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The evolution of the Strategic role of Designers for Sustainable Development

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Design for Sustainable Development refers to the application of a design process to solve a problem related to sustainability, such as creating a pair of shoes that can be recycled or managing waste collection in a large city. Since the origins of this concept in the 1960s, Design for Sustainable Development has been evolving, gradually broadening its scope over time from the design of products to the design of services, business models and wider ecosystems. In this evolution, designers have come closer and closer to business problems, thus becoming more strategic. In this paper, we explore this evolution from a business perspective. We visualize it into a framework and interview eight academic experts about the *Strategic role of Designers for Sustainable Development*. We find that the evolution can be framed around five topics: the strategic goal of designers, and their related perspective, language, key activities and main challenge. After discussing how the evolution took place around each topic, we draw implications for designers and managers who are willing to play an active role in the transition towards sustainable development.

Keywords: Strategic Design, Sustainability, Product Service System, Business Model, Ecosystem

Introduction

The research fields of sustainability and design have grown significantly in the last decades and increasingly crossed their paths in addressing contemporary societal challenges (Bhamra & Lofthouse, 2016; Ceschin & Gaziulusoy, 2016).

Sustainability is a concept that can be traced back to the 1960s, when increasing concerns about the impact of human activities on the planet started to arise around issues such as the pollution of natural ecosystems and the depletion of critical resources (Carson, 1962; Fuller, 1969; Hardin, 1968). In 1972, an academic report called "The Limits to Growth" argued that our planet is a finite system and human development must not exceed its limits if collapse is to be avoided (Meadows, Meadows, Randers, & Behrens, 1972). Sustainability is therefore defined as a dynamic state of development in which a complex system can thrive without collapsing (Meadows, Meadows, Randers, & Behrens, 1972). Afterwards, the United Nations defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland, 1987). More recently, the transition towards sustainable development has been framed through a set of specific goals: the Millennium Goals (United Nations, 2009), later turned into the Sustainable Development Goals (United Nations, 2015), for countries and organizations to jointly pursue.

Design is a discipline with human centricity and the meaningful fulfillment of individual and societal needs as core principles. Therefore, its applicability to sustainable development challenges is straightforward.



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Particularly, design has a twofold nature: “design-as-an-outcome” and “design-as-a-process” (Kimbell, 2012). “Design-as-an-outcome” refers to an artifact, a physical object created by someone who is the designer. “Design-as-a-process” refers to a creative, yet rational process, to develop the solution to a complex problem (Buchanan, 1992; Simon, 1973). In this paper, we focus on how design-as-a-process can contribute to Sustainable Development.

We define *Design for Sustainable Development (DfSD)* as the application of a design process to solve a complex problem related to sustainability, such as waste management in a large city (Bhamra & Lofthouse, 2016; Manzini, 1999, 2009). Over time, academic research and industry practice picked up this concept in different ways, resulting in an evolution of *DfSD* (Ceschin & Gaziulusoy, 2016; Konietzko, Bocken, & Hultink, 2018). Our goal is to provide a comprehensive and up-to-date mapping of this evolution, by integrating the business perspective as one of its current and future drivers. Specifically, the scope of *DfSD* has become broader over time, moving from leveraging design principles and practices for addressing exclusively technical challenges to using such principles and practices for looking at sustainable development from the perspective of people behaviors and socio-economic systems (Ceschin & Gaziulusoy, 2016). In recent years, a new focus at the intersection between design and sustainable development research has emerged, which looks at design as a way of bringing business considerations at the core of sustainable development. This is the consequence of two occurrences: first a progressive realization in research and practice that the implementation of the sustainability transition requires its integration with business objectives (Maas & Boons, 2009; Whiteman, Walker, & Perego, 2013); second, the increasing role that design plays in driving the strategic decision making of organizations that strive for meaningful innovation (Brown, 2008; Calabretta, Gemser & Karpen, 2016).

In this paper, we want to integrate these recent developments and incorporate the business perspective as a driver of the evolution of *DfSD*. As a result, we propose and validate a four-level framework of how the role of designers in sustainable development has evolved by becoming more strategic in integrating business goals. We start from a comprehensive literature review to identify four nested levels of *DfSD*: Product Design, Product Service System Design, Business Model Design and Ecosystem Design. We subsequently use eight in-depth expert interviews to validate the framework and to further characterize the strategic role of designers in sustainable development from a business perspective. We conclude with some implications for designers and managers, and with some directions for future research.

Literature review

Product Design

The first level of *Design for Sustainable Development* is Product Design.

