A METHODOLOGY PROPOSAL FOR THE USER NEEDS INTEGRATION IN THE PRODUCT DESIGN PROCESS

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Abstract: This paper presents a methodology proposal for the user needs integration in the product design process. The design methodology proposed was approached correlate with ISO 13407 standard previsions and is funded on integration of knowledge from different activity areas, like: engineering, informatics, marketing and sociology. Product design is dynamic and complex process in which a primordial role is hold by human intervention, and for this reason the design process where the user is integrated represents the key for product achievement.

1. Introduction

The objective that stands at the basis of this paper realization is: the development of a methodology of user needs integration in product design phase. To accomplish this objective it has to be made a multidisciplinary research and for this reason it is necessary the optimization of different categories of specialists' collaboration: design engineers, marketing people, psychologists, sociologists, specialists in ergonomics, designing engineers, designers.

In the actual context, the companies are constrained to make products, which differentiate from the ones offered by the competitors and for this reason is necessary to develop products, which satisfy the best, the potential users, needs.

The present trends heed a special interest to services design to the detriment of material product.

The product design is a complex and dynamic process where a primordial role is hold by human intervention. The definition of "design" word is coming from the verb "to conceive". According to a definition from Big Universal Dictionary Larousse, 1994 [6] „To conceive any thing (action, idea, system, device, plan, etc.) means to elaborate it in mind, to arrange different elements and to realize it effectively or to make possible the realization.

A product design will consist of three aspects elaboration – and also the connection between them – for a product: functional aspect, esthetic and socio-cultural aspect, economical aspect of the achievement.

The stake of realization of different product's aspects consists in determination of physical characteristics of the product, its attributes and the way to obtain, to realize it.

In conclusion, the product design is referring to conversion, from abstract to concrete, from a (new) idea to product (vendible), of a problem in solution, from functional to structural etc.

2. Localization of research

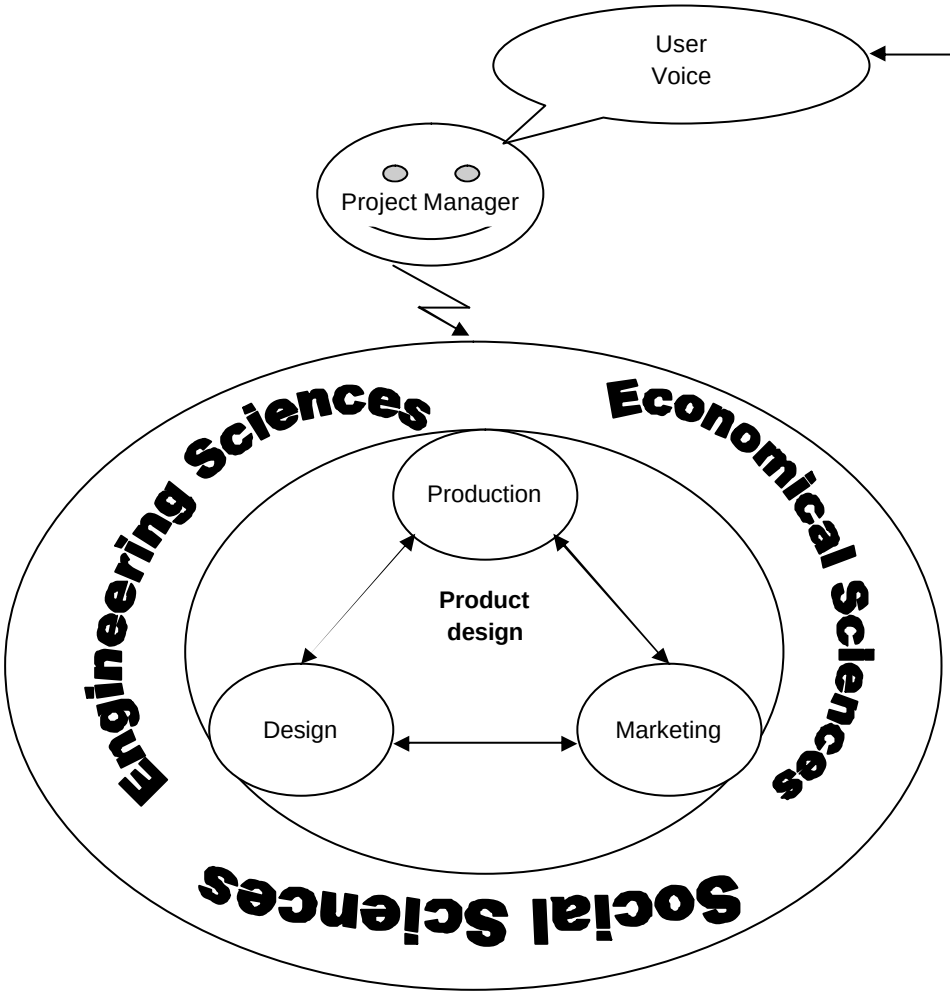
The necessity of a design methodology is due to the necessity of multidisciplinary teams. The multidisciplinary design teams need coordination-administration, not only single action of teams' members, which, in many cases, are different from that of the other participants at the design process.

