HOW ENVIRONMENTAL SUSTAINABILITY IMPACTS ON DESIGN DRIVEN PRODUCT STRATEGIES

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ABSTRACT

Given the growing emergence of environmental problems, sustainability, and related issues have become strategic in firms aiming to achieve environmental improvement and profitability. This paper aims to investigate how environmental sustainability relates to a design-driven approach to product strategies, focusing the attention on companies which are strongly design-oriented. The objective is to examine to what extent design products in these companies are sustainable at the environmental level. This study is based on an empirical investigation of the Italian manufacturing companies associated to the Industrial Design Association (ADI, Associazione del Design Industriale), by following the entrepreneur's perspective.

Keywords*: Sustainability, Product, Design driven product strategies, Design driven companies, Industrial Design Association (ADI)*

1. INTRODUCTION

Nowadays, increasingly interested customers in environmental issues, legislation changes, environmental pollution and reduction of natural resources, force companies to face new challenges (Karimi Takalo et al., 2021). At the same time, environmental factors are increasingly seen by companies as opportunities to stimulate innovation, drive business efficiency, improve brand positioning and enhance business communication (Santolaria et al., 2011).

Practitioners are aware of the increasing importance of sustainability. For example, Mc Kinsey & Company recognizes sustainability as a strategic priority that carries significant business opportunity and risk, and suggests that success is more likely when executives enable sustainable organizations to actively and strategically engage, being responsible for creating measurable impact (De Smet et al., 2021).

In the context of design, a recent study promoted by the Italian Association of Industrial Design (ADI, Associazione del Design Industriale) stressed the role of environmental sustainability in design-related projects (Fondazione Symbola, 2022).

This paper aims to empirically investigate how environmental sustainability relates to design products and customer value. The objective is to examine to what extent companies adopt environmentally sustainable product strategies (in processes and products) and how they contribute to create value for customers. To achieve this objective, the study performs a quantitative analysis based on a survey addressed to companies which are strongly design-oriented and belong to ADI, the Italian Association of Industrial Design.

2. THEORETICAL BACKGROUND AND RESEARCH QUESTIONS

2.1 Sustainable Product Strategies

Sustainable product strategies are aimed at designing products that offer environmental benefits to consumers, such as reducing CO2 emissions, better product recyclability and energy saving (Varadarajan, 2017). Therefore, sustainable product strategies can concern products and processes aimed at creating environmental benefits.

There is agreement on the importance of sustainable product strategies in addressing concerns about sustainability issues such as climate change, the circular economy and biodiversity loss, because they enable more sustainable behaviours (Adams et al., 2016; Dangelico, 2016; Oduro et al., 2022).

The literature has examined the factors that influence the adoption of sustainable products, including sustainability features, functional performance, consumer beliefs, aesthetic design, and policy support (Bohnsack & Pinkse, 2017; Pickett-Baker & Ozaki, 2008).

As sustainable products create novelty and sustainable benefits, they could have a relative advantage over existing products (Rogers, 1995). However, a consumer divide exists because although consumers claim to have green preferences, many still avoid buying sustainable products (Olson, 2013) and green products are sometimes perceived as having lower functional performance (Luchs et al., 2012).

2.2 Environmental Sustainability and Design Driven Strategies

Environmental sustainability refers to consuming natural resources at a rate below the natural regeneration, or consuming a substitute, generating limited emissions, and not being engaged in activities that can degrade the ecosystem (Karimi Takalo et al., 2021; Kleindorfer et al., 2009).

Design products integrate functionality, technology, aesthetics and meanings (Bloch, 2011; Verganti, 2017), and are able to satisfy customers looking for high quality products, as well as abundant hedonistic and semiotic benefits (D′Ippolito, 2014; M. Luchs & Swan, 2011). However, designers still must develop skills and guidance to design for the new circular economy (Charnley et al., 2011).

A recent study has stressed that sustainability is considered by some entrepreneurs an important attribute of new design product development which creates value for customers (Conti et al., 2019). Other recent studies focused on design management have analyzed sustainable design in organizations according to different perspectives (Jevnaker & Olaisen, 2022). Therefore, good design practice should consider sustainable issues connected to product design (e.g. the use of recyclable materials, low consumption of energy, user-friendly material, etc.) as key elements of competitiveness (Bumgardner & Nicholls, 2020).

2.3 Eco-Design Approaches

Eco-design, is defined as “the systematic incorporation of life cycle considerations into the design of products, processes or services (Tukker et al., 2001) and plays a fundamental role in companies, adding a sustainable value to their strategy (Santolaria et al., 2011). Many techniques have been proposed to adopt and apply eco-design in product development processes (Knight & Jenkins, 2009) but it seems that they are “tools for experts” and are quite generic. By this point of view, a recent study of ADI (Fondazione Symbola, 2022) proposed a checklist identifying the level of environmental sustainability of designers’ project, including several types of sustainable design approaches:

- "design for durability" (the product or its methods of use are designed in such a way as to improve its maintainability, physical and emotional duration);
- "design for reduction" (the products minimize the use of materials and energy and the production of waste);
- "design for recycling" (reduction of the quantity of materials used, use of mono-materials, use of easily recyclable materials and regenerated materials, ease in the separation of materials);
- "design for repairability" (replacement of components or updating of their functions is permitted);
- "design for disassembly" (the aim is to design products using reversible connection systems, functional to the separation of all the components of the different types of materials in order to facilitate the recovery and recycling process);
- " design for regeneration " (functional to the re-manufacture of products with the same or different function of use, or to the design of modular products to facilitate the reuse of parts of the product).

