Analysis of the Bernardo Mascarenhas Cultural Complex based on the criteria of sustainable development

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ABSTRACT: The Bernardo Mascarenhas Textile Company, founded in 1888, was an important company located in the historical centre of Juiz de Fora city (Minas Gerais, Brazil). Since the bankruptcy of the factory in 1984, the complex of buildings went through several building works. This article aims to explore the edifications taking in consideration the concepts of sustainable development, that is to say, to investigate applicability the social, economic, environmental and institutional parameters after the restoration. In order to elaborate this paper, it was conducted a survey with a qualitative approach, through the collection of visual data, identification of the building materials and survey of the adopted solutions. It were employed the iconographical archives that collaborate in the narrative of the modifications that have occurred in the buildings. As a result, it was observed that some of the mentioned aspects insert the complex of buildings in the sustainability issues, especially if its social dimension. It is expected that this work may give a contribution for the entire complex of buildings may be included in the context of the sustainable development.

Keywords *Heritage, Rehabilitation, Sustainability, Sustainable Development*

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1. INTRODUCTION "THE MASCARENHAS COMPLEX"

The Bernardo Mascarenhas Cultural Complex, a former textile company located in the historical centre of Juiz de Fora, in Minas Gerais, was inaugurated on May 7th, 1888, being responsible, according to Croce (2008), for the development and industrialization of the "countryside", turning it into a modern municipality, which has, subsequently, propitiated the construction of the first hydroelectric dam in Latin America, the hydroelectric power plant of Marmelos, designed in 1889.

The entire complex of buildings has about 12.498 m², being that 11.233 m² are of built area and 1.264 m² are free areas, such as: parking, loading and unloading areas, civic squares and circulation areas. Nowadays, the Bernardo Mascarenhas Cultural Complex (see Figure 1) is composed by four edifications: the Bernardo Mascarenhas Cultural Centre (BMCC) (1); the Municipal Market and the Municipal Secretary of Education (2); the Murilo Mendes Municipal Library (3) and the Dr. Geraldo Moutinho Centre of Education of Youth and Adults (CEM) (4). The judgment of the Division of Artistic and Cultural Heritage (DIPAC), contained in the process number 3649/82, is reflected in the law decree 2866 of the year 1983, which deals with the preservation of the Complex where there are a description of the buildings that house the BMCC and the Municipal Market, being established the prohibition of modifications that may modify the characteristics of the facade being only allowed internal changes that may provide new adhibition.

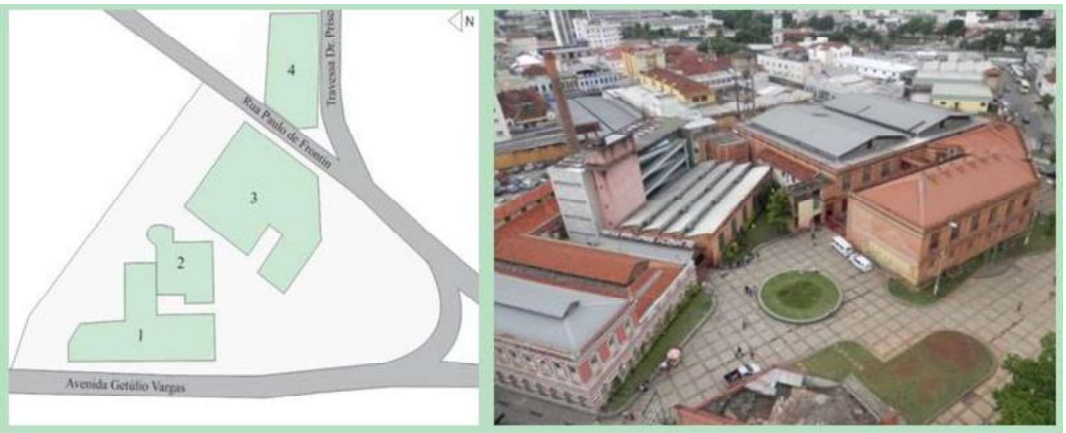

Figure 1: Location of the buildings of the Cultural Complex.

The actions analyzed in this study are contemplated within the point of view of the sustainable development, which, according to a report by Brundtland (1987), can be defined as being the ability of man to meet its needs without compromising future generations, that is to say, social, economic, environmental and institutional parameters are observed in order to extend the lifespan of the building.