A product elaboration is a complex job that means **to know** and **to make** specialists din different activity domains to collaborate to achieve a product that is competitive on the market. For this reason is necessary to organize and develop a product in "designing groups."

The design methodology must be considered as a „turn key technology".

The research is based on different profession integration with the newest technologies on purpose to optimize the design process and to develop methods and tools that can be disseminate inside the companies.

The research aims to formalize the knowledge that contributes to design and innovation process amelioration. This is based on three axes, which are schematized in figure 1.



Industrial design vision	Technical point of view	Marketing point of view
- Aesthetics (shape, color, texture, etc); - Social and cultural context; - Environmental connection; - Ergonomic imperatives; - Visual trends; - Marketing visions consideration.	- Technical study; - Technical analysis; - Production optimization; - Production processes; - Ergonomical study.	- Market study; - Market analysis; - Economical aspects; - Distribution network; - **Communication with user**

Fig. 1. Localization of research

Working hypothesis: After the market studies and marketing research concerning the product evolution made by a company, it can be acknowledge the following:

- The product is not corresponding with the users expectations, from different points of view (ergonomically, qualitative, ecological etc);
- The product is in the decline phase, because of obsolescence.

Once these problems are identified the decision of launching a new product is taken, therefore there are two possibilities: redesign of the actual product or design of a new product.

In figure 2 are presented the stages undertaken before the actual realization, which means production. The concept development is based on "thinking processes", like: problem identification, analysis, synthesis and validation. The results of implementation of these phases have to be validating before to go on effective product making. In the figure it can be observed the cooperation between specialists from different domains like: marketing, design, fabrication. From the figure results that the stages of concept developing process evolve sequential and that every action starts when the previous one is over. Actually these actions often overlap, and many times evolve iterative, because new information that may influence the previous activity are getting.

