DEVELOPMENT OF A DESIGN MANAGEMENT AUDITING MODEL FOR THE CERAMIC SECTOR

Amalia Diéguez (*); David Gobert (*); Ricardo Chiva (**)

(*) ALICER, Asociación para la Promoción de Diseño Cerámico
(**) UNIVERSITAT JAUME I
Spain

ABSTRACT

Owing to the growing importance of product design and design management for enhancing corporate competitiveness in the ceramic sector, the development was undertaken of an analysis tool that would allow determining the situation of both aspects in ceramic companies. The tool is a design management audit applied to the ceramic sector, which for its development required using other audits and management features considered of importance, besides performing an empirical verification at four sectoral companies, specifically involving ceramic floor and wall tile manufacturing companies. This empirical study of the four cases yielded certain further conclusions regarding design management in this branch. The four studied companies were selected as being a priori representative of different ways of managing design in the Spanish ceramic sector.

INTRODUCTION

Owing to the need for ceramic floor and wall tile manufacturers to achieve greater effectiveness in introducing new product models in their target markets, product design and design management are starting to play a determining role in the ceramic sector. However, for companies to set about improving product design and design management, it is first necessary to analyse their situation in this regard. The development of an analysis tool termed a design management audit was therefore undertaken for this purpose.

The audit was developed in two contexts:

1) Theoretical. This has required studying and using other currently existing design audits, besides incorporating new features considered of great importance, which had not been analysed. On the other hand, all the excessively generic requirements were fitted to the specific situation of the ceramic branch. The sector is characterised amongst other aspects by the fact that certain companies leave generating new models to suppliers of raw materials and other products, which offer ceramic product design free, incorporating the cost in the price of their products.

2) Empirical. In this context empirical verification was required of the auditing model at four ceramic floor and wall tile manufacturing companies, on considering them producers of the ceramic end product. This verification concurrently involved performing case studies. Furthermore, the case studies revealed processes and problems in design generation and management in the end ceramic product relating to corporate organisational and directive features.

The design management audit aims to provide an in-depth analysis of design processes and management for ceramic products and models. Using this, companies can obtain a detailed view of the method that they are presently following, with its weaknesses and strengths, based on the existing theoretical framework. With this knowledge, companies can programme courses of action for improvement to achieve greater success of the models developed by each company.

DESIGN MANAGEMENT

With a view to defining the theoretical framework, product management design, this section sets out the theoretical concepts and the associated ideas that were developed.

Considering innovation as the process through which new ideas, objects and practices are created, developed or invented, the process will include an essential, prior design stage, followed by other stages of development, adoption, implementation and dissemination (Slappendel, 1996, pp. 107-108). Aubert (1982, in Walsh, 1996, p.513) takes design to be the essence of innovation, the moment at which a new object is imagined, materialised and formed as a prototype. Design is thus closely related to innovation, as the act of designing itself always introduces something new (Felip and Gimmy, 1995, p. 94). Moreover, the corporate innovation process is conceived as a process of individual and collective learning, which responds to a pattern of constant search for problem-solving approaches (García, 1995, p. 28), which ties innovation to organisational learning.

Amongst the various types of innovation, product innovation (activity) involves prior product design, which could be defined as the product formalising process with regard to its functional, use, manufacturing and communication requirements. This process would not only involve a creative act, but the concurrence of technical and market aspects, amongst others (Walsh, 1996, p.50). Thus, design not only manifests an activity in the process of developing new products, but the conjunction of all the activities that affect the performance and appearance of the product (Mintzberg and Dumas, 1991, p. 31). Gorb and Dumas (1987) define design as a process to develop an artefact or thing,

which includes the various organisational activities required to achieve this process. Hence "design is crucial to innovation, as it involves the part of creativity where ideas are materialised, but also where technical possibilities and market demands or opportunities merge"(Freeman, 1982, in Walsh, 1996, p. 514).

