*The implications of the
use of Value Analysis in
construction designs of
shopping centers*

Las consecuencias de la utilización de Análisis de Valor en diseños de construcción de centros comerciales

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Resumen

La creatividad es una herramienta para lograr soluciones más oportunas, menos costosas, de mejor técnica y mayor percepción de valor para quien concibe y utiliza un recurso. Basándose en la creatividad y en el pensamiento lateral para alcanzar soluciones más oportunas, menos gravosas y de mejor técnica para alcanzar objetivos, la Ingeniería y Análisis de Valor, aplicada a los proyectos de emprendimientos de centros comerciales, trae mayor productividad en la construcción y operación de los edificios. La relevancia del estudio está en contribuir al conocimiento diseminado de las prácticas de Ingeniería y Análisis de Valor en los proyectos de

centros comerciales y qué influencia ejercen en los costos operacionales. Además de la importante participación del segmento al PBI (Producto Bruto Interno) brasileño, los empresarios de centros comerciales han contribuido inmensamente con la sostenibilidad y apoyo a las comunidades de escasos recursos en el entorno de dichos edificios. Este artículo pretende demostrar que existe la práctica de Ingeniería y Análisis de Valor en los proyectos de emprendimientos de centros comerciales y la gran preocupación de todos los agentes inmersos en los proyectos para la reducción de los costos operacionales.

Palabras clave: EAV (ingeniería y análisis de valor); Centros comerciales; Proceso de los proyectos.

Abstract

Creativity is a tool to achieve timely, less costly solutions, best technique and greater perception of value for anyone who makes and uses the resource. Relying on creativity and lateral thinking to achieve timely, less costly solutions and best technique to achieve goals, value Analysis and engineering, applied to construction projects of shopping malls, leads to greater productivity in better operability to buildings. The study contributes to the widespread knowledge of the practices of the engineering and value Analysis in projects, shopping malls, and

how it affects the operating costs. In addition to the important participation of the thread to the Brazilian GDP (gross domestic product), owners of shopping malls have exercised extensive contribution to sustainability and support the communities living in the surroundings of these buildings. This article seeks to demonstrate that there is the engineering practice and value Analysis in construction projects of shopping malls and the great concern of all agents involved in projects for the reduction of operating costs.

Keywords: EAV (Engineering and Analysis of Value); Shopping Centers; Process of projects.

1. Introduction

According to data (2011) from the Associação Brasileira de Shopping Centers –ABRASCE–, the shopping center industry accounts for 18% (eighteen percent) of retail business and 2% (two percent) of GDP (gross domestic product) excluding the automotive sector, being, an important segment for the Brazilian society not only due to the volume of transaction resources but also because of its social impacts, creating direct and indirect jobs and encouraging social responsibility, among others.

Thus, it is understood that studies that enable the provision of shopping centers with better services, upgraded modernity, beauty, sophistication, and costs among others contribute to the society as a whole.

For the enterprise shopping center brings better financial results to investors and have more physical space and tapped and easier access to users (retailers) and the general public, the philosophy of architectural design and proper compatibility of this with other complementary projects is of great importance.

However, the increasing specializations of outsourced designers make difficult the agreement to reach consensus about the compatibility of the various projects without needing to change the architectural proposal. Sometimes, there are different perceptions that lead to an outcome of difficult solution, and these have been delayed –usually postponed until the stage of the execution of the work, i.e. when there's little time for a proper study considering the dynamism required in such conditions.

This type of situation often leads to financial loss and sometimes more expensive solutions as also extends the contractual timelines and delays the operation of the enterprise.

Besides understanding the desires and needs of the intended audience of the venture, using background knowledge to design according to this demand, it is necessary to outline plans that allow the creation of value by the user, increasing, the chances of success and the return of the investment.