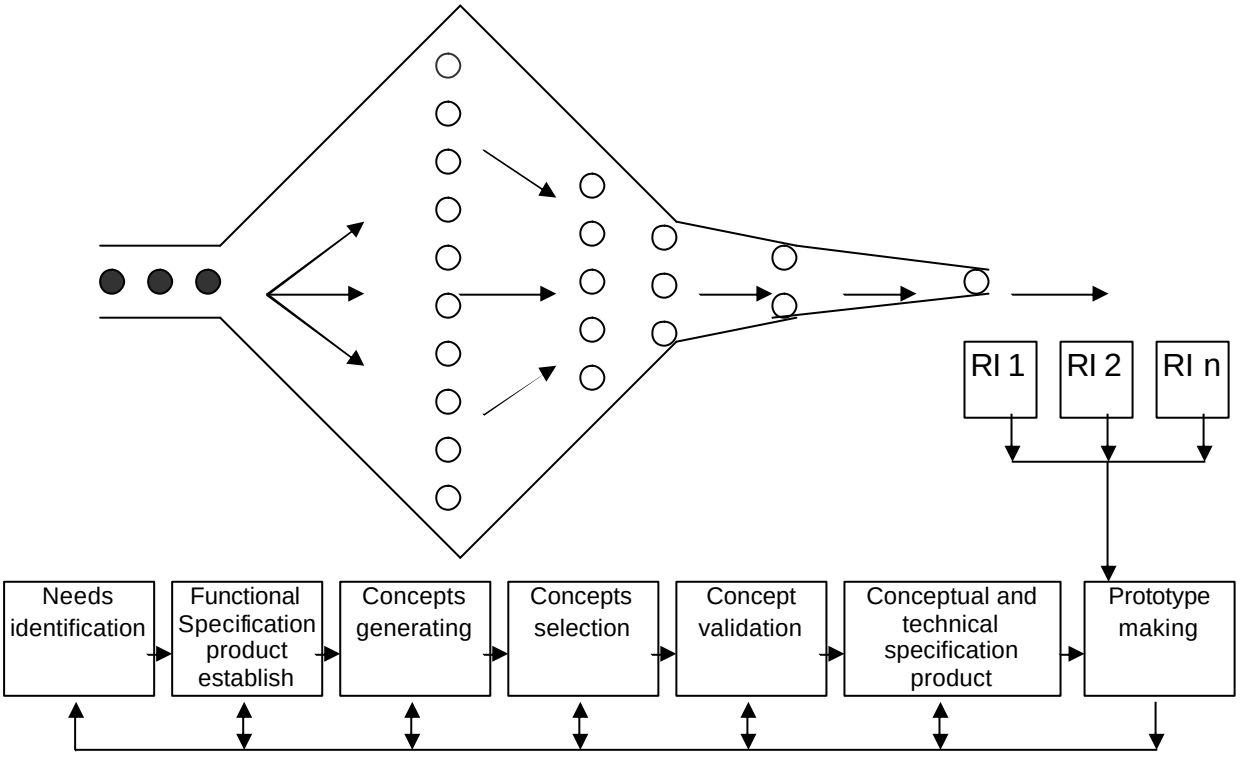


Fig. 2. Preceding design process stages

Intermediate representations (RI) are necessary to facilitate the discussion between "the actors" (specialists in marketing, design, sociology, psychology, engineering, ergonomics, users) of design process, based on models.

3. Design methodology

Design methodology is a research of design principles, practices and procedures. Its research area is design and the way through which the design approach must be lead. Design methodology includes [1]:

- The research of design people working and thinking mode;
- Implementation of adequate structures for the design processes;
- Development and apply of new methods, techniques and procedures;
- Reflections on nature and application areas of design knowledge, and their applications for solving design problems;

At that previous mentioned, for the design based on user, are attached the information given by the user, which are collected through the techniques and instruments specifically for the marketing research and through the sociological studies.

Integration users in product design process is a „project" which approach the potential product users for the design process and for the development of product model. This can be done through direct discussions with user about project key points, which determine product making accordingly with its needs. The realization stages are iterative models, with a cycle that repeats until the product models accomplish the usability objectives. This can be critical in the case that participants at these methods don't reflect with precision the actual users profile. Bibliography and standards [2, 5] consider four key activities of the design process orientated to user, which must be done in incorporation order of usability needs in product's development process. These are:

- Utilization context understanding and determination;
- User and organization demands determination;
- Prototype design and realization;
- Finalize through user pull-through.

In next table is shown a proposal of design methodology based on user's needs integration, according with standard ISO 13407 [5]. In proposed methodology are integrated techniques, tools and methods specifically for marketing and sociology (questionnaires, interviews, Focus Group), engineering (Focus Group, Value analysis, Testing Usability), Ergonomics (Testing Usability), informatics (QFD, SPSS software)

The proposed methodology is based on traditional methods (Focus Group, questionnaires, interviews, Value Analysis) and also on modern methods (Testing Usability, Collaborative Design, SPSS, QFD).

Table. 1. Proposal of user's needs integration methodology in product design process

Domain	Method	Simple Size	When is used?	Characteristics
Marketing Sociology	Questionnaires	High	Identification needs and Prototype realization	Questionnaires could be used in a broad sense, but the information obtained are less detailed
Marketing Sociology	Interviews	Low	Identification needs and Prototype realization	Through dialogues with users are obtained qualitative results
Marketing Sociology Engineering	Focus Group	Low	Identification needs and Prototype realization	Ideal for attitude, experience, altitude, wishes identification
Marketing Sociology	SPSS	-	Identification needs and data analysis	Statistical analysis which allow uni various analysis of characteristics of studied population
Engineering	Collaborative design	Low	Design	Effective involvement of user in design process
Ergonomics	Testing Usability	Low	Prototype design and realization	The actual behavior is observed and listened The results obtained could be quantitative or qualitative Are developed scenarios of utilization
Informatics Engineering	QFD	-	Finalize through user pull-through	Quantification of user needs and their transformation in key parameters
Engineering	Value analysis	-	Finalize through user pull-through	Complex, creative design method. Are established product functions, the global one and the secondary ones

The questionnaires are the most frequent used tool in order to obtain the information, data from user and it consists of a set of question the subject is invited to answer. The questionnaires allow the statistical analysis of results that can raise the credibility of realized studies. They are used especially for measuring the subjective satisfaction, but also the factors that lead to frustration and inquietude for users, which are measured indirectly and which it would be preferable to be made directly.

Interviews need presence of an interview operator who talks to potential-actual product users. The advantage of using interview as collecting information method is that every participant point of view can be explored in detail. Any misunderstanding, confusion between interview operator and subject is quickly identified and solved. Interviews are usually used in design process with the purpose to obtain more details about activity domain/area or specific-individual demands.

Focus Group encourages the involvement of potential/actual product users groups', by idea, feelings, attitudes and perceptions exposition, connected with product, which is to be made. The establishment of Focus Groups in organizations is very useful for attracting and involving the user in project accomplish and implicit of the product model. Focus Group is used many times at the beginning of design process. Generally it offers non-statistical data and is an efficient mean to obtain information from the considered domain. It is necessary that the moderator has experience and be a person with a great analytic sense in order to Focus Group be efficient.

