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CRITERIA FOR SELECTION OF DESIGN MANAGEMENT INDICATORS IN PRODUCT DEVELOPMENT COMPANIES

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ABSTRACT
The role of design in business has changed with the rapidly growing number of products and services available. Design management has emerged as a way of formally establishing design in organizations. This research was developed in this scenario in an attempt to contribute to discussions in the field of design management, by focusing on the selection of performance indicators to be applied to design management. The research consisted of case studies of three companies situated in (CITY, COUNTRY). In order to understand the criteria used to select the indicators, members of the product development department of each company were interviewed. The main contribution to the academic and professional field is the criteria for selecting indicators for design management. Conclusions pointed out that companies from different sectors of the economy select indicators that provide (a) customer feedback about the products launched in the market and evidence both their (b) team productivity and their (c) relationship with competitors.

Keywords: design management, indicators, performance measurement

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1 INTRODUCTION

Design management can be defined as the use of a company's design resources arranged to help the organization achieve its goals (Gorb, 1990), the implantation of design as a formal program of activities in a company aimed at accomplishing its strategic goals (Borja de Mozota, 2003), and as a company's skills and activities to improve its design process (Chiva and Alegre, 2007).

Regarding design evaluation, Best (2010) has stated that it is a complex task. According to this author, in qualitative terms, design can be measured through aesthetic elements, improved brand image and increased organizational learning. However, when considering quantitative aspects such as profits and units sold, among others, isolating the design contribution is a hard task. Design managers need ways of measuring performance that aligned with both the design success measures and the company's success strategy measures (Best, 2010).

The design process can be regarded as part of the product development process in a company (Ulrich and Eppinger, 2008; Cross 2008). Better integration of design with the product development process may result in increased competitiveness of a company in its market (Gemser and Leenders, 2000). Performance measurement has been considered as a way of improving processes in companies (Griffin, 1997). The product development process is one of them, which consequently involves the design management process. Therefore, performance evaluation may provide design managers with a more effective decision-making process.

There are a large number of indicators for measuring the performance of the product development process that can function as a basis of a measurement system in product development companies (Kaplan and Norton, 1997; Nixon, 2002; Oliver, 2002; Lockwood, 2008; Andrew et al., 2009; Viladas, 2009; Borja de Mozota, 2011). It is possible to question which criteria for selection of indicators can be used by product development companies to evaluate their design management process. The identification of such criteria can favor the conception of a system of indicators in consonance with the peculiarities specificity of each company.

The main purpose of this research is to identify through case studies, criteria to be used by product development companies to select indicators that may be used in design process management. This research has been based on the idea that companies should use performance indicators to measure design results, but which selection criteria should be used to choose such indicators? The hypothesis is that product development companies from different industries select indicators according to particular criteria due to the unique characteristics of the industry to which they belong.

2 BACKGROUND

Metrics such as weight, size, price, and temperature, among others (Harrington, 1991), are part of our daily routine, and they usually guide our decisions. The development of metrics allow for performance comparisons and predictions. In a research carried out in 2000 with 20 small business owners in the United Kingdom, Jarvis et al. (2000) found that those entrepreneurs regarded not only financial indicators as something important to assess their companies; rather, they considered a combination of quantitative and qualitative indicators, involving issues such as customer relations and productivity, besides the ones related to finances.

Research carried out by the Danish Design Center in 2004 (Ramlau and Melander, 2004) attempted to understand the contribution of design to 1,500 companies in Denmark. Among the results, we could highlight the following:

- twenty percent of companies that invested in design obtained higher gross revenue than those that did not in a five-year period;
- forty percent of companies that increased their investment in design, either through consulting or training, increased their revenue in a five-year period;
- companies that had design professionals working internally achieved a 34-percent higher export rate than those that did not.

Similarly to the research mentioned before, in 2009 the Design Management Europe developed and applied a model named Design Staircase (Best et al., 2010). The model assesses the level of application of design by companies. Four levels are considered: 1 – No design application; 2 – Design as project; 3 – Design as function; 4 – Design as culture. From the 421 companies studied, it was found that the higher the level of the companies in the Design Staircase, the higher their revenues, increase rate and export rate will be(Best et al., 2010).

