Received 24 September 2023
Revised 18 January 2024
27 March 2024
Accepted 5 April 2024

Traditional and environmentally friendly attributes in products of highly design-oriented firms: an exploratory study in the perception of Italian entrepreneurs

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Abstract

Purpose – The aim of this study was to empirically examine how much traditional attributes and green attributes characterize products within design-oriented firms. Further, we explored how these attributes relate to the perceived level of innovation of the firms.

Design/methodology/approach – An exploratory research was carried out in 86 Italian manufacturing companies that are members of the Industrial Design Association. Using the questionnaire method, the entrepreneurs' perceptions have been analyzed. Data have been treated with hierarchical cluster analysis.

Findings – The analysis shows that environmental sustainability is the least important attribute of a design product and four clusters of highly design-oriented firms differ by design-product attributes. Further, the least green firms are also the least innovative in terms of incremental and general innovation.

Research limitations/implications – The small size of the sample and the provenance of firms from a single country imply limited generalizability, and further research on the topic is recommended.

Practical implications – Design-driven innovation based on traditional design attributes provides many competitive advantages to firms. However, given the growing concern about environmental challenges, investing in green attributes in design products allows for remaining competitive and more effective in innovation.

Originality/value – This study, for the first time, reveals the heterogeneity among design-oriented firms, particularly regarding the presence and assortment of traditional design attributes, as well as the incorporation of environmentally friendly attributes in their products. Moreover, the study uncovers the relationship between varying levels of green attributes in the offerings and the perception of the firm's innovativeness.

Keywords Design-driven innovation, Product attributes, Environmental sustainability, Green innovation, Design-oriented firms

Paper type Research paper

The TQM Journal
Vol. 36 No. 9, 2024
pp. 114-135
Emerald Publishing Limited
1754-2731
DOI 10.1108/TQM-09-2023-0306

1. Introduction

Design as a source of product innovation is becoming more and more important for competitiveness (Fondazione Symbola, 2022; Moultrie and Livesey, 2014), prosperity and the well-being of companies and nations (EU, 2013; Fondazione Symbola, 2022; Moultrie and Livesey, 2014), especially those with a strong design tradition like Italy or Sweden (Verganti, 2003, 2009). Among European countries, Italy has a high concentration of design-driven companies and the highest number of design services (about 30,000), serving more than 60% of the domestic market, particularly in the furniture and automotive sectors (Fondazione Symbola, 2023).

A plethora of global changes and environmental challenges have however arisen (see, e.g. Buchert *et al.*, 2017; Kautish *et al.*, 2020) that call for new design approaches. Furthermore, design tends to be a highly dynamic but less understood competitor factor, and what kinds of new design attributes are perceived and prioritized by industry entrepreneurs are only sparsely known. Design-driven innovation (DDI) is a special kind of innovation that differs from market-pull and technology-push strategies for product innovation (Verganti, 2003). It is guided by design characterized and focused on the new meaning of products, rather than the novelty of functionality and technology (Verganti, 2003, 2009). Firms that adopt the DDI approach work closely with designers to create breakthrough products with new meanings and languages for users who appreciate them as they make new sense (Verganti, 2003, 2009). However, design is a relatively recent "hot" topic in management studies (Verganti, 2003; Conti and Chiarini, 2021) and requires further theoretical and empirical investigation (Jevnaker, 2012; Wang, 2019). Overall, there is a need for new knowledge and solutions on how both innovative and green product design attributes can be developed.

While existing literature on DDI and the attributes of a design product has identified and extensively explored the "traditional" attributes of design products (such as aesthetics, functionality, etc.), there is a noticeable research gap in understanding how in practice traditional attributes relate to each other.

Being innovative is not sufficient as firms face the pressures for both their external environmental impact and environmental protection (Zhang *et al.*, 2020). In the context of industrial design, the European community has recently proposed to improve the rules to protect industrial designs across the (Fondazione Symbola, 2023), ensuring that designs can be reproduced for replacement parts and, therefore, increasing consumers' choices when repairing complex products such as automobiles. Furthermore, the Italian Association of Industrial Design (Associazione del Design Industriale or ADI) has promoted studies stressing the growing attention paid by designers to environmental sustainability in design-related projects for companies (Fondazione Symbola, 2022, 2023).

However, understanding how design-oriented companies innovate while being environmentally sustainable remains understudied, and the managerial literature investigating both green product innovation and DDI is even more scarce (Aversa *et al.*, 2017; Wang, 2019; Gasparin *et al.*, 2020; Jevnaker and Olaisen, 2022). Thus, the literature on DDI reveals another gap due to the scarcity of empirical research aimed at assessing the extent to which design products are environmentally sustainable (e.g. products made with recyclable materials, products that have a longer lifespan, and those that are more easily repairable) (Luttropp and Lagerstedt, 2006; Brower *et al.*, 2009; Tseng *et al.*, 2013).

To address this gap, this paper builds on research on green product innovation, DDI and the resource-based view (RBV; Barney, 1991), to empirically investigate how much both the traditional and the green design attributes characterize the products of highly design-oriented companies. A third gap in the DDI literature is the limited understanding of how traditional and eco-friendly product design attributes are connected to the innovation of firms. By innovation of the firms, we mean both product and process innovation, including radical and incremental innovation. More specifically, we seek to understand if companies that pay more attention to environmental sustainability in design products are more innovative.

Given that most companies typically undertake incremental product innovation and considering that the literature on DDI is focused on radical product innovation, we find it valuable to examine the perceived presence of traditional and green attributes related to the perceived level of incremental product innovation.

To achieve these objectives, we conducted an exploratory study based on a survey addressed to companies that are strongly design-oriented and are members of ADI. Since entrepreneurs play a central role in the strategic decision-making of companies regarding product innovation and green issues (Banerjee, 2017; Chabowski *et al.*, 2011), knowing their first-hand opinions is fundamental. Hence, the survey has been addressed to entrepreneurs leading highly design-driven firms.

The findings of a cluster analysis conducted on the data gathered via the survey are then reported. A regression was performed to identify the relationship between the groups and the perceived levels of innovation of the firms. Exploring the design-product attributes considered by design-oriented companies may offer theoretical contributions and practical implications for entrepreneurs and policymakers.

The paper begins with a literature review on green product innovation, DDI, green design products and design-product attributes. Then, it describes the research design and data collection. The results regarding the relationship between design-product attributes and innovation are then discussed, and indications for further research are suggested in the conclusion.

