

THE SPECIFICITIES OF MANOR HOUSES AS BUILT HERITAGE: A CASE STUDY (PROHITECH2017)

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Abstract. *In Portugal there are many heritage buildings with patrimonial, historical and cultural values in an advanced degradation process. These heritage buildings has unparalleled architectural features and uniqueness in addition to all the wealth and associated history which could be adapt for different typologies of uses such as the tourism sector. The architectural valorization and rehabilitation works of this type of building has generally some constraints that are not only related with their work specificities but also with other factors many others related with misunderstandings among owners, inheritance problems, lack of money, and others. The article describes a case study that involves the surveying of constraints and other problems concerning the rehabilitation works of a manor house. The definition of adjusted and compatible solutions is balanced in a way to make it compatible with the build heritage existences. For this purpose some measures and ideas of a management system to support buildings rehabilitation works based on sustainable practices are used.*

1 INTRODUCTION

Conservation process in old buildings contributes to their assumed sustainable development, fulfilling of its everyday needs and maintenance during their entire life cycle. [1]. When original, old buildings reflect the contemporary building solutions, sometimes revealing some rare and most often very ingenious technological solutions, meanwhile abandoned or forgotten [2]. In most cases, it is possible to understand the social context of that time, while they keep unique architectural and artistic features, which is not the case in new buildings [3]. Monumental buildings are even more specific in these cases, possessing acknowledged details and cultural values with national, public or municipal interest [4].

Manor houses and small palaces are generally owned by recognized and affluent families of the contemporary society and are usually located in villages, surrounded by land with agricultural potentialities, Most of those buildings are now degraded, lacking habitability conditions and far away from the expectable investment needs. Nevertheless, it is possible to rehabilitate and dignify their appearance for several different purposes, touristic or even cultural, attending to very specific commercial demands [3].

Yet there are some problems linked to their rehabilitation, such as cultural and patrimonial constraints, real estate pressures, demolitions of possible reusable elements, and difficulties in adaptation to realistic needs, mistakes in building planning, time overruns and increases in expected costs, among others [5].

The case study deals with the investigation of constraints and other specificities of a manor house focusing on technical recommendations, sustainable practices and looking for adequate solutions that match the building existences. For this purpose, a toolkit “*management system for rehabilitation of consolidated urban centre localized buildings*”, here after called

management system, is used [6]. This system considers the application of sustainable practices to help in the management of the whole building complex, besides contributing in the decision-making of the different parts involved in the rehabilitation process.

2 METHODOLOGY

The paper has adopted a case study to investigate the management of building rehabilitation works in a manor house, focusing on its characterization and. The study is of a qualitative nature and uses available documentation (building project design) and direct observation (“in situ” real and direct observation) which may permit a better convergence of available information [7]. Table 1 contains strengths and weaknesses of data sources used in the case study.

Table 1: Strengths and weaknesses of data sources used in the case study (Adapted from Yin, 2002)

Data Resources	Strengths	Weaknesses
Documentation (Design project)	<ul style="list-style-type: none"> - Stable (it could be revised several times); - Discreet (not used as result); - Exact (names, references and details); - Wide coverage (time, events and distinct environments). 	<ul style="list-style-type: none"> - Recuperation low capacity; - Tendency selection (if data collection is not complete); - Pre-conceived ideas of the author; - Information access could be deliberated.
Direct Observation	<ul style="list-style-type: none"> - Events in real time; - Contextual (take the event context). 	<ul style="list-style-type: none"> - Selectivity, uses much time and expensive; - Reflexivity (The event could be differentiated).

Using a management system developed in a research to support old building rehabilitation projects, 39 from out of a set of 50 parameters is used in the study [6]. Each parameter has 5 possible choice options, classified from less sustainable to more sustainable. The idea and main goal consists in the reflection and option for viable solutions in building rehabilitation project design project and relate them with the recommendations from each management system parameter. And whenever possible, it is chosen the option for solutions that have more benefits to sustainability.