Despite the evidences that design yields results for companies, measuring effect of design is still regarded as a complex task (Borja de Mozota, 2003; Best, 2010). This occurs because it is easier to measure design success in qualitative terms (such as brand image improvement, organizational learning increase, and better communication) than in quantitative terms (sales and profit increase). Another factor that makes design measurement difficult is that results may be seen in the long run, not immediately (Best, 2010).

Parallel to researches into design performance measurement, the Boston Consulting Group has annually carried out a survey called 'Measuring Innovation'. In its 2009 edition, executives agreed on the great importance of measuring results in the innovation area as much as in other areas (finances, production, and customer relations). However, only 46 percent of respondents claimed that they did measure the performance of the innovation area. When asked about the reason not to measure performance, the main factors mentioned were as follows: (a) uncertainty about which metrics should be used, and (b) low priority of this kind of measure (Andrew et al., 2009). Researches like that evidence the need for deepening investigations in the area of performance measurement.

3 RESEARCH METHOD

In order to attain the main objective of this research, which is to identify criteria for selection of indicators by companies, a data collection protocol was developed from indicators found in the literature (Kaplan and Norton, 1997; Nixon, 2002; Oliver, 2002; Lockwood, 2008; Andrew et al., 2009; Viladas, 2009; Borja de Mozota, 2011). The data collection protocol is shown in the appendix of this paper and presents a list of 46 indicators distributed among the following categories: (1) financial; (2) customer; (3) design and innovation; (4) PDP (product development process); and (5) Human Resource.

The protocol was used to develop three case studies. According to Yin (2008), this method is suitable when the investigators have little control over the events and their focus is on a contemporary phenomenon from real life. Three criteria for the selection of the companies were considered: the main activity of the companies should be product development, thus service firms were excluded from the study; the companies should be located in (CITY, COUNTRY) so as to facilitate visits and personal interviews by the researcher; the companies should have an internal department in charge of product development, with at least one professional working as a designer. The case studies were carried out from November 2011 to May 2012.

The research protocol was applied by means of an interview with either the designers or the people in charge of the design department in the companies studied. The respondents were free to select the indicators they regarded as the most suitable to their reality. They were also required to justify the selection of each indicator, thus characterizing the selection criterion used.

The respondents were asked to select the three most relevant indicators to their contexts from the set of 46 indicators. The interviews with the design team members were followed by a meeting to present and discuss the data.

After the interviews with collaborators from the three companies, their answers were analyzed and compared, thus generating the criteria for selection of indicators.

4. FINDINGS

4.1 COMPANY A

Founded in 1966, Company A belongs to a conglomerate of six companies that produce different kinds of products (house utensils, cleaning supplies, office supplies, and home organizing products). Company A produces hand tools. It is located in Esteio/RS and has approximately 600 employees. The research protocol was applied to collaborators that participate directly in the design management process. Four people were interviewed: (1) director of products, (2) Design coordinator, (3) Product designer, and (4) Design trainee.

In the survey process, before starting the process of indicator selection, the respondents were asked about the objectives defined at the launching of a new product. The respondents stated that the main objective is always related to the company's financial return, but this objective is only reached through the attainment of other objectives, such as increased sales, reduced production costs, and increased consumer satisfaction, among others. Some products are launched in order to create a new market. This may initially cause financial losses, but the product may generate profits later.

Regarding the objectives of the product development process, the indicators selected may point whether the company is following the right path to attain its objective. The justifications given by the respondents for the selection of indicators may be listed as follows:

- Feedback: The indicators must give some feedback to the team about the acceptance of the product by the market. Such feedback may be related to sales, and even consumer satisfaction.
- Productivity: The indicators selected provide an overview of the industry productivity, the number of projects being executed at the same time, and the number of cancelled projects, among other things.
- Development time: One of the ways to evaluate the development process is to check how long it takes to convert an idea into a product to be marketed. The respondents stated that the market is dynamic; therefore, it is necessary to accelerate the process to launch the products ahead of the company's business competitors.
- Competitors: Monitoring the market is important to the product development process, since it positions the company in the market in relation to its competitors and also follows the launching of new products.

The justifications mentioned above have been interpreted as criteria for the selection of indicators of design management in Company A. At the end of each interview, three indicators from the list were selected as the most important ones.