2. Theoretical background

2.1 Green product innovation

A transformative shift toward environmentally friendly patterns of consumption and production is required to meet the sustainable development goals (SDG12) of the United Nations' Agenda 2030. In particular, firms are asked to develop sustainable growth, which requires minimizing the use of natural resources and toxic materials and the generation of waste and pollutants throughout the entire production and consumption process. Despite the potential high costs of such changes, the negative environmental impact has forced companies to shift their attention to designing for the environment and eco-efficiency (Banerjee, 2017).

In particular, environmental sustainability refers to consuming natural resources at a rate below natural regeneration or consuming substitutes, generating limited emissions and not engaging in activities that can degrade the ecosystem (Karimi Takalo *et al.*, 2021; Kleindorfer *et al.*, 2009).

The reduced negative impact of innovations on the environment has been described in the literature with terms like "green," "environmental" and "sustainable" innovation (Harc, 2018; Jevnaker and Olaisen, 2022). Green innovation can be defined as innovation that allows firms to reach profitability and environmental improvement (Cillo *et al.*, 2019). Thus, firms must achieve efficiency and market share through constant innovation, which requires resources, capabilities, investments, and a certain degree of ethical responsibility and coherence with the society in which they operate (Oduro *et al.*, 2022). Achieving these objectives is particularly challenging for Small and Medium Enterprises (SMEs), which often have limited resources and competencies compared to large firms (Khizar *et al.*, 2023).

The literature on green innovation is broad and examines the phenomenon from different perspectives (e.g. Dangelico, 2016; Karimi Takalo *et al.*, 2021; Oduro *et al.*, 2022). Regarding the business context, there is agreement on the importance of developing green product strategies in addressing concerns about sustainability issues such as climate change, circular economy and biodiversity loss, with companies being in the condition to enable more sustainable behaviors (Adams *et al.*, 2016; Oduro *et al.*, 2022). In particular,

green product innovation strategies aim at designing products that offer environmental benefits, such as reducing CO_2 emissions, better product recyclability and energy saving (Varadarajan, 2017; Wang, 2019). The literature on green innovation has been developed from both the perspective of firms and customers, as well as other angles. Firms increasingly see environmental factors as opportunities to stimulate innovation, drive business efficiency and improve brand positioning (Santolaria *et al.*, 2011). The potential for firms to develop green innovations increases over time, driven by a growing number of environmentally conscious customers, by the adoption of legislation aimed at environmental protection, reducing pollution and contrasting the diminishing availability of natural resources (Karimi Takalo *et al.*, 2021).

Further, firms with green product offerings are more likely to obtain extended financial gains, improving their business performance (Singh *et al.*, 2019) and ecological performance (El-Kassar and Singh, 2019). In this regard, practitioners recognize the increasing importance of environmental sustainability and the pivotal role played by entrepreneurs and top management in this area. For example, sustainability is recognized by McKinsey and Co. As a strategic priority that carries significant business opportunities but also risk, it 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).

The literature has also examined the factors that influence the consumer demand for sustainable products, including green features, functional performance, consumer beliefs, aesthetic design and policy support (Bohnsack and Pinkse, 2017; Wang, 2019). Although consumers claim to have green preferences, many still avoid buying sustainable products (Olson, 2013), since green products are sometimes perceived as having lower functional performance (Luchs *et al.*, 2012). However, a growing body of literature has stressed that sustainable product attributes and communication about sustainability contribute to the development of an environmentally sustainable lifestyle (Kumar and Christodoulopoulou, 2014). For instance, they increase the awareness of the selection and recyclability of products to protect the environment (Hartmann and Siegrist, 2017; Peyer *et al.*, 2017). In a similar vein, other scholars have emphasized that consumers are more and more aware of the importance of buying low-impact, organic, healthy and natural products (Abutaleb and El-Bassiouny, 2020; Kautish *et al.*, 2020).

2.2 Design-driven innovation and design-product attributes

DDI is a specific kind of innovation that differs from technology-push and demand-pull innovation as designers play a central role in promoting new, aesthetically beautiful and functional products that can incorporate new technologies and have new meanings (e.g., Jevnaker, 2005). Design products (in the meaning design-associated products) tend to integrate functionality, new technologies, beautiful aesthetics, high performance, perfect processing of new materials and new meanings (Kotler and Rath, 1984; Bloch, 2011; Verganti, 2003, 2009; De Mozota, 2008) and can satisfy customers looking for high-quality products as well as abundant hedonistic and semiotic benefits (D'Ippolito, 2014; Luchs and Swan, 2011).

Even though the importance of design for competitiveness is well documented in many countries, especially those with a strong design tradition, such as Italy and Sweden (De Mozota, 2008; Verganti, 2003, 2009), this kind of innovation requires further theoretical and empirical deepening in management studies. The first gap in the literature relates to understanding which traditional attributes characterize design-associated products and how these attributes interrelate.

Another gap is the lack of research, particularly studies that investigate the intersection of green product innovation and design-product innovation (Jevnaker and Olaisen, 2022).

Both academics and practitioners have recognized the importance of integrating environmental sustainability among design-product attributes. DDI is mainly a kind of innovation that is potentially strongly connected to green issues as it refers to radical innovation. Talented designers who are highly creative individuals immersed in a very creative network of actors (the design discourse) can design and co-develop green design products that customers may appreciate as very different from those on the market and as having new, interesting meanings (Wang, 2019).

An earlier study emphasized that designers must develop skills and guidance to design for the new circular economy (Charnley *et al.*, 2011) and recent industrial reports reveal that many designers express a strong dedication to offering green design services (Fondazione Symbola, 2022, 2023).

Environmentally friendly attributes are, indeed, considered by some entrepreneurs important attributes of design products that create value for customers (Conti *et al.*, 2019). Other recent studies focused on design management have analyzed environmentally sustainable design in organizations from different perspectives (Aversa *et al.*, 2017; Gasparin *et al.*, 2020; Jevnaker and Olaisen, 2022). Therefore, good design practice should regard sustainable issues (Brower *et al.*, 2009; Tseng *et al.*, 2013) connected to product design (e.g. the use of recyclable and user-friendly materials, products that last longer, more easily repairable, low energy consumption, etc.) as key elements of competitiveness (Bumgardner and Nicholls, 2020).

Many stakeholders, including governments, consultants and trade associations, have also recognized the importance of green DDI. At the European level, the recent ecological transition has stressed the importance of designing and manufacturing recyclable products and components. Recent studies promoted by the ADI emphasized that environmental sustainability in designer projects is increasing, and specific eco-design approaches to new design products are emerging (Fondazione Symbola, 2022, 2023). In particular, Italy is characterized by a high presence of design companies that offer services to manufacturing firms, especially in the furniture and automotive sectors, which are highly innovative and competitive in the international context (Fondazione Symbola, 2022, 2023).