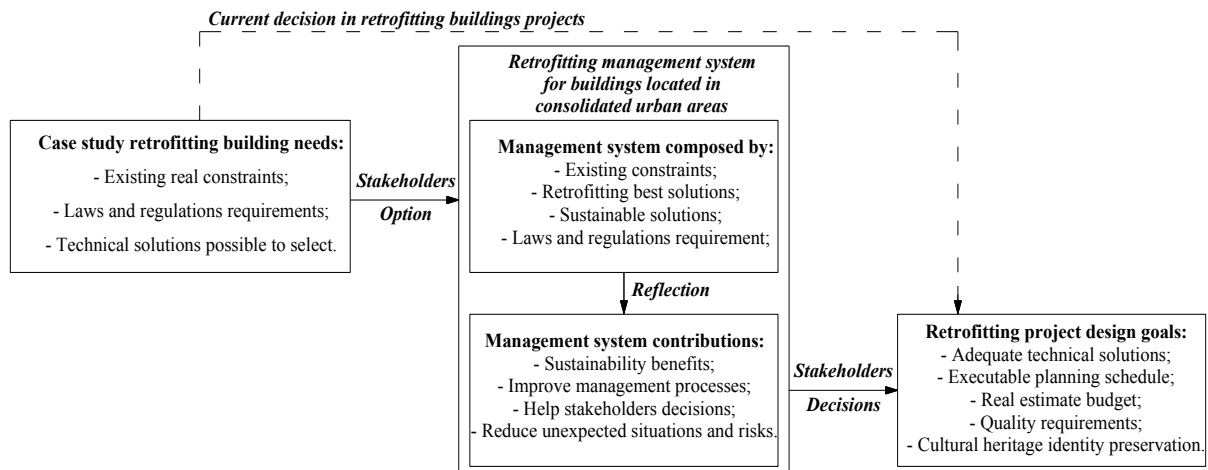


Figure 1: Framework scheme of management system uses for building retrofitting works

Each solution/option has a careful reflection in the project and these selected solutions intend to give more benefits to sustainability when compared with conventional or similar solutions. Some management system solutions are proposed to improve building rehabilitation management process, such as reducing some unforeseen problems [8].

The management system could give a contribution in the project design phase about the adequacy of technical solutions and also in weighting some aspects about planning, budgeting, quality and preservation of existing heritage building. These aspects are frequently often neglected or are managed in a conventional way [5].

3 OLD BUILDINGS RETROFIT PARTICULARITIES AND PRACTICES

Building rehabilitations consists of “*reparation, extended renewal and modification of a building in order to leave it according to the economical or functional criteria equivalent to those requested to a new building conceived for the same purpose*” [9]. This consists in the actions needed to the recover buildings’ functional performance, through resolution of physical and constructive faults and functional adaptations to improve comfort and performance conditions [3]. These interventions consider the re-use of pre-existing materials, fitting them to promotion of sustainable practices and keeping, as much as possible, the buildings’ original features. Meanwhile some interventions on these buildings are built as new building constructions, with total destruction of the existing elements, using only the exterior walls, contradicting the rehabilitation concept, figure 1.

According to the *Census 2011 from National Statistis Institute*, buildings constructed before 1919 represented 206343 units and buildings dated between 1919 and 1945 represented 305696 units [10]. In 2016, the number of total buildings in Portugal was estimated at 3.592.580 which represented 5.932.990 family lodgments [11]. Of the total of buildings constructed before 1919 about 45% need reparation works and of these 12% are in a much degraded status.



Figure 2: Examples of building retrofitting works using only the external walls

3.1 Constraints linked to old building rehabilitation works

In building rehabilitation projects is necessary requiring to management of current rehabilitation works problems and specificities for resolution [3]. Old buildings before concrete generalization have generally particular characteristics which differ from recent building construction [2].

