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Evaluation decision support models: Highest and Best Use choice

Lucia Della Spina[a,]*

[a]*Mediterranea University of Reggio Calabria. Italy*

Abstract

All decisions relating to the development, transformation, upgrading and enhancement of historical heritageare, by their very nature, characterised by a multi-dimensional profile of the objectives, often conflicting and influenced by each other, thus constituting a complex decision problem. This increasingly requires the use of tools to support in the decision making to improve the rationality of the procedure, ensuring rationalitythe whole evaluation process is an integrated, multidisciplinary and transparent approach. It emerged that these tools are extremely strategic, especially if they are adopted during the planning stage or pre-feasibility study. They play a role in control and management to support the public body in the choice among different policy options and through negotiation among the various stakeholders for a more transparent and efficient identification of shared choices. Multi-Criteria Decision Making (MCDM) as techniques which consider the views of the various parties involved in the development processes, play a role of paramount importance towards sustainability in multiple dimensions. The paper, through case study,among the different analysis techniques multi-criteria, illustrates the application of a model Analytic Hierarchy Process (AHP) together with Delphi Method, which support the public decision to locate, among all stakeholders, the best appropriate use (Highest and Best Use) relating to the conservation and reuse of the historic building, Palazzo Zani (Reggio Calabria, Italy), through a variety of independent but often conflicting criteria.

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*Keywords:*Cultural Heritage Valorization;Multi-Criteria Decision Making; Analitic Hierarchy Process; Delphi Method.

* Corresponding author. Tel. +39 0965 169 6302; fax: +39 0965 169 6550.
*E-mail address:*lucia.dellaspina@unirc.it

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1. Introduction

Working on the historical and cultural heritage is a complex task as it involves unique and exclusive resources which are closely related to the environment and also concern immeasurable values depending on the socio-cultural attitudes of society. They are appreciated differently in time and in space. In these cases the use itself becomes the reason for the vital conservation of the asset. Under those circumstances it is vital that the research, for possible compromises, pays attention to reasonable interventions and correct actions, noting that the role of witness may not be altered in any way. Considering economic criteria as the only valid evaluation indicator and choosing to concentrate on economic values often involves serious risks to the assets in question, such as the possibility of effect of "congestion "or" pollution". The contextualisation of the work, the importance of the time during transformation processes, the rational legitimacy of choices - pose a number of difficult problems to solve that lead to the need to experiment with new tools to support decision makers identifying "the most suitable use" - Highest and Best use- to assign to the asset in order for it to be restored and any inclusion of new features, from the early stage of planning or in the pre-design phase (Saaty, 1990; 2008). This support system tool becomes strategic when used in the programming phase or in a preliminary step of the project.

In this valuation context of compatible functional solutions, theMultiple-Criteria Decision Making(MCDM) methodologies (Roy &Bouyssou, 1993), and the Analytic Hierarchy Process (AHP) in particular, play a significant role as they allow to be taken into account all the intrinsic values of the assets in question, both economic and extra-economic. The use of these methods can provide choices that are not always based on the best cost-benefit ratio but, for example, that which optimizes the quality of conservation or that safeguards the intrinsic value of the asset (Nesticò, Macchiaroli, &Pipolo, 2015). As well as guaranteeing the presence and the clarification of different values, the formalisation of an evaluation process carried out in these terms, expression of the community needs, also allows the control and the correspondence between general and specific choices. Since the asset is of particular value it is, however, necessary that the various criteria and weights taken on the basis of the evaluation are shared by the community or rather, by direct users and by potential or future users.

2. MCDM and the Analytic Hierarchy Process

The Analytic Hierarchy Process (AHP), among various MCDM, provides a hierarchical analytical method that has found many applications in evaluation of priority and pre-feasibility of different projects. As help techniques to the decision making, the AHP hasbeen, up till now, applied to an extensive variety of decision problems, such as the selection of projects, planning public resources such as energy and medical resources and, more generally, conflict analysis and strategic planning (Calabrò& Della Spina, 2014a). Specifically, the AHP, developed by Saaty, is used to achieve preference scales on the basis of the comparison pairwise technique between the elements that make up the decision problem in relation to a defined objective (Saaty, 1980). Users of the AHP first break down the decision problem into elementary parts and subsequently compare each pair of data in order to develop a priorities scale among the alternatives at each level of the decomposition.