The global ecological and social concerns that had been brewing through the 1960s reached a crisis point in the 1970s, and affected design as well. Papanek’s book, *Design for the Real World*, urged designers to introspect deeply about how they could contribute meaningfully to global social and ecological issues (Papanek, 1971). Papanek called on designers to be accountable for - and driven by - global ecological and social needs, rather than the consumer-led economy. As a consequence, the concept of “Green Design” for responsible consumers started to emerge. John Elkington formulated “*Ten questions for the Green Designer*”, for a 1986 UK Design Council booklet, inviting reflection on the fact that each product has an impact associated to its life cycle, namely the way in which it is produced, distributed, used by people and ultimately dismissed. In the 1990s, the concept of “Green Design” evolved into the concept of “Eco-Design” (Brezet & van Hemel, 1997). Eco-design aimed to create a win-win situation by addressing both the ecology and the economy; it sought to minimize the negative ecological impacts of the product life cycle, while simultaneously offering financial benefits (so-called win-win situations) (Ceschin & Gaziulusoy, 2016). In Eco-design, the environment was given the same status as more traditional industrial values such as profit, functionality, aesthetics, ergonomics, image and overall quality (Brezet & van Hemel, 1997). It is just since 1995 that the term “*Design for Sustainability*” has received greater acceptance (Bragd, Baumann, & Boons, 2002). Many scholars, in describing *Design for Sustainability* draw heavily on a more broader and holistic scope than Eco-design by incorporating social, ethical and equity issues (such as wealth disparities and developing world factors) into design (Crul & Diehl, 2006; Crul, Diehl, & Ryan, 2009; Dewberry & Goggin, 1996; van Weenen, 1995). Initially, the strategic aspects of *DfSD* were minor and mostly related to identifying internal and external

drivers that could result in win-win situations in which the ecological benefit would result as well in economic benefits.

Summarizing the previous paragraph, we conclude that at the Product level of *DfSD*, the outcome of the design process is typically a “green” product with a life cycle that results in a lower environmental impact. An example of this is the Aeron Chair by Hermann Miller, which can be fully disassembled and recycled in all its parts.

Product Service System Design

The second level of *Design for Sustainable Development* is Product Service System Design.

In the late 1990s, several scholars and practitioners realized that a focus only on products would not be sufficient to achieve sustainability goals. Leveraging this and former Eco-design ideas, Manzini stated that *DfSD* should take into account not just products but also services (Manzini, 1999). As firms become responsible not only for production and delivery of products but also for other phases in the life cycle of products (e.g. offering maintenance services in the use phase and designing take-back systems for the end-of-life of products), they have more incentives to adopt life-cycle thinking during the design and development phase of products (Manzini & Vezzoli, 2003). Consequently, the concept of Product Service System (PSS) emerged. PSSs are defined as “a mix of tangible products and intangible services designed and combined so that they are jointly capable of fulfilling final customer needs” (Tukker & Tischner, 2006). PSSs Design for Sustainability then became a research field of its own (Tukker, 2004; Tukker & Tischner, 2006). This new perspective positioned design as a strategic competence for creating new business opportunities and new ways of fulfilling product functions through the design and combination of novel sustainable products and services (Manzini, 1999; Manzini & Vezzoli, 2003). In a PSS strategy, the starting point is not a product or service, but the final functionality or satisfaction of customer needs (Tukker & Tischner, 2006). In that respect, PSS are also referred to as ‘function-oriented business models’ (Tukker, 2004). Such a business model has implications for the ownership structure of products since the main activity of firms moves and/or extends from selling products to giving access to the use of products via, for example, leasing schemes or pay-per-service models (Tukker, 2004). Finally, the changes in the ownership structures replace material intensive products with intangible services. Thus, this potentially leads to the ‘dematerialization’ of the economy, which is associated with the reduction of material flows in production and consumption (Mont, 2002).

Summarizing the previous paragraph, we conclude that at the Product Service System level of *DfSD*, the outcome of the design process is a product - service combination that reduces the impact of the product while providing something better to people. An example of this is the “OV bikes”, a bike sharing service from the Dutch Railways that reduces the use of cars by helping people who take public transport to reach their final destination.

Business Model Design

The third level of *Design for Sustainable Development* is Business Model Design.