Some times in old buildings rehabilitation projects, the works begins without consideration of risks occurrence and unforeseen resultant from constraints and some other specificities. The design project phase must consider some reflection about site works and the rehabilitation works beginning.

Some several rehabilitation works constraints are connected to “Surroundings and location”, such as [5]:

- People preferences looking for new buildings out of degraded or dangerous areas,
- Lack of parking spaces and limited spaces and frequent inexistence of common areas uses.
- Places with potential larger damage and higher difficulty of control in case of fire;
- Morphology and topography conditions (narrow streets, proximity of opposite buildings and no car accessibilities or parking and without access condition by people with low mobility);

- Inexistent, degraded or outdated infrastructure networks;
- Unsuccessful refurbishment operations which spoil the surrounding area.

Some of them could affect the rehabilitation works planning and requires a specific contractor with knowledge and experience to manage and build that works [12].

3.2 Management system to support old buiding rehabilitation works

As stated before the focus of the management system is to support old buildings rehabilitation projects and their stakeholders. Even more, it encourages a reflection about some technical aspects neglected in rehabilitation works context. The management system contains frequent and possible old buildings rehabilitation works constraints and also technical recommendations, solutions to promote sustainable benefits and legal regulations present in that kind of projects.

According to table 2 (part 1 and 2), the management system is structured in 4 thematic groups, 15 indicators and 50 parameters.

Table 2: Management system thematic areas, indicators and parameters (part 1) [5]

Area	Indicators description	Parameters description
A1. Surroundings and location	I1. Mobility and amenities	P01. Public transport P02. Car parking P03. Local amenities
	I2. Local infrastructures	P04. Outward firefighting means P05. Technical networks in public space P06. Urban space quality
	I3. Land use occupation	P07. Land occupation P08. Total area and deployment area P09. Gardens and leisure places
	I4. Solar orientation and exposure	P10. Solar exposure P11. Solar orientation
A2. Project design	I5. Characterization of building conditions	P12. Request for technical studies P13. Characterization diagnoses of building conservation status P14. Project Design specificities
	I6. Architectonic organization and salubrity	P15. Conceptual architecture configuration and adaptability P16. Ratio useful floor area/Gross lettable area (GLA) P17. Acoustic insulation and indoor air quality
	I7. Infrastructures, foundations and structural elements conditions	P18. Building technical networks P19. Peripheral retaining structures P20. Foundations P21. Structural elements
	I8. Materials	P22. Materials reuse P23. New materials P24. Fire safety
	I9. Sustainability promotion	P25. Water recovery and reuse P26. Solar collectors for hot water production P27. Electrical energy production P28. Energetic efficiency in thermal comfort P29. Other solutions for energetic efficiency P30. Bioclimatic solutions P31. Other sustainable solutions

Table 2: Management system thematic areas, indicators and parameters (part 2) [5]

Area	Indicators description	Parameters description
A3. Construction works and site works	I10. Initial works constraints	P32. Site works and surrounding space P33. Adjoining building conservation state P34. Stabilization and consolidation of building works and adjoining buildings P35. Adjoining buildings waterproofing

	I11. Industrialization/ execution of works	P36. Workforce P37. Specialized workforce and company's technical capacities P38. Specialized subcontracts P39. Technical requirements monitoring
	I12. Risk and constraints potential	P40. Propensity to project design changes P41. Propensity to the occurrence of unexpected works P42. Propensity to time overruns P43. Propensity to other work constraints
	I13. Other features resulting from works	P44. Archaeological Works prospection P45. Construction and demolition waste management P46. Needs of occupant's relocation
A4. Costs	I14. Work costs	P47. Costs of urban space works P48. Costs of general building works
	I15. Tax incentives and other costs	P49. Possibility to apply for benefits and tax incentives P50. Maintenance and conservation strategies

Each parameter has a description about the contents and the main goal proposal, such as it has a set of possible solutions classified from 1 (less sustainable) to 5 (more sustainable). The solutions classified in 2 are considered conventional ones and without increasing sustainability levels. The management system utilization is optional, but their uses make the design project more consistent in technical points and also it reflects a set of contents sometimes ignored or without a careful reflection in similar rehabilitation projects, figure 1.

