the approach you now try to develop?