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A multi-objective decision-making process for reuse selection of historic buildings

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ABSTRACT

The ongoing reuse of historic buildings is important work for both World Heritage properties and listed cultural properties recognized by national or local governments. However, the varied concerns among related people of different positions make reuse selection problems become a difficult task. Effective and proper evaluation for reuse selection may accelerate the implementation of sustainable conservation. This study presents a comprehensive methodology for the reuse selection of historic buildings. The criteria, which are relevant to the reuse selection of historic buildings, have been identified through FDM method and used to construct an ANP model. Thereafter, the application of ANP for the reuse selection has been demonstrated through two illustrative examples in Taiwan. The result reveals that the proposed methodology can effectively capture the interdependencies among the various criteria. These have rarely been applied in the context of reuse selection problems and their utilization has made evaluation and selection for reuse a feasible concept. This approach also enables decision-makers to better understand the complex relationships of the relevant attributes in reuse selection problems, which may subsequently improve the acceptability of the decision.

1. Introduction

The Operational Guidelines for the Implementation of the World Heritage Convention (Intergovernmental Committee for the Protection of the World Cultural & Natural Heritage, 2008) suggest that historic buildings are regarded as world cultural heritage properties since they are of outstanding universal value from the point of view of history, art or science. It is also suggested that world heritage properties may support a variety of ongoing and proposed uses that are ecologically and culturally sustainable.

At the same time, heritage and culture are two important components of the leisure sector (Bedate, Herrero, & Sanz, 2004). There are many historic buildings with local historic and cultural value recognized by governments all over the world. These buildings may also become important assets to develop a local tourism industry (Pedersen, 2002). However, there are some conflicts between cultural preservation and economic development in reuse selection, especially between the people working in disparate worlds with regard to reuse (Irit, 2005; Murtagh, 2006; Tiesdell, 1995; Teo & Huang, 1995).

On one side are the professionals in local and national governments whose responsibility is to see that the standards are heeded in the interest of protecting the historical fabric in question. As architects or architectural historians do not lend themselves to absolutes, their judgments will vary case by case. On the other side are the developers, for whom, time is money in the reuse process. At times, in the haste to turn a profit, the actions of developers may appear insensitive to the integrity and authenticity of historic buildings (Murtagh, 2006).

In other words, the governments, architectural historians, developers, architects and owners have different concerns. Therefore, the selection problems are difficult tasks, any place and for any decision-makers. To choose an optimal selection from the proposed reuse alternatives of historic buildings, the selectors should consider multiple factors.

Besides, the factors interact with each other; for instance, the preservation of architectural value may increase the level of local recognition or construction matching local landscape characteristics. The increase of economic benefits can lead to will for historic preservation and changes in social relationships. Sustainable reuse plans which can be implemented by local people would pass the value of historic buildings to the next generation, lead to more community identification and upgrade local culture, landscapes and even the economic level (Farrell, 1979; Irit, 2005; Luther, 1988; Pedersen, 2002; Tiesdell, 1995; Teo & Huang, 1995).

Although the World Heritage Convention or nations separate have developed useful techniques and criteria for reuse selection of historic buildings (Cultural Properties Protection Department, 1999; National park Service, 1977; The Government Logistics Department of Hong Kong, 2004); their application has been restricted because only independent evaluation criteria have been considered.

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Numerous methodologies for selecting an optimal solution have been developed and reported on in the last two decades (Baker, 1974). The analytic hierarchy process (AHP) (Saaty, 1980) is one of the widely used approaches to handle such a multi-criteria decision-making problem. However, a significant limitation of AHP is the assumption of independence among various criteria of decision-making. The analytic network process (ANP) (Saaty, 1996), on the other hand, considers interdependent criteria by feedback and the evaluation results tend to match the real world selection problem. In recent years, there has been an increase in the use of ANP in multi-criteria decision-making problems (Cheng & Li, 2006; Lin, Chiu, & Tsai, 2008; Lin, Lee, & Chen, 2009; Sarkis, 1998).

In addition, querying experts during interviews in a group at the same time is extremely difficult. The Delphi method (Dalkey & Helmer, 1963), with anonymous questionnaires to avoid the effect of individual opinions, which helps experts to fully express their professional opinions, is an effective means of querying experts to identify factors as criteria. Ishikawa proposed the fuzzy Delphi method (Ishikawa, Amagasa, Tamizawa, Totsuta, & Mieno, 1993) in 1993 and further integrated experts' opinions into fuzzy quantities to reduce the times of questionnaire and thus the experts' opinions became more reasonable with fuzzy theory. Therefore, the fuzzy Delphi method is used in this paper to determine the criteria and the degree of interdependence.