3.3 Old buildings - The Manor houses

The manor houses are a type of heritage building being different and distinctive characteristics from conventional ones. They are from domestic typology predomination and contains, almost, a chapel or a place to pray. Usually, the façades, especially principal ones, have some architectonic richness of detailed and sculptor works. Superior areas than conventional buildings are another characteristic, as more the existence coat of arms or family coat of arms, being considered emblematic symbols and a reference for region and local people. Some of these building are listed by heritage building according to an administrative procedure for listing an immovable property.

There are some criteria to asset the interest and relative value attending to architectonic or artistic value, landscape, historical-documentary and cultural to local, regional or national scale [13]. The immovable cultural heritage may be listed as bearing national interest, public interest or municipal interest which depends from its relative value, figure 3.



Figure 3: a) Mateus Palace, in Vila Real (National interest - National Monument); b) Pimenteis Manor house, in Mogadouro (Public interest); c) Correia Alves Manor house, in Moimenta da Beira (Municipality interest)

Any national interest property is deemed to be a “national monument” independent of the category: monument, a group of buildings or a site [13]. All listed property has a general protection area (ZEP) extending for 50 meters around their external boundaries which may

include non aedificandi areas. However there are manor houses or other type of buildings with cultural values but not listed as building heritage properties.

4 CASE STUDY OF A MANOR HOUSE

The case study approach the constraints study support related to a manor house rehabilitation works, as well as the set of technical solution in their project management, preserving as possible, the building originality as main goal.

4.1 Manor house description and characterization

The manor house in the case study are located in a village near the town of Viseu (Portugal), dated from second half of 18th century and listed as bearing municipal interest [14]. It is characterize by a building with two different volumes connected each other and composed by external walls in granite masonry with 65cm to 80cm thickness. The principal façade has some richness of decorative detail, figure 5a), and there is an internal staircase differentiate that building, figure 5b). The building was abandoned and uninhabited since 1970, without any conservation practices which contribute to interior ruins (wooden floors, internal walls and roof), figure 5c). The previous owners sold all furniture and art objects like some paintings and an oratory. Some old photos, little objects, books, newspapers and personal letters (dated from 1851) were recuperated by the actual owner being historic part of that building existence.



Figure 5: a) Principal façade of a Manor house in case study; b) Internal staircase; c) Interior ruins.

4.2 Manor house constraints and problems

The manor house present in this case study had the interior structure in ruins without any technical or economical possibility of recuperation [2]. Some constraints of that manor house are described in table 3.

Table 3: Constraints of the manor house in case study

Code and Group	Description:
(A) Existent and design project aspects	<ul style="list-style-type: none"> - (A1) Principal façade has some sculpture stone elements and a staircase in the street to preserve, figure 5a); - (A2) The mil in an annex building must be preserved, figure 6a); - (A3) There are some annex buildings without architectonic interest, figure 6b); - (A4) Vacant state with internal wooden structure were in ruins, figure 5c); - (A5) The building has 3 storage floors. The middle floor had 1,9 m of finish ceiling height; - (A6) Right façade partially leaning against an adjoining building, figure 5a); - (A7) Principal façade define the street direction, figure 5a); - (A8) The adjoining building has no gable rakes in the roof. - (A9) The garden space entrance has 2m width and 2.4m height;