According to Bennet et al. (1988 in Bruce and Cooper, 1997, p.65-66) and Cooper and Press (1995, p. 38-39), the product design process involves four stages, which determine design as a wide-ranging process that goes beyond the simple creation of a projection:

1) **Planning**, formulation or origins of design: the need is investigated and the required idea or concept is defined in accordance with the situation and trends of technology and the market.

2) Specification of the idea and concept; **projecting** and generating the prototype or design.

3) **Developing** product design and manufacture. Launching and distributing the product with the corresponding **communication** thereof.

4) Analysis of the **reaction or results** of the created design.

To carry out the design process, correct management is required together with the existence of a series of aspects and knowledge that facilitate the unfolding of this process. Rothwell and Gardiner (1989) consider that design management includes various features:

(1) Knowing and situating the company, its products and main technologies in relation to competing products and companies.

(2) Defining where the company wishes to act and where not, in terms of technologies, products and markets.

(3) Defining options and paths, from a rational standpoint, based on its weakness and strengths.

(4) Stimulating the dialogue between product development, production, marketing and financial staff to discover and assess potential product markets and the possibilities of new products for present markets.

(5) Making the idea of design and innovation part of corporate culture, something absolutely necessary for the company to be profitable in the long term.

If product design is linked to a "*network*" or social and technical structure, this will involve relations, connections, teamwork, conflicts, ambiguity, etc., from different perspectives and agent approaches. Design management needs to ensure that the dialogue takes place between persons interested in the use of design, including the end user (Walsh, 1996, p.515).

Based on Porter's (1985) value chain concept, Borja de Mozota (1998) establishes the guidelines for measuring design performance. He sets three types of design for each company activity:

Types of design	*Types of activities*	*Guidelines or key features*
Operative Design: Value-creating design for Primary activities. Design creates added value for the customer through differentiation. Design is an **economic competence**.	Design as Primary activity	Market positioning Corporate image Product strategy (1) (2) (3): Rothwell and Gardiner (1989)
Functional design: Value-creating design for supporting activities. Design creates value through function co-ordination (especially if the new product design process is improved). Design is a **management competence**.	Design as Supporting activity	Project management Team management Relation with other departments Technological change (4): Rothwell and Gardiner (1989)
Anticipating Design: Vision-creating design for the whole value chain system. Design adds value by anticipating internal and external changes in the company environment. Design becomes an **essential competence**.	Design as Vision. Design as Activity that affects the whole corporate environment.	Overall marketing Competitive environment (5): Rothwell and Gardiner (1989)

Table 1. *Types of design. Adapted from Borja de Mozota (1998).*

The existence of all these types of design involves correct design management.

DESIGN MANAGEMENT AUDIT

As design and design management have acquired greater importance for companies, tools have been developed for analysing these. The design audit is one such efficient tool (Cooper and Press, 1995, p. 187; Bruce and Cooper, 1997, p.60).

Although the term audit is for many a synonym for financial analysis, it is currently used for any type of business analysis (Cooper y Press, 1995, p.189). It generally involves the objective analysis of the present situation in the organisation, with regard to a given topic, in this case design management. However, design audits have not been developed to any great extent, so that they are not very consistent.

Design audits have been approached in different ways. The following are particularly noteworthy:

- Kotler and Rath, (1990), which is a brief questionnaire on company sensitivity to design and its efficiency in design management.

- Topalian (1984) developed a framework in which the various features to be analysed for conducting design audits were related.

- Morton, as director of the "Design Council" (Cooper and Press, 1995, p.207) created a questionnaire model based on three levels: general management, project management and design team, and five topics: objectives, plans, communication, implementation and evaluation. This formed the basis for the following model.