RBV offers appropriate theoretical lenses to integrate DDI and green product innovation.

In the context of the RBV (Barney, 1991), implementing green product innovation in design-oriented firms can be classified as a resource that requires specific capabilities. To be sources of sustained competitive advantage, green and design innovation resources and capabilities must be valuable, rare, inimitable and not substitutable. Green innovation within the design sector can be seen as valuable and not substitutable as it can improve firms' competitive advantage and profitability in the long term. Although creating green design products may not seem rare or inimitable, its implementation must be tailored to the specific needs, limitations and capabilities of each firm. The management of green innovation integrated with the business strategy (Porter and Van der Linde, 1995) may generate a competitive advantage in environmental sustainability (Serrano-García *et al.*, 2021) and superior financial performance (Sharma and Vredenburgh, 1998), which are deeply rooted in the firm's resources and capabilities, as posited by the RBV. Importantly, radical green innovation is characterized by higher complexity and uncertainty (Dai *et al.*, 2015; Martínez-Ros and Kunapatarawong, 2019) than incremental green innovation. Consequently, since DDI primarily focuses on radical product innovation, incorporating eco-friendly features in design products presents an even greater challenge in the context of RBV.

Thus, the literature on green innovation, DDI and RBV offer appropriate theoretical lenses through which to understand the integration of green attributes in design products of highly design-driven companies.

2.3 Green design products and firm innovativeness

On one side, DDI firms are highly innovative companies as designers help them generate radical and design-based innovation (Verganti, 2003, 2009; Jevnaker, 2005, 2012). On the other side, the literature on eco-innovation and eco-design suggests that to protect the environment both product innovation and process innovation must try to contribute to limiting the environmental impact (Karimi Takalo *et al.*, 2021; Kleindorfer *et al.*, 2009). Thus, it seems important that design products need to incorporate green attributes together with traditional design attributes.

In this regard, the life cycle assessment (LCA) is one of the most appreciated methods in the green literature for evaluating the environmental impact of products, starting with the collection and quantification of inputs and outputs for a specific product system throughout its life cycle (Suh and Huppes, 2005; Reap *et al.*, 2008). This method is based on objective data and is time-consuming. In this paper, we adopt a different and unique angle, focusing on the subjective perspective of entrepreneurs.

Since entrepreneurs play a key role in innovation processes (e.g. Liu *et al.*, 2022), in the context of DDI, we assume that entrepreneurs work together with designers and play a key role in innovation decisions, and, therefore can evaluate if and how their products are environmentally friendly.

It is well-known that innovation performance primarily stems from product innovation (Liu *et al.*, 2022) and that multiple methods are available to measure innovation performance, both subjective and objective (e.g. financial measurements, patent measurement methods, etc.). Hence, to assess green design-product innovation, we opt for a more subjective approach over the complex LCA method, concentrating on the entrepreneur's perceptions of the green attributes of a design product.

While the relationship between DDI and innovation performance and competitiveness in design-driven firms is well documented (Moultrie and Livesey, 2014), as well as the contribution of DDI to customer value creation (De Goey *et al.*, 2019), the relationship between design-product attributes and innovation of the firms has received less attention. Furthermore, green design innovation in companies is hitherto only sparsely researched (Brower *et al.*, 2009; Tseng *et al.*, 2013; Wang, 2019).

As the literature on DDI primarily focuses on radical product innovation, the relationship between design-product attributes and the firm's innovativeness, specifically product and process innovation and incremental product innovation has not yet been explored. Given that design-driven firms, like all firms, should continuously undertake product and process innovation, as well as incremental product innovations, it would be valuable to understand how design-product attributes relate to product and process innovation, as well as to incremental product innovation, from the entrepreneur's view.

Therefore, our empirical study contributes to the analysis of both the traditional attributes and the green attributes that characterize design products to understand how these attributes interrelate and how they relate to the perceived level of product and process innovation (and, more specifically, to incremental product innovation. The research questions are as follows:

RQ1. What types of traditional and environmentally friendly attributes characterize the products of design-oriented firms?

RQ2. To what degree do the identified clusters based on the product attributes differ in terms of product type, company size, sector and revenues?

RQ3. What is the relationship between the traditional and environmentally friendly attributes of design products, and the level of product and process innovation and incremental product innovation of the firms, in the entrepreneurs' view?

3. Methodology and data collection

To answer the research questions, a survey was conducted on a sample of Italian design-driven manufacturing companies that are members of the ADI. Given the current gaps of knowledge and solutions in DDI and green design in management studies, this approach allowed us to explore which types of product attributes and levels of design innovation are addressed specifically in a relevant set of contemporary design-oriented firms. A questionnaire was created based on the literature on DDI and green product innovation making the exploration theory-informed. A pilot test was carried out with two entrepreneurs, and their recommendations were used to modify some questions and add options for multiple-choice questions.

The final version of the questionnaire consists of three parts. The first contains questions about the company's profile, and the second investigates design-product attributes – aesthetics, functionality, high performance, new technologies, new materials, processing (industrial and/or artisanal), new meanings (or sense-making) and environmental sustainability – and the third investigates the innovativeness of the firms, including incremental innovation and the general level of innovation (that is product and process innovation). Respondents were asked to indicate the relevance of statements using a five-point Likert scale, where 1 corresponds to "not at all" and 5 to "very much."

The sample was selected from the list of 146 companies associated with the ADI. Data were gathered between July 2022 and January 2023, requesting that the questionnaire be completed by the entrepreneur/owner. Then, phone calls and personalized emails were sent to each company. A total of 86 useful responses were received after personalized reminders, representing a response rate of 58.9%. Most of the sample consists of small and medium-sized companies in the furniture and wood sector located in the northern part of Italy.

3.1 Cluster variables

The sample companies were classified and described according to fourteen criteria. The first eight variables of the clustering are the key design-product attributes derived from the literature. Seven attributes were identified in the DDI literature (Bloch, 2011; Kotler and Rath, 1984; Verganti, 2003, 2009; De Mozota, 2008): aesthetics, functionality, high performance, new technologies, new materials, perfect processing and new meanings. Environmental sustainability, the eighth attribute, consists of consuming natural resources at a rate below the natural regeneration, product recyclability and energy saving (Varadarajan, 2017) 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). Hence, a design product is considered environmentally sustainable if both the product and the innovation processes are aimed at reducing the negative impact and/or creating benefits for the environment.