Silva (2013) mentions that rehabilitation is a way towards the conservation of environmental resources, through the modernization of the conditions of functionality and comfort, seeking to improve the environmental performance, besides being also an act that will enhance the value of the historical and cultural resources of a community.

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According to Tayra (2006), the indicators that point to the sustainable development are essential when they join the environmental, social and economic parameters. In this paper was conducted a survey with a qualitative approach, through the collection of visual data, iconographical material, identification of the building materials, identification of the pathological manifestations, and, finally, the identification of the solutions adopted in the building works considering the indicators of sustainable development.

2. THE CULTURAL CENTRE

The building, which currently works as a space for art and culture, was the focus of the premises of the social movement "Mascarenhas, my love" in 1983, supported by exponents of the arts from Brazil and, in particular, from Minas Gerais (PEREIRA, 2013). The BMCC has strict symmetry (see Figure 2), with an architectural project grounded in a central body constituted by three floors. The building can be divided in two parts: the technical area and the public access area. The facades are dominated by the symmetrical rhythm of the sequence of arched openings, with fences made of wood and glass (FUNALFA, 2015).

Figure 2: Bernardo Mascarenhas Cultural Centre (BMCC).

The structure of the building has received great attention during the process of restoration, which occurred in the 1990's, after its collapse**.** The external facade of the factory apparently appeared to be in good condition, but, internally, it was in ruins and modifications were needed to recover it (PEREIRA, 2013). The positive point in the restoring was employment the steel as the main material, since it is a recyclable, distinguishable and of easy reversibility material, that one of the better meets the demands of a sustainable work. Table 1 shows the clarifications about the survey that has been conducted.

In the qualitative approach adopted the scales the Development Indicators provided in the Brazilian Geography and Statistics Institute (2015) in according to the Commission on Sustainable Development, summarized below: *Complete (C), Partial (P) and absent (A)*, i.e., the appointment categories include the indicators who guaranteed the integration in sustainable development.

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Table 1: Conformity of the sustainability categories in the BMCC.

Categories	Conformity	Comments
Economic	**P**	Promotes the integration between society and groups of producers of culture in the city. However, there is mismanagement in the energy consumption coming from an inadequate air conditioning system throughout the entire building, and this is a characteristic that has been neglected yet.
Institutional	**P**	The maintenance of the building is a responsibility of the public agency of the city which seek, where possible, to attain the best cost-benefit ratio as well as to perform building works that act in accordance with the sustainability and management of natural resources..
Social	**C**	It's an important element of the culture and education in the city.
Comfort	**P**	The building was designed before the generalized utilisation of electrical energy and, for that reason, the constitution of the architectural elements and of the openings have as aim a greater capture of light and natural ventilation.
Water Management	**A**	There is not water management system.

Subtitle: Complete (C), Partial (P), absent (A).

3. THE MUNICIPAL MARKET AND THE SECRETARY OF EDUCATION

Municipal Market is the name given to the building that contains the market since 1987, as well as the Municipal Secretary of Education. This building is the result of a reconstruction, after the fire that occurred in 1991. Composed by two floors, follows the same constructive guidance of the British manufacturing models, with apparent solid bricks possessing ornamentation in the intermediate and superior entablature. The solid bricks are arranged in zigzag, with indentations and protrusions (FUNALFA, 2015), as it can be seen in Figures 3 and 4.

Figure 3: Municipal Market and the Municipal Secretary of Education.

The regularity of the building is marked by the large windows entirely torn, with straight lintels, metal finishing and occlusion made with glass, having security bars in the entire ground floor.

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Figure 4: Ground Floor of the Municipal Market, with windows and a circulation corridor, improvised thermal conditioners installed on the facade of the building, facilities for sales stands of concrete and masonry, with a roof of metal structure, hollow elements and systems of air exchange.

Table 2 shows the clarifications about the survey that has been conducted. It was put in evidence in the survey the employment of the internal steel structure of support. Besides the masonry of solid bricks, it were also adopted in the reconstruction some characteristics that allow the adaptation of the space to the new proposed utilizations, such as double height ceilings, ceiling vents and ceiling atrium for smoke exhaust and, finally, the construction of stairs for safer access.

Table 2: Conformity of the sustainability categories in the Municipal Market and the Secretary of Education.

