

# An approximation to the design process as a dynamic capability in manufacturing small and medium enterprises: A multiple case study

**Juan Carlos Marquez Cañizares**

jcmarquez@itesm.mx

Instituto Tecnológico y de Estudios Superiores de Monterrey. Av. Eugenio Garza Sada 2501, 64849, Monterrey, Nuevo Leon, Mexico

**Gerardo Haces Atondo**

ghaces@uat.edu.mx

Universidad Autónoma de Tamaulipas. Av. Matamoros, 87000, Ciudad Victoria, Tamaulipas, Mexico

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## Abstract

This research identifies the particularities of the industrial design process in 18 manufacturing small and medium enterprises (SMEs) in the central region of Venezuela. To achieve this result, an investigation of the current status of the situation was done with the purpose of establishing a theoretical framework as basis. Following a qualitative approach, subsequently the phenomenon under study was identified and an initial response to this approach was obtained, leading to the selection of the method of semi-structured interviews. The result of these interviews, and the process of triangulation with other data allowed to create an exploratory case of studies. For the data analysis it was used the Atlas.ti software, which allowed the generation of categories as well as coding and grouping concepts based on similarities. As a result, after a selective comparison of propositions, a Grounded Theory represented by an explanatory model was established, as well as a design process as a dynamic capacity in SMEs manufacturing, which is divided into three levels, namely trigger, execution and manufacturing.

**Keywords:** design process, dynamic capability, SMEs, design management.

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## Introduction

Industrial design within companies has gone through a number of approaches ranging from an element primarily responsible for the function of the product, to another that allows the generation of a new business model. Particularly design management has gone from virtually non-existent in the early 1940s, to actually be a process that allows new creative forms of organization in enterprises (Borja and Young, 2009). Within the design management, special emphasis on product design process is done, as this involved or are considered a significant number of variables involving different areas of the organization. However, the dynamics imposed by the design process suggests that it may be considered this as a dynamic capability (Eisenhardt and Martin, 2000), as lead companies to create, modify and integrate different functions and resources in the organization, becoming and a core competence (Barney, 1991; Prahalad and Hamel, 1990).

However, there are few studies of the design process as a dynamic capability (Aramand and Vallieri, 2012), despite of some of them consider the flexibility that must have this process to meet the particularities of each project and to the demands and needs of customers. For this

research the proposal of Montana and Moll (2008) was considered, which identifies the conditions of design management in the company without restricting its own nuances and, suggests an open management model emphasizing key factors of the process for this that can be incorporated into the strategy of the company. Finally, this study is based on the qualitative approach which is suitable to investigate the phenomenon in context; and this article represents part of a wider investigation that involved another series of aspects were not submitted.

## Design management

The definition of design management is an activity that involves many factors, and seeks the interaction of two areas which are very different in their processes followed. As explained by Liedtka (2010), in that regard Rizal Sebastian (2005), suggest that, on the one hand, the designers assume that management is dominated by "strictly formulated techniques, methods, and tools of thought, which make it hardly compatible with the open, free and holistic techniques with which the design handles a countless number of variables" (Sebastian, 2005, p. 84). On the other hand, managers assume that the design "is out of the

instrumentality of the managerial techniques, their priorities are cultural and aesthetic, its methods are hard to explain, its values misunderstood, and are handled more like a *wildcard* in the project management pack" (Sebastian, 2005, p. 84). Such conceptions (designers' and managers'), show a strong mutual lack of knowledge, which marks a great distance between them.

Beyond all the difficulties previously mentioned, to define or understand design management, it is important to mention that the design is seen as a process which requires in all its phases, groups of specialists to take a number of decisions. These include, among other things, the form, function and manufacturing of the product. In the decision-making process, participants carry out activities related to the design and activities which are not, which may be routine or comparatively unique given the characteristics of the project or product (Rosenthal and Tattikonda, 1992). However, this dynamic is not far from what managers have to face in their daily practice and which can then indicate a point of encounter between two professional profiles (designers' and managers'). These conditions are also open to the possibility of categorizing the process that can be divided into: product, management of the design process and management of the organization (Borja, 2003; Rizal, 2005).

Finally, the design management process has to do with "adequate and successful use of participants, projects, processes and procedures that are behind the products, services, experiences and environments that are part of the everyday life of people" (Best, 2010, p. 8), within which the activities of diagnosis coordination, negotiation and design stand out (Leiro, 2008). Consequently, an effective management of the design can lead the company to have better visual impact, to a more efficient information management and a considerable increase of consumer satisfaction (Kotler and Rath, 1984), factors that will have an impact on the value-for-money of the products as well as the overall performance of the company. An effective design management may allow companies to respond to an increase in the demand of products and customers' increasingly higher demands (Ariza and Ramirez, 2007).

### Design management models

Montana and Moll (2008) propose a management design model in which the design is conceived as a set of processes involved in all activities related to innovation, primarily in the generation of new concepts, the development of new products, the redefinition of productive processes, the redefinition of commercialization and knowledge management. At the same time, the authors propose that the design be a strategic process, linked to the company's strategy. This is how the proposed model is composed:

- *Generation of concepts*: it has to do with generating ideas, product concepts, relationship marketing, and design recruitment opportunities, relationship with other departments of the company and the use of internal capabilities.
- *Strategy design*: it refers to the contribution of the design to the company's objectives, as well as to the strategy. Resources, in other words, the manage-

ment of all the resources devoted to design, from its acquisition to the protection of the same.

- *Implementation and results*: they refer to the process of designing and the impact it has on the final results for the company.

All of these concepts are framed as a cyclic process, within the corporate culture and the design orientation thus it is of vital importance that the direction of the company and its owners be involved in the design management (Iduarte and Zarza, 2010; Ward and Dekker, 2009). This model also allows for in depth learning about aspects that help determine some key elements of the company's success that have allowed for continuous operation and constant growth.

Acklin and Kaspar (2007) propose a design management model that has been called *Guide of Design Management*, with the idea of establishing a suitable route for the integration of the design and the design management in companies. This guide is raised from the following four perspectives:

- (i) *Levels*, such as the Design Staircase® model poses developed by the Danish Design Center (2001), in which it is suggested that companies be analyzed from a maturity point of view with regard to the use of the design. Within this design, four levels of maturity are established, allowing to distinguish knowledge owned by the company in relation to the design and the degree with which the company applies it.
- (ii) *Triggers*, or external factors arising from the needs of the market and the economic, political, social or environmental conditions.
- (iii) *Participants*, which are the members of the Small and Medium Enterprises (SME) capable of influencing or deciding upon the use and integration of the design and the design management.
- (iv) *Success factors*, which are the internal levers with the potential to unleash the dynamics of change within the company.