2.4 Research Questions

In this paper, a survey on Italian design driven companies was carried out adopting the checklist proposed by ADI. The main research questions are the following:

> *What types of sustainable design approaches characterize manufacturing design driven companies?*
>
> *How much do the elements of a design product – included environmental sustainability - contribute to the creation of customer value within manufacturing design driven companies?*

3. METHODOLOGY AND DATA COLLECTION

To answer the research questions, a survey was conducted on a sample of Italian manufacturing design driven companies which are members of the Association for Industrial Design (ADI – Associazione del Disegno Industriale).

Based on the literature on eco-design, a questionnaire was designed. A pilot test was carried out on two entrepreneurs and based on their recommendations, some questions were modified and some options for multiple choice questions were added.

The final version of the questionnaire consists of five parts. The first contains questions about the company profile, the second part investigates the impact of sustainability on actual design projects and on design projects of the next three years, and the type of sustainable design approaches adopting the checklist of ADI, the third part is aimed at identifying the contribution of the attributes of a design product to the value creation for customers (aesthetic, functional, high performance, new technologies, new material, sustainability, processing (industrial and or artisanal) and sense making).

Respondents were asked to answer multiple-choice questions and to indicate the relevance of the statements using a five-point Likert scale, where 1 represents “not at all” and 5 represents “very much”.

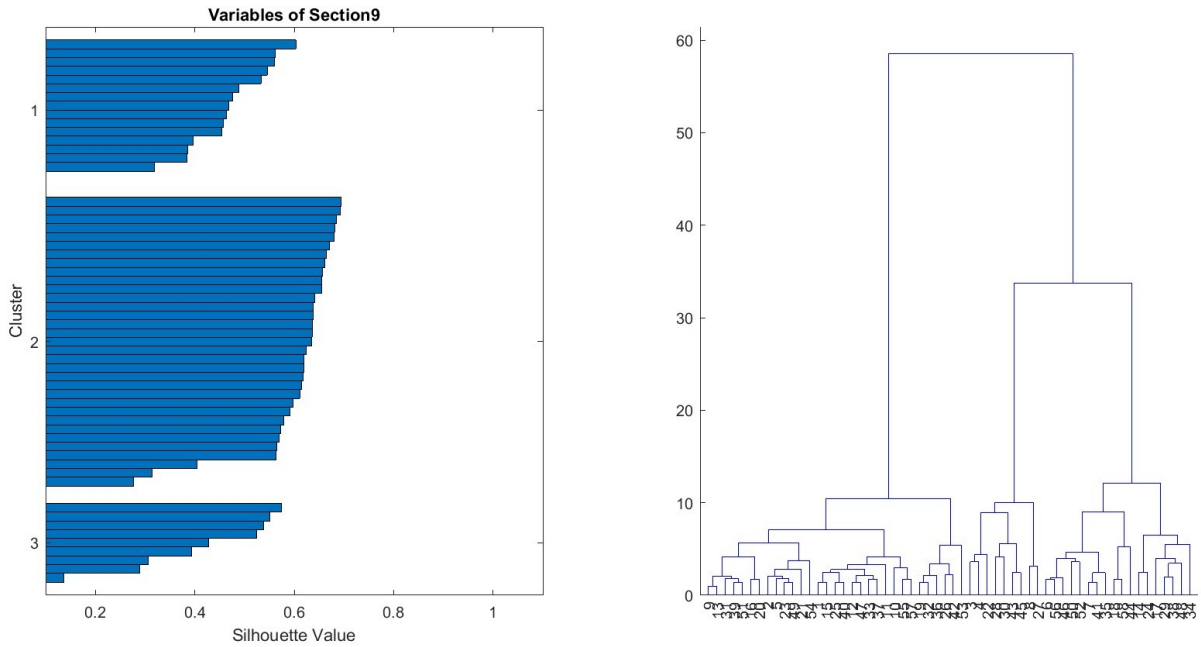
The sample was selected among companies belonging to ADI. A list of all the 146 companies associated with ADI was collected. A questionnaire was sent to these companies by e-mail in June 2022 with the request to have it completed by the entrepreneur/owner. Then, phone calls and personalized emails were sent to each company. 58 useful responses were collected, with a response rate, after personalized reminders, of 39.7%. The largest slice of the sample