After the emergence of the Internet in the business field as well as the steep rise of technology-heavy companies on the stock exchange, academic research on business models rapidly increased in the first decade of the 2000s (Osterwalder & Tucci, 2005; Wirtz, Pistoia, Ullrich, & Göttel, 2015; Zott, Amit, & Massa, 2011). The business model is a conceptual construct that describes how organizations propose, create, deliver and capture value (Richardson, 2008; Teece, 2010). In parallel, business model innovation was positioned as a way to tap into and even create new markets rather than a ‘trade-off’ (Porter & Kramer, 2011; Yunus, Moingeon, & Lehmann-Ortega, 2010). It was recognized that the construct provides an effective and systemic lens to investigate sustainable innovation and to discuss with organizations about the integration of sustainability into their objectives and operations (Bocken, Short, Rana, & Evans, 2014; Boons & Lüdeke-Freund, 2013; Stubbs & Cocklin, 2008). With increasing evidence on pressing sustainability challenges, sustainable business model innovation rapidly emerged as a research field (Bocken et al., 2014; Boons & Lüdeke-Freund, 2013; Dentchev et al., 2018; Geissdoerfer, Vladimirova, & Evans, 2018; Lüdeke-Freund & Dembek, 2017; Stefan Schaltegger, Hansen, & Lüdeke-Freund, 2016). This field places a prominent focus on design, which is mentioned repeatedly in some key publications as a strategic process for the creation of sustainable business models (Bocken, Short, Rana, & Evans, 2013; Boons & Lüdeke-Freund, 2013). Boons & Lüdeke-Freund recognized that the design of sustainable business models is a key challenge of the field (Boons & Lüdeke-Freund, 2013). Bocken and

colleagues explained that there are several archetypes of sustainable business models and that PSS is one of them, thus reinforcing the connection with earlier design literature on *DfSD* (Bocken et al., 2014; Tukker, 2004). Later work explicitly included design approaches in sustainable business modeling (Baldassarre, Calabretta, Bocken, & Jaskiewicz, 2017; Geissdoerfer, Bocken, & Hultink, 2016; Keskin, Diehl, & Molenaar, 2013). An analysis of this work shows that through the sustainable business model innovation field, *DfSD* research and practice has evolved beyond the Product Service System level, becoming even more closely connected with the business domain.

Summarizing the previous paragraph, we conclude that at the Business Model level of *DfSD*, the outcome of the design process is a (new) organization or a corporate venture driven by a social and environmental purpose. An example of this is Peerby, a company whose core mission is reducing the amount of products that are consumed while connecting people in the same neighborhood.

Ecosystem Design

The fourth level of *Design for Sustainable Development* is Ecosystem Design.

Across the first and second decade of the 2000s, the discussion on Sustainable Development has been increasingly leveraging a new paradigm defined as Circular Economy, which has gained momentum in business, policy and academy, not the least catalyzed by the Ellen MacArthur Foundation (Geissdoerfer, Savaget, Bocken, & Hultink, 2017; MacArthur, 2013). The origins of this concept can be traced back to the 1960s (Carson, 1962; Fuller, 1969; Hardin, 1968) and it refers to an economic system in which resource input and waste, emission, and energy leakage are eliminated or minimized (i.e. closing their loops) in order to achieve a positive environmental and economic impact simultaneously (Geissdoerfer et al., 2017; Lüdeke-freund, Gold, & Bocken, 2018). The transition to a Circular Economy requires the intentional design of new products and services, and experimentation with new business models to deliver them (Antikainen, Aminoff, Paloheimo, & Kettunen, 2017; Bocken, de Pauw, Bakker, & van der Grinten, 2016; Bocken, Schuit, & Kraaijenhagen, 2018). However, in order for these new business models to work in practice, it is essential to establish a collaborative capacity across organizations in the form of ecosystems (P. Brown, Bocken, & Balkenende, 2019; Kraaijenhagen, van Oppen, & Bocken, 2016). The term ecosystem comes from the fields of environmental sciences and industrial ecology, where it is used to depict relationships across businesses and their impact on the environment, exemplified by the concept of industrial symbiosis (Chertow, 2000; Froesch & Gallopoulos, 1989). The term has also been used in business and management literature to establish a connection with strategic innovation and business models (Adner, 2017; Talmar, Walrave, Podoyntsyna, Holmström, & Romme, 2018). In this context, ecosystems can be seen as “macro” business models in which multiple organizations create a value network and achieve together competitive advantage by jointly delivering a value proposition (Adner, 2017; Bocken et al., 2013; Clarysse, Wright, Bruneel, & Mahajan, 2014; Short, Bocken, Barlow, & Chertow, 2014; Talmar et al., 2018). More recently, these ideas on ecosystems have been leveraged by design literature as well, and reframed from the related perspective. Specifically, it has been pointed out that the discipline of design, the design process, design practices and capabilities, can be used beyond the definition of firm-centric business models, for the definition of ecosystems, or in other words coalitions, of organizations collaborating towards sustainable development and / or a Circular Economy (Baldassarre et al., 2019; Bocken, Boons, & Baldassarre, 2019; Den Ouden, 2012; Konietzko et al., 2018).

Summarizing the previous paragraph, we conclude that at the Ecosystem level of *DfSD*, the outcome of the design process is a coalition of organizations collaborating to drive the sustainable transformation of the economic system. An example of this is the “Adaptive City Mobility”, a national consortium of 13 organizations collaborating to implement an Electric Mobility System for cities in Germany.

