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Analysis of the perception and presence of design in the fruit and vegetable cluster: The case of southeast Spain

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Abstract: Companies must provide economic, environmental and social added value based on innovation strategies, design and creative thinking in a globalised and competitive world characterised by rapid change and constantly evolving technologies. In this context, this paper analyses the role of design practice in companies in the agri-food sector (i.e. what is the design component present like; what are its relevance and importance?) An exploratory, descriptive study was conducted with 30 companies in southeast (SE) Spain's fruit/vegetable sector. The findings reveal that all the surveyed companies make financial investments in design and positively value this (7.6 out of 10), which indicates they recognise its strategic and operative importance. However, integration, training and design promotion in the agri-food sector remains somewhat limited. Most companies lack an in-house design department or design professionals as staff members and perform mainly design activities limited to the visual and communication tasks related to marketing initiatives. These results unveil opportunities for enhancing design incorporation and appreciation in the agri-food sector, which could boost its competitiveness and differentiation in the market. Finally, this study can be considered a starting point for future development in line with the horticultural sector's theory, practice, and design management policies.

Keywords: agri-food; design-driven innovation; organizations competitiveness; strategy making; value creation

Since the beginning of the 21st century, society has required more sustainable approaches to design and develop products and services. (Coley and Lemon 2009). Companies increasingly identify design as a multidisciplinary system and a holistic process that involves different dimensions (economic, sociocultural, technological, environmental). Design is also considered an important source of innovation in any business activity (Perks et al.et al. 2005). Moreover, the design component generates a design-business symbiosis that translates into a positive correlation between the introduction of design and business results (Roy 1994; Hertenstein et al. 2001, 2005). In line with this, Gemser and Leenders (2001) show that industrial design positively impacts profits, sales, and exports. In the 1980s, Kotler and Rath (1984) pointed out design as a power-

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ful strategic tool that would play an increasingly important role in companies' constant search for a sustainable competitive advantage.

As an approach to the design concept, it should be noted that it includes all activities associated with creating a design as a specification for a solution, product, service, system, or organisation. It refers to making something primarily tangible (Hertenstein et al. 2013). The definition itself may vary according to use situations (e.g. industrial, graphic, product, service) because it is a broad and multidimensional concept (Walsh 1996; Nixon 1999). In agriculture, Prost (2017) defines design as the process concerned with devising entities to attain goals following Simon (1969). This definition supports the notion that various objects have been designed in agriculture to achieve specific objectives (plant varieties, animal breeds, cropping, farming systems, landscapes, decision support systems, agricultural implements, or inputs) (Prost et al. 2017). Thus, for this study, design is understood as the structured multidisciplinary work process that aims to create products (Raudberget et al. 2022; Roxas et al. 2023), images, spaces (Trubetskaya et al. 2023), services (Brinkman et al. 2023) and digital/multimedia content (Liu et al. 2019).

In the agri-food innovation field, since this century began, the vectors introduced into the industry have been based on food quality and safety, sustainability and, in recent years, organic production (Galdeano-Gómez et al. 2013). So one of the strategic actions that arouse the most interest of traditional actors is innovation related to environmental aspects and their relation to profitability (Kemp 2013). However, it is not enough for crops of origin to be organic because the entire agri-food chain must be holistically considered. For example, in the life cycle assessment (LCA) of the production and marketing of fruit and vegetables, packaging represents the most significant overall impact and is related to environmental problems that arise from the generation of plant and industrial waste, such as plastics (Galdeano-Gómez et al. 2013). Hence the need for greater literacy in this area involves eco-conscious product designers and engineers to design, redesign and develop more sustainable eco-efficient packaging (Pérez-Ortega et al. 2021). Research suggests opening innovation networks like incorporating design theories into agriculture to foster sustainable transitions and to improve current agricultural models from a socio-environmental viewpoint (Prost et al. 2017; Berthet et al. 2018). Design, as a differentiating element with a high added value, is present directly or indirectly in all agri-food sector activities, from the planning of agri-food farms to the marketing and sale of final fruit and vegetable products (González-Yebra 2019a, b) (Figure 1).

In a round table held with professionals from the design sector and the agri-food industry with a higher innovation level, the five determined priority lines of action for design development in this sector were: *i*) promotion of design knowledge depending on companies; *ii*) design as a dynamising element of the new bioeconomy paradigm (González-Yebra et al. 2019b).

Given the described framework, we pose two research questions at the fruit and vegetable companies level: 1) what is the design component present like?; 2) what importance is attached to design in these organisations? In short, these questions aim to address three specific objectives to: *i*) identify the role of design in the organisation chart of fruit and vegetable companies; *ii*) determine the level of importance and satisfac-