	<ul style="list-style-type: none"> - (A10) Posterior façade has 8,5 meters of height, figure 6c) - (A11) The steps height of the internal stairs had 25cm to 28cm, figure 5b); - (A12) Some part of the posterior façade external wall had not some reinforcement and strengthened locking; - (A13) The building had not water and electricity networks; - (A14) Some doors closure and height need adaptation changes; - (A15) Floors and roof structure was supported in external walls, figure 6d). - (A16) The rehabilitation works has some technical complexity and some constraints; - (A17) Building has supported by consolidated granite rock in foundations;
(B) Cultural and historical aspects	<ul style="list-style-type: none"> - (B1) Important historical context are present for the village and region; - (B2) Legends and histories are presented about the house and the family; - (B3) The building has a collection of existing photographs, books, newspaper and letters dating from 19th century.
(C) Economical, financial and sustainability	<ul style="list-style-type: none"> - (C1) The Priority intervention was to protect external walls from rain quickly; - (C2) Maximal limit of economic resources were imposed without margins; - (C3) Networks, equipment's and finishing works would be in 2025 year; - (C4) Water pipes were inexistent even solutions for consumption reduction; - (C5) Energy networks were inexistent even solution for consumption reduction; - (C6) Regulatory verification are above conventional minimal requirements; - (C7) Some materials with environmental concern were present in the design project; - (C8) Procurement of local construction and materials supplied companies; - (C9) Minimal time was imposed for inspection and engineering service's needs.
(D) Rehabilitation works	<ul style="list-style-type: none"> - (D1) Lack of space in site works for materials deposit, figure 6c); - (D2) Site works access were narrow; - (D3) Cleaning needs were necessary for demolition and ruin waste, figure 5c); - (D4) Other existing constraints, figures 5a) and 5b); - (D5) Overhead electrical lighting lines on the street are distant 3m from the façade; - (D6) Narrow street which is the only connecting access within the village, figure 5a).

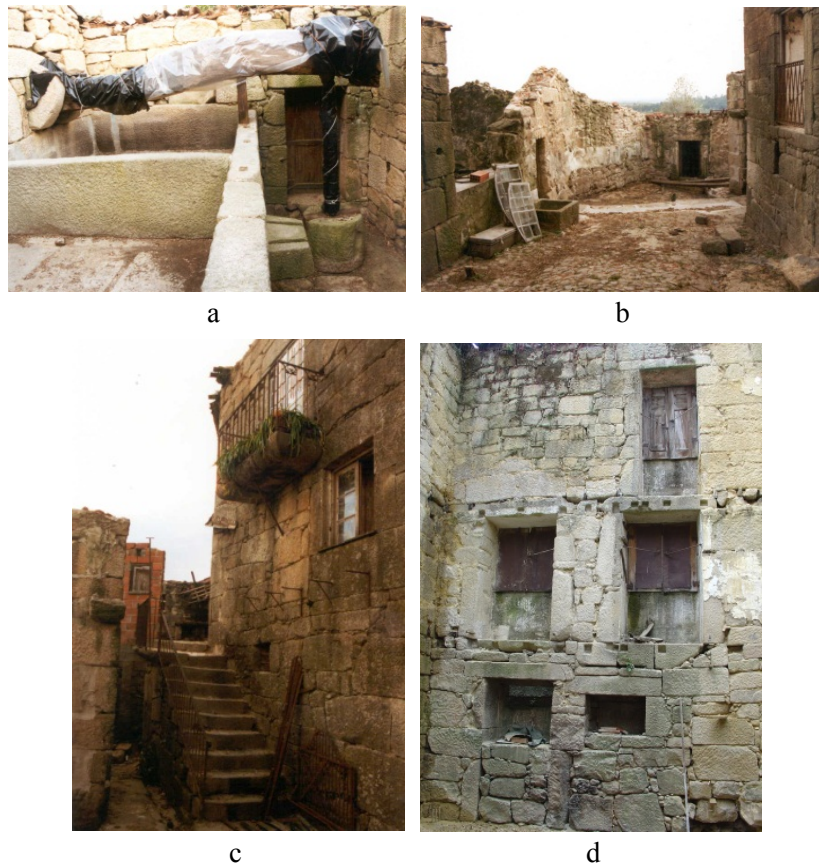


Figure 6: a) The existing mil; b) Annex buildings without architectonic interest; c) Posterior façade; d) Floors and roof structure supported by external walls (holes to fix floors wooden structure)