SPSS (Statistical Package for the Social Sciences) is a statistical analysis software that contains many procedures that allow uni-varied analysis of studied population characteristics. Through its options, the SPSS software can carry on the effective data processing (once they are defined, codified, regrouped an so on). Also, SPSS software through its options (ex. Summarize) make the distribution analysis of the characteristic interesting for the studied population.

SPSS contain more calculating options for position, dispersion and variable distribution shape indicators. Also, SPSS software offers some graphical expressing possibilities for those values, in a suggestive way.

The SPSS software has many menus through which it can be built association tables, calculating the percent for the variable situated in lines, and also for the one situated in the column (simultaneous for both variables those association interest us)
SPSS software has applications for various domains, for the present research we approached:

- Marketing efficacy:
  - **Customers' segmentation** – group individuals or organizations from similar demographic profiles, attitudes, product types achieved or other attributes that help to understand the clients needs. For that the software use statistical tools and databases with which it can be made *predictive analysis*. The predictive analysis identifies the target, how can it be attained, when the client will be contacted and what will be the message to communicate.

Predictive analysis	=	Advanced analysis	+	Decision optimization

    Advanced analysis use statistics, mathematical models and algorithms.
  - **Profitable customers attraction and keeping is** fundamental for an organization success. SPSS offer some technologies selections that help to identify the future customers and offer the best solutions to reach them.
  - **Increasing the value at customer.** If you offer value to client he will remain faithful, this should be the motto of any organization. For that the SPSS software use *statistical tools and a careful research surveillance* to deepen customers' attitudes, preferences and behavior understanding and also to assure high satisfaction level for them. It can be integrated feedback from the clients with predictive models to generate databases.
- **Statistics.** The software can be used for making decisions based on: variable attributes, data value, and error elimination.
- **Market observing and analysis.** SPSS software helps to collect data as a base function, and as an advanced function analyze and interpret data.

Collaborative design doesn't consist only of asking the users about their opinion about the design process. Users are effectively involved in design and in taking the design decision. Collaborative design is frequently used to achieve the project (at Intermediate Representations) to achieve the prototype product and implicit at final product achievement. An example of collaborative design could be the one in which the designers specialists, users work together at initial design of prototype product. When collaborative design is used, it is necessary the project manager (who will play the moderator role) to have solid knowledge about the domain in which the product will be used.

During the **Testing Usability** sessions it is evaluated the product through data collection from subjects/people that have use the product. The persons are invited to participate at sessions in which they are questioned about the expected performance, meanwhile the moderator take notes about observations and difficulties they met in using the actual product model. During this action it is necessary to be presents two specialists, one to lead the discussions, and the other to write the observations made by the participants. Testing product usability is good to be used at the beginning of design – redesign process or at its end. It represents an excellent way to identify the potential problems about product usability. Testing Usability can be used to generate statistical or non-statistical data. Testing Usability require a condition fulfillment in order to stands the test– the model produced must be available at least on paper or on electronic support. Testing is efficient if it is based on connection between feedback from user and statistical determinations, from the beginning to the end of the design process.

QFD (Quality Function Development) is a organizing methodology and a mathematics tool used to identify and quantify user's demands and their transformation in key parameters for future product. QFD helps to prioritize some actions that improve the product and process accordingly with user expectations. The main characteristics of QFD are: concentrating on needs collection from the market through declaration (transpose in CLIENT'S VOICE) of actual users, effectively needs a multi disciplinary team and uses the relations matrix (QUALITY HOUSE) for information, perceptions and decisions documentation.

Value Analysis (AV) constitute as a complex and creative designing method. Value analysis consider a global product as an materialized assembly of functions which must be realized in the most efficient way, this mean with the simplest and ingenious structures, which ensure minimal possible costs for the component functions of the global function of the product [8].

Applying **Value Analysis** in industries impose that technical documentation (feasibility study, designing theme, technical project, base documentation) to be unitary and consequent elaborate [4]. Value analysis is a process that is developing in many phases and stages [7].

4. Conclusions

Methodology for user needs integration in product design process proposed incorporates the methods and techniques specifically for marketing, engineering, sociology, and informatics. Using techniques specifically for marketing, and sociology are collected the information from the user, using the informatics resources are processed (SPSS) the data obtained and then transformed into key (QFD), and based on the results achieved and through Collaborative Design and Value Analysis can be made the product prototype which Usability will be Tested.

For the future, the authors propose themselves to realize an informatics pattern for administrate the user's needs in order to integrate them in the product design phase, because the data-information collected from the user must be formalized and transformed in knowledge.

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