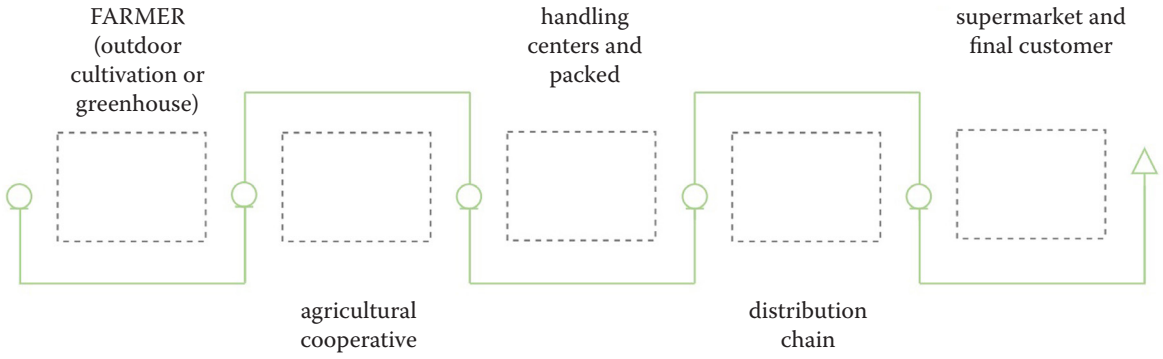

Figure 1. Characterisation of the agricultural production model of southeast Spain

Source: author's elaboration

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tion that companies in the fruit and vegetable sector attach to design; *iii*) establish the tangible and intangible benefits that agricultural organisations obtain from applying design. Another complementary question concerning landscape design and the planning of the productive environment is also explored.

MATERIAL AND METHODS

Study area. For the company selection phase, the contact rounds focused on a study area in Spain (Figure 2), specifically in the southeast. This area comprises four provinces (Almería, Granada, Murcia, Alicante) as the basis for the socio-business mapping of the target population that was consulted. It focuses on the three most everyday design application areas: industrial or product design, graphic design, and the design of spaces or environments.

Methodology. The methodological approach forms part of a broader research project based on mixed research postulates [see Figure S1 in the Electronic Supplementary Material (ESM)]. The complementarity of quantitative and qualitative methods can take research teams closer to a better and more accurate understanding of the study object (Tashakkori and Teddli 2003). The specific stage of the reported project focused on exploratory and descriptive analyses. A panel of companies was selected and received a questionnaire designed *ad hoc*. The study spanned three years and was divided into two phases. The results analysed in this paper correspond to the second phase (field study). In the first phase, research was designed, as was the validity of the proposed measurement instrument: a questionnaire with 15 multiple-choice single-response and two open-ended questions were tested. A rigorous protocol was established in which all the communication and questionnaires were completed via a single corporate email associated with the study. This fact guarantees the traceability and veracity of the data. A copy of all the submissions and obtained responses were recorded.

Figure 2. Location of the companies participating in the survey

A – Alicante; B – Murcia; C – Almeria; D – Granada
Source: author's elaboration

The procedure was as follows: *i*) send an introductory email with a brief description of the study and invite companies to participate; *ii*) send the questionnaire with instructions about filling it into the companies that positively replied. A 15-day deadline was set to complete the questionnaire; *iii*) send up to three reminders if no response is received after the first deadline.

Measurement instrument. The instrument designed *ad hoc* deliberately consisted of five blocks (Table 1) to triangulate the obtained data and information. The first part was introductory and included three central parts with the study questions. The last one contained open-ended comments.

Concerning the structuring of study content, in blocks 3 and 4, questions were asked to assess the design importance and satisfaction on a scale from 0 to 10 (0 – not important at all to 10 – very important) (Tables S3 and S4 in the ESM). Block 3 asked companies about design practices' tangible and intangible benefits. The results rated the highest (with an average of 7 points or more out of 10) were selected. This selection was based on a characterisation previously done by the Delphi method, with a panel of experts

Table 1. Parts of the research questionnaire

Block	Description	Type of question
1	characterisation of the study panel	company data (Table S1, ESM)
2	how is design present in agri-food companies?	multiple choice (Table S2, ESM)
3	level of importance/satisfaction of design in business strategy	Likert – 10 points (Table S3, ESM)
4	tangible and intangible benefits gained from design integration	Likert – 10 points (Table S4, ESM)
5	overall assessment and final contributions (experiences)	Likert – 10 points (open question)

ESM – Electronic Supplementary Material
Source: author's elaboration

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made up of design and agri-food sector professionals (González-Yebra et al. 2019b).

By recapitulation, questions 1–13 from blocks 1–4 appear in Tables S1–S4 (ESM). Questions 14 and 15 (measured on a Likert scale) and two more open-ended questions/comments were included in the last part. Question 14 asked about the landscape design and the planning of the productive environment of the agricultural model in SE Spain. In question 15, a general assessment was made of companies' satisfaction with the usefulness of the design component. Subsequently, in the open questions, they were asked how they could demonstrate the score awarded in question 15 as an organisation. In the last optional question, they were asked about what proposals they considered were necessary for the companies in the sector to incorporate design into their organisation.

Definition of the study population. The study population comprised fruit and vegetable companies as sample units: *i*) companies were established as traders as their only activity; *ii*) traders and producers; *iii*) traders and processors. Panel selection was carried out following the quota sampling method by giving the weight of the Almeria cluster at the national level (70% of the participating companies were from Almeria, with the rest from Granada, Murcia, and Alicante). A coordinating group was set up for the phase in which to select companies, conduct the field study and monitor questionnaires. Research groups and several technicians from the Agri-food Campus of International Excellence (ceiA3) were involved in this work.