consists of small and medium sized companies of the furniture and wood sector located in the North of Italy.
A hierarchical cluster analysis was performed on software Mac-Lab to identify groups of sample companies. The *k-means++ algorithm* uses a heuristic to find centroid seeds for *k*-means clustering.
The results of the cluster analysis based on the Ward method indicate that a three-cluster solution appeared to be appropriate. The graphic representation (Fig. 1), consisting of a silhouette graph and a dendrogram, together with a brief description using the average values, and the most frequent answers over the threshold value of 60%, are presented.
The silhouette graph shows that the data is divided into three groups of approximately equal size. All points in the three clusters have large silhouette values (approximately 0.6 or greater), indicating that the clusters are well separated.
A dendrogram consists of many U-shaped lines that connect data points in a hierarchical tree. The height of each U represents the distance between the two data points being connected.
Fuzzy c-means is a data clustering technique in which a data set is grouped into N clusters with each data point in the data set belonging to a certain extent to each cluster.

4. RESULTS AND DISCUSSION

The Cluster analysis is aimed at highlighting the product attributes of design driven product strategies. It consists of 18 companies in Cluster 1, 31 companies in Cluster 2, and 9 companies in Cluster 3 (Fig. 1).

Figure 1 – Graphic representations (silhouette and dendrogram) of the Cluster analysis



Cluster 1 is composed by 18 companies heterogenous by product type (as half manufacture final products and half industrial products and components) and by size (half are small, half medium and large) that consider aesthetics (77% over the threshold and average value 4.7), functionality, performance, and processing (all attributes about 67% over the threshold and average value about 4.6) the most important attributes of a design product. This is the less "green" cluster, as it attributes low importance to the environmental sustainability (average

value 3.8, the same of cluster 2) among design products attributes. Therefore, it was named "*The functionality-focused companies*".

In the biggest cluster, Cluster 2, there are 31 companies producing mainly final products (76%) and of different sizes (about 50% are small companies and about 50% medium and large) and they all operate in the furniture sector. For these companies the most important attributes of a design product are aesthetics (80.65% over the threshold and average value 4.8) and processing (industrial and/or artisanal) (71% threshold and average value 4.7), followed by functionality, performance and sense-making or meanings. Also, for companies of this cluster environmental sustainability is considered the less important attribute (average value 3.8) of a design product. Therefore, this cluster has been named "*The aesthetics-focused companies*"

Cluster 3 is the smallest cluster composed by 2/3 of companies that produce final products and 1/3 producing components of heterogenous size of different sectors such as sanitary ware, paints, household objects. They attribute high importance to environmental sustainability among design product attributes (average 4.2) at the same level of functionality, new technology and high performance. The most important attribute of a design value that creates value for clients in the perspective of the entrepreneur is aesthetic (77% over the threshold and average value 4.8). For the above reasons we call them "*The green-focuesd companies*".

5. CONCLUSION

The results of this study show the existence of a still low impact of issues related to environmental sustainability in addressing design practices of manufacturing companies in their product strategies. Moreover, a certain heterogeneity in sustainable design approaches emerges, since the three clusters identified stress similarities and differences in terms of the relationship between design-driven product strategies and environmental sustainability.

As a matter of fact, in the entrepreneurial perspective, environmental sustainability is not yet considered among the most important attributes that create value for customers.

A possible interpretation of this results can be linked to the type of products considered. When we think of a design product we usually refer to a product destined to last over time due to its beauty and the iconic values it transmits. Consequently, the problems related to the impact of the processes used, and the recycling and recovery opportunities, become less relevant because it is assumed that a product intended to be preserved over time is less capable of impacting the environment. Indeed, conditioning the results of the study is the fact that most of the companies of the sample belong to the furniture and home accessories industries, and the weight of companies from different sectors, such as apparel and fashion accessories, was much lower. In these cases, the short life of products has a potential greater impact on the environment. Therefore, for future studies on these issues, it would be important to look more specifically at the fashion industry. Another sector to be considered, as regards design-driven product choices, is that of food products, not for the products themselves, but for packaging. Also, in this case there is relevant discussion on the design of packaging which by its nature is largely destined for destruction after use. Even in this case it would be important to identify new models for approaching more sustainable design solutions.

The research adds to the literature on design-oriented companies, showing that the majority of companies continue to pay much of their attention to aesthetics in their product strategies and only a smaller proportion of companies emphasize environmental sustainability. This is an issued linked to the perception of consumers regarding the value attributed to product design, still disconnected from the concept of sustainability. Indeed, according to the interviewees, product choices are still made taking into account what consumers appreciate most, rather than what they should appreciate. Companies can follow sustainable practices and emphasize

their use through communication, as indeed they are starting to do in all sectors, but if consumers do not fully recognize this value, companies will continue to prioritize consumer preferences. The issue is above all at a cultural level. Therefore, what companies can do is to express their social responsibility by contributing to cultural change through communication that associates the design attributes of products with their sustainability characteristics, both in the products themselves and in the processes followed to create them

The research has of course some limits. In addition to the aforementioned focus on durable goods, the most relevant is that the sample size is limited and a wider sample would allow to improve the results and address further analysis. Future research should also include qualitative research (case studies) to analyze in depth some best practices among the most green-focused companies.

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