- State Society for Design Development and Innovation (DDI). This audit approaches analysis through interviews and data collection in the company on the following aspects:

A. Corporate Audit: general analysis of the company and its environment. - Internal analysis: description of the company, production resources, financial economic resources, customer portfolio analysis. - External analysis: industrial sector, competition, market.
B. Product Audit: analysis of the current product portfolio with regard to lines and marks, together their economic results. - Product portfolio profitability, ABC products, sales evolution analysis, product portfolio analysis, product configuration, production capacity, applied technologies.
C. Design Audit: product portfolio analysis, with regard to those aspects in which design can act directly. - Analysis of the product concept, descriptive aspects of the line (formal product, broadening and evolution of the company product), industrial design audit (functional features, use, production, and shape/image), packaging audit, mark and logotype audit, and analysis of corporate image and culture.

According to Cooper and Press (1995), to develop a design audit model, the features to be dealt with shall be clear. These authors set four levels, which could be taken into account in a design audit:

(1) The environment, market, design trends, legislation, etc.

(2) The organisational culture, design role and values, design strategies, degree of design integration with other organisational functions, etc.

(3) Management of resources, skills, processes, etc., in project development.

(4) Physical manifestations of design: products, work environment, marks, etc.

The Alicer design audit focuses particularly on features (2) and (3), without however disregarding points (1) and (4), therefore terming it a design management audit. The audit is based on the DDI model, outlined above, though it also includes ideas from other auditing models, as well as analysing other particularly relevant organisational features. Furthermore, an essential feature was to adapt each type of framework or questionnaire to the ceramic sector to achieve a fully fitted model, which will be used on eventually providing this service.

The following features, considered to be lacking in other models, have been incorporated in our model:

- Analysis of the various different competencies in different functional areas of the company such as marketing, production, finance, human resources, R&D, general management and design, with a view to having a better view of the strengths and weaknesses of the company from its point of view.

- Analysis of company organisational learning, which studies company flexibility and capacity for innovation, adaptation and change. This analysis is closely related to the type of functional design mentioned above.

- Determination and evaluation of organisational performance with regard to different aspects: economic profitability, product quality, etc.

On the other hand:

- Special attention has been paid to **product design**, leaving aside for the moment features regarding image, mark, packaging or environment.

- Nor was it considered a priority to study each company model in detail, as **process and management** are considered essential to this audit.

- Environment and market analysis were initially disregarded.

Our audit uses various techniques: interviews, questionnaires and documentation, gathering qualitative and quantitative data. The final theoretical version of this audit was thus found.

1) Study of the Organisational and Directive Environment. This analyses company reality from a general perspective. To do so requires:

- Strategic data analysis (general and product strategies, competitive differences), and descriptive organisational data on the company. Analysis of the customer portfolio (without nominal data on the customers, just general and percent data). General vision of design. Minimum analysis of production resources and economic-financial resources.
- Measurement of competitive differences in Marketing, Technology and R&D, Production, Finance, Design, Organisation and Human Resources and General Management.
- Measurement of Organisational Performance (business performance).

2) The Questionnaire on Organisational Learning. This analyses the company's flexibility, and ability to adapt and change.

3) Study of the Product Design Environment. This part is designed to determine and analyse present product portfolio structure, besides studying the product design management process. The following tasks are thus performed:

- Analysis of the latest general investments in products, product ABC, analysis of sales evolution, analysis of the product portfolio.
- Study of the product development process and its design management.
- Analysis of the most important series, especially focussing on design aspects and sources.

The Alicer Design management audit thus aims to provide a general analysis of the organisation, particularly focussing on the product design process and product management, distinctive company competences, and company level of organisational learning.

The audit there has the following objectives:

- Discerning the organisation's capacity for change and innovation through an analysis of organisational learning.
- Obtaining a more complete view of the organisational system, by an internal company audit.
- Establishing the different competences of each company area.
- Setting the company in its environment.
- Analysing company product portfolio.
- Analysing product design management.

CASE STUDIES

With a view to developing this model from an empirical standpoint and thus validating it, case studies were undertaken in the ceramic floor and wall tile manufacturing business, which simultaneously enabled going more deeply into the design management situation in this branch.

