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THE ROLE OF AN INTEGRATED METHODOLOGY: ASSESSMENT OF HISTORIC RESIDENTIAL BUILDINGS FROM PORTO

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Abstract *This paper presents an integrated methodology for the general assessment of built heritage. The relevance of such methodology emerges from the need to solve gaps that result from the existence of fragmented studies that don't take into consideration the complex interaction of the different aspects involved in the interventions on built heritage. The methodology combines multidisciplinary analyses based on three dimensions: patrimonial, technical and social, which are associated to criteria, such as: identification of characteristics and values; assessment of safety and housing conditions; recognition of residents profile, expectations and basic needs.*

This methodology may be applied to different specific contexts. In this paper it will be directed to the analysis of the inhabited historic residential buildings of Porto city centre. Our findings show that the proposed methodology is able to collect detailed and integrated information about these buildings, promoting the application of flexible and proportional criteria, depending on the asset classification. These results offer new inputs for the definition and optimization of intervention procedures on built heritage.

1. INTRODUCTION

The rehabilitation of built heritage has been highlighted by several authors as result of the eminent degradation of existing buildings, [1]-[4], and the importance of preserving the values of authenticity and exception of historical centers and central urban areas [5], [6], and reestablishing the quality of life of its inhabitants [7], [8]. In particular, the debate around safeguarding of old buildings points out the need to assess safety, thermal, acoustic and housing conditions, but also materials and constructive characteristics, in order to better adjust the interventions to the buildings features [9]-[12]. Furthermore, it shows that the actual building codes and regulations criteria are mainly concerned with new constructions, discarding the particularities of old buildings [13]-[15]; i.e. that a more flexible and multidisciplinary approach is needed to evaluate old buildings, especially when having patrimonial value. Last, but not least, the debate highlights the need to verify the basic needs of residents living in these buildings/areas, in particular to assess and understand their views and expectations [16]-[18].

In the light of this debate, this paper aims presenting a multidisciplinary approach to assess inhabited built heritage, following a holistic methodology that integrates the patrimonial, technical and social dimensions of the rehabilitation of these buildings. It details the methodology and the results of its application to historic residential buildings of Porto, Portugal. Some outcomes of this application are highlighted in order to underline the importance of applying integrated methodologies when dealing with built heritage.

2. AN INTEGRATED METHODOLOGY

This paper presents an assessment methodology for inhabited built heritage referred to as MAPEH (*Metodologia de Avaliação de Património Edificado Habitado* [19]). The MAPEH points out general and homogeneous criteria that are drawn through the theoretical contributions of the literature review and the comparative analysis of building codes and regulations of Italy, Spain and Portugal [20], [21]. This comprehensive study highlights the main role of the inspection and diagnosis procedures on the identification of the patrimonial value and the safety and housing conditions of individual buildings, or group of buildings, as well as the importance of identifying the profile, basic needs and expectations of the residents.

2.1. Dimensions and criteria

The MAPEH is composed by three assessment parts, which one concerned with a particular dimension of the rehabilitation procedure: patrimonial, technical and social. The patrimonial dimension focuses on the patrimonial value of the buildings, namely on their characteristics and particular elements: typology/morphology, materials and constructive systems and architectural elements. These criteria are related to tangible and intangible values of the built heritage.

The technical dimension is directed to the assessment of the structural and physical characteristics of the buildings, and takes into account the geometric configurations, the

structural elements and the state of conservation of materials, infrastructures and facilities. The safety conditions criteria consider structural, fire and usage issues, and the housing conditions criteria include health, hygiene, comfort, accessibility and functional requirements of buildings' compartments. These criteria have as main goal the verification of the buildings safety conditions and the quality of life of its inhabitants.

The social dimension is concerned with the socio-economic profile of the residents and the satisfaction with their dwelling and residential area. This analysis includes the assessment of the expectations and difficulties of the residents and the perception of their basic needs. Notice that these issues are linked to the physical characteristics of the houses and help prioritizing the intervention actions in the buildings.

2.2. Operability of the assessment methodology

The MAPEH was developed to be a general methodology with general and homogeneous criteria to be applied to different contexts of analysis. Its application to a specific context is done through an assessment form that converts the general criteria of MAPEH to the criteria of the specific context of analysis. This procedure is supported by the technical and scientific knowledge of experts from the different areas involved, and by bibliographic and code and regulations research/study.

The application of MAPEH is made in two parts. The first one consists of collecting detailed and integrated information through visual inspections, photographic records and inquiries to the residents. The second part deals with the organization and processing of the collected data, i.e. the characterization/diagnosis of the situation, creating "identity cards/registers" of the buildings, a fundamental tool within any inventorying and cataloguing procedure.

