
Is the design process integrated to product development?

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Abstract. The objective of the article is to compare the Engineering and Design fields in relation to the Product Development Process (PDP). In both areas we can identify different methodologies that guide, each one under its own optic, the product project. Although aiming the same objective, the product development, these two fields present a certain disconnection, if we compare the models presented in the literature. This can be explained by the fact that Engineering traditionally develops the products with emphasis in the technical aspects of the products and Design investigates the interfaces of the users with the products. Considering this, this article consists in a theoretical discussion regarding to an appropriation of planning models of the Product Development by the Design field, looking models for the problem solving process as well as the systematization and coordination of the creation activity. As conclusion, the work presents a methodological systematization with the implementation of new techniques for the process of Design, focusing at the trends adopted for the corporations that search constant innovation, efficiency of the products and services, and adaptation to the changes, among others factors.

Keywords. Methodology; Design; Development of Products; Operational Level.

1 Introduction

From this point of view, the literature of two fields will be investigated; they are Business and Production. The reason for it is that organizations demand administrative processes that, according to a new understanding, businesses have to focus on what can be done to please the external clients as much as balancing its profits so that they do not go bankrupt.

Likewise, in this work, the concept of process is considered as [1] in which the term has its origin from the Latin word *procedere* and as a verb it indicates the

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action of going forward, going ahead (*pro+cedere*), as in a peculiar sequence of changes that intends to reach a certain goal. It is used to create, invent, project, transform, produce, control, keep and use products or systems. And for a better understanding here the concept of business process [2] will be differentiated as management action, from the *Design* concept, as projectual action [3], *Design* will start being considered for the processual activity, which is developed since the enterprise's strategic business, named strategic *Design*, to its operational aspects [4]. That having been explained, during the work, the term *Design* will refer not only to the result of the design action, but also to designate the process of transforming actions.

Another initial aspect to be discussed is related to the concept of *Design* as a project activity and to the concept of Product Development, activity developed by Engineering. In *Design*, as well as in Product Development (PD), activity developed by Engineering, many functional sectors of an enterprise are involved.

With this, it is possible verify that there is an overlapping between the Product Development Activity, developed by Engineering and *Design*. In literature, the following definitions to Product Development (PD) can be found. Comparing the two definitions, one can affirm that both in Product Development, activity developed by Engineering, as well as in *Design*, a group of systematic project activities is developed, and these activities involve organization, people, functional areas and the product itself and that, through information transformation, data and inputs, considering the enterprises technological and human resources, it is possible to create and produce products that fulfill the expectations of the markets where they are requested.

To both Engineering and *Design* areas, the basic principle of Product Development (PD) is founded in one process, hence the initials (PDP) for Product Development Process, which is a transformation process through which an idea becomes an object (product) with the premise that it be industrially produced in sufficiently large scales in order to satisfy *stakeholders* conditions, and also conjugate and harmonize knowledge from a handful of different natures.

Subsequently, in this work, the terminology Product Development Process (PDP) will be adopted. In PDP both Engineering and *Design*, which act in Product Development, are activities that act in an integrative interdisciplinary way, for they develop a “group of systematic activities” that encloses product, processes, people and organization, they are either simple or direct.

2 Product Development: Strategic Level

2.1 Engineering's Actuation

For Product Development (PD), at a strategic level, Engineering's approach is characterized in literature by Product Development Management (PDM). The work of [8] allows us to identify works that center on this level, which has two (2)

distinct approaches to those who start a study in this knowledge area: one of them is the Engineering Production approach, which focuses on the development processes and products production and the other one is the Marketing approach, which focuses on strategies of products intended for the market.

When discussing the PD issue from a strategic level (which is a permanent attempt of articulating the market's necessities, technologies possibilities and the enterprises competences in such a horizon that allows the enterprises' business to have continuity), the same author quotes the topic adopted as a central question of this study (strategic level), it is the *Portfolio* Management, characterized by three (3) objectives:

- 1 - Aligning development project strategies with the business strategy;
- 2- Maximizing the *Portfolio* values by taking into consideration the available resources; and
- 3- Balancing the projects under many different criteria (Cooper, Edgett e Kleinschmidt, 1997a) [6].

This first objective, aligning the strategies of the development projects with those of business, suits perfectly to the brilliant work developed by [9] whose authors present a Product Management structure, and, as the authors quote, it is a work that is about a model which is an excellent reference for improving the Product Development Process (PDP), where the approached PDP structure presented by the authors penetrates all of the organizational business model.

Still, the authors present, in details, a holistic vision, including all PDP's phases, from Pre-Conception, through Development until it gets to Post-Development. In the Development phase, a special emphasis is given to the Engineering activities.