Categories	Conformity	Comments
Economic	**P**	The combination between commerce and municipal agency was effective in maintaining the building. However private resources through a consortium coukd facilitate the constructions and would allow the accomplishment of the guidelines that fulfil sustainability.
Institutional	**P**	FUNALFA, DIPAC, COMPAC, and the City Hall perform the management of the space.
Social	**C**	A positive aspect. It generates integration and provides an articulation between the different utilizations.
Thermal Comfort Lighting and Ventilation	**P**	The use of natural lighting is flawed. Natural ventilation is profitable, being complemented by mechanical devices due to the fact that there are different temperatures between the different environments.
Water Management	**I**	Inexistence of elements and systems that may allow a better control of the water flows and reduce water consumption.

Subtitle: Complete (C), Partial (P), nonexistent (I).

4. THE CENTRE OF EDUCATION OF YOUTH AND ADULTS (CEM)

The CEM (Dr. Geraldo Moutinho Centre of Education of Youth and Adults) is a municipal school located in the “extension” of the Mascarenhas Factory (see Figures 1, 5 and 6 and Table 3). It is a ground floor building that has a double height ceiling highlighted by the crowning in the shape of fascia, following the same constructive guidance with apparent solid bricks and ornamentations in the upper entablature arranged in zigzag, with indentations and protrusions; its main facades are composed by rims of windows with small window sills that extend to the ceiling of the building, being the windows also characterized by the iron bars that make the security of the entire complex.

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Figure 5: Dr. Geraldo Moutinho Centre of Education of Youth and Adults (CEM).

Figure 6: Teacher training centre, sign language class, opening on the second floor to the air vents. Air conditioning is provided in the reconstruction of the building.

Table 3: Conformity of the sustainability categories in the CEM.

Categories	Conformity	Comments
Economic	**P**	The space has limited solutions regarding the guidelines of economic sustainability, since there are no signs of improvements and updating, nor signs of proper adequacy of the system that composes the building.
Institutional	**P**	Institutionally, the management is carried out by the city hall, which is responsible for the maintenance and adequacy of the space.
Social	**C**	Works in agreement with the department of education, offering education and free training courses, and integrates young people and adults in social and cultural life.
Thermal Comfort Lighting and Ventilation	**P**	It has excessive overheating that result in discomfort and there are no mechanical thermal conditioning systems on the premises. Natural lighting is a positive aspect; however, the excessive incidence of the direct sunlight causes damages to the thermal.
Water Management	**I**	It were not found any solutions that allow the reuse of rainwater, the gutters have no systems able to drive the waters toward reservoirs and the roofs show problems with periodic water infiltrations. In the bathrooms, the toilet flushes don´t have any control device with a system to reduce the water expenses.

Subtitle: Complete (C), Partial (P), nonexistent (I).

The environments are composed by large multifunctional areas, which emphasize the plurality of utilizations of the building, such as workshops, classrooms, spaces reserved for the administrative services and for the administration. The double height ceiling helps with the dispersion of the heat, along with the openings of the shed, producing the exchange of air in the inner environments.

It weren't found any records that can explain the plans that were adopted when the adaptations of the space were performed, nor what kind of building works has the

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building received. It is, however, possible to visually check the outdating and disagreement with the proposed use and point out that the expenses with the maintenance of the space could be better managed through the improvement of the systems that compose the building.

5. THE MURILO MENDES MUNICIPAL LIBRARY

A building with three floors and an area that totalizes 2104 yards square, the library was built by the City Hall of Juiz de Fora in partnership with the Ministry of Culture. It is divided into five sectors, namely the memory sectors, Braille, loans, periodicals, children's and reference sector, with a collection of about 80,000 volumes (FUNALFA 2016). It was inaugurated in 1996 and was designed to facilitate the transit of people with special needs (see Figures 1 and 7).

Figure 7: Murilo Mendes Municipal Library.

In accordance with the recommendations of Conarq (2011), one of the main functions of the archive is the protection of its collection. The choice of the construction materials, of the finishing and of the equipments must obey to strict safety specifications in order to prevent accidents, environmental or biological aggression, and ensure a good conservation. The materials found in the building are associated with the techniques of precast and with metallic structures, which allow them to be reused, being this a positive aspect of the building. Through photographic survey, it can be seen that these materials preserve their good quality and durability, besides having great resistance to heavy loads, as illustrated in Figure 8 and Table 4.

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Figure 8: Interior of the Murilo Mendes Library. 2016.

Table 4. Conformity of the sustainability categories in the Murilo Mendes Municipal Library.