4.3 Intervention Proposal and contribution of the management system

This building has the proposal to be adapted to a vacations house for the owners and/or season rental, also enabling it to a public (touristic) use. Besides architectural proposal for the adaptation of that building, there were a set of technical solutions [15] that made it possible to manage the rehabilitation process, minimizing resources, costs and time [16]. These solutions were developed attending to the existing constraints and using the management system previously mentioned in point 3.2, to assure option for more sustainable and integrated solutions [5] [17] [18].

The (A1) “*surroundings and location*” area and respective P1 to P11 parameters of the management system were not considered in this study because the building was acquired yet, so enabling to dismiss that study has it bring no further gain to this project. At this phase of the process, it is impossible to improve suggested requests by the parameters’ analysis, as the surroundings and existing location which are assumed by the owners.

Tables 4, 5 and 6 address the areas of the management system, the options considered for each one of the used parameters (P12 to P50), answering to the constraints and other problems analyzed in table 3, solved or lessened with the parameters’ recommendations [19]. Table 4 refers to parameter options from “*project design area*”, table 5 addresses parameter options from “*construction works and site works area*” and table 6 reports to the parameter options from “*costs area*”.

Table 4: Parameters options from “Project Design” area

Code and Parameter Solution selected	Constraints
P12 – Realization of geometrical drawings only requires traditional equipment’s.	A4, A10, A16
P13 – Foundation in consolidate granite do not need inspection or specific testing.	A17
P14 – Rehabilitation design project were object of revision or design project internally revised or validated. The design project contains technical solutions to a construction sustainable.	A16
P15- Existing building with constraints solved in design project, preserving some elements with historical and cultural values which contribute to maintain the authenticity and identity of the building such as the façades. The design project study improve the existing building conditions, such as the constraint (A5) has 2,2m for finish ceiling height and the staircase was substituted by new and legal ones (constraint A11).	A1, A2, A5, A11, A14, A16, B1, B2, B3
P16 – The rehabilitation building was at building scale and it promoted internal remodeling with superior areas comparing to minimal legal regulations.	A4, A5, A15
P17 – The building has minimal legal regulations superior than minimal requirements in acoustic and air renovation foreseen in thermal regulations.	A16
P18 – The building need all infrastructures and networks connections.	A13
P19 – The building has not peripheral containment needs, but it needs some simple solutions which promoted the existing elements reinforcement.	A12
P20 – Isolated foundations were built for pillars support and the walls do not need reinforcement.	A17
P21 – The exterior walls are reutilized complying the regular requirements. The internal structure was built in steel profiles. Some part of the beams transmits their loads to external walls with load levels very similar to original ones. The floors area was built in composite metal deck (steel decking for concrete floors slabs) (14 cm height), figure 7a). The roof structure was built in steel profiles and the tile batons also in steel profiles over thermal insulation, figure, 7b)	A15
P22 – Façades and up to 25% of other materials quantity (stone and wood) were reutilized.	A3, A4
P23 – The design project had some concern in materials selection coming from manufacturing sites near from building localization which was not superior of 50% of all building materials cost.	C7,C8
P24 – The building meets all legal requirements but the adjoining building has fire propagation risk.	A4, A6, A15, A16
P25 – The design project contains rain water reuse for toilets and garden watering in quantities which reduce 50% of the current consumption.	C4
P26 – Solar collectors will be used in a roof place not visible from the streets.	C5

