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An integrated decision making model for district revitalization and regeneration project selection

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ABSTRACT

The main purpose of this research is to propose an effective hybrid process for evaluating district development directions concerning district revitalization and regeneration (DRAR) prospects along with simultaneous positive and negative conflict criteria and their interdependence. Accordingly, the fuzzy Delphi method (FDM), the interpretive structural modeling (ISM), and the analytic network process (ANP) with benefits, opportunities, costs, and risks (BOCR) are integrated to construct a project selection model regarding the DRAR. A real case in Jiufen in Taiwan is studied using the proposed model to evaluate four feasible development directions, and the results verify the applicability of the novel MCDM method. This hybrid process can not only transform complex interaction of district reviving factors into simple quantitative evaluation, but its result can also be guidance for determining future development direction.

1. Introduction

The contemporary urban development and management often focuses on innovative construction and district reviving simultaneously. Especially, with the consideration of local characteristics and cultural values, the new and progressive development can expand expeditiously. A number of studies [14,15,22,46,47] show that manifesting local values and identities and creating renaissance in developed districts have become significant issues.

A district's sustainable development should not simply focus on external demolition and construction, but should also stress on manifesting internal local values and identities (revitalization), and further create renaissance and competitiveness of local development (regeneration). Consequently, the core of district revitalization and regeneration (DRAR) should reveal provincialism and continuity and stimulate new life and competitiveness [8,14,48]. Nevertheless, there are many complex influence factors involved for DRAR, and the DRAR project evaluation and selection problems are multi-criteria decision-making (MCDM) problems in nature. Since a suitable decision-making model is important for evaluating and selecting project alternatives, numerous methodologies have been developed and proposed over the last few decades [10].

Like many multiple criteria decision-making (MCDM) problems in real world, there are usually several tangible and intangible elements and favorable and unfavorable concerns that must be considered at the same time for DRAR project evaluation [54,80]. Complicated interdependence may exist in the problem with simultaneous interaction of positive or negative impacts, such as criteria in benefits versus those in costs, and criteria in opportunities versus those in risks. It would simply make perplexity for DRAR project selection and decision.

In order to tackle the above-mentioned inevitable problem effectively, this paper proposed a systematic approach that integrates the fuzzy Delphi method (FDM), the interpretive structural modeling (ISM) and the analytic network process (ANP) with the benefits, opportunities, costs, and risks (the BOCR merits). The FDM is a methodical procedure for evoking expert group opinion to sift the critical criteria from multitudinous possible impact factors [10,27,56]. The ISM is applied to clarify interdependencies among evaluation criteria [1,37,71]. The ANP with BOCR, proposed by Saaty [51], is a mathematically-based MCDM tool to deal with interdependent and multi-attribute problems. Especially, it can solve the positive and negative impacts of a problem simultaneously, and it has been applied in some recent works with outstanding outcomes [12,28,53].

In Taiwan, due to dense population with small land area and diverse immigrant societies, the district development has been saturated and

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possessed of the characteristics of various historical cultures. District reviving is highly related to the physical construction of traditional urban renewal [68]. Accordingly, developing arts and cultures, injecting commercial activities, and advancing tourisms and recreations have been the major development types in recent years. Nevertheless, local characteristics were usually neglected, and the resulted developments had a very high similarity and lack of uniqueness. In order to fill the vacancy, this paper studies Jiufen, a district with self-characteristics in Taiwan, to find critical criteria of DRAR and construct an evaluation model to help the district in selecting the most suitable revitalization and regeneration project.

The objective of this paper is to propose a methodology for DRAR project selection problems that have interdependence property and simultaneous positive and negative impacts among evaluation criteria. Specifically, this paper demonstrates how an integrated FDM, ISM and ANP with BOCR model can be used as an aid in DRAR project selection problems. An evaluation framework for project selection of DRAR is proposed, and the related importance weights of the critical criteria and alternatives are calculated. The results show that the model can transform complex positive or negative impacts and interrelationship into simple quantitative values for objective and effective evaluation. The empirical results also can be the consultation and guidance for practical project development selection in the future. This paper is organized as follows. DRAR and relevant project selection works are reviewed in Section 2. The integrated MCDM methodology is presented in Section 3. The proposed methodology is applied to a real case in Section 4. Discussions and conclusions are provided in the last section.

2. DRAR and project selection

In today's rapidly changing society and environment, revitalization and regeneration as a major source of competitive advantage for district development is widely accepted by practitioners, governments and academics [11,47,61,66]. The ideas of revitalization and regeneration have meant an introduction of broader ideas of environmental sustainability containing social dimension and localization targets [55].