Research question

We have explained that *DfSD* refers to the application of a design process to solve complex sustainability problems (Manzini, 1999, 2009). By looking at different streams of literature from different domains, we have explained that over time this idea has been picked up by academic research and business practice in different ways resulting in an evolution of *Design for Sustainable Development* into four nested levels of design (Ceschin & Gaziulusoy, 2016; Konietzko et al., 2018). This evolution is visualized in figure 1.

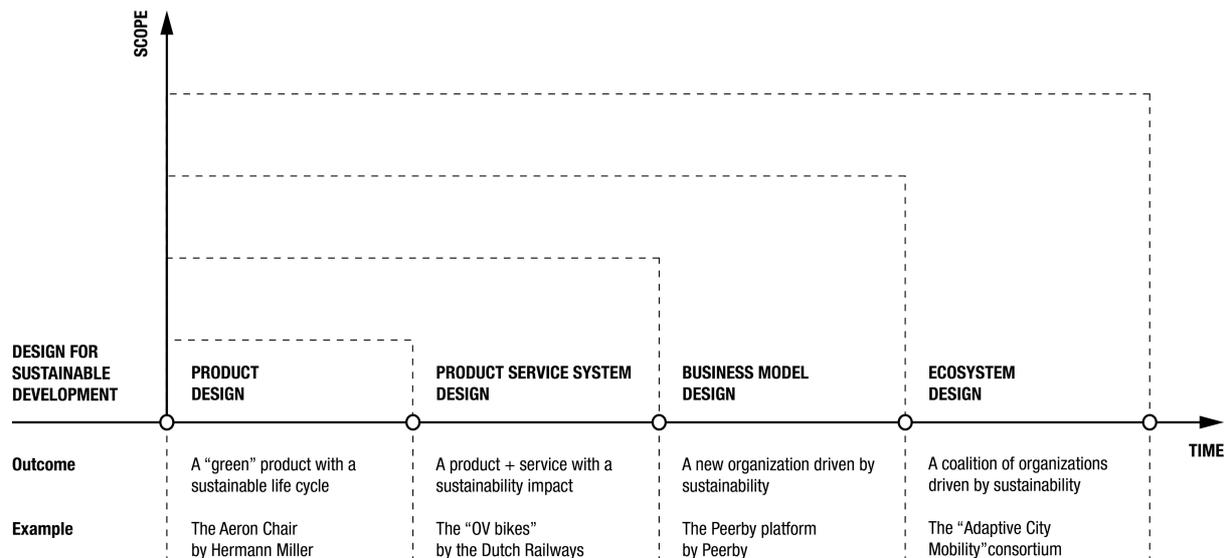


Figure 1: Framework of the evolution of Design for Sustainable Development. Based and adapted from: (Ceschin & Gaziulusoy, 2016; Konietzko et al., 2018)

Throughout this evolution, *DfSD* becomes increasingly strategic, establishing a connection with literature and practice from the domain of sustainable business (Baldassarre et al., 2017; Bocken et al., 2014; Manzini, 1999). Better understanding and leveraging these connections is of utmost importance if design researchers and practitioners want to play an active role as agent of change in the transition towards sustainable development (Manzini, 2009). Consequently, the goal of this paper is to explore the evolution of *Design for Sustainable Development* more in depth and from a business perspective.

Taking a business perspective on *DfSD* means looking at how designers can help in creating value for organizations while addressing sustainability challenges. Research has already studied how design practices and principles can play a strategic role in business domains like innovation (Calabretta, Gemser, & Wijnberg, 2017), branding (Beverland, Wilner, & Micheli, 2015), and shaping the organizational culture (Elsbach & Stigliani, 2018). However, how this might be the case in the context of *DfSD* and its evolution has not been analyzed yet. Consequently, we pose the following research question:

How has the Strategic role of Designers for Sustainable Development evolved over time?

In this paper, we leverage on a decision-making logic on the strategic role of design (Calabretta et al., 2017) and define the role of designers as 'strategic' when designers are able to get involved and influence strategic decisions on sustainable development. Strategic decisions are decisions implying high uncertainty in the final outcome, prolonged course of actions, significant resource commitment, and involvement of several decision makers (Eisenhardt & Zbaracki, 2019)

Method

In order to address the research questions, we used the framework of the evolution of *Design for Sustainable Development* derived from the literature (see Figure 1) as the starting point for a discussion with eight international academic experts working in six different European countries. In order to gain richer insights into the strategic role of designers for sustainable development, we selected experts with different research focuses. Furthermore, four of the experts that we selected have been working in the industry on related topics. The research focus, academic experience, and industry experience of the eight experts are summarized below in Table 1.