Based on the answers given by the Company A team, it is possible to notice a certain diversity among the indicators selected. No indicator from the "HR" category was selected as one of the most relevant. The team evidenced a constant concern with the evaluation of the financial return derived from their projects, but there is a clear idea that, in the end, the other indicators selected would result in a higher financial return. As already seen in the Balanced Scorecard model (Kaplan and Norton, 1992), the indicators show a cause-and-effect relationship, i.e. a variation in one indicator causes variation in the others.

4.2 COMPANY B

Company B was founded in 1958. It is situated in Porto Alegre, and develops thermal conservation products. It has approximately 700 collaborators. Presently, the product development department has three collaborators: (1) design coordinator, (2) engineer, and (3) product designer. The department reports directly to the company's board of directors. The two designers of Company B answered the research protocol.

With regard to the result indicators, the design coordinator of Company B stated that two indicators are taken into consideration by the department: (1) number of projects launched per month and (2) attainment of sales expectations, which is also known as *payback* in the company.

Based on the interviews, the criteria for selection of indicators identified were the following:

- Financial return: The main objective of product development in Company B is to achieve financial return. The indicators selected must show whether the product meets the sales expectations estimated by the commercial department at the stage of Investment Analysis.
- Production cost reduction: Indicators that evidence reduced costs of the production process are important, especially in projects of existing products.
- Product performance: The portfolio of products in Company B is monthly evaluated in order to identify the products that must be kept and those that must be taken out of the production line. For this purpose, the consumer acceptance of a particular product should be measured and assessed through financial indicators in the first place, according to the development team, but issues related to consumer satisfaction are also analyzed.
- Productivity: The board of directors of Company B requires good productivity of the product development department; for this reason, indicators showing the productivity of the design team should be taken into account along the analysis of the design process. According to the design coordinator, the main indicators that meet this criterion are the number of products launched and the number of patent applications per year.

Half of the indicators selected as the most relevant ones by the Company B team are in the 'Financial' category. It was noticed that the designers interviewed focused on financial issues as well as on the return provided by their products. The evaluation of product success in Company B is grounded on both the confirmation of sales and the financial return estimated before the product is produced. These indicators guide the work of the product development team.

4.3 COMPANY C

Company C was founded in 1958 in the city of Canoas/RS and its head office is currently located in the city of Nova Santa Rita/RS. It has approximately 600 collaborators and focuses on the development of audio speakers for professional – night clubs, stadiums, etc. - and domestic users – speakers for computers, cars, houses, etc. The area of product development is within the engineering department. It is represented by one product designer with master's degree in strategic design who has worked at Company C for 10 years.

The only designer working in Company C answered the research protocol. On being questioned about the existence of indicators to evaluate design in the company, the respondent said that, in accordance with the company strategic planning, his goal is to develop three low-cost innovations. Therefore, his productivity is measured in conformity with the creation and implantation of innovations, which can be either improvement of existing products or development of new products. The second indicator is related to the company sales revenue, but this indicator is shared with the area of product engineering.

Concerning the way the design results are evaluated in Company C, the designer stated that this evaluation is performed through the use of indicators related to sales and financial return. After the application of the protocol, the criteria for selection of indicators were:

- Financial return: From the interviews with the designer and the portfolio manager, the concern with the financial return that the product development must generate has become evident. For this purpose, it is important to use indicators that show the sales performance and product profits.
- Feedback: Indicators that point out improvement opportunities are regarded as sources of information for the development of future products. Most of the time, such return appears in the form of complaints through customer service and internet.
- Competitors: The assessment of both the market in which the company participates and its relationship with competitors is relevant to the product development process. For this reason, indicators that show the company position in its competitive setting are important.
- Productivity: The company designer's goal is to develop three low cost innovations per year. Therefore, the use of indicators showing the industry productivity is important.

The results of the application of the research protocol in Company C were similar to those found in Company A and Company B, i.e. the financial goal is the main reason for the selection of indicators. The cause-and-effect relationship presented by Kaplan e Norton (1992) in their Balanced Scorecard model has been noticed in the selection of indicators by the designer: ideas converted into products generate a larger number of patents, which eventually generate increased sales.

5 DISCUSSION

From the study of Companies A, B and C, it is possible to group the criteria for selection used by identifying choice similarities and patterns. Chart 1 summarizes the criteria for the selection of indicators used by the respondents in the companies, in importance order given by the respondents.