The last four variables describe the characteristics of the companies' profiles:

(1) Product type: consumer, industrial and component.

(2) Company size: micro (less than 10 employees), small (11–50 employees), medium (51–250 employees) and large (more than 250 employees).

(3) Sector: furniture and wood, lighting technology, household goods, sanitary ware, mechanics, footwear and accessories, building and complementary activities, agrifood, accessories for pets and others.

(4) Revenues: five discrete categories calculated in millions of euros (<1, 1–4, 5–9.9, 10–49.9, >50).

3.2 Tandem approach to clustering: a pure data-driven view of opinion data

The methodology adopted for the clustering of respondents' opinions was the classic and well-known strategy of the tandem approach to cluster analysis (Aluja and Morineau, 1999). As part of a sequential (tandem) approach, the analyst can apply a dimension-reduction technique and then subject the low-dimensional orthogonal solution to a clustering algorithm (Lebart *et al.*, 1984). In our case, the tandem strategy was applied to the answers to the eight items that represent design attributes that may have value for customers. The data matrix was diagonalized by using principal component analysis, and the structure of correlations generated by the respondents concerning the eight items was analyzed. To reduce the bias generated by the subjective use of the suggested scale in the survey, a new scale (between −1 and +1) was adopted.

The importance of the size effect was very high and emerged from the first principal component, which was correlated to the individual average value for a correlation coefficient, which reached 0.9998. After the size effect was removed and the tandem approach to the new opinion variables was adopted, the dendrogram in Appendix 1 was obtained. Using the finest of the three possible tree-cut levels, four clusters of companies were generated. Multivariate analysis indicated that statistically significant differences existed between the four clusters.

The semantic content of the four groups of companies was obtained from a statistical description of each of the clusters, using both the variables that algorithmically determined the clustering (active variables) and the descriptors listed above (illustrative variables). The statistical technique of description is based on the calculation of an adequate test-value to measure the probability that the difference between a single cluster and the entire sample is random. We relied on the *t*-test for the quantitative variables and on a hypergeometric distribution penalized with the dimensions of the single cluster for the characterization provided by the single categories of a qualitative variable (Lebart *et al.*, 1984).

Fundamentally, our approach aimed to represent data-driven clusters, defined by the analysis of a dendrogram; the constructs have naturally been defined by homogeneous sets of respondents, rather than merely "simplifying" the number of individuals in the analysis. This approach is in line with what has been expected, suggested and studied over the years by the aforementioned school of multidimensional data analysis (Bezécri, 1987).

Moreover, regression analysis was conducted to explore any significant associations between clusters and the incremental innovation activities and overall innovative activities of the firms.

4. Results

Before answering the research questions, the basic characteristics of the sample of highly design-oriented firms are presented in Table 1. As this table shows, the largest share of the sample consists of small- and medium-sized companies in the furniture and wood sector located in the North of Italy.

To answer the first research question (RQ1), aimed at identifying the types of traditional and environmentally friendly attributes that characterize products of the ADI companies, descriptive statistics and cluster analysis were performed. Table 2 presents descriptive statistics relating to the different attributes that characterize design products based on a five-point Likert scale. The most relevant attributes that characterize design products from the entrepreneurial perspective are aesthetics (4.78), perfect processing (4.57) and functionality (4.50), followed by high performance (4.40) and new meanings (4.34). Environmental sustainability is considered by entrepreneurs the least characterizing attribute of their design products (3.93).

We delved deeper into this finding and used cluster analysis to identify clusters of design-driven companies significantly characterized by specific product design attributes. To this

	n	%
Product Type		
Consumer product	55	63.95
Industrial product	16	18.60
Components	15	17.44
Sectors		
Furniture and wood	48	55.81
Other	8	9.30
Lighting technology	7	8.14
Household goods	6	6.98
Sanitary ware	5	5.81
Mechanics	4	4.65
Footwear and accessories	2	2.33
Buildings and complementary activities	2	2.33
Agrifood	2	2.33
Accessories for pets	2	2.33
Company size		
Micro (<10 employees)	13	15.12
Small (11–50 employees)	25	29.07
Medium (51–250 employees)	31	36.05
Large (>250 employees)	17	19.77
Geographical provenance (Italy)		
North	62	72.09
Center	21	24.42
South	3	3.49
Revenue class (mil. euros)		
<5	20	23.26
5–9	9	10.47
10–49	32	37.21
50–99	12	13.95
100–199	5	5.81
200–400	4	4.65
>400	4	4.65
Revenue trend in the last 3 years		
Increasing	57	66.28
Stable	25	29.07
Decreasing	4	4.65

Table 1.
Descriptive statistics of the sample

Note(s): $n = 86$
Source(s): Table by authors

scope, we identified the cluster variables grounded in the relevant literature and empirically investigated how they are related to each other.

Four groups of ADI companies were identified as a result of the hierarchical cluster analysis. Table 3 shows the values of the *t*-test adjusted based on the adoption as a hypothesis of the simultaneous random extraction of the respondents in a cluster. In other words, we postulated equality between the judgment expressed on a single item by the specific cluster and what was expressed on average by the entire sample. For test values greater than approximately 2, the probability that a difference is observed between the cluster and the sample tends to be 0. Hence, this item significantly characterizes (positively or negatively) the cluster (Lebart *et al.*, 1984).

Variables	Mean	St. Dev	Min	Max
Design-product attributes				
Aesthetics	4.78	0.44	3	5
Functionality	4.50	0.65	2	5
New technologies	3.99	0.96	1	5
New materials	3.94	0.91	2	5
High performance	4.40	0.64	3	5
Environmental sustainability	3.93	0.81	2	5
Perfect processing	4.57	0.56	3	5
New meanings	4.34	0.79	2	5
Average values	*4.31*	*0.72*	*2,25*	*5*

Source(s): Table by authors

Table 2. The attributes that characterize design products (N = 86)

Variable	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Aesthetics	−0.32	2.38	0.86	−2.57
Functionality	0.40	−0.72	2.57	−2.18
New technologies	6.07	−4.03	−2.70	0.85
New materials	−1.40	2.79	−4.99	3.60
High performance	−0.18	0.52	0.17	−0.45
Environmental sustainability	0.12	1.30	−2.10	0.81
Perfect processing	1.81	2.42	3.92	−7.35
New meanings	4.08	3.18	−3.58	−2.75

Source(s): Table by authors

Table 3. Synthesis of the results of the cluster analysis (active variables)

The four clusters created based on the eight active variables are presented in detail in Appendix 2.