These four perspectives represent the access points through which the SMEs can improve the incorporation of their design and recognize its potential. However, the main premise is that the company's level of maturity is determined first and then the factors of success are to be evaluated in its three levels (strategy, products and culture). This will allow at the same time to define ways to improve the integration and the management of the design.

Ariza and Ramirez (2007) propose, within the Design Program of the National Institute of Industrial Technology of the Republic of Argentina, a model of *technical assistance to SMEs*. The model seeks to help companies in their design management process and is divided into four successive stages: integral diagnosis, counseling, monitoring and evaluation. These are performed simultaneously in regard to the organization, the design process and the product.

In the case of the *organization*, the model seeks to improve the link with the designers, the incorporation of the design in the culture of the company and the importance of the design in its strategy. From the point of view of the

design process, the methods and tools used intend to optimize the management of the information and the knowledge generated, as well as the relationship between all those involved in the process. Regarding *product*, the focus is on all the elements that are involved in its configuration. These are considered a set of related subsystems that involves the material (materials, form and function), transformation, communication and consumption. The idea of simultaneously addressing the organization, the design process and the product, makes Ariza and Ramirez's model (2007) much more interesting in practical terms, since, unlike other design management models, it does not focus on a single aspect or considers them all as one thing. This allows for a more precise diagnosis and to conduct specific actions in regard to each aspect, thus increasing the chances of success at the time of its application.

As it has been observed in the design management models previously described, this is a process with a particular set of constituent elements and actions that may be developed. This could be attributed to the nature of the design and the company's activities, which require the participation of different actors through a well-structured communication system to allow a cyclical process of cooperation throughout the company so that it can generate the expected results.

## Methodology

Given the characteristics of the phenomenon under analysis and the lack of formal documentation in this regard in the Venezuelan context, the research was conducted under a qualitative approach (Strauss and Corbin, 2002). A review and deeper analysis of literature was performed (Strauss and Corbin, 2002), which enabled the development of a theoretical framework and allowed the comprehension of other approaches that have studied a similar phenomenon or in another context in particular (Kim and Kang, 2008; Hevner *et al.*, 2004). Additionally, this method encouraged the learning of different methods or ways to address the approach and include the collection and analysis of data (Hernandez *et al.*, 2010). The literature review allowed us to select a model that would serve as a framework of reference for structuring the data collection instrument and guide other aspects related to the subject of research (Yin, 2003), without constraining the same approach (Strauss and Corbin, 2002).

The selection of the sample was based on the existence of the phenomenon that occurs in manufacturing companies of finished products that use the services of the industrial design. The sampling method of standard cases was chosen. The criteria applied in the selection were the following:

- (i) They were SMEs (according to Venezuelan law) of manufacturing finished products.
- (ii) They were companies that use or have used the services of industrial design.

- (iii) They were located in the geographical area where there was the largest concentration of companies with similar characteristics. The sample included 18 companies.

Due to the nature of the phenomenon under analysis, a semi-structured interview (Iduarte and Zarza, 2010; Marquez *et al.*, 2012) was used. For the design of interview protocol, a management model design was considered proposed by Montana and Moll (2008). The instrument was conducted with a manager or owner of each company, considering that they were the most informed to explain the phenomenon analyzed in this paper (Iduarte and Zarza, 2010; Marquez *et al.*, 2012). During the interview process, notes were simultaneously taken regarding aspects that caught the attention of the researcher and which contained new information about the phenomenon and serving immediate reference to the generation of grounded theory (Eisenhardt, 1989). In this sense, and following the recommendations of Yin (2003), a multiple-case study approach of exploratory nature was chosen, since it adapts to the nature of the investigation and is appropriate since the results seek to answer the questions of "how?" and "why?". It also allows inquiring about a contemporary phenomenon (Eisenhardt, 1989) and its participants in a real environment (Lee *et al.*, 2009; Montiel, 2012). For the construction of cases, a triangulation<sup>1</sup> technique of the different sources of information was also used (key informants, literature review, websites of the companies, etc.).

For data analysis, an *open coding process* was followed (Strauss and Corbin, 2002). In this process, segments were analyzed to extract concepts. At the same time, other segments were compared to establish similarities and differences. This was defined by Hernandez *et al.* (2010) as "constant comparison", since it is done at all times of the open coding process. The differences between segments allowed defining the dimensions of the concepts and similarities allowed to establish categories and properties (Strauss and Corbin, 2002).

Defined categories were considered as codes (Miles and Huberman, 1994). The "constant unit" was defined (segments or elements of content present in the whole sample and on which the comparison is made). After the reviewing all the data and having consolidated the categories, it was determined that the most appropriate constant units were "text lines", considering that it written information being analyzed (Hernandez *et al.*, 2010).

Once the coding and the unit of analysis (constant) was defined, the information was loaded to the *software* ALTAS.ti<sup>2</sup>. The information was grouped into categories thus leading to the analysis phase which took place (under a constant comparison process) separately from these large blocks of information, to extract and define the concepts (Aramand and Vallieri, 2012). In regard to the "Design Management" 21 concepts were identified and

<sup>1</sup> According to Zapata (2005), triangulation consists in using multiple techniques for collecting data and interpretations, in different cases and conditions. It is also a technique for testing results using different methods.

<sup>2</sup> Atlas.ti is a *software* for the analysis of qualitative data, which enables: segment information in units of meaning, encryption of data and construction of theory. It is currently one of the most recommended software for qualitative research which seeks to generate grounded theory (Hernandez *et al.*, 2010).

**Table 1.** Established concepts for “Design Management” (MD).

N°	Concept	Definition
1	Triggers	Immediate cause of a project or design process
2	Process	Set of tasks pursuing a common goal
3	Organization	Coherent arrangement of all the elements that make up the company
4	Competitive monitoring	Ongoing monitoring of activities and competitive products
5	Customer participation	Activities of the client project in the realization of it
6	Participation of executives	Activities carried out by company executives in activities related to the design
7	Design philosophy	Knowledge that seeks to establish the principles of design guidance
8	Relationship to other areas	Relationship of the design area with other areas of the company
9	Multitask	Element that performs various tasks that may or may not be interconnected
10	Professionalism	Training and control over the activities staff design company
11	Generation concepts	Generating ideas about new products
12	Design policies	Set of guidelines that guide the design activities
13	Outsourcing	Assign to third parties certain activities related to the design
14	Risk	Degree of uncertainty with which the activities are performed
15	Approval	Activity give as good or sufficient results something in particular
16	Control	Domain or command over activities
17	Evaluation	Assign value or estimate the value of activities
18	Human Resources	Persons involved in design activities and their capabilities
19	Versatility	Ability to adapt
20	Briefing	Document the guidelines and conditions of the project
21	Communication	Exchange process and interpretation of messages between participants design activities

Source: Own elaboration from the analysis of the information.

defined (see Table 1), within which all the phrases or Constant Units were grouped. With this new segmentation or encryption units, we were able to, at the same time, set the frequency with which each concept was present in the cases. The frequency allowed to define which concepts where the ones that prevailed or had preponderant place, in addition to identifying in which Cases each concept was present, thus establishing patterns that would reach the Selective Coding (Strauss and Corbin, 2002).

