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The Analytic Hierarchy Process (AHP) Approach for Assessment of Urban Renewal Proposals

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Abstract The problem of urban decay in Hong Kong is getting worse recently; therefore, the importance of urban renewal in improving the physical environment conditions and the living standards of the citizens is widely recognized in the territory. However, it is not an easy task for the Hong Kong Government to prepare welcome urban renewal proposals because the citizens, professionals and other concerned parties have their own expectations which are difficult to be addressed all at the same time. Although it is impossible to satisfy all stakeholders concerning urban renewal, it is preferable to have proposals conforming to the interests of the majority and beneficial to the present and future generations. This paper adopts the analytic hierarchy process (AHP) to work out the most sustainable design proposal for an area undergoing urban renewal. AHP is a robust multi-criteria decision making (MCDM) method for solving social, governmental and corporate decision problems. Since there is a lack of published papers demonstrating a systematic and effective way for urban renewal proposal assessment, this paper attempts to fill this gap with the help of AHP.

Keywords AHP · MCDM · Urban renewal · Proposal assessment · Hong Kong

1 Introduction

Urban renewal is a complex process that has been commonly adopted to cope with changing urban environment, to rectify the problem of urban decay and to meet various socioeconomic objectives. In Hong Kong, numbers of urban renewal projects have been conducted but many of them fail to achieve their goals and generate environmental and social problems in the community (Ng et al. 2001; Chui 2003). Some people argue that this

social problems in the community (Ng et al. 2001; Chui 2003). Some people argue that this phenomenon is probably due to poor quality of the urban renewal proposals. Therefore, the Government and the concerned parties in the territory attempt to improve the design of the proposals by promoting sustainability concept (Fung 2001). They believe that thinking over this concept when preparing the urban renewal proposals can produce positive results

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after projects completion in future such as further economic growth, better quality of the natural and built environment, and increased social well-being. However, it is a hard task for the Government to produce appropriate urban renewal proposals fulfilling sustainable development objectives even it intends to do so and has made a great effort. In view of it, it is necessary to have a tool to assist the Government in working out the most sustainable urban renewal proposal for a renewed area. Determining a sustainable renewal proposal is a difficult and complicated process because a lot of tradeoff decisions have to be made. Parties either affected by or involved in different stages of urban renewal have their concerns and expectations which cannot be satisfied all by a single proposal. In order to ensure that the final proposal is convincing, a more systematic and sophisticated method to make the tradeoff decisions is required. Therefore, this paper encourages the use of analytic hierarchy process (AHP) in dealing with this challenge.

2 What is AHP?

Before discussing AHP, it is necessary to know what multi-criteria decision making (MCDM) method is. MCDM methods are valuable in reaching important decisions that cannot be determined straightforwardly. Nowadays, there are numbers of MCDM methods available for selection. In order to select the most appropriate method for this study, it is necessary to know the general characteristics of different methods. With reference to a study conducted by De Montis et al. (2000), a summary comparing the features of various MCDM methods is produced (Table 1).

From the table, it can be observed that AHP has excellent performance in dealing with interdependent criteria and the local problems involving both quantitative and qualitative

Table 1 Comparison of the general characteristics of MCDM methods

	AHP	NAIADE[a]	MAUT[b]	MOP[c]
Interdependence of criteria	Necessary	Unimportant	Unimportant	Necessary
Transparency of weighting process	Weights given explicitly by mean of pairwise comparisons	Weights are not set explicitly	Depend on expert decision	Weights given explicitly

comparisons.

Problem solving process	Only experts involved	Only experts involved	Only representatives & experts involved to derive the matrix	No stakeholders included. Problems structured with reference to existing data
Applicability	Used for local scale problem	Used for local scale problem	Used for local scale problem	Used for local scale problem
Types of data used	Quantitative & qualitative data used	Crisp, fuzzy & linguistic data used	Qualitative data used	Fuzzy & linguistic data used

Source: De Montis et al. (2000)

[a] Novel approach to imprecise assessment and decision environments

[b] Multi-attribute utility theory

[c] Multiobjective programming

issues. It is expected that AHP is a suitable method for this study concerning about the urban renewal which is commonly regarded as a social problem (Chan and Lee 2007).

As mentioned, AHP is one of the MCDM methods and the underlying principle of MCDM is that these decisions have to be made by means of sets of criteria. By apply this principle, Saaty (1980) developed AHP which models a hierarchical decision problem framework that consists of multiple levels of criteria having unidirectional relationships. AHP works with such hierarchy that can combine both subjective (intangible) and objective (tangible) criteria.

AHP is a reliable tool to facilitate systematic and logical decision making processes, and determine the significance of a set of criteria and sub-criteria. It is widely applied to construction fields such as resources allocation, project design, planning for urban development, maintenance management, policy evaluation, etc. (Saaty 1980; Cook et al. 1984; Shen et al. 1998; Cheng et al. 2005; Banai 2005). Saaty (1980) laid down the proof and the mathematical calculations of AHP but in this study, the complicated mathematical algorithm is skipped and only a brief description of this method is provided. AHP is composed of eight major steps:

(i) To identify the decision problem—The decision problem has to be stated in the topmost level of a hierarchy that is broken down into different levels in which the final level is usually the scenarios or alternatives to be selected;
(ii) To ascertain that the problem can be solved by AHP—AHP is suitable for the decision problem that can be turned into a hierarchical decision model;
(iii) To structure the decision problem—A hierarchy structure formed for the decision problem consists of several levels. A focus in the topmost level is decomposed into criteria bearing on the focus in the second level followed by sub-criteria in the third level and so forth;
(iv) To determine the raters—AHP solicits expert's judgment and therefore, only experts are eligible to be the raters who are responsible for making the decision;
(v) To collect data from the raters—AHP determines the relative priorities of different

criteria in every level of the hierarchy by employing a pairwise comparison. During the process, each expert is required to make judgments on their relative importance in relation to the element at the higher level with reference to a 9-point scale;

(vi) To calculate the priority weights of each criterion—Each decomposed level with respect to a higher level forms a matrix. The pairwise comparison data are summarized in the absolute priority weights on the basis of Saaty's eigenvector procedure; and

(vii) To measure the consistency ratio (C.R.)—This practice is to ascertain that the experts are consistent in rating the relative importance of the criteria. AHP does not demand perfect consistency but a judgment is only considered acceptable when C.R. is of 0.10 or less. If the C.R. value cannot pass such acceptable level, it is certain that the experts make judgments arbitrarily or mistakenly and then they have to do it again.

Pairwise comparison is an important step in AHP to be completed by the experts. However, AHP is widely criticized for such tedious process especially when a large number of criteria or alternatives is involved. Someone may doubt the expert judgments because people are very likely to feel tired and lose patience during this process and therefore, they may not make their judgments conscientiously. They may change their minds frequently in order to ascertain the acceptance of the C.R. value as well as shorten the whole process. To avoid such drawback, only reasonable and manageable amounts of criteria are contained in the model and the author of this study has acted as a facilitator to take over the judgment process.

Although AHP is subject to criticism, it is regarded as the most appropriate method for this study. It is because pairwise comparison form of data input is straightforward and