2.1. Application of methodology to the case study

The work began from an experiment carried out by the Mediterranean University of Reggio Calabria in the drafting of a pre-feasibility study which attempted to address the choice of the most appropriate intended uses of the Palazzo Zani, a historic building located in the centre of Reggio Calabria (Italy), the former headquarters of Civil Engineering and now the Faculty of Law.

Effective help to the study and supporting the decision of those issues is offered through the multi-criteria analysis group (Figueira, Greco, &Ehrgott,2005). Among them is the AHP methodology used as a tool that can provide an integrated approach to the issue of sustainability assessments, which in practical application to the case study, is represented by the identification of the most appropriate best functional solutions for Palazzo Zani(Tajani&Morano, 2014).

Based on the general objective: conservation and reuseof Palazzo Zani, two levels of criteria and four alternative uses were identified. To this end, after having set the goal (Conservation and Reuseof Palazzo Zani) and

evaluationcriteria (in this case two criteria: three at level I and five level II),were employed as alternatives (to III level) the four alternatives.

The hierarchical scheme, illustrated in Figure 1, is organised on two levels of criteria: the first, through the use of artistic, economic, social and cultural indicators, tries to define the priority matrix in three different scenarios whilst the second level of criteria, through characteristic elements of the problem, addresses the construction of "appreciation matrices" of the criterion in relation to the four alternatives.

Evaluating the conservation and reuseof Palazzo Zani, the approach adopted aimed at analysing the value of the asset from the point of view of its features.It has been attempted to gather and explain, based on recognition of the essential characteristics of historical and architectural resources (shortage, not repeatable, existence of external and intangible effects), the three essential aspects of the value of the asset, according to the definition of "complex social value"(Forte& De Rossi, 1974; Fusco Girard, 1987;Grillenzoni&Grittani, 1990;Forte & Girard, 2009).

After a very direct and even implicit initial screening, four cases of reusing were seen as feasible, assessed according to two criteria levels. The assumptions and criteria used in the evaluation process, represent the synthesis of a comparison made with Delphi-type procedures, through the interaction of a panel of selected and independent individuals, (experts, privileged witnesses, etc.). They anonymously interacted and actively debated the complex problem thus creating an independent communication process (Okoli&Pawlowski, 2004). The communication among participants in the panel, has allowed each expert to express their knowledge, perspective and opinion on the evaluation issue and reconsider, after feedback, the opinion expressed by others.

The aspects of the overall value of the property thus identified are, the fundamental coordinates against which to assess the possible works of transformation and reusing of the asset and, above all, the evaluation of any required conversion to it.

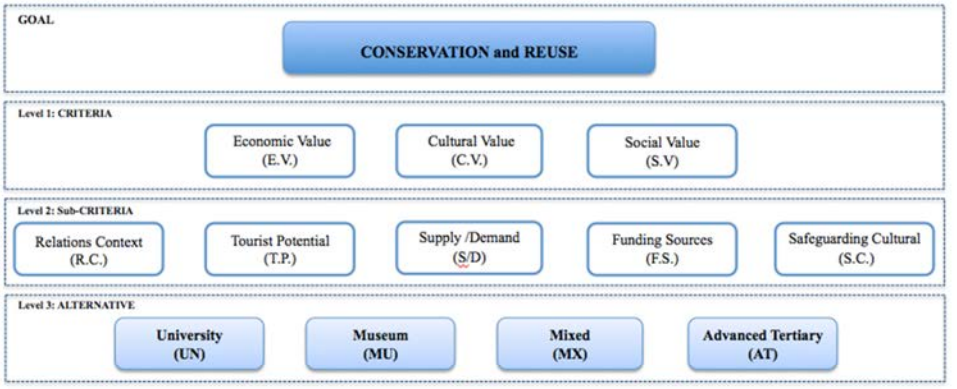

Fig 1. Hierarchical decisional scheme: Objective - Criteria - Sub-criteria – Alternatives

The Economic Value (E.V.) is expressed by the monetary benefits resulting from the asset, or rather the benefits it should return (in terms of opportunity cost) (Calabrò&Della Spina, 2014b).

The Cultural Value (C.V.) represents the "intrinsic value" of the asset, namely the incommensurable or qualitative values. It is expressed with the use of Multi-Criteria analysis.

The Social Value (S.V.) is expressed in order to gather all the benefits originated, in time and space, by the conservation using the division among the different types of users. The Social Value as an expression of the needs of the present, potential and future community also reflects those "post-materialistic" needs that manifest the need to conserve and protect its cultural and historical heritage.