Nevertheless, due to the volume of Units, rather than reducing the concepts, they were divided into the following subcategories: triggers, organization of the process, the design relationship with other areas and activities of the company, and customer engagement. Once the concepts were located in each subcategory, the frequency and prevalence of these in the Cases was determined. However, to identify and define the concepts of “Risk Management” (see Table 2), it was determined that there was a very close relationship with “Design Management” (Hernandez *et al.*, 2010). Thus, this could be considered a subcategory especially because of the link that exists between the set of activities involving each of these. Accord-

ingly, the concepts of “Risk Management” were regrouped and related to the concepts of “Design management” in a process of axial comparison<sup>3</sup> to generate a consolidated analysis of these two groups as if it were one.

Holistically, Figure 1, outlines the sequence of steps that the data analysis process followed, which, despite not being applied with the same rigor for all categories, does allow to graphically describe the process.

In the case of this research, theorizing for the construction of the grounded theory (Strauss and Corbin, 2002), arises through the *open coding process*, which post to the analysis, the constant comparison, categorization and coding (Miles and Huberman, 1994), a phase of relating the categories with their concepts and the frequency of these began. This initiation gradually allowed the delimitation of the theory through the specification and determination of the dimensions with the idea of building a theoretical model (Strauss and Corbin, 2002).

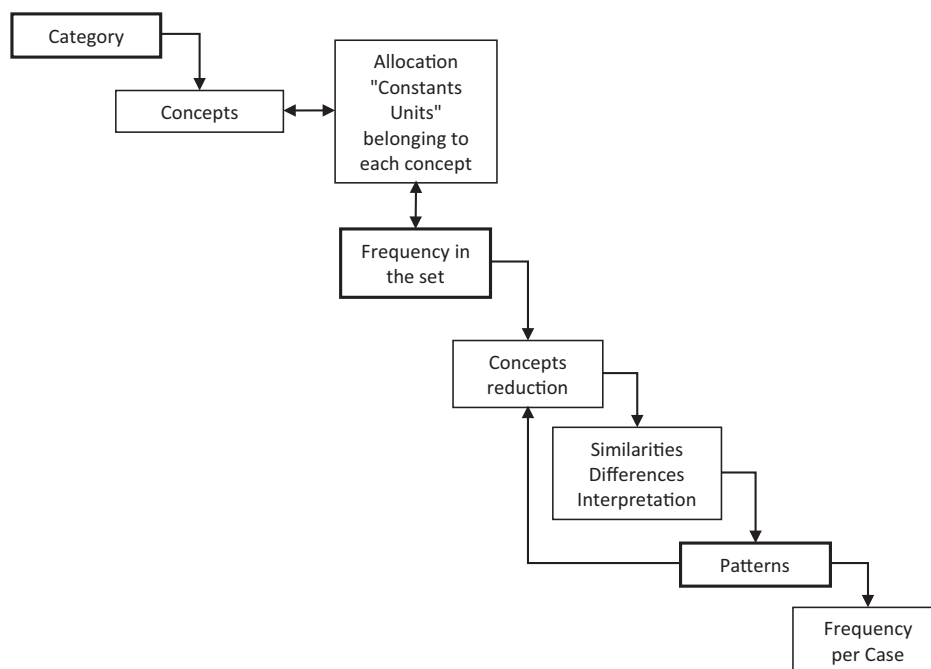
The construction of the model starts with the analysis of similarities (or coincidences) of cases (Miles and Huberman, 1994; Montiel, 2012; Serrano and Villalobos, 2006), under what is called *Selective Coding* (Hernandez *et al.*,

<sup>3</sup> Axial comparison mainly consists in regrouping the data that has emerged from coding to create connections between categories and topics. However, open connections that are generated or new groups, are fixed by the researchers considering the conditions in which they occur or not, context, actions and consequences (Hernandez *et al.*, 2010).

**Table 2.** Established concepts for “Risk Management” (RM).

Nº	Concept	Definition
1	Briefing	Document the guidelines and conditions of the project
2	Customer participation	Activities of the client project in the realization of it
3	Customer Selection	Discard process not potential customers
4	Projects selection	Discard process projects with much uncertainty or not potential
5	Procedures	Set of activities of a process or steps to perform a particular activity
6	Vertical integration	Absorb or acquire other companies that make up the chain of activities of the company
7	Approval	Activity give as good or sufficient results something in particular
8	Capital goods	Goods that are intended for a particular project or constitute assets of the company
9	Efficiency	Optimum arrangement of company resources
10	Evaluation	Assign value or estimate the value of activities
11	Participation of executives	Activities carried out by company executives in activities related to the design
12	Experience	Prolonged practice of the activities in question
13	Outsourcing	Assign to third parties certain activities related to the design
14	Professionalism	Training and control over the activities staff design company
15	Diversification	To convert to multiple and diverse than it was uniform and unique
16	Reactivity	React to events or actions of competitors
17	Alliances	Alliances with suppliers or other companies in the industry for increase the level of certainty
18	Advance payment	Payment made by the client for the project to start
19	Differentiation	Action and effect to differentiate from others. Distinction
20	Specialization	Cultivating knowledge of any activity of the company
21	Multidisciplinary team	Development teams comprised of professionals from different branches of knowledge

Source: Own elaboration from the analysis of the information.



**Figure 1.** General diagram of the data analysis process.

Source: Proprietary development.

2010). In other words, you select the concepts that have been most frequent and which explain with more detail the situation analyzed, returning to the units of analysis or segments. From these similarities, *propositions* arise that support each of the parts of the theoretical model as well as underlying theories which arise from the comparison. In this scheme, a *description* of the findings (which often includes the exact phrases of the cases), an *explanation or interpretation* of the same, and finally the *relationships* that emerged among them, organized under a few sections that allow a clearer discussion of the theoretical proposal are included.

As a culmination of the process, the proposed model was subjected to analysis by three businessmen. The proposal was sent by e-mail and then they were interviewed using Skype®, a program which facilitates calls and video calls over the Internet. In these feedback sessions, the proposal was explained and the entrepreneurs expressed openly and without conditions, their general and specific views of the model, which was a very important activity for the validation of the grounded theory.