3. ASSESSMENT OF HISTORIC RESIDENTIAL BUILDINGS FROM PORTO

The MAPEH was applied to the old residential buildings of Porto city centre, Portugal. Most of these buildings are commonly named "bourgeois house"; they were typically constructed between the 17th and 20th centuries and are part of the urban fabric of Porto central areas. In this study it was selected a set of forty two old buildings with visible signs of degradation and inhabited by a socioeconomically disadvantaged population. The selected buildings are localized in different areas of Porto centre, including the historic centre actually classified World Cultural Heritage by UNESCO.

3.1. Assessment form

The Assessment Form (AF), i.e. the main operational tool of MAPEH, has the same tripartite configuration of MAPEH (see Figure 1). Its construction involves the adjustment of the Portuguese regulatory parameters and requirements to the characteristics and features of the old residential buildings of Porto, a process that requires technical knowledge obtained mainly through the support of multidisciplinary teams of experts.

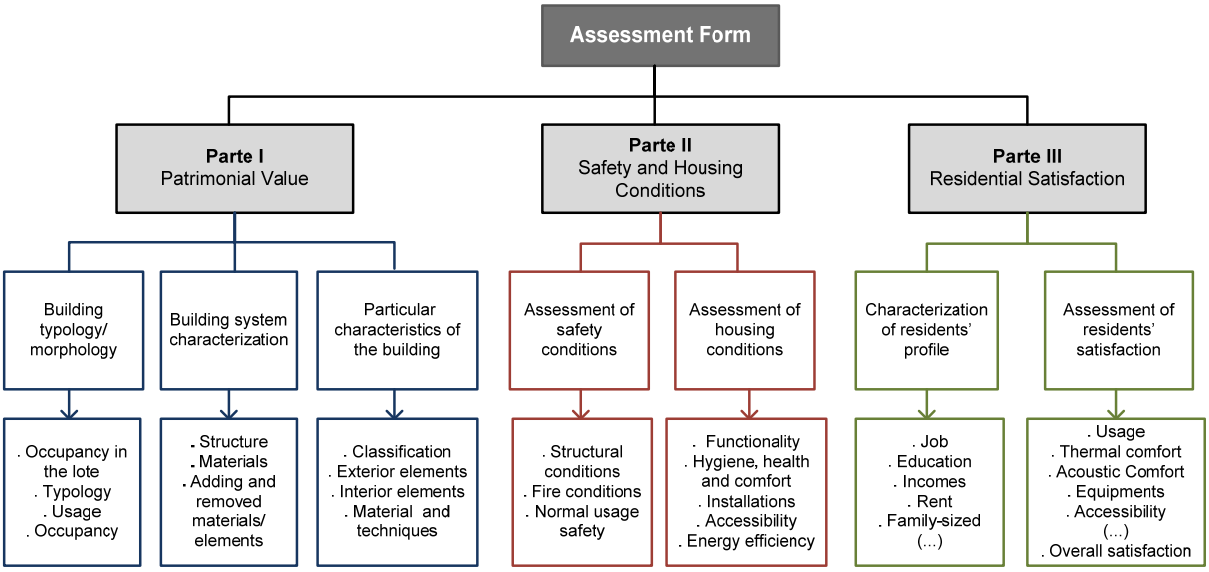

Figure 1. The configuration of AF.

The first part of AF evaluates the buildings patrimonial value. It identifies the buildings' typology and morphology (e.g. lot occupation, typology and usage), constructive systems (e.g. structural elements) and original, adding and removed materials/elements. It also recognizes characteristics that add patrimonial value to the buildings (particular exterior and interior elements, material and techniques).

The second part of AF is concerned with the assessment of safety and housing conditions, and uses Portuguese building codes and regulations as reference criteria. The safety conditions includes: structural safety (namely the stability conditions of roofs, walls, pavements/ceilings and staircases); fire safety (analyses escape routes, like corridors and staircases, estimates the materials fire resistance and the state of conservation of electrical and gas installations); and normal usage safety (e.g. the conditions of pavements, staircases and balconies to evaluate the danger of falling and trapping). The housing conditions involve the assessment of the buildings compartments dimensions and functionality (bedrooms, kitchens, toilets, hallways, stairwells...), comfort (lighting, ventilation, hygiene, thermal and acoustic conditions) and accessibility (entrance conditions and dimensions of stairs, corridors and elevators).