	Company A	Company B	Company C
Criterion	Feedback	Financial return	Financial return
	Productivity	Reduced production costs	Feedback
	Development time	Product performance	Competitors
	Competitors	Productivity	Productivity

Chart 1: Summary of criteria for selection of indicators

From the analysis of the criteria for selection of indicators pointed out by the three companies surveyed, it is possible to notice some similarities among the answers, although the companies develop different kinds of products: (1) hand tools, (2) thermal conservation products, and (3) speakers. The researcher's initial idea was that companies from different industries could have different criteria for the selection of indicators. However, this was not seen in practice, since the companies evidenced some convergence in the ways they select indicators.

Each company used four criteria for the selection of indicators, totalizing 12 criteria. Some of the criteria were mentioned by more than one company; this reduced the list to seven criteria: (1) Feedback, (2) Productivity, (3) Development Time, (4) Competitors, (5) Financial Return, (6) Production Cost Reduction, and (7) Product Performance. The analysis of the seven criteria has evidenced similarities between some of them. For this reason, the criteria Feedback, Financial Return and Product Performance were grouped together, as they all focus on information that the indicators will provide to the product development team. The criteria Productivity, Development Time and Production Cost Reduction also formed a group, as they all address issues related to the product development process itself.

The three criteria for the selection of indicators resulting from the case studies in Companies A, B and C approach different views of the companies and their relationships with the market. Criterion 1 (Feedback) selects indicators associated with results, which provide the company with information given by users after the product is introduced into the market. Criterion 2 (Productivity) is related to performance indicators, which evaluate internal processes linked to the production and launching of products in the market. Criterion 3 (Market) involves market indicators, which monitor the competitor activity and provide information to the development team. Figure 1 illustrates the relationships among the criteria, the indicators and the parties involved.

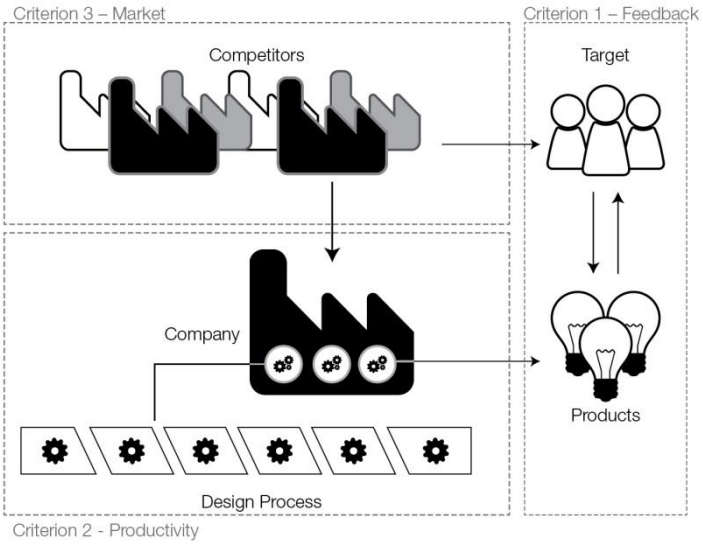

Figure 1: Criteria for selection of indicators

Indicators related to criterion 1 (Feedback) point out the result of the interaction between the product developed by the company and its target. The traditional financial measures are part of this criterion. Indicators of criterion 2 (Productivity) evaluate the product development process as a whole, i.e. the design management process, idea management and others that the company may adopt. Indicators of criterion 3 (Market) are related to interactions the competitors may have with both the target and the company itself.

6 CONCLUSIONS AND FUTURE RESEARCH

The criteria for selection of indicators have directly resulted from the application of the research protocol to design teams of the companies surveyed. Based on the answers to the question 'why has this indicator been selected?', a list of three criteria that guided the respondents has been made:

a) Feedback: Indicators that meet this criterion give the design team information about the acceptance of the product: whether customers like it or not, whether they have suggestions for improvement, among other situations. The indicators of this criterion analyze the product and its relationship with customers, but do not analyze either the company internal processes or their relationship with competitors. As these indicators are collected after the products are launched into the market, they can be called result indicators.