Table 1: Research focus, academic experience and industry experience of the experts selected for the interviews

	<i>Research focus</i>	<i>Academic experience</i>	<i>Industry experience</i>
Expert 1	Sustainable Design, Sustainable Business Strategy	3 years	5 years
Expert 2	Sustainable Design	27 years	-
Expert 3	Corporate Sustainability	12 years	-
Expert 4	Sustainable Business Strategy	8 years	5 years
Expert 5	Sustainable Design, Sustainability Policy	38 years	-
Expert 6	Sustainable Design	13 years	3 years
Expert 7	Corporate Sustainability	15 years	-
Expert 8	Sustainable Business Strategy	5 years	12 years

Data collection

Data has been collected using semi-structured qualitative interviews (Patton, 2002). Two researchers conducted the interviews. While one researcher showed the framework to the experts and probed them with the research question, the other researcher noted all the answers and comments on a printed copy of the framework. Some interviews were conducted face-to-face and some over Skype. All interviews were digitally recorded and consequently transcribed.

Data analysis

Data has been analyzed using a qualitative approach (Corbin & Strauss, 2008; Miles, Huberman, & Saldaña, 2013). The transcripts of the interviews and the experts' comments noted upon the printed models, have been scanned by the lead researcher and consequently condensed into written highlights and visual diagrams (Corbin & Strauss, 2008). After this first level of analysis, the written highlights and visual diagrams have been further analyzed through a set of face-to-face discussions involving the authors of this paper (who have relevant academic and industry experience on the *Strategic role of Designers for Development*). This second level of analysis allowed defining key topics (Miles et al., 2013). Written notes were taken during this process. Consequently, these notes have been used to map key developments onto the framework, to understand how the *Strategic role of Designers for Sustainable Development* has evolved around each key topic.

Results and discussion

The eight interviews, the follow up brainstorming and visual analysis allowed defining five topics related to the *Strategic role of Designers for Sustainable Development*. The topics are: strategic objective, perspective, language, key activities, and main challenge. They are presented and discussed in the following paragraphs. A visualization of how the *Strategic role of Designers for Sustainable Development* has evolved over time around these topics is presented in figure 2.

Strategic objective

Throughout the evolution of their role across the four levels of our framework (figure 1), the strategic objective of designers - namely what they need to focus on to steer the strategic decisions of organizations - has changed.

Designers traditionally focus on the "form and function" of products. Eco-designers are different because they do not only focus on how products look like but also on how they are produced, distributed and dismissed (Expert 2, Expert 5). Eco-design places a major focus on reducing the life cycle impact of products (Ramani et al., 2010). Consequently, at the Product level the strategic objective of designers is pushing an organization to

think beyond the “form and function” of their product, and steer decisions towards changing its life cycle (production, distribution, use, end of life), in order to reduce its environmental footprint while making profit. When the scope is broadened to services, suddenly the focus is placed on the exchanges with other stakeholders, and on how these affect the environmental and social impact of the supply chain (Expert 4, Expert 6). The design of sustainable services and business models places in fact a major focus on stakeholder interactions (Ceschin, 2012). Consequently, at the Product Service System level, the strategic objective of designers is pushing an organization to think beyond the life cycle of its product, and steer decisions towards changing tangible and intangible stakeholder exchanges (e.g. knowledge, materials, energy, money, etc.), in order to foster a positive social and environmental impact while making profit. Designers of sustainable business models place their focus on the entire organization (Expert 3, Expert 6). In fact, Sustainable Business Model Innovation entails redefining the core goals and underlying processes of organizations (Bocken et al., 2013). Consequently, at the Business Model level the strategic objective of designers is pushing an organization to think beyond products and services, and steer decisions towards (re)defining its purpose, how it functions from an economic and operational standpoint, in order to pursue sustainability goals while making profit. When broadening the scope further, the focus of designers is fostering a sustainability transition (Gaziulusoy & Ryan, 2017). In other words, this can be described as a focus on the transformation of an entire market sector or industry through a collective conversation of all the parties involved (Expert 3, Expert 6). Consequently, at the Ecosystem level, the strategic objective of designers is pushing multiple organizations to think beyond their individual business, and steer decisions towards collectively (re)defining (un)sustainable market practices, in order to facilitate the transformation of existing sectors while making profit together.

Perspective

Throughout the evolution of their role across the four levels of our framework (figure 1), the perspective of designers - namely the point of view from which they approach a problem and develop a solution - has changed.