## Results

The different processes of comparison and coding of information (open, axial and selective), which were described in the previous section, led to the categories: importance of design for the company, policies, design and strategic planning, management of the design process, and novelty, which is emphasized in the management of the design process and on which this paper focuses.

To illustrate the correlation of the analysis in this chapter, Table 3 portrays the cases that were used for the research and which are numbered and described. This table presents a general description of each case, according to different aspects which allowed the interpretation of the results not only with reference to the number that identifies each case, but also to how each company determines or influences their response, thus extending the depth of the analysis.

## About triggers

A key element in the management of the design is the trigger or activator that gives birth to the participation of the design, whether it is for the development of a product or for other activities as suggested by Acklin and Kaspar (2007)<sup>4</sup>. In this regard, one of the main reasons described in cases 4, 7, 9, 11, 16, 17 and 18, is by the direct request of a client. Reason that is very logical considering that cases 4 and 17, design stands, cases 7 and 18, make point of sale material and cases 9, 11 and 16, make, in addition to a series of products, almost exclusive products (e.g. boats custom case 16). This does not mean that all projects are for new customers. However, they respond frequently to captive customers, so it depends on the trust and reputation of the company. This may also be influenced when it comes to attracting new customers, if it is considered that

new customers will seek references from the company. On the other hand, there are companies that have a sales department as it occurs in cases 3, 4, 5 and 8, and this has a positive impact on the frequency of projects.

Another important reason, for several of the cases and which triggered the process of design, is the *request or need of consumers*. This situation occurs in cases 2, 3, 5, 6, 8, 9, 10 and 12, in which the nature of its products and industry, forced them to investigate or listen to what consumers manifest frequently. Based on these approaches, they decide to develop new products or make changes to existing ones. However, this dynamic means for businesses, the implementation of procedures or techniques that allow an effective collection and interpretation of consumer requirements (needs, wishes and demands).

Cases 1, 2, 10 and 11, pointed out as one of the main reasons to activate a design process, *management concerns*; reason that can be related with competitive monitoring and field observation, that were other reasons outlined in cases 2, 9, 14 and 15, since it is exactly the management team the one that must pay attention to this monitoring and observation to take actions that may allow the company to respond suitably and to hold a position competitively. However, while these are activities of the management of the company, they allow to demonstrate a reactive position or an "imitative" one by these companies, as suggested by Christopher Freeman (1986 [1982]).

It is important to mention that cases 2, 14 and 16, said to have taken on several occasions, as their main reason, *move from a reactive position to a more "proactive"* as well as *being at the forefront with the latest trends in the market and innovation*. These reasons can be interpreted under strategic premises driving such decisions, since they seek to achieve a more advantageous competitive position (Table 4, proposition 1).

## Implementation

Once the company has decided to start the project, all cases agreed that the immediate activity to fulfill was the preparation of the *briefing*, which was made with the intention of defining and clarifying the details of the product design (Iduarte and Zarza, 2010; Lacruz-Rengel, 2008; Onzi *et al.*, 2009). They can be made in different ways, but the purpose is the same. In cases 3, 4, 7, 9, 16, 17 and 18, designers are involved directly in the preparation of the briefing, while in the cases 1, 5, 8, 13 and 15, is made mainly by the sales or marketing department. In cases 2, 6, 10, 11, 12 and 14, it is elaborated by the CEO or the board of the company. However, in companies where the trigger is a client request (cases 4, 7, 9, 11, 16, 17 and 18), this often intervenes in the generation of the briefing. Since it must give its approval for the project, it will develop and agree to the terms and conditions of delivery that are usually specified in a contractual document (Table 4, proposition 2).

<sup>4</sup> Despite that Acklin and Kaspar (2007), describe triggers mainly as external factors, this research does not make such a distinction, because internal elements that can be triggers for a design or product development process are also considered.

**Table 3.** Case list.

Case	General description	Products manufactured by the company	Quantity of products	How to incorporate design	Most important production processes
1	Manufacturing scaffolding and shelves	Shelves, kit and equipment for housing construction.	12	Internal development department	Metalworking, electrostatic painting
2	Manufacture of chairs and office furniture and home	Chairs, filing cabinets, bookcases, conference tables, receptions and desks, entertainment centers, kitchens and tables.	45	Consulting with external designers, and by projects	Metalworking, machining wood, paint, polyurethane injection
3	Design and manufacture of school furniture and office equipment.	Archives, libraries, desks, tables and modular systems	22	Internal design and development department	Metalworking CNC, CNC woodworking, painting
4	Design and manufacture of custom and serial exhibition stands	Exhibition stands, merchandising furniture and stage sets.	15	Internal design department	Wood machining, welding, painting in oven
5	Design and manufacture of children's furniture for the home.	Bedroom furniture, cots and bed-cots	11	Full-time designer	CNC Woodworking
6	Design and manufacture of furniture Ready To Assembly (R.T.A.)	Furniture, libraries, bed-cot, chifffonier, cribs, games room, desks, bunk bed and chairs	33	Internal design department	CNC woodworking, and automation
7	Design and manufacture of material for the point of sale/purchase of products	Floor displays, counter displays, tray gun towers, gondolas, shelves, pennants	42	Internal design department	Thermoforming, blacksmithing, and woodworking CNC
8	Design and manufacture of modular furniture for the home.	Modular kitchens, bathrooms, bedrooms and kitchen accessories	27	Full-time designer	CNC Woodworking
9	Design and manufacturing of custom lighting systems and standard	Commercial lighting, outdoor, led, table, wall, standing, ceiling and spotline.	220	Internal design department	Metalworking, electrostatic painting, comprising
10	Design and manufacture of furniture for home R.T.A.	Bookcases, tables, entertainment centers, closets, desks, tables, etc.	54	Internal design department	CNC woodworking, and automation
11	Manufacture and assembly of military vehicles	Body and parts of military vehicles	9	Internal design and development department	Metalworking, fiberglass molding, upholstery
12	Design, manufacture and marketing of children's furniture and youth	Bunk beds, games room, beds, closets	23	Internal design department	CNC Woodworking
13	Manufacture of home furnishings and decorative coating	Modular structures, elements for closets, coatings	11	Internal design department	Machining wood and ironwork
14	Design and manufacture of furniture and equipment for beauty centers.	Chairs, combers, benches, couches, lamps, assistants carts, shampoo basins and tables	129	Company hiring external design project	Upholstery, metalworking, thermoforming, machining Wood
15	Making small boats with inflatable parts.	Rowers, boats and light boats	27	Internal design and development department	Fiberglass molding, paint oven, and making Neoprene
16	Design and manufacture of custom and standard sports boats	Sport boats and fishing boats	16	Internal design and development department	Fiberglass molding, ironwork, painting in oven
17	Design and manufacture of custom and serial exhibition stands	Exhibition stands	35	Internal design department	Wood machining, welding, painting, and laser cutting
18	Design and manufacture of material for the point of sale/purchase of products	Floor displays, islands, counter displays, tray gun towers, gondolas, gondola tip, shelves, pennants and break-traffic	68	Internal design department	Wood processing, metalworking, laser cutting, thermoforming, and painting

Source: own elaboration starting from the selected sample and preparation of cases.