The studies that make the job feasible and facilitate the project operation during its lifetime, is characterized as being of Value Engineering and must be made at the project stage, aiming at the best operating results. Engineering and Analysis of value (EAV) is a research model of functions which studies cheaper solutions maintaining the quality of product.

Assuming that the use of principles of EAV during the design process of shopping centers enables solutions which add greater value for the user and result in better financial return, one may ask if: in the design of projects of Shopping Centers is being practiced engineering and Value Analysis and what results are being obtained from these initiatives?

For this reason, this study aims to investigate whether Engineering and Analysis of Value are being used in designing projects of Shopping Centers and what results are gathered from these initiatives with regard to the building projects and overheads.

The intention of this research is to register, analyze and examine these procedures to come up with solutions which meet the VE/VA assumptions of Value Analysis and Engineering and at the same time meet the viability of the business, creating the perception of value by customers and serve as default and query source for other companies in the sector.

2. Methodology

This study used the method of the exploratory research which –according to Gil (2007)– presents the most rigid planning and involves bibliographical, documentary research, non-standard interviews, and case studies. The applied and exploratory methods have been chosen to establish comparison parameters between what is referred to in the literature and what designers effectively practice in drafting shopping centers related to the application of EAV. Also, understand that by exploratory research which could investigate the claims of industry entrepreneurs, what companies do in their everyday life to reduce overheads, the causes of the difficulties encountered in reaching these goals, which would be the agents for facilitators of the same range, and what would be the best way to find them.

2.1. Bibliographic Searches

Initially, bibliographical research was carried on shopping centers, Value Engineering and process projects covering reading, analysis and interpretation of specific and complementary material on the topic in books, journals, dissertations and theses.

2.2. Field Research

The first step was an interview with an experienced Brazilian engineer, Ronaldo Vieira, specialist in Administration, project management, construction and shopping centers operation enabling the

understanding of specific aspects of the topic and helping to determine a better definition of the data set that should be collected.

Then, a list of questions for designers of different areas of shopping centers construction has been prepared, featuring a qualitative method of field research which, according to Yin (2005), is defined as one that involves questionnaire of open-ended questions, where the responders are free to develop their thoughts without getting stuck in previously framed responses.

The interview agenda method was adopted – a method that summarizes objectively few questions that intercommunicate. The interview agenda – according to Gil (2007) – is somewhat structured by following goals focused on the interviewer to follow a line of reasoning questions related to each other, and that allows the interviewee to speak freely, and the investigator, subtly, just keep the conversation within the agenda.

The use of the interview agenda responded in part the question of research analyzed by the deductive method of observation. However, the issue unfolds in part questioning whether there is the use of Value Engineering in shopping malls projects, and another that directs to the influence of use of EAV in projects and operation of shopping centers. In this case, it was necessary to listen to experienced professionals who work on shopping centers projects and operations.

2.3. Characterization of the Research Sample

The research has led to some professionals with ability to securely respond to questions about the topic that could only be answered by professionals with large experience in the subject. The interviews focus was, therefore, quality not quantity. Most of the interviewees have more than fifty designs in their shopping malls' portfolio and are considered Brazilian top specialists.

Thus, important designers have been selected for the interviews – the ones with extensive experience in shopping centers construction in Brazil and abroad - plus entrepreneurs of this sector and an experienced building operating Manager.

The architects Eduardo Mondolfo and Virginia Portugal were initially interviewed in respect to EAV application issues in architectural projects and the hiring criteria of other designers. After these, the designers of building installations and central air conditioning systems were interviewed.

Right after, two important representatives of this segment were interviewed: an entrepreneur from Aliansce Shopping Centers SA group which owns and manages twenty-eight (28) malls in Brazil and has partnerships with local and overseas entrepreneurs and also constantly expanding the business; and an entrepreneur delegate constructor from Construtora Santa Isabel, which invests in shopping centers.