Previous publications on the Almeria agri-food cluster were used as valid references to determine the population size. Pérez-Mesa and Galdeano-Gómez (2010) and Galdeano-Gómez et al. (2016) estimate the existence of 200 fruit and vegetable marketing and handling companies. A general email with the questionnaire was initially sent to 150 companies. Personalised contact was made with 50 companies, of which 20 did not complete all the requested questions and were discarded to avoid bias in the conclusions. Some of these companies stated that they could not provide some data requested in the questionnaire due to company privacy policy, which proved a significant handicap. Therefore, the final study sample size was 30 companies.

Data analysis. A data validation analysis was done. To this end, responses to questionnaires were recorded in an Excel database created *ad hoc*. The obtained data were analysed using descriptive statistics. The median (m) and arithmetic mean (μ) were used as central measures. Standard deviation (σ) was employed to test response variability. The coefficient of variation (*CV*), expressed as %, was included to check the results' consistency. The *CV* is the parametric statistics composed of the standard deviation divided by the mean obtained to test the degree of agreement reached in the study panel's responses. In this case, a *CV* of less than or equal to 25% is taken as a reference and indicates a very good agreement (minimal variability). Up to 50% is considered a good agreement with little variability. Data were processed using Excel calculation tools and the Statistical Product and Service Solutions (SPSS) package (version 28).

RESULTS AND DISCUSSION

Characterisation of the participating companies. About 60% were large, while the rest were micro-enterprises, small and medium-sized enterprises (SMEs) (Table 2). In the last 3 years, the average turnover of the participating enterprises was around 68 million EUR, with a minimum of 50 000 EUR (micro-enterprises) and a maximum of 280 million EUR (large enterprises). Of all the companies, 73% were marketers and producer-marketers, and the rest were processors or simply producers. All (100%) of the companies had an international target, 77% shared production with a national destination, and only 27% destined their products for the local market. Practically all the companies (97%) affirmed knowing the difference between 'design and marketing'. Concerning prior knowledge of the design concept, although 63% identified design as a structured work process, 37% considered that design only responded to aesthetic aspects (Table 2). This fact is worrying because design requires knowledge of a series of technical, strategic and market fac-

Table 2. Characterisation of the companies making up the study panel

Size classification		Design concept in business	
Micro-enterprises (< 10 employees)	10%	structured work process	63%
SMEs (10–50 employees)	10%	synonymous with advertising	23%
Medium (50–250 employees)	33%	one-off activity (a style, a fashion)	7%
Large (> 250 employees)	57%	synonymous with modern aesthetics	7%

SME – small and medium-sized enterprises
Source: author's elaboration

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tors and a creative or aesthetic sense. In other words, it is a process that encompasses management (Chiva and Alegre 2007). This can be attributed to the fact that some design interpretations tend to be closer to product development, market research, and even branding. This is why many people think designs relate only to product form, aesthetics, and style (Verganti 2008). Finally, it was concluded from the feedback obtained from some of the companies that did not participate in the study panel that farmer-producers do not have enough resources to include design practices in their small organisations. Thus, marketing companies design brands under which small producer enterprises' products (fruit/vegetables) are marketed.

Presence of design on the organisation chart. Of all the companies, 77% had no design professionals as staff members. Of these, no one was responsible for design functions in 33% of the cases (Figure 3). In the remainder, 44% (17% of organisations), design decisions were made by management, 10% by the sales team and 17% by 'other profiles'. All this indicates that marketing professionals were in charge. As in other sectors like the ceramics industry (Chiva and Alegre 2007), the marketing department had the most significant responsibility for design if there was no design department.

Regarding how design pervades organisations, roughly one-third of the companies (37%) stated that they had integrated design, while another third (34%) had not included it on their company's organisation chart (Figure 4A). Only the remaining third (30%) of the participating organisations had fully integrated design and perceived it as another managerial and business pillar, i.e. with a strategic value for the company.

When asked about the company areas in which design was present (Figure 4C), the reference was marketing (60%), and only 33% had transversally incorporated design into all the areas, and at a similar percentage to those that took design into account as a management tool.

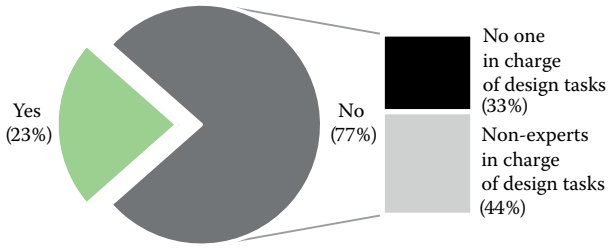

Figure 3. Presence of design professionals in companies in the agri-food sector

Source: author's elaboration

The literature considers design management as the organisational and managerial practices and skills that enable a company to achieve good and effective use of design through a managed process. However, no consensus has been reached about design management's activities (Chiva-Gómez 2004). Therefore, it could be determined that only the companies that took design as a management tool considered it in the definition of company strategies. However, only 13% of the participating organisations had a design department. Design activities were usually integrated into another department supported by external design professionals. In other cases, the company directly relied on external staff (27%). It should be noted that when companies attempted to contemplate design as an essential resource, they seemed to create an internal department which would also favour the development of design management skills (Chiva and Alegre 2007).