The third part of AF is related to the social dimension and consists on a questionnaire directed to the representative of each family living in the buildings. It contains questions related to the residents' profile (e.g. employment situation, education, income, marital status, family-sized, among others) and their residential satisfaction concerning the physical characteristics of the house (size, privacy, accessibility and comfort…). Notice, that although the case study contains forty-two buildings originally built to be single-family residences, the questionnaire involved sixty-one families/representatives, namely forty-one elderly tenants (older than 64 years) and twenty adults (up to 25 years old), i.e. more than one family shares the same building.

4. THE ROLE OF AN INTEGRATED METHODOLOGY

After applying the AF to the case study, in this case the old residential buildings of Porto, the MAPEH goes into its second part: the organization and processing of the collected data. This part should allow: (i) recognizing the particular characteristics of the buildings; (ii) verifying their safety and housing conditions, outlining anomalies; (iii) identifying the socio-economic profile of the residents, their basic needs and expectations, as well as their perception about the houses characteristics.

4.1. Diagnosis of built heritage

To make a comprehensive analysis/diagnosis of the case study, it was first necessary to transform the qualitative data collected by AF into quantitative data. This procedure includes the transformation of singular qualitative replies into numbers by associating binary variables ("0" and "1"), where "1" corresponds to the quality indicator status.

The quantitative database allows comparing, in percentage, the behaviour of the patrimonial, technical and social dimensions. The data processing enables identifying: the elements with major contributions to the patrimonial value, the most important and common anomalies related to safety and housing conditions and the most relevant expectations and needs of the residents (see Figure 2). In particular, this diagnosis reveals that this built heritage has high patrimonial value, considering its particular exterior (e.g. volumetric, facade and windows frames) and interior elements (e.g. flooring, ceilings and stairs), and used material and techniques (e.g. stonework, carpentry and stucco).

Moreover, the influx of water to the inside by the roof and the material degradation of structural and non-structural walls, roofs and stairs are current anomalies involved in the buildings safety conditions. Also, the adding of interior compartments (e.g. bathrooms and kitchens), the lack of ventilation and the presence of molds and spots resulting from surface condensation are important anomalies that contribute to the poor housing conditions of these buildings. These aspects are reflected in the analysis of the social dimension, which reports a negative perception of the residents concerning their housing conditions. In particular the residents express negative perception about their housing thermal comfort and accessibility, but a positive perception about the patrimonial value of their buildings. Finally, the inquired residents are mostly elderly people who live on their own, living in their houses for more than 30 years. These residents also, have low incomes and low rents, as well as low education level (see Figure 3).

The outcomes of the diagnosis are supported by a photographic catalogue, witnessing and recording the current state of conservation of the buildings (see Figure 4). These photographs show that the poor housing conditions are a consequence of the physical degradation of the buildings, a situation that cause loss of patrimonial value.