2.4. Summary of the respondents qualifications:

- Eduardo Mondolfo- experienced architect in shopping center design both in Brazil and abroad. Co-owner of Eduardo Mondolfo Architects. His portfolio includes the execution of 16 shopping centers projects in Brazil and abroad. He holds a UC Berkeley Master's degree.
- Virginia Portugal- architect with vast project experience in shopping malls. Pioneer on such enterprises in Brazil. Currently, she works for various construction companies in this segment. Partner at Viable Architecture –a company that runs shopping malls projects all over the country. Her expertise is firmly focused on the projects' sustainability aspects. She holds a Master's degree in Environmental Management– Universidade Federal do Rio de Janeiro;
- Heraldo Monteiro - Electrical engineer and one of the most important specialists in building installations in Brazil with extensive experience in complementary projects, shopping centers. Partner and Director at CEMOPE - Consultoria e Projetos de Engenharia Ltda - a company that runs building installations projects. Currently, one of the most sought-after shopping malls designers in Brazil.
- Jorge Sardinha - highly requested designer with extensive experience in central air conditioning projects for buildings in Brazil, including shopping centers. He has vast experience in central air conditioning projects, and is a teacher of extension courses of air conditioning systems at ABRAVA - Associação Brasileira de Refrigeração Ar Condicionado (Brazilian Association of Ventilation and Air Conditioning). Partner and Director at Vector Engenharia Ltda.
- Delcio Lage Mendes - investor in shopping center ventures and partner at Aliansce Shopping Centers S.A. Engineer with over twenty-five years of experience in this segment.

- Creston Fernandes - investor with extensive management experience and partner at Construtora Santa Isabel Ltda. – prestigious company in the construction industry.

2.5. Purpose of the Questions and Observation and Treatment of the Answers

The questions were to establish some positions of designers and entrepreneurs which would indicate the use of EAV in shopping center projects and its objectives. Upon investigating who provides the project guidelines, the purpose was to establish links between the intention of hiring managers or if the architects act as managers and are responsible for these signings.

In addition, it was investigated whether there were different practices among administrators and construction entrepreneurs.

These questions had the purpose to establish a criterion of research to understand which philosophy prevails in architectural projects: creative, commercial (market), the sustainable, economic, etc. The other objective was to verify whether there are communication problems among the various designers, and who manages this communication.

There have been deepened what measures are adopted and what projects of EAV entail consequences in shopping centers. In addition, because the principles of sustainability are more comprehensive than EAV, it was investigated whether they are considered in several shopping malls projects and the motivations behind them, i.e., if they are used for the sake of company's image (as marketing strategy), for the constructive and operating cost reductions, or if there is in fact an environmental concern.

3. The Shopping Mall Industry in Brazil

In Brazil, there are two associations responsible for the organization of the shopping center segment: ABRASCE (aforementioned) - representing the Association of entrepreneurs and ALSHOP – Associação de Lojistas de Shopping (Brazilian Association of Shopkeepers at Shopping Centers).

The shopping mall sector in Brazil is relatively new and has experienced a sharp growth, as shown in Table 1.

Table I. Shopping malls growth in Brazil

Year	Number of malls	Number of shops (x100)
2006	351	564
2007	363	620
2008	376	655
2009	392	705
2010	408	737
2011	430	802

Source: site ABRASCE (12/02/2012)

According to ABRASCE, the shopping center sector has an average annual turnover of 108 billion reais (2011), corresponding to 18.3% of retail total sales in Brazil (excluding the automotive sector). However, according to ALSHOP, this annual revenue reached 104 billion reais (2011).

According to ABRASCE, in September 2001 there were 239 malls comprising 36,257 stores resulting in 400,000 direct jobs. At the end of 2011, these figures increased to 430 shopping centers, 80,192 shops, and 775,383 direct jobs.

The trade associations have different definitions for shopping center. The difference is based on whether the shops are rented or sold and whether there are flagship stores able to attract a larger share of customers.