Investment and design professionals. All the companies had invested financially in design in the last three years. Obviously, the investment made by SMEs and micro enterprises was lower than that of medium and large companies (and proportional to turnover), with a minimum of 500 EUR (micro-enterprises) and a maximum of 2 000 000 EUR (large companies). The average investment in design was 20 000 EUR and 80% was made in graphic/communication and industrial/product design (Figure 5A). This trend was supported by the fact that 73% of the participating companies have legally protected or registered a brand (graphic/communication dimension) in the last three years. In the industrial domain, fewer companies covered a trademark, with 20% protecting patents and only one protecting an industrial design. These data could be related to the fact that many companies still consider industrial design a cost, not an investment. No company selected the 'copyright' and 'copyleft' questionnaire options.

73% of the companies in the study stated hiring design services only for specific projects, versus the 20% that did so constantly (even several times a month). The remaining 7% required design every 1 or 2 years. In any case, if it was not enough to make a monetary investment in design, design management played an important role in determining the effects of such investment assets on the company's activity and performance (Chiva and Alegre 2009). Only seven companies had design professionals (three medium-sized companies and four large companies). According to an open consultation, four companies had design professionals on their staff. They had other qualified professionals (e.g. technical architecture, audiovisual communication, advertis-

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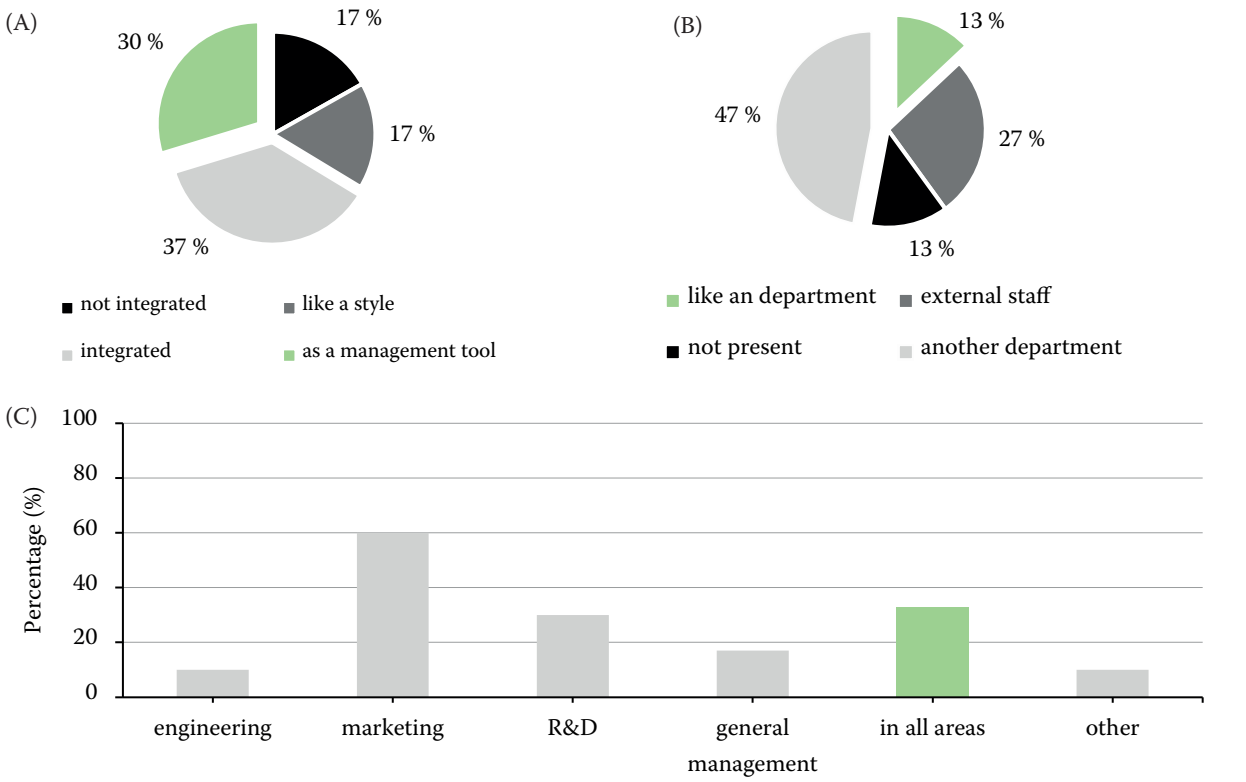

Figure 4. Presence of the design function (A) design in management and business strategy; (B) design within the organisation chart of the companies; (C) company areas in which design is present

R & D – research and development; green – the options towards which it would be desirable for the sector to advance
Source: author's elaboration

ing, and public relations) invested in design training courses. Two of the other three companies had professionals with a higher level of graphic design education. The third one had two industrial design engineers on its staff and was the only company with a professional product design and development profile. This heterogeneity could be related to the fact that no single universally accepted definition of industrial design can be established. Gemser and Leenders (2001) and Verganti (2008) point out the difficulty of defining the industrial design role, which also hinders the visibility of industrial design in companies in general and in the agri-food field in particular.

Regarding hiring techniques, 47% of the companies indicated that they used professional relations to find design professionals, compared to only two companies that resorted to universities. None showed art schools (Figure 5B). Those who chose the other option indicated they engaged professional assistance from advertising agencies. This could be related to a lack of matching between the design competencies provided by universities and industry demands. In line with this, Alonso-García et al. (2020) concluded that only around 20% of the contents taught in Industrial Design Engineering degrees align with companies' current demands.