When the briefing is already defined, what can be called the *creative stage* or the generation of ideas begins<sup>5</sup>. At this stage, the procedural or methodological peculiarities that have implemented the companies come to light, in this respect we can distinguish the following: some cases begin with an *investigation of existing products* or to address a similar problem situation (cases 4, 6, 7, 17 and 18), which are performed mainly by Internet. On the other hand, cases 1, 3, 5, 8, 10, 11, 15 and 16, said they receive from own or external sources results of market research about products that consider the competition. There are other companies such as cases 2, 9, 12, 13 and 14, where related product research is avoided at the beginning of the project to not condition the creativity of designers, or simply for it not to have great relevance (Table 4, proposition 3).

In cases 2, 3, 7, 9, 14, 16, 17 and 18, the beginning of the creative phase of the project is accompanied by the definition of a "design concept", this concept can be graphic by analogy or in words that are interpreted by consensus. At this stage of idea generation, methods are also used as brainstorming and drafts made (Ulrich and Eppinger, 2004), where designers express their approaches with drawings and words of what they believe may be the solution or the characteristics the product should have to develop it. In cases 3, 7, 9, 16 and 18, this activity is considered essential and is verified or even approved by the general management to make a selection from among all the ideas that have emerged in the creative process. However, it should be noted that while other companies do not devote special attention to the sketches by hand, this does not mean that they do not make them, but this is ephemeral or drawn directly onto the computer using programs of computer-aided design (CAD Computer-Aided Design).

In the creative phase and generation of ideas, two activities stand out that can be considered for support, (i) the management of information and (ii) the approval (which is explained below in the section on risk mitigation), both of which facilitate and allow the selection of the final design. To reach a nearly final approach of the product, cases 9, 11, 14 and 16, expressed to make volumetric models of a scaled-down proposal (smaller than the product once finished) or scale (with the same measures that will have the finished product), with materials that a nearly identical simulation of the appearance of the finished product can be achieved. In cases 4, 11 and 17, most of their prototypes are already the product that will be delivered to the customer or the first of the series. For their part, companies that do perform a physical prototype, do it as a means of validation and verification of the final proposal, so as to obtain an approval from the customer before manufacturing the series (cases 1, 2, 7, 9, 16 and 18) (Table 4, Proposition 4).

When the prototype has been fully approved, a stage of *production, planning and tuning starts*, on which companies have developed particular procedures according to their expertise and resources at their disposal. However, it

is important to mention that almost all of the companies said that the designers in some way or another are also involved in this stage (Table 4, propositions 5 and 6).

### About the relationship of design with other areas and activities of the company

The fact that in the majority of companies, designers are related to the area or the department of *production* is highlighted, which is not strange since due to the nature of the activities carried out and the close relationship that exists between both. However, it has caught our attention that in cases 3, 4, 5, 10, 16 and 18, the designers have some kind of responsibility in the productive part or specifically, have to be guarantors of quality in the processes of manufacturing (cases 5 and 18), as mentioned above. Another area with which the design relates is *marketing*. Cases 5, 6, 10, 12, 14 and 16, been particularly interested in describing these areas (marketing and design) to work dependently. As "of closely related to the design part", cases 1, 2, 3, 4, 7, 9, 13, 16 and 18, mentioned the part of *sales*, where these areas communicate constantly to make queries or share information about projects and clients. This point strongly calls for attention on case 18, since it was mentioned that sales not only have a relationship with the design, but that is formed by industrial designers.

This particularity, in relation to different areas of the company that have the design<sup>6</sup>, is linked to the importance that it has for these companies. However, it is important clarify that such a relationship is also a dynamic process that is determined by the project the company is carrying out or by the phase in which it is located, including the areas with which the design department can interact within a design (Table 4, proposition 7) project.

### About risk mitigation

As result from this investigation, different measures or actions that the companies consider to mitigate the risk that the product generation and the management of the industrial design implies (Jerrard *et al.*, 2008). In this regard, three groups of activities can be distinguished. In a first group there are those that can be catalogued as control activities, between which the definition of briefing stands out, mainly in cases 4, 7, 9, 11, 13, 16, 17 and 18. Half of the companies (cases 1, 3, 5, 7, 10, 11, 13, 15 and 18), stated having clearly established procedures as part of their control activities. Thus, this allows them to track the development of projects and take the corrective measures that are needed. Cases 1, 3, 5, 11, 13 and 15, justified its use (of control activities) also by the pretense of obtaining any certification or accreditation.

Another activity that cases 1, 2, 3, 7, 9, 10, 14, 17 and 18, considered to be of great value for the mitigation of risks, is the participation of the directive board. It moni-

<sup>5</sup> The generation of ideas is the first stage of the development process of new products proposed by Kotler and Armstrong (1998), under the approach of marketing, the difference is that in this case (of the design process) the type of product is already much clearer to design or what is expected from it.

<sup>6</sup> These findings have a great relation to what was said by Valencia *et al.* (2013), stating that industrial designers play different roles in the companies that are relevant to other functional areas such as production, marketing, engineering and sales. However, in this research we have been somewhat specify regarding the importance of the role played by the designers.



**Table 4.** Set of propositions that came up as part of results.

No.	Proposition
1	Starting from the differences and similarities of the companies it is possible to speak of a pattern when referring to triggers of design process, since three non-excluding types stand out as the most significant: the request of the clients, the demands of the market and the own interests of the company.
2	Once the accomplishment of the product has taken shape, an execution stage begins, where the company develops a briefing to define the details of the project and the product, in whose elaboration the designers, the department of sales or marketing, the general management and/or the client can intervene.
3	After the making of the briefing, companies start with an investigation of existing products that keep some relationship with what is intended to design and for that they use different sources of information, which can range from a custom search to external sources of data about products.
4	The most important activities that allow to reach the final proposal of the product are: investigation of existing products, idea generation, development of the design concept, elaboration of sketches by hand, digitization of the proposal through CAD and prototyping.
5	The activities of designers in the design management will be held until the verification of production processes, according to conditions and quality standards established for the developed product.
6	The design process in companies is marked by procedures that in the majority of cases are tacit, but that guide the steps that must be followed since a project of design is started until the product is on the market. However, this sequence of steps is not necessarily a method, but it is a flexible process, which is adjusted according to the nature of the project.
7	The team or industrial design Department will always have some sort of relationship with other areas; mainly with production, marketing and sales. Where useful information is shared for projects and the details which are the responsibility of each area in relation to the others is collaboratively defined.
8	Companies seek to mitigate the risk on the development of products through control activities, having to do with selection of clients, projects, manufacturing, quality and participation in policy development. Activities of approval which relate to the participation of customers, the directive board and the evaluation activities that have to do with the commercial feasibility, costs and profitability. This set of activities varies according to the nature of the project and the purpose of it.
9	Customer or consumer participation varies depending on the nature of the products of the company or of the project that is been run, however, it is possible to distinguish some specific activities in which their participation is more significant, as the trigger for the project, the preparation of the briefing, the generation of ideas and concepts, the approval and evaluation of the project.
10	Customer or consumer participation in the management of the design process, is conditioned by the dynamics of communication established by the company, and how it favors conditions so that such participation is effective and generates significant contributions in the process. The dynamics of communication is evident in different activities that enterprises carry out so that the customer or consumer expresses concerns on activities that have greater importance.