ABRASCE considers as shopping centers, the enterprises that have a single and centralized administration, rented or owned shops, and stores that according to size and power of attraction, are called flagship stores. Commercial trade centers, on the contrary, have stores that are sold and the Administration is not centralized since the owners have the right to vote and can interfere in the Administration. According to ABRASCE this misleads the concept of shopping center since the owners of the shops may manage their properties freely.

ALSHOP defines as shopping centers the ventures that have centralized administration, rented or sold shops and flagship stores.

This study focused on the shopping centers as per ABRASCE's concept.

3.1. Types of malls and stores according to ABRASCE

ABRASCE sorts the shopping centers based on the ICSC (International Council of Shopping Center), according to their physical configuration, products characteristics, market profile, and other aspects. Thus, there are community, neighborhood, regional, specialized malls, and Outlet and Festival Centers.

Both ABRASCE and ALSHOP classify the stores as follows:

- Retail stores: are the vast majority in shopping centers. They are usually included in the following segments: apparel, footwear and accessories, household goods, cosmetics, stationery stores, drugstores, newspapers and magazines plus food, services and leisure.
- Flagship stores: with a total area exceeding 1,000 square meters, they are leading advertisers, have audacious advertising policies and transact mostly with credit sales. The flagship stores are usually department stores, hypermarkets, supermarkets - the latest called traditional flagships.

4. Engineering and Value Analysis

Value engineering is based on creative and lateral thinking processes leading to differentiated and timely solutions. According to Csillag (2009), creativity is related to: sensitivity to problems, flow of thought and originality - being sensitivity to problems the acceptance that the problem exists, without denials or pessimism; flexibility as being the ability to study other possibilities in finding solutions; and originality the condition of producing ideas.

Lateral thinking and creativity have different characteristics. Lateral thinking is the ability of considering unconventional ways in problem solving. Its study was developed by De Bono (1971) and differs from the term creativity because it is based on solution attempts which may originate from several reasons, including the error. It is not, therefore, a study intended to find a solution. It relies mainly on attempts by luck, chance or mistake.

Value analysis is a research element fully divided into parts which have the quality of estimates, cost, use or price, on the understanding that it is the thorough study of the product or service value, in respect of each of its functions.

There are some aspects involved in the identification of value such as quality, durability, and different options in the market, according to who buys or uses the service.

Value analysis is a methodology that considers the object from the perspective of functions regardless of their nature. Currently, the AV/EV is being applied more widely in a set of activities and not just to an object. For this reason, Analysis of value is better known recently as Value Management since it meets more broadly to the processes of a company (CSILLAG, 2009).

There are some basic meanings to Engineering/Value Analysis:

- a) Function- Csillag (2009) presents some definitions for the meaning of an object function. It may be the purpose of an object or part of an object purpose or service goal; the characteristic of an object or service that meets the desires of the buyer, or the characteristic of an object to function or sell, and, briefly, to understand the meaning of function as performance of the object or service.
- b) Activity - the way a function is put into practice.
- c) System - set of processes that interact.
- d) Value - equivalence of something in transactions, therefore, it involves comparison, being possible to measure it monetarily. For Csillag (2009), there are 4 (four) types of economic values:
  - Cost value which is the value converted in currency either to purchase or to manufacture the object;
  - Use-Value which is the utility of an object or service;
  - Esteem value which is the quality that makes you wish to own the product or service;
  - Exchange value which is the ability to interchange.
- e) Performance - set of activities the object or service aims and that can be marketable. The characteristics of the activities performance can be diverse and shall comply with the following requirements: reliability, quality, interchangeability, appearance and easy maintenance.

According to Csillag (2009), a set of products can require many items and achieve the various functions. The proposal of Value Engineering is to eliminate those which do not add value and that increase costs.

Due to the fact that Analysis and Value Engineering is a study that fragments the functions of an object or service and seeks solutions through in-depth analysis investigating timely solutions seeking greater quality to lower the product or service costs, the most suitable tool for this analysis is the FAST diagram (Function Analysis System Technique). The FAST diagram is meant to define and classify the functions to qualify an object, system or service problem, using the problem itself for the analysis.