Level of importance/satisfaction with the design. The only design type with a lower rating (average lower than 7 points) was service design in terms of both importance (Figure 6A) and satisfaction (Figure 6B). The graphic and digital/multimedia design stood out with an average rating of 8 points (Figure 6A). All the different design types obtained good ($CV \leq 50\%$) or very good ($CV \leq 25\%$) agreements, i.e. little, or very little variability in responses. These data were corroborated by triangulating the results (background González-Yebra et al. 2019a, b), quantitative data and qualitative feedback, and the perception of the agri-food industry and design professionals). It could be stated that the agri-food sector identified design mainly with the graphic dimension (including digital/ multimedia design). No single case stood out for satisfaction with design, with satisfaction levels averaging around

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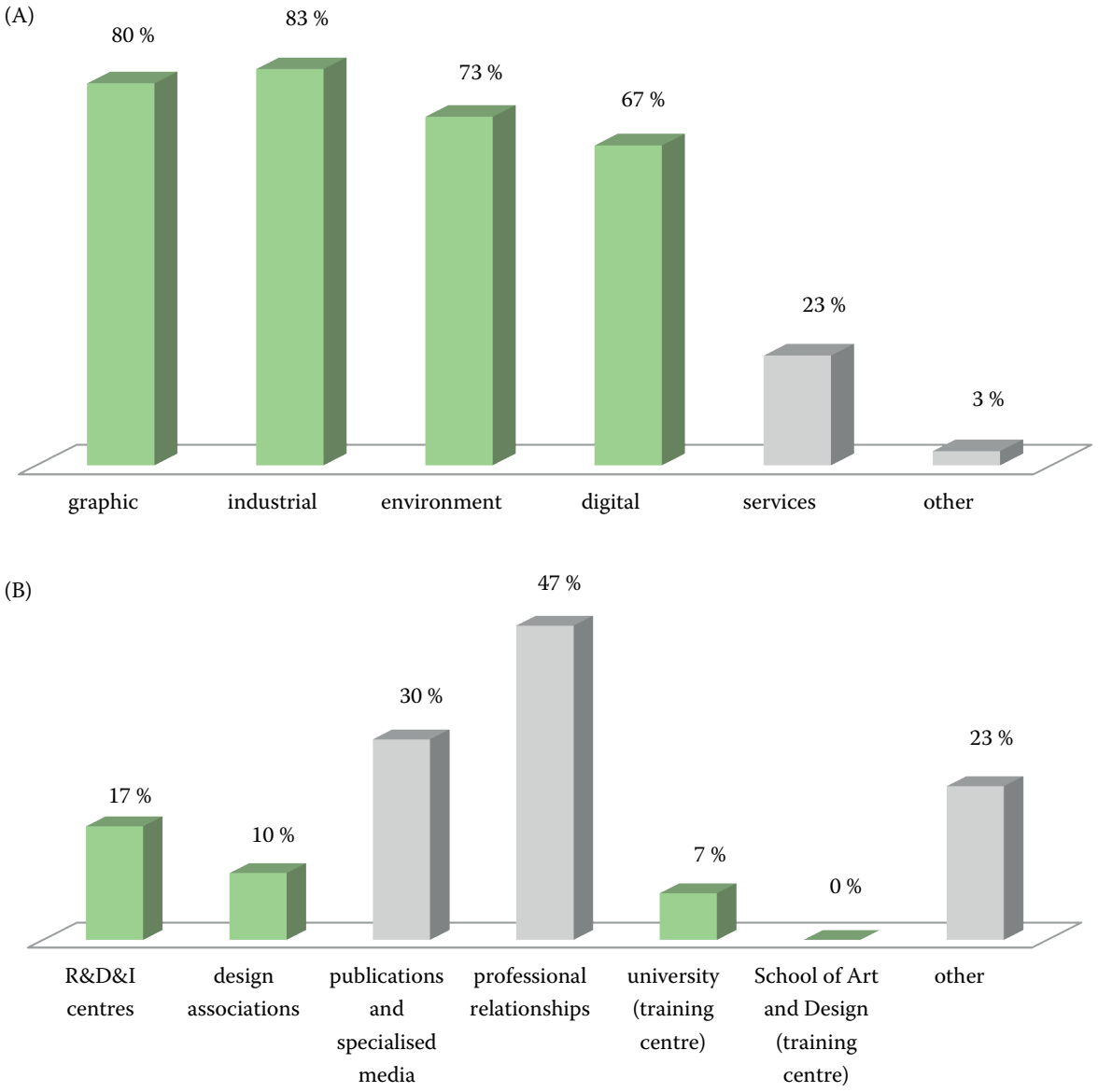

Figure 5. (A) Types of investment in design made in the last 3 years and (B) sources to which companies turn for designers' recruitment

R&D&I – research, development, and innovation; green – options into which responses were expected to be grouped
Source: author's elaboration

7.5 and very high agreement values for graphic, industrial, and service design (Figure 6B).