Numerous previous works [14,16,42,48] have indicated that the aims of revitalization and regeneration are to manifest local environmental identities, promote inhabitant emotions, enhance regional belongingness, and stimulate local industrial animation and economic benefits. In contrast with such developments and tendencies, Mese [43] proposed the concept of revitalization planning, which uses regional resources to change current situation and to leap toward new objectives. Yang [76] presented the local revitalization approach, which adopts integrated local development strategies to promote district socio-economic revivification and to infuse new vitality into the area. Kuo et al. [30] defined district revitalization as integrating and manipulating the inherent characteristic resources of district to promote localized industrial development and life quality, and further to highlight the existent orientation and value of district.

In addition to the implementation of the above-mentioned concepts, benign interaction among inhabitants, professionals, and governments is necessary to advance DRAR [31]. In fact, the DRAR project is a series of actions designed to accomplish DRAR goals such as improvement in economic, physical, social, and environmental conditions of an area that has been subject to change [78]. In the DRAR problem, there exist many complex influence factors such as planning and operating, existing culture patterns, inhabitant' consciousness, living interaction, and so on, and these factors have simultaneous positive and negative impacts. For example, Wagner et al. [64] stated that a successful local revitalization planning consists of strong public leadership, well-focused planning notions, ability to respond to traumatic events, existing community characteristics, and good relationship among levels of government. Besides, the culture-led regeneration also can be deployed by locales to advance a new development and also to liven up a decayed local area [20]. Wang [65] proposed that a culture-led regeneration should be shaped distinctively by conjoining the heritage conservation of archaic buildings, the reinforced widespread use of cultural symbols, and urban regime. Other relevant studies can refer to Aravot [3], Çevik et al. [8], Helleman and Wassenberg [24], Raco [47], Wang and Wu [69], and Wedding and Crawford-Brown [74], etc. To sum up, a DRAR project is a systematic program developed to reconstruct the district spatial structure, improve its infrastructure, and foster its natural functions [78]. Moreover, it has special characteristics such as high risks, long time return, and large proportion of intangible costs and benefits, and these make the process of decisions very difficult and the direction of the oncoming development very uncertain. Because the revitalization and regeneration of a district involves many complex situations and influence factors, the DRAR project evaluation and selection is a MCDM problem.

In general, the issues related to project evaluation and project selection have been discussed in various fields such as quality management, research and development, environmental management, and district development. Decision makers have to gather information from various sources about relevant alternatives, and evaluate these alternatives against each other or some set of criteria through appropriate methods [6,33]. Different methods have been proposed to help make good project selection decisions [10]. The existing methods for project evaluation and selection range from single criterion cost/benefit analysis to multiple criteria scoring models and ranking methods, subjective committee evaluation [75], or mathematical programming. Overall, the methodologies frequently used in the past include ranking technique [7], balanced scorecard [4], analytic hierarchy process (AHP) [13,26], analytic network process [23,63], technique for order preference by similarity to ideal solution (TOPSIS) [45], data envelopment analysis (DEA) [29], multivariable analysis method [40], dynamic programming [32], goal programming [5], etc. These studies unanimously demonstrate the necessity and importance for a careful assessment of different development directions to overcome the difficulties of project selection.

A review of current related DRAR models and evaluation methods shows that most past works applied economic concept, environmental impact assessment (EIA) and multiple criteria decision making (MCDM). For example, Mazzanti [41] adopted the microeconomic concept to treat cultural heritages as multi-attribute goods, and applied conjoint analysis techniques to perform the evaluation. Dutta et al. [16] based on the economic point of view and adopted the contingent valuation method (CVM). Tobit regression model was used to understand the determinants of the willingness to pay, and the results were used to quantify the total economic value (TEV) of the heritage sites. EIA has been applied abundantly in many cities and areas in Europe [57]. For example, Tweed and Sutherland [60] applied EIA in the sustainable development of historical areas by integrating the satisfaction of human needs and different people's perceptions of and attitudes to urban historical areas. MCDM has been used in many DRAR works. Aravot [3] used post occupancy evaluation (POE) to generalize the values of the environmental characteristics, and applied statistics and Logit to analyze the quality and suitability of local revitalization. Thomas [58] used geographic information system (GIS) to develop the evaluation criteria for area development, and applied decision support systems (DSS) to evaluate the new developments. Doratli et al. [15] used strengths, weaknesses, opportunities and threats (SWOT) to determine the key criteria of historic urban quarters and devised an appropriate revitalization strategy. Other recent works include Zavadskas and Antucheviciene [79] and Dutta and Husain [17].

Based on the above analysis, we can see that most of current models and evaluation methods have some deficiencies. First, the types of evaluation criteria can be very limited, for example, only based on the economic aspect, or very subjective. Even for an objective categorization such as SWOT analysis, the results of the key criteria under the four aspects cannot be integrated together to provide a final ranking of the alternatives. Second, the selection of criteria is generally based on