tors the development of projects and takes steps to ensure that they reach a successful conclusion. Cases 2, 7, 9, 14 and 17, stated that many of the decisions correspond to the experience of the directive board or the intuition in a way that some of them may focus on a design project in particular (cases 2 and 17).

A second group comprised by what can be considered as *approval activities*, which seek, from a different perspective to control activities, ensure the development of the projects with an emphasis on the validity of what is being done. In relation to this point, the participation of the client stands out, as in cases 4, 7, 9, 11, 16, 17 and 18, not only to seek an agreement during the briefing, but rather the client must give the go-ahead of the project in stages as the generation of concepts, the final design and prototype. The participation of the directive in approval activities is also found. This acquires significant importance when companies decide to establish that some have called a "Steering Committee" as in cases 1, 2 and 10, where depending on the magnitude of the project, the directive board is organized to make the decisions required

by this project with the idea of reducing approval times and optimizing the time invested in development.

Finally, there is another group that is listed as *assessment activities*, since they seek to estimate and evaluate certain aspects of the projects, as well as an overview of the same. In this sense, the evaluation of the commercial feasibility stands out first, which passes through the relevance with the production processes of the enterprises, a point on which cases 1, 3, 5, 6, 8, 10, 12, 14, 15 and 16 make emphasis. Related to this are the market tests, which cases 3, 5, 6, 10 and 15, constantly carry out seeking to evaluate new product ideas, as well as the economic feasibility-level price. Another activity of evaluation is the analysis of costs and profitability, on which all cases, without exception, evaluate the impact on the company if the project were carried out.

As mentioned at the beginning of this section, this set of activities (control, approval and evaluation) are intended to mitigate risk and provide greater certainty to companies when generating new products or activities. These are related to the management of industrial design, and are not in a mutually exclusive relationship (Table 4, proposition 8).

## On the participation of the client and consumer

In cases 4, 7, 9, 11, 13, 16, 17 and 18, it is the *customer* which proposes the initiation of the project. This may be a company or applicant institution, while in cases 2, 3, 5, 6, 8, 9, 10 and 12 they are perceived as consumers who purchase and use products. However, it is important to clarify that there may be two figures, users, who are using products and *buyers* which are those who buy the product at the point of sale, which finally turn out to be those who requested (through different communication channels), a need for a product that triggers on a project's design for the company.

There are companies that handle series of products and specific products for clients, such as cases 1, 2, 9, 11, 13 and 16, as well as companies that can have a single client. But this has not intervened in the process of design, but who buys a batch of a series product designed and manufactured by the company (cases 1, 3, 8, 9, 13, 15 and 18). Having clarified this, you can then define that clients in cases 4, 7, 9, 11, 13, 16, 17 and 18, have a significant role throughout the project and play a particular role in the activities of control and approval as mentioned in the section on risk mitigation. They are even asked to participate in assessment activities in a timely manner in the final phase of the design and "prototyping" since at that time details can be defined and corrected before starting production. In this regard, it was strongly highlighted in cases 4, 7, 9, 17 and 18, that designers tend to make sketches of the product in the first meetings with the client. Thus, making it part of the generation of ideas<sup>7</sup> and corroborating what he expects is something similar to what the company can offer as a product, reducing time of elaboration of proposals and facilitating the necessary agreements.

With respect to users and buyers, as well as appearing as triggers of projects, they also play an important role in evaluation activities as it was previously mentioned. They come to participate in product testing before they are released in series to the market, as manifested by cases 3, 5, 6, 10 and 14. On the other hand, lines of direct communication with consumers, are handled through the points of sale and after-sales toll-free numbers, allowing companies to obtain first-hand information on the acceptance of products and the needs and expectations of users. Beyond this participation that users or buyers have, each product design project is an in-depth analysis of them in terms of ergonomic, aesthetic, functional aspects and segmentation of the market (Table 4, propositions 9 and 10).

## Conclusions: An approximation to the design process as a dynamic capability in manufacturing SMEs

The results of the research have allowed the structuring of a sequence of actions tailored to the reality of the companies under study. Despite relating to proposals openly broadcasted on media, academics and profes-