The FAST diagram has been used to assist the functions of an object at different levels, being considered the first level assessment, one for which the object was designed, the level two are secondary functions which meet users objectives and level three are also secondary functions, but concerning the producer (MARAMALDO, D. ,1983).

5. Architecture Design Process

As per the Brazilian Association of Technical Standards (ABNT, 1977) rule NBR 5670 the concept of project is " the qualitative and quantitative definition of the technical, economic and financial attributes of a service or work of engineering and architecture, based on data, elements, information, studies, technical breakdowns, calculations, drawings, standards, projections and special provisions", and, according to NBR 13,531, establishes the building project as being the "determination and prior representation of functional attributes, formal and technical elements of the building, to construct, to assemble, to prefabricate, extend, (...), covering the outer and inner environments and projects of building elements and building installations".

For the Brazilian Association of Architecture Office (AsBEA, 1992), the word design means "generically, intent, purpose" and in its technical sense "a set of actions identified and quantified required to achieve a goal".

Liikkanen, L. A. (2009) thinks the stages of a project process do not follow pre-established patterns. There is a division of the main architectural problems into subproblems to be analysed and not a whole study including all parts. The result is that architects first identify the size of issues looking for a greater number of alternatives leaving the in-depth study of these issues for afterwards.

Löhnert, G. (2003) observes that the projects process is not a linear process where a goal is traced to achieve the objective, meaning specifications that are

successively performed by drawn plans. The architects draw plans that initially should be followed, but to meet with engineers of complementary facilities, such as mechanics and electricians, the suggestions are implemented to suit demand. The project will guide the intentions you want and organize activities in order to achieve the purposes, in principle, efficiently, with reduced costs in less time and with higher quality.

Polydoropolou & Roumboutsos (2009) identify the decision-making in the project as the element that will reduce construction potential problems by analyzing their possible impacts in the construction and creating a mechanism for monitoring and comparison during construction of the project.

Melhado (2001) divides the development of construction enterprises in stages where assembly is the preliminary study, followed by the stages of development, organization, implementation and delivery of services, using the operating systems and the maintenance of the building. This evolution of the role of the project in construction is due mainly to search for reduced costs as a result of a tougher competition in a scattered and increasingly competitive market.

Sabbatini (1989) understands that projects must consider operations and maintenance factors to comply with the customers' expectations finding solutions for problems and considering the factors related to the operation and maintenance of the projects.

Gonçalves (2001) states that it is possible to realize that the project will affect the various subsequent stages of the venture such as:

- during the design process, the interferences are in the reconciliation of the various projects, the choice of the constructive system etc.;
- during the construction phase, the interference of the projects are in costs, deadlines and schedules fulfillment, materials and workmanship waste, overall performance of the building, the introduction of new technologies, constructability, rationalization, etc;

Different situations comprise the value that the customer will perceive from projects. This perception is directly linked to different activities among them are: the customers' difficulty in expressing their needs; different postures and expectations of many users; lack of information among the designers; inefficient market analysis; differentiated use of the product etc. (Koskela, 1992).

Koskela (op. cit.) introduces some principles of process improvements that include the reduction of activities that do not add any value to the product, the customer value perception according to their expectations fulfillment, the reduction of product diversification, reducing procedures, increased product flexibility, transparency of the process, constant improvement, improving balance and flow of conversions, benchmarking etc.

Bertezini (2006) considers that the development of the design process is subject to failures that result from difficulties occurred during the execution of the project. These can be subdivided into three categories (according to Table II), namely:

The deficiency of information flow between designers and Construction Department is - according to Melhado (2003) - one of the biggest problems at construction companies. Besides the poor communication due to failures during the project process, Reis (1998) highlights the inefficiency of information from changes made as a result of running processes of the enterprise during the execution stage. These communication failures result in the absence of alignment between the construction and the designers causing recurrent errors creating obstacles to the elaboration of the projects "as built".