Case studies were conducted at four companies, chosen theoretically on the basis of two dimensions related to product design, which characterise this ceramic business: the existence of a design department and the degree of use of product design provided by suppliers of raw materials and other products. The first dimension determined a first strategy regarding the way the company managed design. The second dimension is a characteristic of the business: suppliers give away or include product design with the sales of their raw materials. It was thus attempted with these four companies to achieve the greatest possible branch representativity with regard to design. The case studies were carried out by interviews, questionnaires, data gathering and process observation.

Existence of a design department	Use of designs provided by suppliers of raw materials and other products	COMPANY
YES	Yes	Company A
	No	Company B
NO	Yes	Company C
	No	Company D

Table 2. *Selection criteria of representative companies on the design sphere.*

On writing this paper the case studies have not been completely finalised, owing to the extent of the work involved in completing the audits. However, all the firms have been analysed with regard to design management, besides other aspects, so that we shall focus particularly on this point in our analysis. It is certainly the most important issue in our study. We shall first describe each company and subsequently set out some of the relations found.

Company A

This company has a design department, which uses or is supplied to a certain degree with designs from the suppliers of raw materials and other products, though they also prepare designs in their department, as well as co-operating with third parties such as design studios or centres for innovation and technology. The company targets upscale and medium market segments in price and quality. In company opinion, their competitive differences lie in product design, existence of a quality centre and a marketing department as a market watcher, participation and co-operation with other sectoral institutions and a professional direction or management. The image sought is that of an innovative, dynamic company.

The purpose of design in this company is to create products demanded by the customers, providing the products with the appropriate aesthetics. The design department only prepares product projections and does some work on trend analysis in a very minor way, based on company experience at trade fairs. Product planning, development and communication are not performed by this department but by others such as marketing, development or communication.

The sales department decides which product is to be manufactured and has the greatest say in this matter. This department commissions the type of product to be designed by the design department. The design department is subordinate to the sales department.

Product meetings are held with different departments linked to the product: marketing, production, sales, communication and design, though the sales staff hold sway.

The first five series sold in 1998 involved 27.3% of that year's turnover. The first ten accounted for 39.5% of the 1998 turnover. The best-sold series was designed in co-operation with a centre for innovation and technology. The second and third series were completely designed in-company. The fourth was again designed in co-operation with the centre. The fifth was designed in-company. The sixth, seventh and eighth came from a design provided by the suppliers of raw materials and other products. Series nine and ten were in-company designs. Summing up, the five best-sold series were designed in-company or with the centre for innovation and technology.

The ideas thus came basically from the sales staff, who take the decisions. Marketing and design advance a few ideas. The sales staff are the administrators of their markets: they decide product issues, logistics, etc. Hence, with a processed idea, the sales department asks the design department for the design, which is either internally designed or externally acquired, be it from suppliers of raw materials and other products, design studios or other sources. If the idea originally came from design, the proposal was obviously more concrete than when it came from the sales department.

As the design departments is quite large and has a high capacity, only 40 or 50% of the designs come from outside. Of these about 30% come from suppliers of raw materials and other products and 10% from design studios, etc.

Company B

This company has a design department that designs most of its products, called the design and development department, as it also develops the products. It also acquires designs from design studios but never uses designs from suppliers of raw materials and other products, as the company feels that their use and designs are too widespread. The firm considers that these designs will be similar in most companies, making the product unoriginal.

The company targets a medium-high market segment. Strategy is based on high quality, products that are innovative in technology and design at lower prices than those of the competition to enable penetrating different markets. The lower price does not stop the company achieving the same or higher profitability as investments in technology cut down average product price.

It distinguishes itself from its competitors by product design, quality and high level of technology. The company has a dynamic, innovating, modern image.

The purpose of design is to differentiate company products from those of the competition. Solutions are sought based on market needs, adding a creative, original touch.

Management sets out sales, marketing and administrative strategies. The other departments do their work based on these criteria. There is an intense, good relationship between the design and development department and production, which is considered essential by the design manager for the success of new product projects.