These three aspects (criteria) represent the fundamental coordinates with respect to that which must be placed on the issue of evaluation of a resource and, above all, the evaluation of possible projects for transforming it.In addition, they define the "complex social value" of the resource, as a whole of all the benefits (economic, cultural and social) that can be achieved over time from the asset by all users (direct, indirect, potential and future).Stability

in social choices and in cultural preferences was evaluated assuming three different scenarios, within which the priorities assigned by the community to the three aspects of the value are changed (Saaty, 1988).

In the first scenario, the criteria are considered to be of equal importance (neutral scenario); in the second, cultural and historical aspects of the asset are privileged; in the third scenario, finally, it considers as main or predominant, those economic and social aspects.

As showen in the Table 1,Matrices 1, 2 and 3, the opinions expressed in the comparison of the elements considered are perfectly symmetrical, balancing each other to betterevaluate the results that this choice also results from the neutral position (Matrix 1) given by first scenario.In the latter case, of course, it will be especially the judgments expressed with respect to the variables of the second level to determine the final result. This makes the proposed application even more interesting and challenging.The above operation allows reasonably reliable sensitivity analysis on the results of the evaluation and their stability over time to be made.

Table 1. Pairwise Comparison Matrices for the definition of the scenario

1. Neutral scenario	E.V.	C.V.	S.V.	
E.V.	1	1	1	33,33%
C.V.	1	1	1	33,33%
S.V.	1	1	1	33,33%
CR = 0.00				

2. Cultural-Historicalscenario	E.V.	C.V.	S.V.	
E.V.	1	1/7	1/3	8,79%
C.V.	7	1	3	66,94%
S.V.	3	1/3	1	24,27%
CR = 0.006				

3. Economic-socialscenario	E.V.	C.V.	S.V.	
E.V.	1	7	3	66,94%
C.V.	1/7	1	1/3	8,79%
S.V.	1/3	3	1	24,27%
CR = 0.006				

The choice of useis conditioned by the reference scenario, although, as will be shown at the end of the application, the results tend to remain reasonably stable as the alternatives considered show homogeneous characteristics.

Four distinct possibilities of reuse have been established as feasible after a very direct and implicitly initial screening:

- University (UN): venue for teaching and research activities of the Mediterranean University of Reggio Calabria, accessible by teachers and non-teaching staff as well as students. In brief, to maintain the current use
- Museum (MU.): site used to host exhibitions and collections, as well as historical and architectural records. Open to the public
- Mixed (MX): the space can be used as Museum and University facilities
- edTertiarysector (AT): representative office for organizations and/or institutions, such as the University, Banks, Research and Development etc. including the possibility of public use of the asset. Such use involves a respectful and prestigious use of the physical structures and spaces

These different uses of the Palazzo Zani space, are evaluated on the basis of five characterizing feasibility criteria (sub-criteria) relating to the feasibility of the intervention:

- Relations with the Context (R.C.) expresses the opportunities and constraints that the location of the asset has in relation to alternative uses. Falling into this category are the impacts on traffic and accessibility levels. In addition, were considered the landscape and environmental elements and location, including the proximity to the Waterfront, the relationship with the main expressways, the train station and the central position in relation to the urban context
- Tourist Potential (T.P.) allows the evaluation of the asset's ability to enable tourists and visitors and thus to indirectly bring an overall beneficial effect to the local economy
- Supply and Demand of the service (S/D) tries to evaluate, on one hand, the explicit demand of the local community and on the other, the current provision of the service at an urban and metropolitan level, through a complete market analysis. The indirect demand of the potential and future community is recognizedthrough the consideration of the social and cultural aspects of the asset, explained at higher level

- Funding Sources (F.S.) to be activate. This will define the type of operators, both public and private, involved in the promotion, realization and management phase. The considered alternative uses allow the success and operational and financial feasibility of the project(Guarini&Battisti, 2014a; Nesticò&Pipolo, 2015).
- Physical and typological Safeguarding of the asset and its architectural and Cultural value (S.C.) are assessments that ensure that the conservation intervention respect the heritage of the asset and its material remains. All the technical indicators requested by law, relating to size and features such as overload, that the alternative uses may require, are essential along with some aesthetic and visual constraints

The five elements described are placed on the second level of the hierarchy and are evaluated from time to time and the three aspects of economic, social and cultural and artistic values, explained in the upper level (Figure 1).