6. Results of the Interviews

Based on the results of the interviews, it was possible to conclude on the following themes:

Sequencing of project actions:

A project starts from a market research by a specialized company identifying and measuring the potential of the public under the influence area. This is the main factor that guides the philosophy of the project. Then, the enterprise's mass study begins - followed by the project draft.

The project management is also influenced by the opinion and direction of entrepreneurs and the team that will operate the property. In general, the entrepreneur contracts the projects and the manager assists the entrepreneur concerning prices and market components. However, it is the entrepreneur who usually suggests the hiring.

The compatibility between the technical and economic feasibility will determine the guidelines in relation to the philosophy of the project.

The ideal situation occurs when all agents are involved since the beginning of the studies of the mall project so the project implementation can run smoothly.

In Brazil, this practice is unusual, but in some projects there is the involvement of all agents from the beginning including: entrepreneurs, designers and those who will manage the property.

It is common to find deficiencies in some shopping malls (especially in those which have not fulfilled all the recommended steps) such as: inadequate distribution of service areas, use of certain types of

Table II - Difficulties in Project Development Process

Categories	Description of difficulties
(a) during the project development process	• develop characteristics for the product to fulfill clients' needs and expectations • create processes able to generate the desired characteristics for the products • establish processes and products control (internal and external monitoring) • provide process feedback with reliable information • carry out improvement
(b) at the interfaces between the project development phase and the other phases	• Identify the clients (internal and external) • Identify clients' needs and expectations • provide process feedback with reliable information • carry out improvement
(c) in the relationships between designers and other agents	• schedule compliance • Designers commitment towards the adopted solutions • Formation of multi-disciplinary teams from the beginning • Intercommunication between designers and other agents

Source: Bertezini (2006).

finishing materials that require more employees for its conservation, installation of inefficient electrical and/or air conditioning systems and various other aspects that if observed during the preparation of the projects would have inserted technologies and details that could have lead to better optimized costs and operating conditions.

Therefore, it is essential the participation of an expert in malls operations during the project development to best evaluate the techniques and technologies required for its proper functioning.

The initial study of a mall is more focused on marketing issues: what the users expects of the Mall and at what cost. The elaboration of the project - mainly regarding the finishing - should be compatible with the expectations of the users. The idealization of what can be done in the desired location, as follows: the constructive potential of the property, and its commercial feasibility in terms of use; if the local is suitable for the market; etc.

In addition to have a great attractive potential for the general public, the shopping center should be a complex of economical and effective operation.

The type of shopping mall and its finishing materials are defined according to the social class to be achieved.

Monitoring and relationship with stakeholders:

In relation to communication difficulties during the project process involving designers, manufacturers and entrepreneurs or their representatives, architects do not realize any difficulties. Respondents usually work with the same designers team for complementary facilities – quite experienced in shopping malls projects and construction. This relationship ends up favoring good communication.

The leaders of the companies interviewed reported that they keep in their staff engineering sectors to monitor project activities and construction of shopping centers which facilitates communication among the agents. However, additional installation engineers see the issue of communication among the agents of shopping mall projects differently. Currently, entrepreneurs save money by not contracting a project coordinator. This role is usually played by the architects. The architects seldom have the necessary conditions to act as project coordinators either due to lack of time and/or knowledge or simply because they have not been hired for that purpose. The consequences of this type of construction management creates problems that have to be solved at the construction sites and, consequently, within a very short term.

Currently, the managers do the compatibility of projects and there is great difficulty to establish priorities due to the overlapping of the various sub-projects. Thus there are increasingly communication issues among the various agents of a joint venture. Even in contracts where there are managers, there is only the construction schedule management, not any involvement of themselves with the technical part of the issue. Therefore, according to the engineers the communication among the agents of a shopping center construction is a negative aspect.