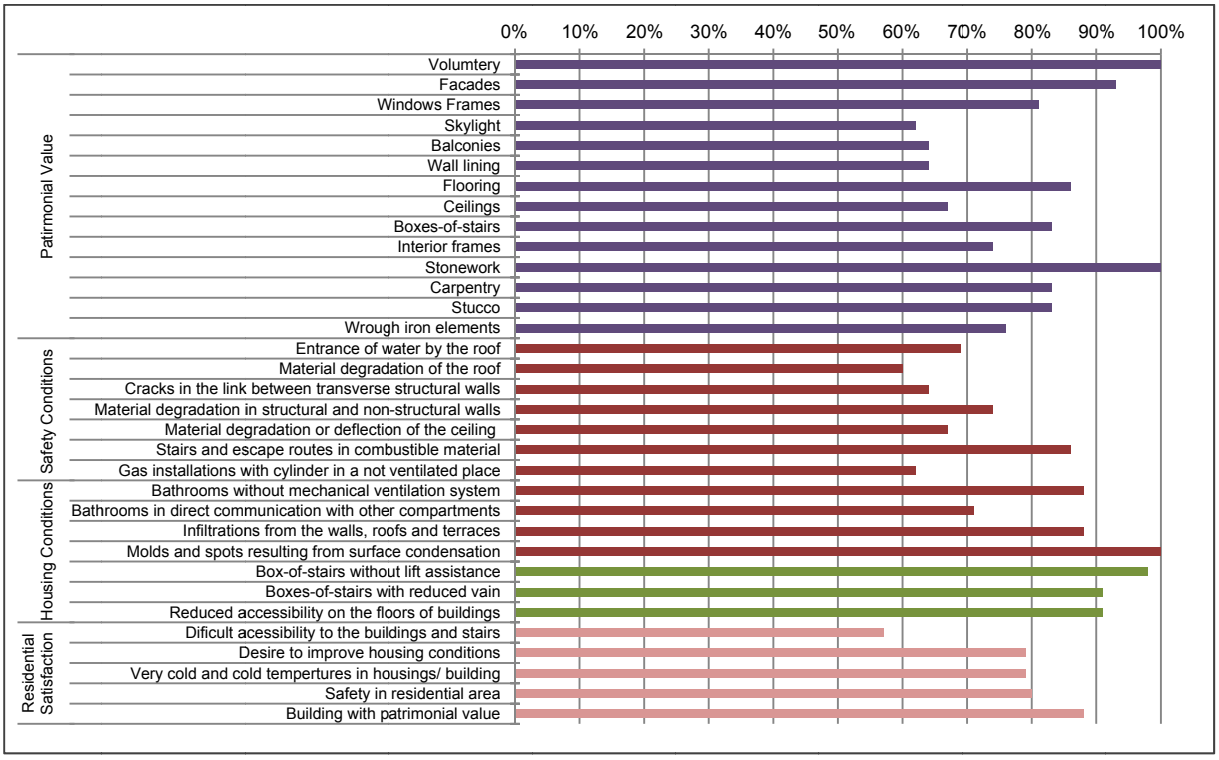

Figure 2. Results of the assessment of the patrimonial, technical and social dimensions of the old residential buildings of Porto.

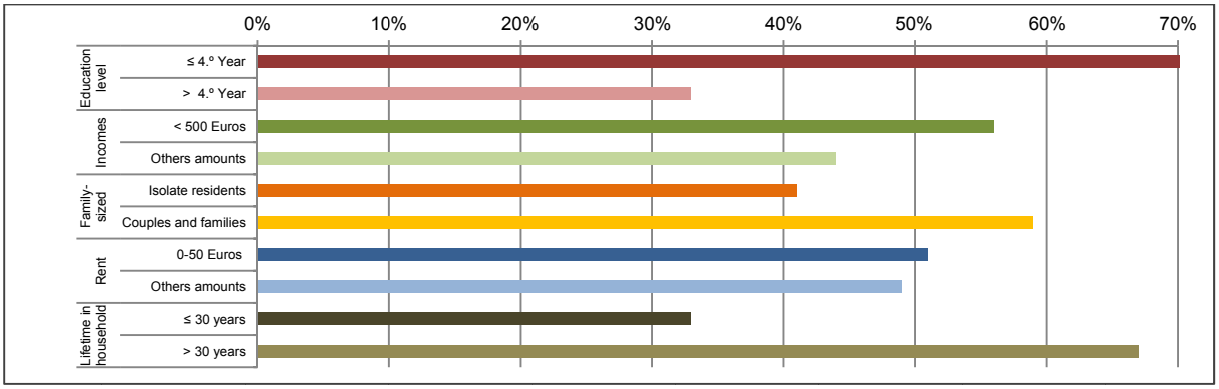

Figure 3. The socioeconomic residents' profile.

Figure 4. Photographs showing elements with patrimonial value and different states of conservation of the old residential buildings of Porto.

Furthermore, the patrimonial and technical information collected by MAPEH makes possible to classify the historic residential buildings of Porto in these two dimensions. To do that, it was necessary to assign weights to each single parameter. That was done with the support of expert´s opinion and giving weights between 0 and 3, so that same thematic quantitative parameters could be joined in "global variables", namely: patrimonial value, safety conditions and housing conditions. This procedure allowed drawing the sample's profile for the patrimonial and technical dimensions. Moreover, it allowed classifying the buildings into four classes, A, B, C and D, arranged by decreasing order of patrimonial value, from A to D (see Figure 5).