Most designers do not know what strategy is and how sustainability relates to it from an organizational perspective (Expert 7). Strategy is a core function of an organization that binds together all the other ones (e.g. R&D, Operations, HR, etc.) and as such, business sustainability can only be achieved if strategy demands it (van Tulder, van Tilburg, Francken, & Da Rosa, 2013). By training, designers have a technical background and are therefore able to change the way products are developed to reduce their impact (Expert 2). Consequently, at the Product level the perspective is department centric. The designer works from the perspective of the R&D department, aiming to change how products are made. However, when innovating with a broader focus, designers are forced to understand what is more relevant for business and how different people in their organization look at sustainability issues (Expert 6). Consequently, at the Product Service System level, the perspective is cross-functional. The designer works from the perspective of the R&D and the commercial departments, aiming to change how products are made and delivered to customers. Eventually, the business model framework can be used to take the perspective of the entire organization on a design change for sustainability (Expert 4). In fact, the business model can be used to define company strategy (Richardson, 2008; Teece, 2010). Consequently, at the Business Model level the perspective is firm-centric. The designer works from the perspective of the entire organization, aiming to change how it operates and makes money. When the focus becomes the sustainable transformation of an entire industry there are many perspectives because all the companies operating in that industry have different priorities and issues to deal with (Expert 1, Expert 5). In this case, the designer must be like a “spider-in-the-web” and be able to take all perspectives into account (Expert 5). Consequently, at the Ecosystem level, the perspective is cross organizational. The designer works from the perspective of multiple organizations, aiming to change together existing market sectors.

Language

Throughout the evolution of their role across the four levels of our framework (figure 1), the language of designers - namely the way in which they communicate with different stakeholders - has changed.

Designers working with complex problems must be able to speak different languages (Calabretta, Gemser, & Karpen, 2016). Over time, designers working with sustainability have learned to speak different languages in order to communicate more effectively with different audiences and foster the adoption of their ideas (Expert 5). When they design products, they must be able to explain to engineers how such products can be developed more sustainably (Expert 5). Consequently, at the Product level they use an engineering language, suitable to

communicate with the R&D department of an organization. When they design services, they must be able to explain to the commercial departments how sustainability requirements will change how the current offering is delivered (Expert 5). Consequently, at the Product Service System level they use an operational language, suitable to communicate with the R&D and commercial departments of an organization. When the focus is the transformation of a business model, it is important to understand and use the same language of the upper management (Expert 7). This is essential to make sure that sustainability efforts are driven from the top of the organization (van Tulder et al., 2013). Consequently, at the Business Model level they use a strategy language, suitable to communicate with the upper management and CEO of an organization. If designers want to focus on the sustainable transformation of an entire industry and take the perspective of multiple organizations, it is important that they understand policy dynamics and language (Expert 5). Consequently, at the Ecosystem level they use a policy language, suitable to communicate with decision makers in the public sector.

Key activities

Throughout the evolution of their role across the four levels of our framework (figure 1), the key activities of designers - namely the most important actions they have to get done - have changed.

Designers who want to develop sustainable products must be able to understand what a life cycle is and how it can be assessed (Expert 2, Expert 5). A life cycle approach to the design of a product is based on first analyzing the current life cycle and then setting clear design objectives and criteria to lower its environmental impact (Vezzoli & Sciama, 2006). Consequently, at the Product level the key activities of designers consist of life cycle analysis supporting product design. When designing services, the interactions of stakeholders and social aspects around the product life cycle come into play (Ceschin, 2012; Tukker, 2004). Thus, it is important to analyze who these stakeholders are, what they exchange with each other and what do they want to achieve (Expert 1, Expert 6). Consequently, at the Product Service System level the key activities are stakeholder analysis supporting product and service design. When the focus is broadened to designing business models, it is essential to try out different options by making very concrete experiments to see which model can work, not only from a sustainability standpoint but also from a business standpoint (Expert 4). Transforming the entire business model of an organization requires experimentation capabilities (Keskin et al., 2013). Consequently, at the Business Model level, the key activities are design of experiments supporting business modeling. When wanting to transform wider industries it is important to consider the role of businesses as well as that of the public sector (Walls & Paquin, 2015). Designers must be able to understand who are the players involved in a certain market, what are the power plays taking place and how they can be disrupted (Expert 3). Consequently, at the Ecosystem level the key activities are industry analysis supporting alignment of private and public sector.

Main challenge

Throughout the evolution of their role across the four levels of our framework (figure 1), the main challenge of designers - namely the most difficult issue that they face - has changed.

The more designers move away from designing products towards solving complex sustainability problems, the more their challenge will change from a technical to a business one (Expert 1, Expert 3, Expert 8). Reducing the energy and material flows associated with a single product is a technical challenge (Ramani et al., 2010). Consequently, at the Product level the main challenge relates to technical issues. Designing a “green” product requires reducing material and energy flows but this has a limited impact if the wider context is unsustainable. In fact, if the material is not sourced responsibly and if the energy comes from fossil fuels a product cannot be sustainable (Expert 2). Beyond the product level, design can foster more radical sustainability changes (Manzini & Vezzoli, 2003). However, when working in industry practice with an organization, the implementation of more radical solutions is difficult (Expert 6, Expert 8). Product - service combinations are complex solutions involving multiple stakeholders, which makes them difficult to implement (Morelli, 2002; Vezzoli, Ceschin, Diehl, & Kohtala, 2015). Consequently, at the Product Service System level the main challenge relates to implementation. Designing a product - service combination requires a change in how stakeholders behave and this may result in a design - implementation gap. Sustainable business models allow pushing forward even more radical changes but they are also affected by a design - implementation gap (Bocken et al., 2013; Geissdoerfer et al., 2018). In addition, the designer needs to make sure that the solution is financially viable in the first place and then that it can be scaled up (Expert 4). Consequently, at the Business Model level the main challenge relates to financial and operational aspects. Designing a sustainable organization (or