Categories	Conformity	Comments
Economic	**I**	The economic aspect was not a premise adopted in the project, in view of the fact that the numerous possibilities to mitigate the ongoing maintenance expenses, the possibilities to improve thermal suitability and technical lighting were not taken into consideration, exemplifying, the glass panel that causes overheating and direct sunlight in the internal environments.
Institutional	**P**	The responsibility for the functioning and maintenance of the space is of the city hall, which dispenses high expenses due to lack of suitability of the project with the use of natural resources.
Social	**C**	Displays a connection with the social environment, since it allows the community to be aware and have access to their heritage.
Thermal Comfort Lighting and Ventilation	**P**	All the categories of comfort have inconsistency in the use; there are no mitigating solutions to internal problems and the architectural elements were not employed to encourage the use of natural resources in an efficient and positive way.
Water Management	**I**	As it happens in the entire complex of buildings, the water management is a deficit that generates costs with the pathologies caused by the lack of efficiency of the sewage systems. It has high costs that could be minimized with systems of water reuse.

Subtitle: Complete (C), Partial (P), nonexistent (I).

This building is the most recent construction of the Cultural Complex. Therefore, its functionality and effectiveness in dealing with the demands of sustainability had a larger contact with possibilities in the fields of civil construction as well as with the technologies targeting to meet such demands. However, the building presents serious problems both in the questions of energy maintenance and in the questions of environmental comfort, characteristics that could be resolved through the preventive and propositional guidelines applied in the phase of the project. About this matter, Tarre (2010) argues that it is necessary to pay special attention to the increase of the energy performance and comfort, and special attention to the materials to be used and their respective durability, pointing also the concern to reduce at the maximum the consumption and waste.

6. CONCLUSION

This paper deals with the subject matter of historic heritage and the criteria of sustainable development, intending to identify the positive and negative actions that took place during the various building works in the buildings that compose the Bernardo Mascarenhas Cultural Complex, a former textile company. The concept of heritage has evolved and has progressively expanded. The diverse and new technologies started to be introduced and accepted as solutions towards the maintenance and conservation of the cultural object, collaborating in the reversibility and distinctness, collaborating in the reduction of the energy costs, and collaborating in the adaptable reuse of buildings in ruins, searching for ways to recover and maintain its structure and identity, besides adapting them to the climatic changes.

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Aspects such as thermal comfort, energy performance, lighting, ventilation, water management and air quality require actions that make use of the natural resources and have sustainability as a target. Markedly, the social / cultural nature is the aspect that clearly highlights the importance of the Cultural Complex for the population. However, it was revealed by the archives that narrate the history of the edifications, as well as through the perception of the solutions adopted, that the decisions and building works were not aligned in accordance with the real efficiency of the buildings in a long term, being, therefore, wasted the opportunities of collective / conjoined acts between all the social agents in the Cultural Complex, being also wasted the opportunity to perform prescriptive actions that could prepare the buildings to the current demands.

The extensive and relentless pursuit by the population for the recognition of the Cultural Complex as being an element of historical and cultural value, together with the long waiting periods for the rehabilitations, reconstructions and maintenance of the buildings emphasizes the evolution line through which the society itself goes through. It becomes evident that the Cultural Complex remains active and is constantly being modernized, a fact that allows us to point out that the discrepancies that are obstructing a harmony between the different buildings of the Cultural Complex concerning to the demands of sustainability tend to be defeated. Therefore, this paper embraces itself in the attempt to collaborate with the appointments of the emergent characteristics in what to the lifespan of the buildings is concerned, not forgetting its maintenance for the future generations. In addition, aims the comfort and security of the users, and aims to collaborate depending on the complex being inserted in the context of sustainable development.

Rehabilitation of historic buildings should be considered, especially the preservation of cultural values (because they can show today as was the recent evolution of humanity and how the buildings were continuously adapting and success with different forms of living); environmental protection (through lower power consumption in the production and application of construction products, reducing CO_2 emissions and limit the quantities of demolition products to remove); economic benefits (such as reduction in demolition costs, the quantities of new materials, among others).

In short, rehabilitation should extend the life of the buildings, ensuring their functional flexibility; minimize energy consumption and CO_2 emissions, while maintaining a certain aesthetic attractiveness has as first beneficiary man and inhabitant of these spaces.

The quality of the buildings is features that convey comfort and safety to users. The incorporation of environmental, social, economic and cultural involved aesthetic and technical parameters to be worked cohesively and harmonica.

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