   In Companies A, B and C, the financial return was always regarded as priority for the product development process. Therefore, the indicators of the criterion Feedback present the quantification of such financial return through the indicators of the financial area.

b) Productivity: The indicators that meet the criterion of productivity inform the team about the course of the projects from the perspective of the company and its internal processes. Such indicators are relevant because they control and manage the design team productivity: the number of products launched, the number of products cancelled, development time, among other factors. The indicators meeting this criterion may be considered as performance indicators, as they evaluate the process from the internal point of view, i.e. the activities involved in both the project and the production of a product.
c) Market: This criterion provides the team with information about the products launched by competitors in their market. The indicators can be called market indicators, as they analyze only the external scenario, for instance, the amount of products launched into the market by another company. The respondents highlighted the importance of monitoring their markets as a way to collect ideas and improve products for their customers.

In order to implement the indicators in a company, the authors briefly suggest that the first step should be some kind of training for the people who will work with the indicators, as a way of educating them to know how to measure and the importance of this measuring. It is also essential to connect the indicators selection with the company vision and goals. For instance, if the company wants to increase its profitability, indicators related to sale, finance and investments should be essential to be chosen. After these steps, it will be possible to choose indicators following the criteria presented in this paper.

As Figure 1 shows, the criteria resulting from the interviews are complementary and tend to monitor the product development process from the standpoint of customers, competitors and the company itself. Based on the utilization of indicators meeting these three criteria, an indicator system can be structured to evaluate the process as a whole, thus avoiding a process perspective from just one point of view, as Kaplan and Norton (1997) stated. Their model was built in opposition to other models that favored only the financial point of view.

The design management process involves the management of design resources to achieve the company's strategic objectives (Gorb, 1990 and Borja de Mozota, 2003). Hence, the application of metrics to the product development process is a way to evaluate the company design process, not only using metrics exclusively directed to the design process, as Cross (2008) has suggested in his design method, in which the evaluation is conducted in relation to the alternatives generated to a particular product.

Regarding future researches, it is suggested that the research protocol is applied to other product development companies to check whether their reasons for selection of indicators coincide with the three criteria identified in this investigation. Another suggestion for future researches is to transform the criteria for choosing indicators in a methodology to be applied for other companies.

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APPENDIX
Research Protocol

1 – Schedule interviews with designers and/or design coordinators of the companies and ask them to select the indicators from the chart below that they regard as important in their company context.
2 – After the selection of each indicator, the respondent should justify his or her choice. This reason will characterize the criterion for selection.
3 – After the selection of the indicators, each respondent should select the three indicators that he or she finds more relevant than all the others selected.
4 – After the interviews with all the participants, a meeting with the company team should be held to present them the data.

Category	Indicators	
Financial	□ Increased sales through new products (%) □ Project costX Product cost (%) □ Savings generated by project changes □ Investment in research and development (R$) □ Profitability of new products in comparison to existing products (%) □ Profitability per customer (R$) □ Profitability per product (R$) □ Profit obtained from new products (R$)	□ Relationship between investment in research andsales (%) □ Relationship between sales of new products and sales of existing products (%) □ Relationship between sales in the home market andsales in the foreign market (exports) (%) □ Value of company stock at the stock exchange (R$) □ Actual sales X Forecasted sales(%)
Customer	□ Number of positive comments (#) □Number of new customers (#) □Number of complaints (#) □Market share (%) □ Consumer satisfaction with products (%)	□ Reputation among customers(quali) □ Customer retention (%) □ Positive and negative comments in social networks (#) □ Number of messages received through the website and social networks (#) □ Website traffic (# of visits)

Design and innovation	□ Ideas generated at the beginning of the product project (#) □ Number of new projects per year □Number of new products launched in comparison to the competition's (%) □ Number of products cancelled during development (#)	□ Number of patents (#) □ Number of awards X Number of contest applications □ Number of new technologies employed per year (#) □ Products X Level of (radical/incremental) innovation (#)
PDP	□ Mean time of product development – from inception through production (days) □ Number of people per project (#) □ Number of projects cancelled (#) □ Number of projects completed on time X Number of projects delayed (#) □ Quality Program – 5S, ISO – (y/n)	□ Failure rate/1,000 products (#) □ Rework (hours) □ Total hours worked by all the professionals involved in the project (#) □ Machine idle time (hours)
HR	□ % of employees per job duration (% – 1 year – 2 years – 3 years – 4 years, + 5 years) □ Absenteeism □ Training hours (#)	□ Number of accidents (#) □ Internal customer satisfaction (quali) □ Turnover rate (#)

R$ = reals # = number % = percentage y/n = Yes or No Quali = qualitative, requiring value scale