Each of these criteria contains a meaning, reasonably explicit, measurable not only on nominal and ordinal scales, but also with quantitative and numeric indicators.

Value judgments were gathered from the comparison in pairs of the elements of the second level, for the three criteria of the first and are shown in the Table 2, matrices number 4, 5 and 6.

Table 2. Pairwise Comparison Matrices to the sub-criteria

4. Economic Value	R.C.	T.P	S/D	F.S.	S.C.
R.C.	1	1/2	1/5	1/7	5
T.P	2	1	1	1/5	3
S/D	5	5	1	1/2	5
F.S.	7	5	2	1	7
S.C.	1/5	1/3	1/5	1/7	1

CR = 0.082

5.Cultural Value	R.C.	T.P	S/D	F.S.	S.C.
R.C.	1	3	5	5	1/3
T.P	1/3	1	3	3	1/5
S/D	1/5	1/3	1	1	1/7
F.S.	1/5	1/3	1	1	1/7
S.C.	3	5	7	7	1

CR = 0.027

6. Social Value	R.C.	T.P	S/D	F.S.	S.C.
R.C.	1	3	1/2	4	1
T.P	1/3	1	1/3	3	1/3
S/D	2	3	1	4	1
F.S.	1/4	1/3	1/4	1	1/4
S.C.	1	3	1	4	1

CR = 0.027

It is interesting that, for the three different scenarios, the element with greatest weight is the preservation of the value of the property, both in the first neutral scenario and in the third, which focuses on the historical and cultural aspects.

Table 3. Preference vectors for the three scenarios

SCENARIOS	Sub-Criteria				
	Relations Context (R.C.)	TouristPotential (T.P.)	Supply/Demand (S/D)	FundingSources (F.S.)	Safeguarding Cultural (S.C.)
Neutral	III 19,49%	V 11,12%	II 22,76%	IV 19,01%	I 27,52%
Cultural- Historical	II 23,87%	IV 11,74%	III 14,02%	V 9,01%	I 41,36%
Economic- Social	III 13,91%	V 10,56%	II 29,07%	I 32,63%	IV 13,83%

The determination of weights takes place, during the implementation of AHP.It combines local eigenvectors resulting from matrices constructed on the basis of the elements of the second level with the final weight vector of the elements of the upper level(Saaty, 1980).

Within in the evaluation, there has been included Matrices 7, 8, 9, 10 and 11, relating to the elements of the final level: alternatives uses (Table 4).

Table 4. Pairwise Comparison Matrices for alternative uses

7. Relations Context	UN	MU	MX	AT
UN	1	1/3	1/2	1/3
MU	3	1	2	1
MX	2	1/2	1	2
AT	3	1	1/2	1

CR = 0.076

8. Tourist Potential	UN	MU	MX	AT
UN	1	1/7	1/5	1
MU	7	1	3	7
MX	5	1/3	1	5
AT	1	1/7	1/5	1

CR = 0.027

9. Supply /Demand	UN	MU	MX	AT
UN	1	1/2	1/2	1/5
MU	2	1	1/3	1/3
MX	2	3	1	1/2
AT	5	3	2	1

CR = 0.041

10. Funding Sources	UN	MU	MX	AT
UN	1	1	1/3	1/5
MU	1	1	1/3	1/5
MX	3	3	1	1/3
AT	5	5	3	1

CR = 0.016

11. Safeguarding Cultural	UN	MU	MX	AT
UN	1	1/7	1/3	1/5
MU	7	1	3	3
MX	3	1/3	1	1
AT	5	1/3	1	1

CR = 0.021

The results of the comparisons made with respect to the five criteria of the top level differ depending on the scenario to which they refer (Table 5). The stability of the results in the first and second scenario and the lack of change in the third can be read as an indication of choice in favour of Museum use or in the Advanced Tertiarysector. It definitely appears inappropriate for the use of the asset as a venue for educational activities of the University, which could use it as a representative and prestige office. Also with regard to the mixed destination, the stability of the results- always at the third place of the ranking- eliminate this choice under the triple architectural-economic-social profile (Table 5).

Table 5. Vectors of preference for the alternatives

		ALTERNATIVE			
		University(UN)	Museum(MU)	Mixed (MX)	Advanced Tertiary (AT)
SCENARIOS	Neutral	IV 8,55%	I 33,23%	III 24,91%	II 33,21%
	Cultural- Historical	IV 8,07%	I 40,33%	III 23,98%	II 27,62%
	Economic- Social	IV 9,02%	II 25,81%	III 25,76%	I 39,41%

In order to assume a hierarchical scale which is able to relate the three scenarios, a weighted summation of the three vectors obtained had to be compared with a list of values which represents the complexity of the choice.