Tangible/ intangible benefits of design. The least valued tangible benefit was the increased sales volume on the international market (i.e. increased exports) (Figure 6C). The least valued intangible benefit was opening new segments to introduce the company's products (i.e. entry into new markets) (Figure 6D). The most valued benefit, with an average score of 8 points out of 10 and a very high level of agreement between companies ($CV \leq 25\%$), was that related to improving the company's image. Once again, it was associated with the graphic dimension of design. It would seem that fruit/vegetable sector companies focus almost all their efforts on graphic design, compared to industrial/product or environmental design. However, organisations generally consider design an interesting provider of non-technological innovation strategy to explore.

This conclusion was supported by the high scores for its application's tangible and intangible benefits (Fig-

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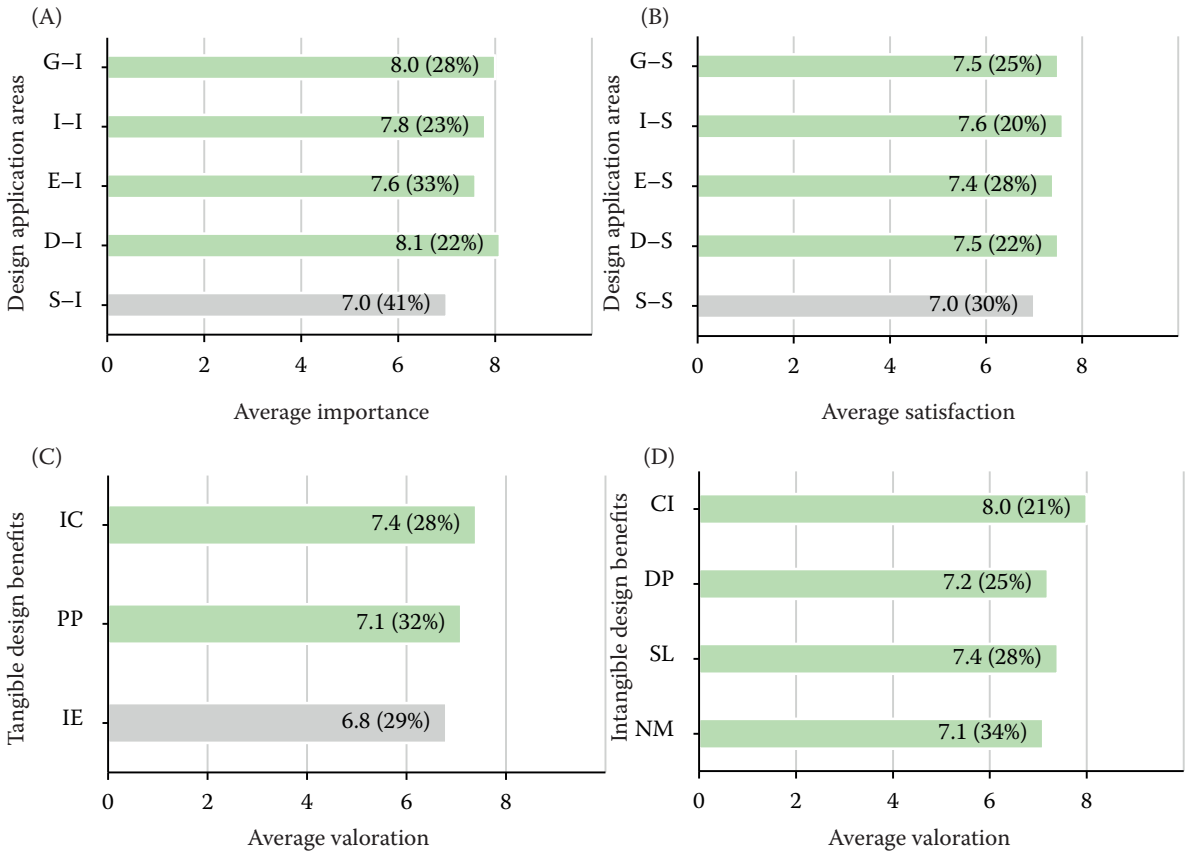

Figure 6. Results of the company evaluations related to the importance/satisfaction of design and the obtained tangible and intangible benefits

(A) G–I – importance that companies attach to graphic design; I–I – importance that companies attach to industrial and product design; E–I – importance that companies attach to the design of spaces; D–I – importance that companies attach to digital and multimedia design; S–I – importance that companies attach to service design; (B) G–S – satisfaction with the graphic/communication design; I–S – satisfaction with the industrial and product design; E–S – satisfaction with the design of spaces; D–S – satisfaction with the digital and multimedia design; S–S – satisfaction with the service design; (C) IC – increased competitiveness; PP – profit-profitability; IE – increased exports; (D) CI – improvement in the corporate image; DP – differentiation and positioning; SL – customer satisfaction and loyalty; NM – entry into new markets; tangible and intangible benefits (Figure 6C and Figure 6D) were surveyed considering the last 3 years; results are expressed using the mean assessment (for Figure 6A 0 – not important at all and 10 – very important) and the *CV* is expressed as % in brackets.

Source: authors elaboration

ure 6C, 6D). These results aligned with the developments in the third edition of the Oslo Manual in terms of incorporating non-technological innovation as a fundamental form of innovative activities (OECD 2005). The results showed the design role in the agri-food sector as non-technological innovation, where managers must be active players who improve how they manage and include design practices in companies to increase their innovation potential.