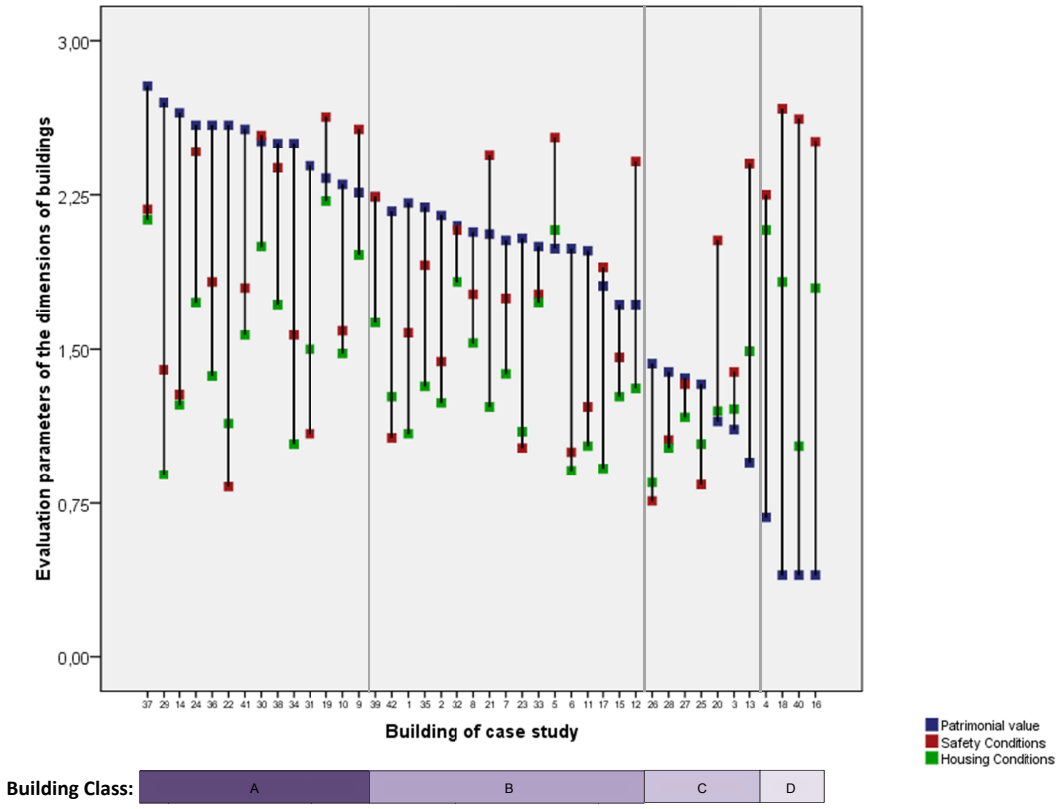

Figure 5. Classification of the old residential buildings of Porto into classes.

In particular, figure 5 shows that there are buildings with quite different safety and housing conditions within each class, i.e. that there is no correlation between the patrimonial value of the buildings and their state of conservation, showing that the high patrimonial value of some buildings did not imply a special attention by the owners or the public entities.

5. DISCUSSION AND CONCLUSIONS

This paper presents a multidisciplinary approach, MAPEH, oriented to an accurate and holistic knowledge and assessment of existing buildings. It comprehends three dimensions associated to the identification of characteristics and values of buildings, the assessment of

safety and housing conditions, and the recognition of the residents profile expectations and basic needs. These homogenous and general criteria are able to be applied to different contexts of analysis, within the methodology aims. This approach meets some gaps pointed out in the theoretical debate [5]-[7], [11], [12], [14]-[16], underling the need for holistic procedures when dealing with the preservation of built heritage.

The operability of MAPEH to the case study is made by AF that specifies criteria/characteristics of a certain group of buildings. This research uses the old and historic residential buildings of Porto as case study and collects detailed and integrated information about these buildings. The data processing allows us measuring/quantifying the patrimonial value and degradation (safety and housing conditions) of these buildings, as well as linking the residential satisfaction of the residents and their basic needs to the physical characteristics of the houses (e.g. accessibility and thermal comfort). Moreover, MAPEH created the conditions to classify the buildings' sample into four classes, showing that there is no correlation between patrimonial value and safety and housing conditions, being detected a wide variability of these conditions within each class.

Finally, this procedure can later be associated to levels of intervention more oriented to the characteristics of this built heritage. Notice that the actual building codes and regulations in Portugal are mainly concerned with new constructions, discarding the particularities of old buildings [11], [12], [14]. Such interventions levels should be based on cataloguing processes involving the patrimonial value of existing buildings, and supported by inspections and diagnoses procedures concerning safety and housing conditions, and by inquiries to residents. The main underlying idea is that any intervention should improve the actual conditions of buildings, but without necessarily having to comply fully with the codes. The level of adequacy will depend on the three aspects integrated in this approach which are strong indicators that sustain the need to apply the legislation following a more flexible and proportional approach, depending on the context of each intervention [22].

The residents' perception of their living conditions and the patrimonial value of the existent buildings are strong indicators that sustain the application of legislation following a more flexible and proportional approach, allowing the optimization of the available resources, while maximizing the outcomes of the intervention in cultural, technical, social and economic terms.

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