venture) requires financial viability and followed by scaling. When multiple organizations are involved at the same time it becomes even more difficult (Expert 1, Expert 8). Operating at this level requires bringing multiple parties together in the form of coalitions (Manzini, 2017). Such joint projects pose several political and legal challenges (Expert 1, Expert 5). Consequently, at the Ecosystem level the main challenge relates to political and legal aspects. Designing a coalition of organizations requires turning a joint project into a legal entity and this entails defining and negotiating roles.

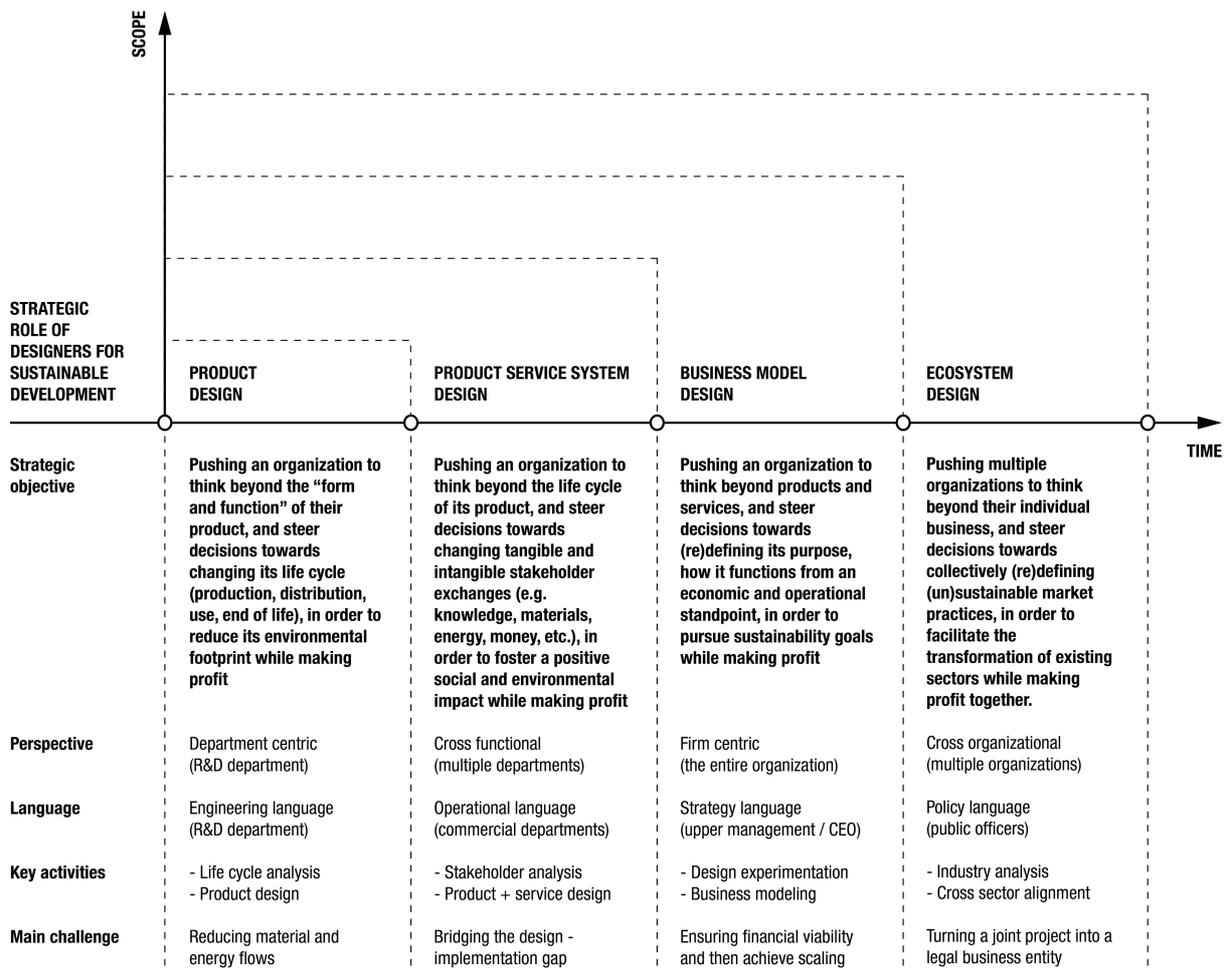


Figure 2: Evolution of the Strategic role of Designers for Sustainable Development. Based and adapted from (Ceschin & Gaziulusoy, 2016; Konietzko et al., 2018), and including the results of this research