The objective of this paper is to introduce a comprehensive decision methodology for the selection of the best reuse of historic buildings that governments, developers, owners or architects may apply to their projects. The proposed methodology allows for evaluation of alternatives in two steps: (1) with literature review and expert interview, the study integrates the issues and factors related to reuse selection and identifies the criteria of the experts' consistent opinions by fuzzy Delphi; (2) according to the above criteria and an ANP-based selection model, get the final priority of the alternatives. Using this methodology, our focus is to demonstrate the application of ANP for the final selection of the best reuse option for a historic building. Therefore, in this paper an ANP-based model has been developed and illustrated for two representative historic buildings in Taipei City, which were built during the Japanese Colonial period.

2. Literature review

This literature review is mainly aimed at the current situation and problems of decision-making in reuse of historic buildings. Such a literature review may help professional teams identify criteria and the interdependence among the criteria that need to be considered in reuse of historic buildings.

In order to successfully reuse historic buildings for economic viability and still preserve that quality of historicity for which the building is being kept, Murtagh (Murtagh, 2006) suggested the following points. First of all, the potential market must be considered and evaluated. For instance, does a need exist for the proposed reuse? Will the local social and demographic characteristics of the area make the project feasible? What type of development is taking place locally and what is the competition? Evaluation of the potential project's location is primary. What sorts of services are available, such as transportation? What other uses exist in the area? What are being planned? What is the existing or potential environmental quality of the surroundings?

Besides, the physical analysis of the building needs to be made. What are the requirements of the local building code? Does the zoning allow or potentially allow the proposed reuse? What is the structural stability of the building? In what condition are the mechanical systems?

Finally, an architectural and historical evaluation must be made. Can the building meet the criteria of the National Register? How much of the historical fabric – the authentic materials and workmanship that give the building its character or integrity – exists and how much is it feasible to preserve?

After the practice on three cases in London, Farrell (Farrell, 1979) proposed the following basic criteria for consideration:

1. What is the building like at the moment; how is it constructed and in what manner is it divided into compartments, and why was it built that way in the first place?
2. What is the current state of the building fabric, and will it realistically achieve a life which is consistent with the use required and the likely expenditure?
3. What is the relationship between the money which must be expended to ensure a good life expectancy and the money which is necessary to allow for the new use of the building?
4. What are the particular characteristics of the building which can be exploited to achieve an optimum solution for the new requirements?
5. What are the respective financial implications of reuse? Reuse is also a process which is labor intensive and not material and energy intensive, which should now be of particular significance in the wider economic sense.

Luther suggested (Luther, 1988) that for most design contracts in the private sector, the dialogue is one between the client and the architect. The focus of attention is the building rather than the surrounding environment.

The building is given a detailed analysis in order to determine factors and attributes that must be used or overcome in order to achieve a vital reuse of the structure. The question of public interest often has little significance in the early stages of project programming and design conceptualization.

However, the values derived from perception and interpretation of the environment are manifested physically in the form of local plans, policies, and regulations. These may be land use plans, or they may exist in other forms, including historic district designations, local neighborhood organizations, and less formal but equally formidable shared perceptions among local residents. The design professional often does not encounter these factors until the design is completed and presented to the local government for approval. That might be cause the risk of failure.

The context of site and situation offers both constraints and opportunities for the design professional. A thorough inventory and analysis of the external opportunities and constraints that could influence the project should be considered (Luther, 1988).

In 2007, Guidelines for building assessment, preservation and utilization, proposed by the Architectural Institute of Japan (Institute of Japan, 2007), referred to five fundamental values as the criteria of: (1) the historical value, (2) the cultural and artistic value, (3) the technological value, (4) the scenic/contextual value and the environmental effect, (5) the social value. Reuse decision-making should be based on above original value of the buildings and the contributions to the environment and society.

In the Operational Guidelines for the Implementation of the World Heritage Convention (Intergovernmental Committee for the Protection of the World Cultural & Natural Heritage, 2008), to be deemed of outstanding universal value, a property must also meet the conditions of integrity and/or authenticity and must have an adequate protection and management system to ensure its safeguarding. Besides increasing public awareness, involvement and support for World Heritage through communication, enhancing the role of communities in the implementation of the World Heritage Convention, are also the goals and objectives of the committee.