Subsequently, this work by [7] does not only present approaches from the Engineering optic, but also from Business, Marketing, Production, Strategy, Quality, Information Technology, Knowledge Management, among others. However, an area that was not totally explored was *Design*, as the approach given by the authors was identified only in the Conception Project, where the *Design* area is mentioned merely as the study of Ergonomics and Aesthetics of a product, in other words, the authors reduced the activities developed by a Designer and reinforced the notion that most of the other areas have about this activity.

The authors excluded, at this point of their work, this activity's other characteristics, like, for instance, the activity considered as being an expression of cultural values, whose *Design* objects, resulted by the Product Development Process (PDP) are the carriers of preoccupations, motivations and dominant values in determined historical moments in a society.

Part of the difficulties in understanding *Design*, its benefits and actuation inside enterprises, comes up with the need to study how this activity is seen and how its

relations on a business environment happen. An approach of the design practice and its importance and influence on the business objectives, may contribute to the understanding of this activity and how relations should happen for its effectuation.

It is also important to emphasize that, throughout history; the professional of this activity has developed in distinct manners due to the social-economical, cultural and technological characteristics existing in each country, which lead to different actuations of the designer in society.

2.2 *Design's Actuation*

As for an approach from the strategic level of *Design's* actuation, this activity is characterized in literature by Design Management (DM). It is possible to identify some of the main authors proceeding from business, who focus on organizational, planning and strategic managing, and innovation models and even adopt the term strategic *Design*.

It was in England, according to HETZEL apud [4], in a joint action of London's *Royal College of Arts*, and of the *Design Management*, of *London Business School*, directed by Peter Gorb that the awareness of the roll that *Design* can have over economy and its enterprises came up. In 1975, in the United States, Bill Hannon and the *Massachusetts College of Arts* established another *Design Management Institute* (DMI²), in Boston, which is nowadays a reference in Design Management, and which also, together with the *Harvard Business School*, develops the TRIAD, first international research project about Design Management. The link of the two institutions was reinforced and the school has diffused the cases edited by the DMI since 1995. In 1989, the *Design Management Journal* was launched, the only periodic dedicated to the professional of this area. [5].

According to [8], *Design Management* “organizes and coordinates all of design activities, they include “structuring of projects and activities, planning of due dates, selection and planning of personnel, planning and controlling the budget” always having the enterprise's objectives and values as a basis. What should be incorporated to the enterprise's mission and to its basic premise for efficiency is the awareness and accepting of design as a quality and strategy factor by the management. According to the author, PM's activities are done in the operative processes are - the concrete accomplishment of the works to be done – and in the strategic projects they are – definition of objectives.

These works, following the same tendency observed in the production engineering field, start comprehending *Design* not only from the operational point

² DMI's goal is helping design managers to become leaders in their professions; making studies available, financing, promoting and conducting research in design management and sustaining the economical and cultural importance of design (DMI, 2004).

of view, but also, they materialize when what is important is to correctly develop the efficiency-product in the design process, and being integrated and participating in the enterprises strategic definitions starting from the highest deciding level and interacting with all of the relevant areas of an enterprise. [9].

3 Product Development: Operational Level

3.1 Engineering's Actuation

As soon as one approaches Product Development's (PD) operational level as an activity done by Engineering, one focuses on the operational matters of the product development, which are centered on specific projects (...) a special attention is given to the project itself and to the use of methods and techniques. This approach quotes two (2) models widely used, they are, 1) The funnel structure one, with its variations by Clark & Wheelwright (1993); and 2) The "*stage-gate*" generic structure one, with its stages and decision processes by Cooper (1993).

The author [6] also presents a list of bibliographic references that approach specific topics of the operational level.

3.2 Design's Actuation

From a *Design* perspective, at the operational level, this activity, according to [9] is defined as "actions turned towards the design process, sorted as work "from the inside to the outside" in intellectual conception style and functional simplicity (European) as well as of what is worth selling and advertising (American). It does not integrate to other areas and the form follows the function (with an emphasis on the practical-operational functions)".

And, opposite to what was presented [6], the same does not happen in the *Design* field, in other words, there was no significative development of methods and techniques that guide the *Design* Process in the way that Product Developments presented nowadays, in constant improvement and in accordance with new business structures, horizontalized and by processes.

Despite there having been a moment in which Design has worried about developing a methodology of its own, which congregates many branches of knowledge, whether they are artistic or technological, apparently, throughout history, there was no development of project methodologies, methods or techniques according to the requirements of the product, like Engineering does it.

On the contrary, the empiric methods and with a strong basis on creative processes is a common practice of the professional dedicated to this activity. Maybe, that is what led the other areas to see *Design* as an area that only worries about the product's aesthetics. Due to its lack of attachments with a methodology, more strongly based on an analytical thought, whether it is reductionist (Cartesian)

or deterministic (cause/effect) or even to the mechanistic methods or the deepening of the system theories

A historical analysis of the design methods evolution is done, initially, by scientific disciplines, General Systems Theory, Information Theory, Decision making Theory and Creative Process Theory. However, what is found in the *Design* methods is that, in its majority, its methods have two (2) good bases, one base guided by the systems theory and another guided by creativity.