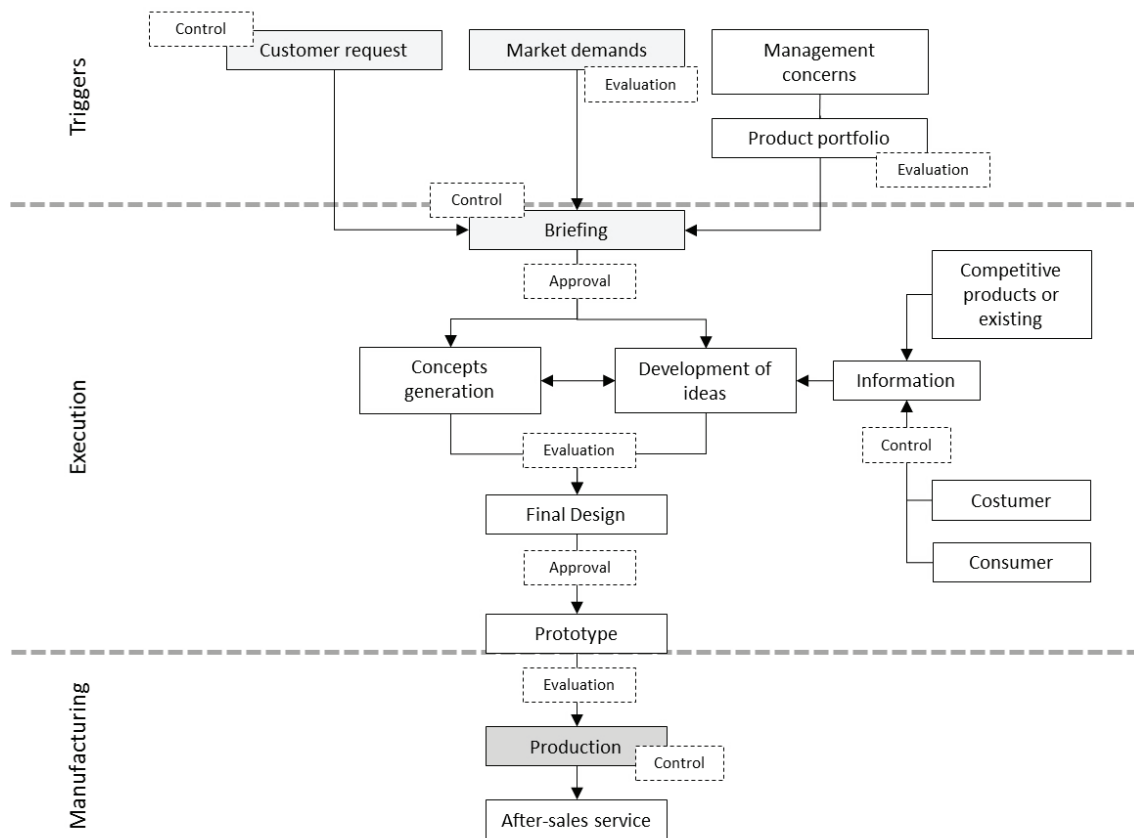
sionals no longer offer new light on other variables that should be considered and which are used by enterprises. Additionally, research has revealed different strategic aspects of SMEs in manufacturing that are directly related to industrial design, but which do not obey formulas or patterns previously established. But, on the contrary, they arise from the ingenuity of entrepreneurs and their interest in maintaining active their companies in the face of environmental "turbulence" or simply by the changes imposed by the economy. In this sense, the magnitude of this research has generated a considerable number of proposition (portrayed in Table 4), but beyond that, the particularities of each one of them is a viable proposal of how these can be integrated to generate a model (see Figure 2) which allows the understanding of all statements as part of an interconnected process.

On the basis of the previous approach, it can be concluded that the management of the process of design, is an activity which establishes first, triggers, or those factors that lead to the project of design of a product, within which are a client's request, the demands of the market and own concerns of management according to the needs of the company and the own portfolio (proposition 1). All triggers must conclude with the generation of a briefing, with which a stage of *execution* is initiated. For briefing the company also defines a format where it specifies all the necessary information for the accomplishment of the project in which the involved parts agree and designers, the department of sales or marketing research, the general management and/or the client can take part in the elaboration (proposition 2) of the project.

With the definition of briefing the creative stage of the process begins. Here one generally begins with an existing product investigation (proposition 3), to optionally define a design concept and begin to sketch what could be the product. Of these ideas, the one that is considered as the most adequate to be digitalized by means of CAD programs is selected. It offers greater certainty before establishing the final details of the product. Once this is done, it is made into a physical representation by means of models or directly to the prototype of the product to establish the final proposal (proposition 4). A last stage of this process is the manufacture, in which the designers involved verify that the production processes are developing as they are defined for the product and under the expected quality standards (proposition 5). However, this step sequence is not a methodology nor a rigid structure, but a flexible or adjustable one according to the project and under the particularities of each company, considering its amassed experience (proposition 6).

The design process and the activities of the designers involve a relationship with other areas of the company. Among them, in the first place the production segment stands out for the obvious condition that designed objects must be produced or manufactured. Another area of great value is that of marketing, as a source of information for projects and adaptation of products for marketing. Finally, the area of sales as a source (trigger) of product design

<sup>7</sup> This participation is suggested by Steen (2013), on collaborative processes where concerns are shared and new ideas generated, among all involved, for the solution of problems or for product design.



**Figure 2.** Organization of the design process.

Source: Own elaboration based on the information obtained in the investigation.

projects. In general, these areas actively participate during the process of product design with contributions from their more important competitions and in relation to the general mission of the project (proposition 7).

Among the activities to mitigate the risk developed by companies, control activities stand out, within which the selection of the clients previous to sending out the budget or the beginning of the project; the control of all the necessary and contemplated activities during the development of the design project; control of the manufacturing process to fulfill in time with the client or the programming; control of the quality of products to fulfill clients or consumers expectations; and personal control of the tasks on the company's directive part. Another group of activities is those of approval, within which the ones that the client conducts in different phases or moments of the process, stand out. And the one that the directive board does so that the project is carried out or advances appropriately. Finally, a group of evaluation activities seeking to estimate the commercial feasibility of the product, the associated costs and profitability that can be generated (proposition 8).

The management of the design process is conditioned, in addition, to the participation of the client and consumer. Clients participate actively as triggers, in the elaboration of the *briefing*, the generation of ideas, approval activities and evaluation activities; whereas the consumers as triggers in the generation of ideas and con-

cepts (proposition 9). This participation of the client and consumer is defined by the dynamics of communication established by the company so that these agents can show their concerns and provide the necessary information according to the activity being carried out (proposition 10).

To finish, we cannot avoid mentioning some limitations of this study. Firstly, it is important to clarify that this research did not analyze the prior design experience the managers of companies might have had, this to decide to include design in the Organization, nor the time they had using the design services. A separate analysis of the companies was not made either according to the type of products they make or the form they incorporate the services of the industrial design.

Finally, the lack of rival interpretations suggests the need to research in greater depth in future studies the aspects that did not come to a substantial conclusion for the case.

## References

- ACKLIN, C.; KASPAR, H. 2007. Design Management for Small and Medium-Sized Enterprises. *In: International Association of Societies of Design Research 2007*, Hong Kong. Available at <http://www.sd.polyu.edu.hk/iasdr/proceeding/papers/Design%20Management%20for%20SME%20Development%20of%20a%20Guide%20for%20the%20Use%20of%20>