P27 – Photovoltaic panels prevision will produce electrical power energy for auto consumption.	C5
P28 – The building had preview class energetic A with thermal insulation thickness superior than minimal requirements. The external walls will have thermal insulation by internal side.	C6
P29 – The design project has some energetic efficiency concerns about natural light and LED artificial ones, renewable resources for building heating systems. And also it contains some monitoring equipment's with controls and savings energy consumptions which contribute to energetic savings and environmental benefits.	C5
P30 – The existing constraints only permit in the architecture design project to promote one solution for heating passive performance, namely big area at South glasses in living room with Summer protection.	C5, C7
P31 – The design project has preview a garden with autochthonous trees which retain winds and protect the house from South Summer exposition.	C7

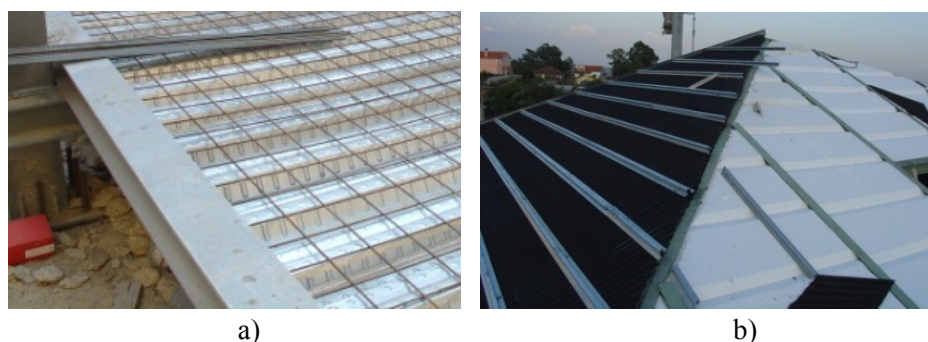


Figure 7: a) Metal steel frame on floors; b) Roof with metal steel beams, insulation and tiles supports

Table 5: Parameters options from “Construction works and site works” area

Code and Parameter Solution selected	Constraints
P32 – Site works limitation space and access restrictions are presented in building equipment's assembly. Some examples: Deconstruction of the entrance portal to put a fixed crane could reduce street occupation and traffic jams. The design project preview ready-mixed concrete pumped as solution to eliminate aggregates <i>in situ</i> for concrete composition.	A9, A13, D1, D2, D4, D5, D6
P33 – The adjoining building has good conservation state and stability without collapse risk.	A6
P34 – There is no needs of stabilization and consolidation solutions beyond of the conventional ones in rehabilitation building even in the adjoining building.	A6, A17
P35 – The adjoining building are in good conservation state which requires some external walls cares and also in roof gable rakes sidekicks. The rain water drainage of the floors is required.	A8
P36 – This building rehabilitation requires smaller quantities and rhythms of labor than new construction. Example: The steel structure was built by beams and pillars in steel profiles and the floors in composite metal deck (steel decking for concrete floors slabs).	A4
P37 – The rehabilitation building only require companies with some labor specialization in rehabilitation works, namely with experience and technical knowledge in similar works. The companies might be regional and they had not requirements needs of management systems certification.	C8
P38 – There was no needs of subcontracting companies specialized in rehabilitation works more specific. The stone decoration elements from the façades require some complexity and preservation cares.	C8
P39 – This rehabilitation works were quite similar to new construction where the dimension and technical works complexity were not required permanently the engineer's supervision.	C9
P40 – The design project are very detail and without fails detection which not requires risk propensity of changes.	C2, C9
P41 – The design project has a description of all the constraints described in that parameter management system and it also has some procedures to mitigate and control them.	C2, C9
P42 – The design project has a description of a set of factors to develop a planning map adjusted to works complexity, without unforeseen works appearance but allowing with some difficulty the fulfillment of deadlines.	D4
P43 – The rehabilitation works has some constraints, such as: construction works signalization on the streets, some traffic problems, overhead electrical power lines near from building façade,	A9, D2, D4, D5, D6

materials transport and supply, lack of parking, Safety and Health Plan supplementary measure's are needs permanently.	
P44 – The building foundations layer is in granite rock which excludes archaeological remains existence. In other hand the design project describe some notes to attend in occurrence cases.	A17
P45 – The design project preview some deconstruction works, façades reutilization, and it define also some proceedings for construction and demolition waste reutilization.	A1, A2, C1, D3
P46 – The building is vacant without any relocation of occupants.	A4