And, among the many analyzed authors who dedicated themselves to building up a new methodology for *Design*, there is a tendency of searching for an orderly *Design* Method and with a strong link to the systems theories, some of these authors are: Bruce Archer, Christopher Alexander, John Christopher Jones, Gui Bonsiepe, Bernad Bürdeck, Hans Gugelot, Don Koberg and Jim Bagnall, Bernard Lobach, Mike Baxter. There are others with a tendency for searching a Method based on creativity and with techniques like brainstorming (Alex Osborn, 1938), Sinetics (Gordon e Prince, 1961) which consists in the analogy between a problem to be solved and a similar one, and also the lateral thinking – characterized by Edward de Bono as a deliberated and systematic process that allows us to activate our capacity of developing and implementing solutions with an optimized productivity – and with this focus, many authors who consider perception as the guidelines to the project can be found, they are: Bruno Munari, Tomás Maldonado, Gillo Dorfles, Taboada and Nápoli.

4 Conclusions

With what has been exposed, what can be concluded at this stage of the work, and it is important to observe is that Design as well as Product Development (PD), activity developed by Engineering, are very wide human activity branches that center on problem resolution, creation, and coordinating and systemic activities.

Each problem to be solved implicates generating balanced results for a number of products developed under the optic of technology, of production and of the market, of the user, of the economy among other factors presented by the two activities.

This fact led processes to be systemized, the information flow to be mapped and the group of activities to be clear and objective, so that, activities and tasks of the process itself that aggregate value to the PD could be done, moreover, capacitating people with different skills and knowledge, generating indicators that improve the process' performance for a constant improvement.

However, in the *Design* activity, there was more preoccupation in developing a knowledge body, in other words, models with strong links to business, marketing, planning, strategies and management, which means there is an advance in the developing of *Design* at a strategic level, as shown before and whose term used by the professionals of the area is *Design* Management. As the models at a strategic

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level, the methods and techniques became outdated or simply were not used anymore by most designers, there was a failure of the methodologies that had been developed more rigidly until the 70's. The teaching models and consequently the professional activity were slowly substituted by models and empiric methodologies with strong links to the creative process.

However, contrary to the methodologies, or models, developed by Engineering, searched to systemize activities performed at the PDP, and taking advantage of the analytical theory, organized the steps logically the phases of the product's project to reach the pre-established objectives. In its majority, methodologies present systematic procedures that conduct the analysis, generating proposals so that they can be verified and, therefore, contrary to the project requirements initially defined.

And in the repetition of these models, a constant perfecting and continuous improvement on each phase of the PDP would be attempted. These constant improvements allow models developed to provide more trust in all of the process, whether it is during the collecting, analysis, proposals generating or making decisions that a Project's team requires in order to continue the PDP, and allow the enterprise to reach its goal its desired success.

Subsequently, from the operational level perspective, *Design* can be considered as an integrating part of the knowledge body needed from the Product Development Process Management (DPM) as well as Marketing, Product Engineering, Manufacturing, Logistic and it does not, in anyway, substitute the PDM, it is just one (1) among the processes that as a group of activities aggregates values to the products developed and that deals with information in a differentiated way, as it adopts as a focus of its actuation, the interactions Man/Object/Environment.

So, *Design* must reconsider its methodologies, models, at an operational level, in other words, it must explore, develop and update in the same way as Engineering does. Besides that, these methodologies must consider in its structure *Design's* main tasks, which are identifying and evaluating structural, organizational, functional, expressive and economical relations targeting the enlargement of a global sustainability and environmental protection; offering benefits and freedom to a human community as a whole, to the final individual and collective users, protagonists of industry and commerce; and still must support cultural diversity, despite the world's globalization; give to the products, services and systems, forms that are expressed semi-optically and be coherent with the aesthetics of its own complexity.

So, maybe the lack of a speech in favor of *Design*, which is a fact that is discussed by the scientific and business communities, comes from this lack of demonstrating that its performance contributes for the progress, or even from the development and application of the methodologies available, or even from the creation of a model that can suit the new market conditions, executives,

organizations and even go against the new business models that make all of the market's technologic, economical and industrial context more dynamic.

The current methodologies, the models, are little systemized and little deepened. That permeates teaching, and with that, professionals without a more dynamic and contextualized project methodological basis are formed, without the knowledge of managing tools, like diagnosis, accompanying, evaluation, time and investment return, without any security in the evaluation of the market's product results, which needs to accompany the dynamic now found in the many industrial sectors.

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