- Design%20and%20Design%20Management.pdf. Accessed on: January 25, 2013.
- ARAMAND, M.; VALLIERI, D. 2012. Dynamic Capabilities in entrepreneurial firms: a case study approach. *Journal of International Entrepreneurship*, **10**:142-157. <https://doi.org/10.1007/s10843-012-0088-3>
- ARIZA, R.; RAMIREZ, R. 2007. Herramientas para mejorar la gestion del diseno en PyMEs. In: Jornadas de Innovación y Desarrollo, 6, Buenos Aires, 2007. *Proceedings...* Instituto Nacional de Tecnologia Industrial.
- BARNEY, J. 1991. Firm Resources and Sustained Competitive Advantage. *Journal of Management*, **17**(1):99-120. <https://doi.org/10.1177/014920639101700108>
- BEST, K. 2010. *Fundamentos del Management del Diseño*. Barcelona, Parramon, 208 p.
- BORJA, B. 2003. *Design management. Using design to build brand value and corporate innovation*. New York, Allworth Press, 288 p.
- BORJA, B.; YOUNG, B. 2009. Managing Design as a Core Competency: Lessons from Korea. *Design Management Review*, **20**(2):67-76.
- EISENHARDT, K. 1989. Building theories from case study research. *Academy of Management Review*, **14**(4):532-550.
- EISENHARDT, K.; MARTIN, J.A. 2000. Dynamic capabilities: What are they? *Strategic Management Journal*, **21**:1105-1121. [https://doi.org/10.1002/1097-0266\(200010/11\)21:10/11<1105::AID-SMJ133>3.0.CO;2-E](https://doi.org/10.1002/1097-0266(200010/11)21:10/11<1105::AID-SMJ133>3.0.CO;2-E)
- FREEMAN, C. 1986 [1982]. Innovation and the strategy of the firm. In: R. ROY; D. WIELD (eds.), *Product design and technological innovation*. Milton Keynes, Open University Press, p. 98-104.
- HERNANDEZ, R.; FERNANDEZ, C.; BAPTISTA, P. 2010. *Metodologia de la Investigacion*. 5<sup>th</sup> ed., Mexico D.F., Mc Graw Hill, 613 p.
- HEVNER, A.; SALVATORE, T.; PARK, J.; RAM, S. 2004. Design Science in Information Systems Research. *Management Information Systems Research, MIS Quarterly*, **28**(1):75-105.
- IDUARTE, J.; ZARZA, M. 2010. Design Management in Small- and Medium-Sized Mexican Enterprises. *Design Issues MIT*, **26**(4):20-31. [https://doi.org/10.1162/DESI\\_a\\_00041](https://doi.org/10.1162/DESI_a_00041)
- JERRARD, R.; BARNES, N.; REID, A. 2008. Design, Risk and New Product Development in Five Small Creative Companies. *International Journal of Design*, **2**(1):21-30.
- KIM, B.; KANG, B. 2008. Cross-Functional Cooperation with Design Teams in New Product Development. *International Journal of Design*, **2**(3):43-54.
- KOTLER, P.; ARMSTRONG, G. 1998. *Fundamentos de mercadotecnia*. Mexico, Editorial Prentice-Hall, 758 p.
- KOTLER, P.; RATH, A. 1984. Design: A powerful but neglected strategic tool. *Journal of Business Strategy*, **5**(2):16-21. <https://doi.org/10.1108/eb039054>
- LACRUZ-RENGEL, R. 2008. *A theory of reference for product design: The semantics of product ideation*. Birmingham, U.K. PhD dissertation. Birmingham City University, 324 p.
- LEE, S.-H.; LEE, J.; LIU, X.; BONK, C.; MAGJUKA, R. 2009. A review of case-based learning practices in an online MBA program: A program-level case study. *Educational Technology & Society*, **12**(3):178-190.
- LEIRO, R. 2008. *Diseno. Estrategia y Gestion*. Buenos Aires, Ediciones Infinito, 220 p.
- LIEDTKA, J. 2010. Business Strategy and Design: Can this Marriage Be Saved? *Design Management Review*, **21**(2):7-11. <https://doi.org/10.1111/j.1948-7169.2010.00059.x>
- MARQUEZ, J.; WENCES, F.; HACES, G.; AMADO, B.; MONTIEL, H. 2012. Impacto de la gestion de los procesos colaborativos utilizando las TIC en empresas de manufactura. *International Review of Business Research Papers* **8**(3):34-44. Available at: <http://www.bizresearchpapers.com/3.%20Wences-Amado%20FV.pdf>. Accessed on: 15/06/2015.
- MILES, M.; HUBERMAN, A. 1994. *Qualitative Data Analysis*. 2<sup>nd</sup> ed., Thousand Oaks, Sage Publications, 338 p.
- MONTANA, J.; MOLL, I. 2008. *Exito empresarial y diseno*. Madrid, Federacion Espanola de Entidades de Promocion del Diseño, 370 p.
- MONTIEL, H. 2012. *Nuevas empresas de base tecnologica derivadas de la universidad. Un estudio multicaso*. Barcelona, Editorial Academica Espanola, 300 p.
- ONZI, D.; MERKER, F.; MACIEL, J.; SEZERA, J.; MONTANA, M.; VISONA, P.; BELEM, T. 2009. *Strategic management process design e o pensamento sistêmico: a emergência de novas metodologias de design*. *Strategic Design Research Journal*, **2**(1):11-23. <https://doi.org/10.4013/sdrj.2009.21.03>
- PRAHALAD, C.; HAMEL, G. 1990. The Core Competence of the Corporation. *Harvard Business Review*, p. 79-91.
- ROSENTHAL, S.; TATIKONDA, M. 1992. Competitive Advantage through Design Tools and Practices. In: G. SUSMAN (ed.), *Integrating Design and Manufacturing for Competitive Advantage*. New York, Oxford University Press, 297 p.
- SEBASTIAN, R. 2005. The interface between design and management. *Design Issues MIT*, **21**(1):81-93. <https://doi.org/10.1162/0747936053103020>
- SERRANO, S.; VILLALOBOS, J. 2006. *La argumentacion discursiva escrita. Teoria y practica*. Merida, Universidad de Los Andes, 126 p.
- STEEN, M. 2013. Co-design as a Process of Joint Inquiry and Imagination. *Design Issues MIT*, **29**(2):16-28. [https://doi.org/10.1162/DESI\\_a\\_00207](https://doi.org/10.1162/DESI_a_00207)
- STRAUSS, A.; CORBIN, J. 2002. *Bases de la investigacion cualitativa*. Medellin, Universidad de Antioquia, 340 p.
- ULRICH, K.; EPPINGER, S. 2004. *Diseno y desarrollo de producto: enfoque multidisciplinario*. Mexico, McGraw-Hill, 384 p.
- VALENCIA, A.; PERSON, O.; SNELDERS, D. 2013. An in-depth case study on the role of industrial design in a business-to-business company. *Journal of Engineering and Technology Management*, **30**(4):363-383. <https://doi.org/10.1016/j.jengtecman.2013.08.002>
- WARD, A.; DEKKER, J. 2009. Managing Design in SMEs. *Design Management Review*, **20**(3):47-53. <https://doi.org/10.1111/j.1948-7169.2009.00021.x>
- YIN, R. 2003. *Case study research, design and methods*. Thousand Oaks, Sage Publications, 181 p.
- ZAPATA, O. 2005. *Herramientas para elaborar tesis e investigaciones socioeducativas*. Mexico, Pax Mexico, 295 p.

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