Next, Table 4 identifies the categorical descriptive variables of each cluster according to a probabilistic ranking criterion, with a significance level greater than 90%, allowing us to answer RQ2.

Finally, Table 5 shows the results of the regression analysis. It allows us to answer RQ3. In particular, it shows how the four clusters relate to the perceived level of incremental product innovation and product and process innovation (both radical and incremental) of the firms.

The three previously presented Tables (3)–(5) will all be described later when we explain the characteristics of the four clusters. Specifically, a description of each cluster using the

Cluster	Variable	Characteristic category	Test-value
Cluster 1	Turnover trend (last 3 years)	Decreasing	1.99
Cluster 2	Turnover trend (last 3 years)	Stable	1.50
	Revenue (million euros)	5–10	1.47
	Size	Micro (<10)	1.42
	Revenue trend (last 3 years)	Increasing	−1.57
Cluster 3	Sector	Sanitary ware	1.44
	Sector	Others	−1.33
Cluster 4	Sector	Others	9.87
	Revenue trend (last 3 years)	Increasing	1.45

Source(s): Table by authors

Table 4. Synthesis of the results of the cluster analysis (categorical descriptive variables)

Table 5.
Regression results: the impact of design-product attributes on innovation

Parameter label	Coefficient	Computed or deduced	Standard deviation	Student - N.F (82)	*p*-value	Test-value
Incremental product innovation						
Cluster 1	0.3634	Computed	0.167	2.181	0.032	2.14
Cluster 2	−0.4602	Computed	0.167	2.762	0.007	−2.69
Cluster 3	0.0276	Computed	0.148	0.186	0.853	0.19
Cluster 4	0.0692	Deduced	0.142	0.489	0.626	0.49
CONSTANT	3.9308		0.090	43.582	0.000	16.12
Product and process innovation						
Cluster 1	0.3338	Computed	0.126	2.652	0.01	2.59
Cluster 2	−0.078	Computed	0.126	0.62	0.537	−0.62
Cluster 3	−0.2618	Computed	0.112	2.335	0.022	−2.29
Cluster 4	0.006	Deduced	0.107	0.056	0.955	0.06
CONSTANT	4.1368		0.068	60.715	0	17.68

Source(s): Table by authors

results of the cluster analysis with active variables (Table 3) and illustrative variables (Table 4), as well as the results of the regression that identifies the impact of design-product attributes on firms' incremental product innovation and product and process innovation (Table 5) follows.

In Cluster 1, composed of 17 firms, new technologies (6.07) and new meanings (4.08) positively and highly significantly characterize the design products of the firms as compared to the sample. Firms with decreasing revenues in the last three years prevail. This cluster shows the highest significant and positive impact of design-product attributes on incremental product innovation (2.14) and product and process innovation of the firm (2.59). Hence, in the entrepreneurs' view, these firms are perceived as more innovative than the total sample firms. Therefore, we called this cluster *new technology and innovative design-driven firms*.

In the second cluster, comprising 17 firms, new meanings (3.18) and new materials (2.79), but also perfect processing (2.48) and aesthetics (2.38) positively and significantly characterize the products of the companies. Unlike with the first cluster, these companies differ from the total sample companies in new technologies (−4.03), which are highly and negatively significant attributes. For these reasons, we named the cluster *classic low-technology design-driven firms*. The prevailing firms of this cluster are micro, with revenues between 5 and 10 million euros, a stable revenue trend in the last 3 years. It is the cluster with the lowest presence of an increasing revenue trend. This cluster shows the highest significant and negative impact of design-product attributes on incremental product innovation (−2.69). These companies are perceived by entrepreneurs as the least innovative in terms of incremental product innovation among the companies of the total sample.

Cluster 3 is composed of 24 firms that are significantly and positively characterized by perfect processing (3.92) and functional (2.57) design products. However, the design-product attributes such as new materials (−4.99), new meanings (−3.58) and new technologies (−2.70) characterize the cluster much less in comparison to the overall sample. Further, these firms are perceived as the least green of the sample as environmental sustainability significantly and negatively (−2.10) characterizes this cluster. Therefore, these firms, second only to those of Cluster 4, are lowly design-driven firms. In this cluster, firms dealing in sanitary prevail. These firms are considered by entrepreneurs to be the least innovative firms among all clusters, as design-product attributes impact significantly and negatively on product and process innovation (−2.29). Hence, we dubbed the cluster *least green, least innovative and lowly design-driven firms*.

Cluster 4, the largest cluster, containing 28 firms, differs from the total sample in that new materials (3.60) significantly characterize the firms' design products. However, these firms are significantly and negatively characterized by the following classic design-product attributes: perfect processing (−7.35), new meanings (−2.75), aesthetics (−2.57) and functionality (−2.17). These firms are perceived by entrepreneurs as the least design-driven firms of the sample, seeing as many of the classic attributes of a design product such as aesthetics, functionality, new meanings and perfect processing characterize much less the cluster as compared to the sample. For this reason, this cluster is referred to as the *least design-driven firm*. Firms in 'other sectors" and with increasing revenues dominate.

5. Discussion

In this paper, we aimed to identify how the products of design-oriented firms are characterized in terms of traditional and green attributes of their products (RQ1), if there are differences among the firms in terms of size, sector, revenue and provenance (RQ2), and what links exist between the attributes of design products and the firm's innovation (RQ3). Regarding RQ1 – the types of attributes that characterize the products - we found that there is primarily heterogeneity among firms in the presence and composition of traditional attributes.

The results of our study using descriptive statistics show that aesthetics, functionality, perfect processing, high performance and new meanings are considered by entrepreneurs to be the attributes that primarily characterize their products. Whereas environmental sustainability somewhat surprisingly was perceived as the least characterizing attribute.

This initial finding indicates that on average contemporary Italian entrepreneurs in ADI of our sample still place significant relevance on the traditional attributes of a design product as highlighted in the literature, whereas environmental sustainability is deemed the least relevant attribute. This result, if compared to the surveys conducted on Italian designers, shows a gap, as professionals seem to be more open and proactive about green issues in the design context (Fondazione Symbola, 2022, 2023).