Consequently, it multiplies the matrix formed by the three vectors resulting from I, II and III scenarios for the vector coefficients of 0.333(Table 6).

Table 6. Output of the evaluation process

		Scenarios					Scenarios
		I	II	III			IV
Alternative	University	8,55	8,07	9,02	x	0,333 0,3330,333	= 8,52
	Museum	33,23	40,33	25,81			33,14
	Mixed	24,91	23,98	25,76			24,9
	Advanced Tertiary	33,21	27,62	25,81			33,43

The calculation provides, as a result, a single vector expressing the hierarchy of choice (ranking) among the various destinations of alternative uses (Figure2). Probably more coherent with reality, this further definition of scenario, in which the values expressed in the three scenarios, are taken into account equally.

The final result shows as more coherent solution the Advanced Tertiarysector which could be helpful to the University management during the feasibility study of the reuse project.

From the point of view of the methodology, it is still useful to emphasize that the A.H.P. flexibility allows a possible and fruitful collaboration with the project at the "meta-project" phase.

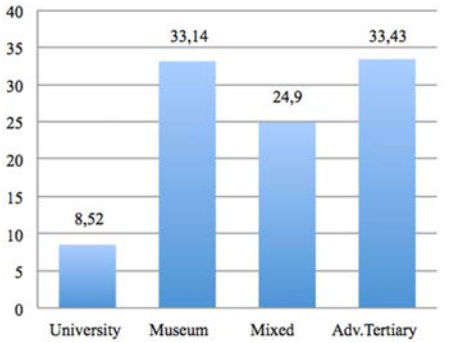

Fig 2. Ranking destinations of alternative uses

3. Conclusions

The multi-criteria methodologies have proven particularly useful in the process of urban enhancement and redevelopment of historical heritage. It is an instrument of mediation among the multiple and often divergent interests and is able to create a shared platform among all decision-makers, stakeholders and people directly affected by the final solutions. The use of different techniques of MCDM in the preliminary stages will support public administration in complex decision-making problems, ensuring an integrated, multidisciplinary and transparency to the whole evaluation process.It has emerged that these tools are extremely strategic, especially if adopted early in the planning stage or the pre-feasibility, playing a role of control and management (Cassalia, 2014). It can support the public body in the choice between different policy options, through negotiation among the various stakeholders for a more transparent and efficient identification of shared and sustainable choices (Guarini&Battisti, 2014b; Della Spina, et al., 2015). Thinking in terms of sustainability, the MCDM plays an important role in the path towards sustainability. To consider the development for sustainability means considering the multiple dimensions involved in the development and planning of the urban transformation (D'Alpaos, 2012), considering the development as the result in the short and long term, interconnected social, economic, and environmental objectives (Calabrò& Della Spina, 2013). Finding the best solution according to the final destination of Palazzo Zani is a complex and multi-

dimensional decision. For this purpose the MCDM and in particular the AHP lends itself as a tool capable of dealing with this multidimensionality in an integrated way and reflects the complex interdependencies among the different dimensions of the transformation and reuse of the asset.The high transparency of the AHP steps and simple hierarchical representation of the various evaluation stages are the widespread application of this multi-criteria technique and its intrinsic effectiveness in identifying shared choices.The use of the hierarchical diagram, the matrix of the criteria and the matrices of the alternatives being inputted, and the vectors of preferences for the different scenarios, in the output stage, characterise the multi-criteria technique of operational simplicity and clarity of the mathematical process, making it logical for everyone involved.

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Corrigendum

Corrigendum to Evaluation decision support models: Highest and Best Use choice

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Author details and affiliation: Lucia Della Spina

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Table 6. Output of the evaluation process

Alternative	Scenarios I	Scenarios II	Scenarios III			Scenarios IV
University	8,55	8,07	9,02			8,52
Museum	33,23	40,33	25,81	x	0,333 0,333 0,333 =	33,14
Mixed	24,91	23,98	25,76			24,9
Advanced Tertiary	33,21	27,62	25,81			33,43

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Corresponding author details: Dr. Lucia Della Spina
Corresponding author email address: lucia.dellaspina@unirc.it

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