With regard to the product design process, there is a first meeting with Management, the sales, production and design department to establish priorities in creating new products, based on available products in the catalogue, in accordance with company commercial and marketing policy. These priorities are restricted to aspects relating to size or product families (marbling, rustic, etc.) or ideas from the market screened by the sales staff or designers. On the basis of these very general conclusions, the design department prepares concrete ideas based on trends or purchases the design outside. It prepares a product projection and submits it at a second meeting with the same interlocutors, who discard or select some of the proposals. Design then starts working on the chosen proposals with development, to develop the product itself: glazes, relief, etc. After developing the product, a third meeting is held at which the prospective product is presented and its manufacture is discussed. As a result of this meeting a semi-industrial trial is run to verify the end product. At a final meeting all the participants decide whether to go ahead with the product or not.

At this company the design and development manager has a similar position to that of the sales manager. For this reason the latter is not on above of him and does not impose the product to be made.

The design department carries out the following tasks:

- Planning: trend analysis; CAD projection, scale models, presentations etc.
- Development: preparation of glazes, bodies, printing, etc., everything but processing the printing screens.
- Communication: displays and catalogues, though the later are prepared together with marketing, etc. A product test is often run or the product is shown to some distributors and customers, though not to the end user, to verify its success.

The design manager considers design to be an element of the greatest profitability for the company. The average product price rises because the product is different from that of the competition (it is possible to compete in the upscale segment) and mark image also rises: the added value is higher.

Company B designers are concerned with product quality, durability, margins, etc., without restricting themselves to purely stylistic matters. This is perhaps all tied to a company slogan: "make faithful customers" in the medium-high market segment; price and quality: seeking their satisfaction. It does not appear to be matter of selling at any price.

Company C

This company has no design department and obtains all its designs from suppliers of raw materials and other products.

It targets the medium segment with regard to price and quality. According to the company its competitive differences lie in product variety, quality control, logistics and perhaps greater customer service. For this company design involves giving the customers what they want or ask for. Design is run by the marketing manager, who mainly acts on company communication. This person obtains the designs from the suppliers of raw materials and other products, with whom he gets into touch when sales staff or catalogue needs become known, to have all types of products. No meetings are held with production or with any other department in this respect. Besides Management, the sales staff ultimately decide if a product is to be developed.

Company D

This company has no design department, though it does not obtain designs from suppliers of raw materials and other products. Its sources are design studios and centres for innovation and technology. Though there is no design department, there is a department that designs and develops products using the outside designs.

The company targets the medium and high market segments in price and quality. According to company opinion, its competitive differences lie in being product innovators, i.e., always ahead of what the market offers; doing market research; having consolidated distribution and sales networks, with company staff in different countries; investing highly in technology; having managers and sales staff with a high level of training.

Design plays a key role in the company, as it drives or is the basis of its innovating capability. Its function is furthermore to contribute quality to the product by the selection of materials and components and through product aesthetics.

Design is run by the general manager and assistant director. Both seek high product quality and aesthetics, taking into account market trends. These two persons have the first idea for a design, based on information from studies of market tendencies in design, fashion, etc., as well as from watching fashion and design centres all over the world: museums, galleries, shops in new York, Paris, London, Milan, etc. They then observe the colours, shapes, ideas, etc., which they suggest to outside designers. They then design products based on these global ideas: they create product ideas and design the product, which after being approved by both managers is passed on to the product design development department, which transforms the design into a ceramic reality.

Both managers are continually in touch with sales staff, production and other technicians who contribute their knowledge and ideas to the product. The ideas of the sales staff are heard but they do not decide on the product, as according to the general manager, their view is a partial, biased one: they would only create what is already available on the market. On the other hand, production tends to be very prudent and cautious when the issue of making a new product is raised. Customer opinion is also heard on the new product but is not conclusive, owing to their restricted vision of the market in space and time.

Besides providing the design, design studios are sometimes also involved in product communication though this is also done in-company by the development group.

The company mentioned that they had tried different ways of running product design, but the best and easiest was still the current system. They had initially had a product committee, made up of production, development and sales, besides the general manager and assistant director. However, these meetings did not allow the company to present truly innovative products, as it meant a brake owing to the individual interests of the departments involved. Now the departments voice their ideas through reports to Management or at meetings with Management, but do not decide on the product.