Design and planning the environment. The environment's design was related to and defined as the space of the company and everything related to it (industrial sites, offices, production areas, common spaces, commercial spaces, exhibition spaces and fairs). In the agri-food sector, previous research highlights that the presence of design in the conception and development of agro-industrial constructions and auxiliary industries (design and production of spaces) is lesser (González-Yebra et al. 2019a, b). The question as to whether improvement in the landscape design and planning of the production environment (greenhouses) could positively influence the image and global position of the fruit and vegetable sector was rated with an average score of 8.2 points out of 10 and a high

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level of agreement for all the participating companies (*CV* – 29%).

Overall rating. Overall, the design was rated positively, with an average of 7.6 points out of 10 and a very high level of agreement for all the participating companies (*CV* – 23 %). Although different studies have analysed the role of design in companies in various industries, for example, the furniture industry, the ceramics industry, or they have focused on the SME sector; there are no previous studies in companies in the fruit/vegetable sector with which to compare the obtained results.

CONCLUSION

This work aims to analyse the role of design and how it is perceived by organisations in the agricultural sector using a triangulation analysis (background, quantitative data, qualitative feedback). Regarding the role of design on the organisation chart, the results show that its practical implementation in the pool of organisations' activities entails two options: outsourcing or in-house development. The former is the more employed alternative. Regarding the level of importance/satisfaction attached to design; the results show that companies generally have a good overall perception of design. All the companies state that they have invested in design; most have invested in graphics/communication in the last 3 years and have legally protected themselves using a registered trademark. From the analysis of design tangible/intangible benefits, the most important benefit is improving the companies' image, and the least important benefit is related to the volume of exports and opening up new markets. The graphic dimension of design is highly valued, but the industrial/product dimension is not so highly valued. Given the particularities of the productive environment related to the fruit and vegetable sector, it is also necessary to work on the design of its spatial/environmental dimension to improve the image and global position of the agri-food cluster's productive model.

The results show a somewhat low level of maturity for implementing the design in the sector. The creative and implicit nature of design leads organisations to underestimate its value and, instead of considering it a strategic pillar of their management, they associate it mainly with brand image and company communication. However, design is doubtlessly essential for business success because of its potential to drive innovation and competitiveness. Nowadays, design has changed not only the strategy of companies but also the way they interpret and inspire consumer behaviour, their approach to new product and service development and, ultimately, the impact on value creation processes at the business level. To remain outside this interpretation of design might lead to a misunderstanding of consumer needs, missing out on the opportunity to capitalise on new technological advances, achieve differentiation from competition, develop innovations, define brand identity, and imbue it with meaning.

This work shows the current state of design in the sector by unveiling opportunities for improvement if design application were strategically considered a driver of policies that enables sustainable economic growth driven by innovation. Therefore, this study can be seen as a starting point for future development in line with the theory, practice, and design of management policies in the studied sector.

Limitations and future research lines. Although this research finds no significant differences among company types, at a practical level, a pattern is repeated in the fruit and vegetable cluster in SE Spain in which small production companies (usually run by self-employed farmers) are organised through large cooperatives for the marketing and sale of their products (fruit and vegetables). In this context, it can be inferred that farmers-producers do not have the time or the means to incorporate the design function into their small organisations. Besides, marketing companies design brands under which fruit and vegetable products are marketed. In many cases, a single brand brings together the products of many small producers. All this indicates the need for further research into this issue. As for the scope and development of the field study, they focus on a single industry in a specific geographical area (SE Spain) with a small sample size. Despite providing valuable information on the design conception in the sector, it only allows for a descriptive analysis of an exploratory nature that would need to be confirmed in future studies with larger samples and a more extensive geographical scope. This could be achieved by limiting the measurement instrument to only a few specific questions (five questions), making it easier to enlarge the sample (e.g. 100–150 companies) because one of the main found handicaps is questionnaire length. Moreover, creating an observatory could allow experts in the field to conduct longitudinal analyses, test returns on investment in design, and propose and monitor strategic research projects. Finally, offering training courses about design is recommended as a tool for management and non-technological innovation for entrepreneurs (directors/managers) and public managers.

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Working with all the stakeholders on a plan to introduce design into the policies and strategies of companies in the agri-food sector is also recommended. In this context, moving towards a design conception as a non-technological innovation for creating new business strategies is proposed. To summarise, the findings of this work provide a starting point to explore the contributions of design and its development to the agri-food industry now and in the future.

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REFERENCES

Alonso-García M., Blázquez-Parra E.B., De-Cózar-Macías Ó.D. (2020): Planning an industrial design engineering curriculum according to the labour market based on dual training. Journal of Engineering Design, 31: 399–425.

Berthet E.T., Hickey G.M., Klerkx L. (2018): Opening design and innovation processes in agriculture: Insights from design and management sciences and future directions. Agricultural Systems, 165, 111–115.

Brinkman G., Van Buuren A., Voorberg W., Van der Bijl-Brouwer M. (2023): Making way for design thinking in the public sector: a taxonomy of strategies. Policy Design and Practice: 1–25.

Chiva-Gómez R. (2004): Repercussions of complex adaptive systems on product design management. Technovation, 24: 707–711.

Chiva R., Alegre J. (2007): Linking design management skills and design function organisation: An empirical study of Spanish and Italian ceramic tile producers. Technovation, 27: 616–627.