Objectives of EAV use in projects:

The operating costs of the building are one of the priority issues for the choice of engineering, materials etc. The initial feasibility study of a mall will already bring information about the profile of the public and their expectations, so this factor shall guide the philosophy of projects that meet such demands keeping the high quality at the lowest possible cost.

In relation to EAV in shopping malls projects there is a concern intended to reduce construction costs. This does not necessarily mean reduction of operating costs.

Sometimes entrepreneurs use cheaper materials or equipment leaving for the enterprise operations managers the solution of the problems.

The reuse of water in malls is not in line with the legislation. The sewage is treated and water reused. In practice, this procedure is not feasible because its seasonal. The collected water is spent very fast not meeting the desired demand, and the reservoirs are most of the times empty.

Cutting-edge generators are being installed in malls during hours when electricity is more expensive with views to reduce energy costs.

Sustainable issues: reasons, methods and consequences:

The designers usually don't have neither the perspective nor the in-depth knowledge of the principles of sustainability. Therefore, some entrepreneurs are seeking this knowledge and respective practices, with respect to the marketing of their businesses.

There is a concern to use mechanisms to reduce the environmental impacts caused by the construction of shopping centers buildings. Alternative technologies, ecological materials, water reuse, and waste storage

locations for waste selection, etc. contribute to reducing operating costs, in addition to the main motivation that is attempting to minimize eventual damages to the environment.

The concern to do projects which promptly qualify to receive the Quality and Sustainability certifications is not yet a priority in corporate projects, according to the architects interviewed. Some projects are executed to meet some requirements of quality legislation such as ISO 9001 and certifications such as Green Building, but this is not the main goal.

In relation to social practices, the malls have funds meant to help the needs of surrounding poor communities. There is a goal to meet the sustainability principles in the venture, but this has to be added to a market factor, bringing advantage and fit within the budget. A business is idealized and so a goal. The issue of sustainability originates from the ecological idea. The intention is to make the best possible enterprise complying with environmental issues, but everything has to fit within the budget. Anything that may impair the results will be cut out.

7. Conclusion

This study investigated whether the assumptions of Engineering and Value Analysis are being used in shopping centers venture projects and the influence of these actions in the operating costs of these buildings. The results confirmed the use of EAV in various projects of shopping centers ventures.

It was possible to verify the differences in purposes of shopping malls entrepreneurs: as constructor or as administrator of malls. There are in most of the goals, and practices, the convergence of thoughts and actions. However, there is a difference between one and another view in relation to EAV because of greater importance to the perceived reduction of the construction (the manufacturer), while the other understands EAV as more appropriate to be applied to projects aiming operating costs reduction (the administrator).

The reason for the existence of shopping mall has been changing since the creation of the first shopping malls in the United States (CHUNG, J.C. *et al.*, 2002). The initial intention of creating malls to attract customers from the suburbs and meet their expectations has been changing its characteristics. Currently, the major urban centers are the ones that attract the population into the malls by changing the characteristics of their function. Shopping malls cater to the community not

only as a place for business transactions. Its function of enabling social meetings, and leisure, in addition to the marketing of products changes the design of the projects and meets various demands, as the principles of sustainability.

Sociologists are concerned about what they call "empty streets" due to insecurity and discomfort that people feel, exchanging walks in the city streets for a shopping mall scenario. This condition requires a greater responsibility of such entrepreneurs to the importance of the sector to the society since the shopping malls are no longer only a place for business transactions but also an important part of the surrounding population everyday life.

Being so, designers have been seeking the enhancement of their projects so that buildings can bring comfort and convenience to users. In this sense, to offer more to the customers, and lower costs that can enable the business, some aspects have to be considered in the preparation of projects and they should obey a primordial condition: cost vs. quality.