Conclusions

In this paper, we explained that Design for Sustainable Development has been evolving over time, gradually broadening its scope from the design of Products to the design Product Service Systems, Business Models and Ecosystems. By combining sustainability literature from the fields of sustainable design and business, we visualized this idea into a framework, and further investigated this evolution from a business perspective, exploring how the strategic role of designers has evolved accordingly. To this end, we interviewed eight academic experts from six different countries, with mixed expertise in sustainable design and/or business, asking to provide their view on the framework and related subject. Their inputs have been analyzed qualitatively and condensed into five topics: strategic objective, perspective, language, key activities, and main challenge. Consequently, we connect interview data with literature to explain how the strategic role of designers for sustainable development has evolved through each one of these topics.

A final, overarching consideration relates to the fact that the four levels of design in our framework are nested. As explained by all the experts, and reinforced by literature, designers traditionally come from the inner level of Product Design and over time have been gradually involved into more strategic business decisions, which are taken at higher levels (Micheli, Perks, & Beverland, 2018). In the light of this consideration, and of the findings of the research, we distill some implications for both designers and managers who aim to contribute to a transition towards sustainable development.

Implications for Designers

If designers want to become active agents of change for sustainability, they should go out of their comfort zone and continuously learn to do something new (Manzini, 2009). As explained, this implies not only having broader strategic objectives, but also being able to work from new perspectives, learning to speak new 'disciplinary languages' and crossing disciplines, to execute new key activities and to deal with new challenges. Working from new perspectives entails understanding how different departments and organizations see innovation related issues, and using design as a way of thinking to connect these multiple viewpoints (Calabretta & Gemser, 2015; Micheli et al., 2018). Learning 'disciplinary languages' and crossing these entails getting to know the terminologies that different professional profiles use when they talk about innovation related issues, and trying to translate those to facilitate communication across profiles (Calabretta et al., 2016; Calabretta, Gemser, & Wijnberg, 2017; Micheli et al., 2018). Executing new key activities and dealing with new challenges entails being comfortable to design in new situations of uncertainty, in a similar way that an entrepreneur would do, leading organizations through growth and transformation towards sustainability (Keskin, 2015; Romme & Reymen, 2018; Sarasvathy, 2008). These considerations underpin a crucial point: as designers acquire these new capabilities and their role becomes more strategic towards the right side of our framework, they should not become something else. They should remain designers and not forget all the capabilities that are described on the left side. Remembering that the path towards sustainable development is collaborative (Manzini, 2017; van Tulder, 2018), designers should use their skills of general specialists in order to bring together people on different levels by being able to move across all the four levels of the framework.

Implications for Managers

If managers want to truly use their influence to promote a sustainable transformation of their organization, they should in the first place acknowledge that designers are not just product makers (T. Brown & Martin, 2015; Liedtka & Ogilvie, 2012). As explained, they should embrace design as a mean of sustainable transformation and involve designers in the strategic decisions concerning corporate sustainability (Jay & Gerard, 2015; S Schaltegger, Lüdeke-Freund, & Hansen, 2012). Specifically, designers may be involved and play a role in balancing the desirability, feasibility and viability dimensions of innovation, with the dimension of sustainability, by performing a set of specific practices (Baldassarre et al., 2017; Bocken et al., 2019; Calabretta et al., 2016). These practices include, but are not limited to, conducting conversational interviews with key stakeholders of the innovation process, leading strategic brainstorming sessions, performing ethnographic observations with customers, conceiving and testing marketing campaigns through digital platforms and prototyping beyond focal products, entire value propositions, service exchanges and business models (Bocken et al., 2019; Schuit, Baldassarre, & Bocken, 2017). Going a step further, managers may consider learning to think more like designers themselves in order to breach corporate conventions and silos, an essential condition for operating sustainably (T. Brown & Martin, 2015; Porter & Kramer, 2011; Yunus et al., 2010).

Limitations and future research

This research has two main limitations. The first limitation relates to the small number of experts we interviewed. We only interviewed eight academic experts. The second limitation relates to our qualitative approach, which is not overly structured due to the exploratory nature of the investigation. We used semi-structured interviews to only start exploring the research question but did not have an interview protocol built on former research.

We encourage future research to address these limitations. A potential way to do that could be to build upon and improve the list of topics that we defined by interviewing more expert about the strategic role of designers for sustainable development by using a more structured data collection protocol. In addition, we see

a fruitful avenue for future research in exploring more in-depth the connections between sustainable design and sustainable business. This might be done with a systematic literature review at the boundary of these two domains.

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