A possible interpretation of this result relates to the fact that well-designed products could be considered intrinsically sustainable. Design products (except fast-fashion) are usually thought of as products destined to last over time due to their beauty, robustness, perfection and the meaning they communicate (Verganti, 2003). Consequently, issues related to the impact of the processes used and recycling/recovery opportunities become less relevant if it is assumed that a good design product is intended to be preserved over time and has a lower impact on the environment. However, studies indicate that design can be sustained as well as unsustained (Fallan, 2019). Furthermore, firms' orientations toward environmental issues may be interpreted as lagging and perhaps currently changing (Khizar *et al.*, 2023). More sustainable product attributes may also in the beginning be both uncertain and complicated to perceive (see, e.g. Jevnaker and Olaisen, 2022), but are becoming increasingly essential in all the industrial sectors, especially in the furniture and home accessory sectors (Conti and Chiarini, 2021), which represent the majority of our sample. In other sectors (e.g. fashion), the short life of products has a potentially greater impact on the environment (Zimon *et al.*, 2022).

To answer RQ1, we further explored through cluster analysis whether and how the traditional design-product attributes of firms differ and what role environmental sustainability has in the products of these firms. We found that design-driven firms are quite heterogeneous both regarding the composition of traditional design-product attributes and the presence of environmentally friendly attributes.

Based on our survey, we identified four clusters. The two smallest clusters, Cluster 1 and Cluster 2, consist of the most design-driven firms. These are firms whose products are distinguished by a higher characterization of traditional design-product attributes compared

to the firms in the sample. Conversely, the other two clusters, Cluster 3 (*least green, least innovative and lowly design-driven firms*) and Cluster 4 (*least design-driven firms)*, the largest ones are composed of relatively less design-oriented firms. Specifically, these are firms whose products are marked by a lower prevalence of design attributes when compared to the sample companies.

Interestingly, among the two most design-oriented clusters, Cluster 1 (*new technology and innovative design-driven firms*) is significantly characterized by products with new technologies and new meanings while Cluster 2 (*classic low new technology design-driven firms*) is significantly and positively characterized by products with classic attributes such as new meanings, new materials, perfect processing and aesthetics but new technologies are much less characteristic of the products. New meanings consistently emerge as a significant attribute alongside the high presence of traditional elements. Differently, the literature on DDI underscores the different mix of these traditional attributes and the contribution of diverse attributes to the creation of a "beautiful and well-crafted" design product (e.g., Verganti, 2003, 2009; De Mozota, 2008; Fondazione Symbola, 2022; Jevnaker, 2005). Therefore, addressing RQ1 reveals a significant heterogeneity among the composition of traditional attributes in design-oriented firms, thereby adding new knowledge to the DDI literature.

Furthermore, our research revealed that the least design-driven cluster (Cluster 3) in terms of high characterization of traditional product attributes is the least green, adding knowledge to the literature. Specifically, we found that the least design-driven firms distinguished by significant and positive functionality and prefer processing but significant and negative new materials, new technologies and new meanings, are also the least environmentally sustainable. In short, in our study, the lack of environmental sustainability is associated with the lack of new materials, new technologies and new meanings rather than other traditional attributes. Differently, the literature on DDI traditionally overlooks the green attributes of design products. Therefore, addressing RQ1 also reveals that green attributes of a design product must be inquired into and included among design product attributes.

In short, our study introduces fresh insights into the DDI literature, which typically presents a set of closely related attributes and might not include green attributes. By highlighting the varied and heterogeneous nature of design attributes, our research expands the understanding of DDI.

RQ2 sought to identify differences among the firms within the aforementioned clusters in terms of product type, size, sector and revenues. The results of this study outlined that these firms differ slightly in terms of the prevalence of these characteristics. The main finding is that among the most design design-oriented firms in terms of traditional attributes (Cluster 2) small firms prevail and in the most tech firms (Cluster 1) revenues in the last three years are decreasing. Additionally, in Cluster 3, sanitary wave prevails and in the least design-oriented firms (Cluster 4), the largest cluster distinguished by significant use of new materials, revenues have increased in the last three years. Thus, the illustrative variables do not offer notable points of discussion and the main contribution to the literature is the prevalence of small firms among the most design-oriented firms. With the RQ3 we aimed to understand the link between traditional and green attributes of products and innovation, specifically product and process innovation of the firm and incremental product innovation.

Two are the main results. First, among the two most design-oriented clusters, Cluster 1 (*new technology and innovative design-driven firms*) distinguished by the presence of new technologies and new meanings is perceived by the entrepreneurs as the most innovative cluster in terms of both product and process innovation and incremental product innovation. Second, and conversely, Cluster 3 (*least green, least innovative and lowly design-driven firms*) shows a prevalence of perfect processing and functionality among attributes, but new materials and new technologies are much less represented concerning all sample firms and

are perceived as the least innovative. Therefore, the association between the prominent presence of new technologies and new meanings in a design product and the firm's innovation capacity (Cluster 1) is corroborated by Cluster 3. Conversely, when new technologies are an attribute that characterizes much less design products, firms are perceived by entrepreneurs as the least innovative.

These findings suggest that highly design-oriented firms' innovation is associated with new technologies and new meanings. Conversely, the absence of a strong presence of new technologies and new materials could significantly impede the development of innovation.

Further, we found that Cluster 2 (*classic low new technology design-driven firms*) is significantly and positively characterized by products with classic attributes but new technologies are much less characteristic of the products. It is perceived as the least innovative cluster in terms of incremental product innovation. This confirms that the absence of new technologies and new meanings is also impossible to develop incremental product innovation.

Hence, answering RQ3 adds further knowledge as seems that the prevalence of new technologies and new meanings among product attributes is associated with both product and process innovation and, incremental product innovation. New technologies and new meanings are perceived by entrepreneurs as the most important attributes capable of generating - more than other classic attributes – product and process innovation and, more specifically, incremental product innovation in design products. To summarize, our study reveals that among design-driven firms, the majority do not exhibit all the classic design attributes typically associated with an ideal design-driven company and a product characterized by all these classic attributes, as suggested in the literature. Another compelling insight for the literature on design innovation is the observed association that the firms with a high prevalence of new technologies and new meanings are also perceived as the most innovative from the entrepreneur's perspective. Further, it is noteworthy to point out that a group of firms that rank the lowest in terms of traditional design attributes also rank the lowest in both innovation and environmental sustainability. These firms are not only less design-driven in terms of classic design-product attributes than the two most design-oriented clusters. From their entrepreneurs' responses they turn out to be also the least innovative, and the least green. Although the study reveals that the green attribute is perceived as the least characteristic of design products, it also shows that there are companies whose products have relatively fewer green components. And it seems that these companies invest relatively less in new technologies and new materials, according to entrepreneurs. Hence, the green attribute should be included in the list of design-product attributes.