Chiva R., Alegre J. (2009): Investment in design and firm performance: The mediating role of design management. Journal of Product Innovation Management, 26: 424–440.

Coley F.J.S., Lemon M. (2009): Exploring the design and perceived benefit of sustainable solutions: A review. Journal of Engineering Design, 20: 543–554.

Galdeano-Gómez E., Aznar-Sánchez J.A., Pérez-Mesa J.C. (2013): Sustainability dimensions related to agricultural-based development: the experience of 50 years of intensive farming in Almeria (Spain). International Journal of Agricultural Sustainability, 11: 125–143.

Galdeano-Gómez E., Pérez-Mesa J.C., Godoy-Durán Á. (2016): The social dimension as a driver of sustainable development: The case of family farms in southeast Spain. Sustainability Science, 11: 349–362.

Gemser G., Leenders M.A.A.M. (2001): How integrating industrial design in the product development process impacts on company performance. Journal of Product Innovation Management, 18: 28–38.

González-Yebra Ó., Aguilar M.A., Aguilar F.J. (2019a): A first approach to the Design Component in the agri-food industry of southern Spain. Revista De La Facultad De Ciencias Agrarias UNCuyo, 51: 125–146.

González-Yebra Ó., Aguilar M.A., Aguilar F.J. (2019b): Is the design a vector to be considered in the agri-food industry? An interprofessional analysis in Andalusia (Spain). In: Chaari F., Gherardini F., Ivanov V., Haddar M. (eds.): Advances on Mechanics, Design Engineering and Manufacturing II. New York, Springer: 610–621.

Hertenstein J.N., Platt M.B., Brown D.R. (2001): Valuing design: Enhancing corporate performance through design effectiveness. Design Management Journal, 12: 10–19.

Hertenstein J.H., Platt M.B., Veryzer R.W. (2005): The impact of industrial design effectiveness on corporate financial performance. Journal of Product Innovation Management, 22: 3–21.

Hertenstein J.H., Platt M.B., Veryzer R.W. (2013): What is 'good design'? an investigation of the complexity and structure of design. Design Management Journal, 8: 8–21.

Kemp D.R., Guodong H., Xiangyang H., Michalk D.L., Fujiang H., Jianping W., Yingjun Z. (2013): Innovative grassland management systems for environmental and livelihood benefits. Proceedings of the National Academy of Sciences, 110: 8369–8374.

Kotler P., Rath G.A. (1984): Design: A powerful but neglected strategic tool. Journal of business strategy, 5: 16–21.

Liu K., Li W., Yang C., Yang G. (2019): Intelligent design of multimedia content in Alibaba. Frontiers of Information Technology and Electronic Engineering, 20: 1657–1664.

Nixon B. (1999): Evaluating design performance. International Journal of Technology Management, 17: 814–829.

https://doi.org/10.17221/169/2023-AGRICECON

OECD/Eurostat (2005): Oslo Manual: Guidelines For Collecting And Interpreting Innovation Data. 3rd Edition. The Measurement of Scientific and Technological Activities. Paris, OECD Publishing.

Pérez-Mesa J., Galdeano-Gómez E. (2010): Agrifood cluster and transfer of technology in the Spanish vegetables exporting sector: The role of multinational enterprises. Agricultural Economics – Czech, 56: 478–488.

Pérez-Ortega S., González-Yebra Ó., Oliva R.M., Álvarez A.J. (2021): Theoretical study for redesign of an agricultural package applying ecodesign strategies and CAD/CAE tools. Dyna, 96: 435–440.

Perks H., Cooper R., Jones C. (2005): Characterizing the role of design in new product development: An empirically derived taxonomy. Journal of Product Innovation Management, 22: 111–127.

Prost L., Berthet E.T., Cerf M., Jeuffroy M.H., Labatut J., Meynard J.M. (2017): Innovative design for agriculture in the move towards sustainability: scientific challenges. Research in Engineering Design, 28: 119–129.

Raudberget D., Elgh F., Lennartsson M., Areth Koroth R. (2022): A study of the application of design assets in product development. Advances in Transdisciplinary Engineering, 28: 24–32.

Roxas C.L.C., Dela Cruz O.G., Dela Cruz R.L.C., De Pedro J.P.Q., Dungca J.R., Lejano B.A., Ongpeng J.M.C. (2023): Application of design for manufacturing and assembly on temporary shelters in the Philippines. GEOMATE Journal, 24: 120–127.

Roy R. (1994): Can the benefits of good design be quantified? Design Management Journal, 5: 9–17.

Simon H.A. (1969): The Sciences of the Artificial. Cambridge, MIT Press: 123.

Tashakkori A., Teddlie C. (2003): The past and future of mixed methods research: From data triangulation to mixed model designs. In: SAGE Handbook of Mixed Methods in Social and Behavioral Research, Thousand Oaks, SAGE: 671–702.

Trubetskaya A., McDermott O., Ryan A. (2023): Application of design for Lean Six Sigma to strategic space management. TQM Journal, 35: 42–58.

Verganti R. (2008): Design, meanings, and radical innovation: A metamodel and a research agenda. Journal of Product Innovation Management, 25: 436–456.

Walsh V. (1996): Design, innovation and the boundaries of the firm. Research Policy, 25: 509–529.

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