All the information produced by the four companies can be summed up as follows:

	Company A	**Company B**	**Company C**	**Company D**
Design department	Yes	Yes	No	No
Use of designs from suppliers of raw materials and other products	Yes	No	Yes	No
Target market segment	Medium - high, high	Medium high	Medium	Medium - high, high
Meaning of design	Giving customers what they ask for	Differentiating the product from competing products	Giving customers what they ask for	It is the basis for its innovating capability
Role of design	Design has a limited role: projection	Broad design vision: projection, development, communication and some planning	Design has a limited role: projection	Design is everything: Management is involved. Great emphasis on planning
Product meetings	Yes	Yes	No	No (meetings of Management with the various interlocutors on the product)
Role of sales staff	Product design is ultimately decided by sales staff	Sales staff are on the same level as the designers in decision taking	Product design is ultimately decided by sales staff	Sales staff inform the design manager of the market situation.
Design manager	Sales staff, designer	Designer	Marketing manager	Management (design planning)
Importance of design sources	The five best sold series were designed in-company and with the co-operation of a centre for innovation and technology	Internal, design studios and centres for innovation and technology	Suppliers of raw materials and other products	Design studios and centres for innovation and technology
Market research	No	No	No	Yes
Design type (Borja de Mozota, 1998)	-	Operative design, Functional design	-	Operative design, Functional design, Anticipatory design

Table 3. *Company characteristics.*

CONCLUSIONS

As the study has shown, the auditing model appears to contain features that determine the situation of product design and design management, besides other directive, organisational information needed to draw up a diagnostics on these features in the company. The model would therefore be validated.

The conclusions of the case studies, by means of the auditing model, are not meant to be generalised to all the companies, but are restricted to the four companies involved, though the conclusions attempt to stress the relations that exist between the various concepts or directive and organisational types of behaviour linked to design.

On the other hand, these conclusions focus on product design and design management, so that they relate to associated behaviour. That is, a company can consider its strategy to lie beyond these aspects and therefore disregard them. This does not mean an entrepreneurial or managerial error. However, if a company wishes to focus on product design, it needs to adhere to these conclusions or requirements of the design process and design management.

The following statements may be made regarding the four companies, based on the case studies conducted with the audit model:

- For good design management or to obtain economic, managerial or essential competences from design management, it does not appear necessary to have a internal design department: Company D manages this without a design department, although it requires directive emphasis on design.
- The large-scale dependence on the design provided by suppliers of raw materials and other products (companies A and C) appears to be related to the design process and design management such as: limited role of design (just projection), a conception of design as being able to give the customers what they ask for, and a power situation in which sales staff largely take the design decisions.
- In companies A and C, as sales staff play a large part in product design decisions, the possibilities of offering innovating or original products is limited, as they tend to defend rather conservative positions.
- The existence of product meetings does not appear to be decisive to good or efficient design management. However, the transfer of knowledge and information between areas or departments appears to be very important (company D).
- Good design management appears to involve an overall role of the designer or design manager in all the aspects relating to product design: planning, projection, development and communication (companies B and D).
- If design is not conceived as a differentiating or innovating element (companies A and C), it does not appear to contribute added value to the company or economic competence. The idea of design meaning being able to give the customers what they ask for stems from the preponderance of the sales department.
- In the companies that do not use designs provided by suppliers of raw materials and other products, B and D, the design managers and design play a pivotal role in the company: either the directors of the design department play an important role in the company or they are the company directors.

In subsequent communications we intend to set out the conclusions drawn from these case studies in detail, highlighting every feature of the auditing model, which it has sometimes not been possible to deal with owing to the extent of the work involved in the audits.

On the other hand, on the basis of these conclusions, it would be interesting in a future study to conduct a quantitative analysis to establish frequencies and determine the percent situation of these aspects in the Spanish ceramic sector.

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