6. Conclusion

Given the gaps in knowledge and solutions on sustainable design attributes in management studies, our explorative study focuses on product design attributes of Italian firms with relevant design orientations. The main result of the study is that strongly design-oriented firms are quite heterogeneous in terms of the distribution of attributes in their design products, as perceived by entrepreneurs. From the sample of ADI companies analyzed the two smallest clusters are characterized by a higher presence of traditional design attributes, while the two largest clusters are less characterized by these attributes. This was surprising when taking both the vast product innovation literature as well as the rich ADI-related design expertise in this study context into account.

Our study also offers new insight into the kinds of heterogeneity in the design orientations of the companies analyzed. Companies with a higher prevalence of attributes such as new meanings and new technologies are perceived as the most innovative if compared to the sample. Conversely, companies that use fewer new technologies and fewer new materials are perceived as the least innovative. Additionally, another significant result is that

environmental sustainability is the least characteristic attribute of the design products of the examined companies. However, one out of four clusters, among the two less design-oriented ones, is both the least sustainable and the least innovative in terms of product and process innovation and incremental product innovation.

Based on the explorative results, our undertaking offers contributions to the literature on both design innovation and product attributes, as well as several implications for practitioners.

6.1 Theoretical contributions

This paper first contributes to furthering the understanding of DDI literature primarily related to entrepreneurs' views toward their firms' essential product attributes. Specifically, we shed light on how design-product attributes relate to each other (e.g., Bloch, 2011; De Mozota, 2008; Verganti, 2003, 2009) in the set of design-oriented firms studied and how environmental sustainability characterizes design products, which has received relatively little attention as of yet in terms of empirical studies of contemporary small and medium-sized firms (Conti *et al.*, 2019; Jevnaker and Olaisen, 2022).

Second, the study contributes to a novel understanding of the relationship between product attributes and a firm's distinctive design orientation. One interesting result concerns the large heterogeneity of the mix of the traditional design-product attributes among design-driven firms in the entrepreneurs' views. Underlining classic design-product attributes, we found that highly design-driven firms differ in this mix. Surprisingly, new meanings – a very important aspect featuring a design (i.e. a highly design-associated) product – characterize only two clusters out of four, the smallest and most innovative ones. Among the most design-driven companies, some are much more new technology oriented (Cluster 1), whereas others (Cluster 2) have no new technology orientation but are characterized mostly by new materials, perfect processing and aesthetics. These identified patterns thus contribute to enriching the existing literature (among other Verganti, 2009; De Mozota, 2008; D'Ippolito, 2014) as they offer a highly differentiated view of design-driven SMEs.

Third, our study contributes to novel insights into some key, contemporary patterns of product design attributes. Among design-oriented firms, a majority of the sample firms exhibit a minimal presence of classic design attributes; in other words, they are only modestly oriented toward design-driven approaches. Two clusters, the smallest ones, are characterized by a strong presence of classic attributes. Accordingly, the theoretical understanding of design innovation in firms needs to distinguish the great heterogeneity of product design approaches and the consequential highly different combinations of product attributes. Interestingly, even in a set of highly design-oriented firms in an Italian relatively design-informed context, it seems that only a smaller group of enterprises are actually "design-driven" in the original radical innovation sense (Verganti, 2003, 2009).

Moreover, our study sheds light on the entrepreneurs' first-hand perspectives on environmental sustainability in design products (Conti *et al.*, 2019). It is worth noting that environmental sustainability is still regarded among entrepreneurs as less important than other design-product attributes, which deserves further discussion (Jevnaker and Olaisen, 2022). We proposed a possible interpretation of this result related to the fact that well-designed products could be considered intrinsically sustainable and destined to last over time due to their beauty, meanings and perfection, they communicate (Verganti, 2003). Thus, issues related to the impact of the processes used and recycling/recovery opportunities become less relevant if it is assumed that a good design product is created to be preserved over time and has a lower impact on the environment.

Further, we observed that one cluster (Cluster 3) is less green than the others and it is the least design-driven and innovative one. These diverse orientations we identified can also

improve the understanding of (lack of) green product innovation (e.g., Peyer *et al.*, 2017; Kautish *et al.*, 2020). Hence, the ability to create new design products with a low impact on the environment may be associated with a higher 'green" culture and/or green capabilities in a few firms/sectors (Dangelico, 2016; Oduro *et al.*, 2022), and, therefore, also with the rare practices and perceptions of higher levels of innovativeness (Jevnaker, 2005, 2012).

Finally, for the first time in a mainly SME-intensive survey, we identified how product attributes relate to firms' process and product innovation (including both radical and incremental innovation), and incremental product innovation. The relationships between DDI, radical product innovation, innovation performance, and competitiveness are documented in the literature (Moultrie and Livesey, 2014), but less is known about the relationship between design-product innovation and process and product innovation and, more specifically, incremental product innovation (Jevnaker, 2012, Conti and Chiarini, 2021). We found that some firms that are highly characterized by new technologies and new meanings are also perceived as the most innovative both in terms of process and product innovation and of incremental product innovation. Conversely, some low design-oriented companies that are less characterized by new technologies (Cluster 3) develop the lowest level of innovation.

Our design-informed discussion resonates with essential streams in strategy thinking. In light of the RBV in strategic management (Barney, 1991), it seems that to be competitive in the long term, design-driven firms have to manage resources and capabilities to create design products that are valuable, rare, inimitable and not substitutable. The green attribute is important to ensure beneficial differentiation while not harming the environment (Cillo *et al.*, 2019; Karimi Takalo *et al.*, 2021). In this respect, designers often represent an external or collaborative source of capabilities for firms, which can become strategic over time (Jevnaker, 2012). However, the fact that entrepreneurs attribute less importance to sustainability attributes than designers is an indicator of a more pragmatic vision of the role of sustainability in ensuring competitive advantage to products. From this point of view, a more market-oriented vision of entrepreneurs emerges, while designers tend to attribute value to elements that, although ethically addressed, do not necessarily reflect consumers' preferences. In this sense, designers appear to be more product-oriented than entrepreneurs, who still have to pay attention to market results for their products.

6.2 Managerial implications

The novelty of our research is mainly addressing how design-product attributes, including environmental sustainability, characterize design-driven SMEs, according to the entrepreneurs' perspective. As firms' innovation characterized by high relevance of new technologies and new meaning are perceived as the most innovative, this study would suggest entrepreneurs of design context enhance these two attributes of their design products The least important attribute was commonly perceived as environmental sustainability but it is an important attribute to include in products to be competitive and respect the planet. This suggests several managerial implications. First of all, entrepreneurs should become more aware of the increasing importance of sustainability-related attributes of products, going beyond a short-term perspective, linked to current market responses, to embrace a longer-term vision, when the final demand will have acquired greater awareness of the importance of sustainability attributes, and will therefore give greater importance to these attributes in the choice of products. To this scope, specific training courses on the topic for entrepreneurs should be offered by universities and trade associations together with fiscal incentives by the State (Conti and Pencarelli, 2016).