The EAV procedures used in the construction industry, particularly in the construction of shopping malls buildings, distanced somewhat from those used in other industries. For being a segment of services by fragmenting certain parts of the process to review them, and it has as advisor and leader, professionals from different companies - therefore with the possibility of other interests. This is not the case of the manufacture of products, where EAV is widely used in which the agents are members of the same team with common interests.

In the design of shopping malls projects, and in consequence of the multidisciplinary approach, EAV is used in such a way that each designer is responsible for a type of engineering doing their own analysis and finding solutions that shall be crossed and submitted to the feasibility opportunity with solutions by other companies in complementary projects. This condition often prevents the execution of private proposals involved in each work, by virtue of compatibility of all projects. In these cases, EAV is postponed in favor of other more appropriate solutions at the discretion of the Manager or even of the entrepreneur.

It has been realized that the opportunity to apply EAV in the projects depends on other circumstances and not only on creative ideas to improve profits and reduce costs. The EAV for projects of shopping malls is a multidisciplinary engineering criterion, more complex, and will serve primarily to commercial interests.

It has been noticed that the majority of designers understand that the operating costs should prevail at the moment of choosing the techniques, materials and the equipment to be designed. However, entrepreneurs also aim at lower construction costs. In this connection, there is often a combination of these factors: lower construction costs and, at the same time, reducing operating costs – a conjunction of goals.

Nevertheless, it is necessary to point out that there is also the need to diminish the operating costs to meet the retailers' requirements that depend on the operating costs to keep their businesses profitable. This condition leads to a permanent search for alternative creative projects to fulfill these requirements. The EAV is the mechanism that leads to studies enhancement and justify their results.

Differently from the processes of various industries, the construction industry is particular because it deals with services. Therefore, it should consider the user's expectations, but keeping the orientation and the need of entrepreneurs on a balance of supply and demand that modifies increasingly each day and by a fierce competition, the client determines what will be built and the price to pay for the service. In other words, the customer's value perception is increasingly influencing the projects.

The research pointed out some interesting aspects in relation to the views of the entrepreneurs. The culture of the entrepreneur-administrator is primarily focused on the reduction of operating costs because they indicate the success of the enterprise to establish favorable rental possibilities because of lower maintenance fees.

During the interview, one of the entrepreneurs reported:

"the shopkeeper has a limit for rent expenses so its business remains feasible. So the lease can be more attractive by decreasing operating costs." Another entrepreneur-builder also considers the operating costs

reduction as a goal to be pursued, but considers that it can encumber the estimated costs of construction. In the entrepreneur-builder's vision, "the goal is to make the best venture possible; environmentally friendly but everything has to fit within the budget. No one builds a building to lose money." Therefore, an entrepreneur is more concerned with the operating costs while the other cares more about the construction costs. It is believed that these views are cultural issues.

The engineers of complementary facilities state that the communication among the different agents of shopping centers projects is the worst possible and it has constantly lead to problems and financial loss to the ventures. It is believed that in fact there are communication problems, not only in the shopping mall developments, as in any construction of buildings. Deadlines and modern life, – when time is a fundamental factor, many situations are not passed in time for all those involved in the process. This deficiency results in errors that accumulate and end up by bringing inconvenience to work and as a result, sometimes, to the operation of the enterprises itself.

Summarizing, it was possible to check that there are important uses of EAV in shopping center projects. This has been proven when the respondents to the interviews admitted that they use many resources to design their projects such as: type of the contracted energies, alternative air conditioner systems projects, and reuse of water. Those decision-making are at the same time related to sustainability resources. According to the experts interviewed, the use of EAV can result in reductions in the operating costs.

When collecting the data to meet the main goal, it was realized that EAV is still a small part in the sustainability proposals which in turn are a huge concern for all actors in shopping malls construction projects.

Therefore, it is suggested more comprehensive researches on the application of sustainability principles in shopping centers projects and further analysis of the influence of these practices in the operating costs.

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