Table 6: Parameters options from “Costs” area

Code and Parameter Solution selected	Constraints
P47 – The building surroundings has some illegal construction, being the urban space elements in good conservation state.	-
P48 – The building rehabilitation costs is estimated in 550€/m ² . The design project, demolitions, deconstruction, cleanings, structure and roofs were coasted 225€/m ² .	C2,C4, C5
P49 – The rehabilitation works were not covered by benefits, tax incentives, or other support programs.	C2
P50 – The design project describes the forecast of reactive maintenance strategy with costs which could be larger in repairs of systems and equipment (repair after failure).	-

The manor house rehabilitation works studied show a set of possible options according to a selection from each management system parameters option possibilities present in table 2. As it was mentioned, each parameter has 5 possible options, classified by levels from 1 (less sustainable) to 5 (more sustainable). The level 2 is considered with conventional options without increase sustainable benefits. Table 7 has a description of the management system thematic parameters by selection levels choices from each parameter.

Table 7: Levels of sustainability selection of the thematic parameters

Parameter level selection/option	Parameters
1 (less sustainable options)	P49
2 (convencional sustainable options)	P12, P13, P18, P24, P32, P33, P35, P39, P47, P48, P50
3	P14, P16,P20, P21, P23,P27, P30, P31, P36, P38, P42, P43, P44, P45
4	P15, P19, P22, P25, P26, P28, P37, P40, P41
5 (more sustainable options)	P17, P29, P34,P46

The case study used 39 parameters from the management system predominating sustainability levels above conventional and better solutions to promote sustainability in 27 parameters. Conventional levels of sustainability and no surcharge for sustainability benefits were found in 11 parameters solution options and only in parameter P49 the level of sustainability was less than conventional solutions. Thus, according to the management system, the total options have been used to improve sustainability benefits in 69% of the parameters used. It could prove the detail, organization and weighting of the design project attending by the designers team, which contains important level of information about technical aspects connected to real constraints and rehabilitation problems of the manor house in study. The management system could be an auxiliary to reducing failures, omissions and errors, deadlines control, improving quality level, costs control, managing risks and other unforeseen events.

5 CONCLUSIONS

This study involves an investigation of the rehabilitation of an old building dated from the second half of the XVIII (eighteenth) century. There was an exhaustive search for the conditionings and constraints to the accomplishment of the necessary works, looking for solutions that enhance sustainability benefits and a more efficient management, contrary to what often happens in similar interventions. For this purpose, a management system was

applied to support the rehabilitation works of an old building (manor house), choosing solutions from this system but adapting them in a way to be compatible with building's specificities. This case study involved 39 (thirty nine) out of 50 (fifty) management system parameters, including "project design", "construction works and site works" and "costs" areas.

The option for more sustainable solutions, with higher than conventional benefits, is presented in 28 (twenty eight) out of 39 (thirty nine) of the used parameters, and represents 69% (sixty nine percent) of the cases. This suggests that it is possible to balance and optimize solutions more effectively than the conventional solutions, considering pre-existing constraints, technical recommendations and solutions that promote sustainability.

Decisions related to the construction site works, as well as measures to support the construction management and planning are crucial to the success of the rehabilitation works [20]. The option for a metallic structure shortened the duration of the working time and reduced construction risk exposure, attending to the owners' priority context. Another constraint worthy of note was the scarcity available financial resources that led to the decision to build first in the structural elements and roof components to protect the exterior walls, in spite of the overall comprehensiveness of the whole project design [21]. In this sense, the management system allows great flexibility in considering project solutions integrated with realistic problems and constraints of a building with heritage recognized but in need of rehabilitation works.

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