Due to a higher awareness of the importance of green issues design companies could invest more in new materials, new technologies, perfect processing, etc., paying attention to how these elements can impact the environment. In particular, investing in technologies and new materials should follow the idea of creating environmentally friendly products, such as using less energy, recyclable products, etc.

For this reason, firms need to select designers and other creatives (e.g. external resources) with adequate knowledge and capabilities that are not only strictly connected to design but also to the environment. Creative designers can contribute to promoting a green culture among entrepreneurs and firms.

This orientation should be supported by an adequate communication strategy to emphasize the value of sustainable choices as regards materials, processes, design and technology.

Hence, to remain competitive, firms adopting the DDI approach should include green attributes in their products thus potentially boosting deeper radical green innovation (Jevnaker and Olaisen, 2022). Designers are asked to create not only "beautiful and well-made products" - an Italian idiomatic phrase to describe made-in-Italy design products - but "beautiful, well-made and green products."

The ADI strongly contributes to promoting environmental sustainability among firms and designers (e.g. through the Compasso D'Oro award section for sustainability). However, policymakers and industrial trade associations, together with universities and professional schools, should improve the diffusion of good practices and the entrepreneurial culture (Jevnaker, 2005, 2012) of green design-driven products.

In particular, industrial associations could promote industrial design culture more actively through meetings with successful design entrepreneurs (Conti and Pencarelli, 2016; Fondazione Symbola, 2022) and demonstrate how design products better meet future consumers' expectations if environmentally sustainable. Often, entrepreneurs better understand and implement practices by observing how the market leaders operate.

Also, universities can play a role, in incorporating design studies within management courses, as design is an important part of the industrial tradition of Italy.

Finally, central government and local administrations could support design companies and their suppliers by providing funding, training, and consulting services.

6.3 Limitations and future research

This study has some limitations that open space for future research. Our analysis has emphasized that environmental sustainability is not yet among the most important attributes of design products, according to entrepreneurs. However, building an inclusive green mix of design-product attributes simultaneously is challenging even for design-driven manufacturing companies (Jevnaker and Olaisen, 2022). Future research can explore what kinds of green product innovation strategies are being developed by differentiated DDI SMEs.

Another limitation is in the sample size, and a larger sample would improve the results and allow further analysis. Future studies should also include qualitative research (case studies) to analyze in depth the best practices among the most green-oriented design companies. In addition, future qualitative and quantitative studies could investigate how these firms communicate their products to consumers and whether they try to develop a culture of green design-driven products.

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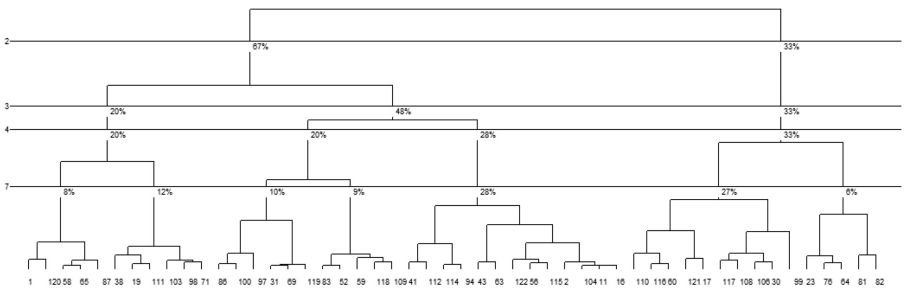
Appendix 1
Dendrogram of the hierarchical cluster analysis



Source(s): Figure by authors

Appendix 2

Characteristic variables	Cluster mean	Overall mean	Cluster std. Deviation	Overall std. Deviation	Test-value	Probability
CLUSTER 1/4 (17)						
New technologies	0.948	−0.16	0.209	0.836	6.07	0
New meanings	0.948	0.225	0.209	0.81	4.08	0
Perfect processing	0.719	0.449	0.508	0.684	1.81	0.035
Functionality	0.495	0.437	0.615	0.665	0.4	0.346
Environmental sustainability	−0.255	−0.275	0.94	0.784	0.12	0.454
High performance	0.207	0.238	0.792	0.769	−0.18	0.427
Aesthetics	0.634	0.677	0.698	0.62	−0.32	0.374
New materials	−0.48	−0.237	0.661	0.795	−1.4	0.081
CLUSTER 2/4 (17)						
New meanings	0.788	0.225	0.461	0.81	3.18	0.001
New materials	0.248	−0.237	0.853	0.795	2.79	0.003
Perfect processing	0.81	0.449	0.417	0.684	2.42	0.008
Aesthetics	1	0.677	0	0.62	2.38	0.009
Environmental sustainability	−0.053	−0.275	0.854	0.784	1.3	0.098
High performance	0.325	0.238	0.814	0.769	0.52	0.301
Functionality	0.332	0.437	0.784	0.665	−0.72	0.235
New technologies	−0.897	−0.16	0.228	0.836	−4.03	0
CLUSTER 3/4 (24)						
Perfect processing	0.917	0.449	0.224	0.684	3.92	0
Functionality	0.735	0.437	0.426	0.665	2.57	0.005
Aesthetics	0.77	0.677	0.574	0.62	0.86	0.196
High performance	0.261	0.238	0.78	0.769	0.17	0.431
Environmental sustainability	−0.561	−0.275	0.608	0.784	−2.1	0.018
New technologies	−0.554	−0.16	0.678	0.836	−2.7	0.003
New meanings	−0.281	0.225	0.696	0.81	−3.58	0
New materials	−0.93	−0.237	0.234	0.795	−4.99	0
CLUSTER 4/4 (28.00)						
New materials	0.209	−0.237	0.633	0.795	3.6	0
New technologies	−0.049	−0.16	0.689	0.836	0.85	0.196
Environmental sustainability	−0.176	−0.275	0.692	0.784	0.81	0.209
High performance	0.184	0.238	0.71	0.769	−0.45	0.325
Functionality	0.211	0.437	0.682	0.665	−2.18	0.015
Aesthetics	0.429	0.677	0.683	0.62	−2.57	0.005
New meanings	−0.123	0.225	0.772	0.81	−2.75	0.003
Perfect processing	−0.336	0.449	0.453	0.684	−7.35	0

Source(s): Table by authors

Table A1. Characteristics by continuous variables of clusters of cut "a" of the tree into four clusters

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