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A Concept toward Decision Support for Collaborative Urban Heritage Selection

Christiono Utomo[1], Yani Rahmawati[1], Suhartono[1] & Nugroho Priyo Negoro[1]

[1] Institut Teknologi Sepuluh Nopember, Kampus ITS Sukolilo, Surabaya, Indonesia

Correspondence: Christiono Utomo, Institut Teknologi Sepuluh Nopember, Kampus ITS Sukolilo, Surabaya, 60111, Indonesia. Tel: 62-81-7936-5536. E-mail: christiono@ce.its.ac.id

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Abstract

Decision making for collaborative urban heritage is very complicated due to the involvement of many parties with many goals and concerns. In such situation where the designer, project manager, facility manager and others are involved in choosing a single alternative from a set of solutions, a decision support is required to evaluate and rank the solution. This paper presents a conceptual model of decision support for collaborative urban heritage with three different conditions on adaptive value, economics value, and spatial value. The research objectives are to find a theoretical basis and research approach for decision support methodology and to develop a decision model for technical solution options. The methodology is started with theoretical approach through literature review to develop the model of collaborative criteria that is shared-understanding, best design achievement, and integration. It is also used to develop the model of urban heritage selection that is economic value, adaptive value, and spatial value. The model are then analyzed by using analytical hierarchy process (AHP) in order to find the best fit model of decision support for developing the urban heritage area. The result of the decision model is verified in a case study.

Keywords: decision support, urban heritage, collaborative, value

1. Background and Motivation

Urban heritage is becoming important value in urban development, where historical and cultural aspects within heritage value of the urban are preserved in order to increase the value of the urban itself (Utomo & Rahmawati, 2012). Some issues appear regarding to the failure as well as less concern in achieving this value. Developers had mostly concerned to achieve the economic value and abandon the heritage value in order to gain highest return (Zancheti & Hidaka, 2011). As a result of less concern to heritage value, the adaptive value in developing heritage area is being less concerned as well. Furthermore, due to the importance and additional value of heritage in the urban development, it is becoming essential value to be concerned in the design process of urban development. The design process of heritage urban development is becoming difficult.

The designers as well as the owners are facing the issues in concerning both economic value and heritage value, where some concepts are adaptable and some others are not. These difficulties able to be solved by involving some parties that has expertise not only in the property and/or building development, but also has capabilities in realizing the achievement of both economic and adaptive value in the urban development itself. The criteria of economic and adaptive had caused complex design. Complex designs need complex parties to be involved. Utomo et al (2014) had described that the involvement of multiple parties had added difficulties in design process, especially in the decision making process. Complex parties also caused complex issues, where it will be difficult to produce best fit design that are not only accepted by all parties but also can be used to achieve the value of economic and adaptive. Collaboration is an important endeavor that needs to be applied in multiple parties of decision making (Utomo & Rahmawati, 2014). It has ability in guiding the design process to achieve common goals through the achievement of best-fit mutual decisions. The concept of collaborative based decision making is needed in the design process of urban heritage development.

This research purposes to develop the concept of collaborative-based decision making in the multiple parties' design process of urban heritage development. The concept is first conceptually built by using literature study. Depth review on collaborative-based decision making researches is needed to find the criteria of collaboration. The review then continued to previous researches on economic, adaptive, and spatial value of urban heritage

development. The conceptual model is then confirmed to experts whom had experiences in design process of urban heritage development. The result is analyzed by using AHP accordingly.

2. Theoretical Basis

2.1 Definition of Collaborative Decision Making

There are three endeavors that can be applied to multiple parties' works or decision making, which consist of collaboration, cooperation, and coordination. Collaboration has different meaning with cooperation and coordination (Kvan, 2000; Lu et al, 2007). The essential meaning that compares those three concepts is the goal that needs to be achieved through those approaches. Lu et al (2007) stated that coordination can be used when works' compilation is the goal, meanwhile cooperation can be used when the goal is concerning the mutualism and advantages of all parties involved. Some research has defined collaborative similar with cooperation (Peng, 1994), but Lu et al (2007) and Kvan (2000) defined differently. The collaborative is an endeavor that is applied in order to integrate multiple parties in achieving mutual and best fit goal, in which it is not concerning individuals' advantages and losses but the integrated and shared-goal is the important matter.

According to its definition, collaborative can also be indicated by its process. The essential process is integration, not compilation nor compromising. According to Rahmawati et al (2014a), the main goal of collaborative is to integrate process, knowledge, and individuals. As Detienne (2006) had also stated that the integration of both aspects, which are process and perspectives, are important for collaboration. Shared-understanding has essential meaning to support the integration, in which it is achieved through similar perspective of design development between participants (Gabriel & Maher 2002). Getting both integration and shared-understanding will lead to the achievement of collaboration's goal, which is best design as integrated result (Kvan, 2000).

2.2 Collaborative Criteria in Urban Heritage Selection

Collaborative-based design process is developed by researchers. Based on reviews to previous studies, the motivation of its application can be classified into three groups. They are shared-understanding (Gabriel & Maher 2002; Saad & Maher 1995; Dave & Koskela 2009), best design achievement (Kvan 2000; Kvan & Candy 2000; Shen et al. 2008), and integration (Chiu 2002; Patel et al. 2012; Detienne 2006; Vivacqua et al. 2011). These motives are three main criteria that can be used to measure variable of collaborative-based urban heritage selection in design process. First criteria are integration. The measurements of integration are conceptually built based on Detienne (2006), which is mainly related with the integration of task interdependencies and multiple perspectives. In realizing integration, shared-understanding is needed to generate similar perception between multiple parties, in which it is determined as second criteria. Rahmawati & Utomo (2014) and Rahmawati et al (2014b) present that the achievement of shared-understanding will support integration through decision making process, where each participant comprehends the outline of design rationale and design elicitation. It will be able to avoid and solve conflicts that are caused by individual thoughts and perceptions of participants in design developments process. The last criteria are the achievement of best integrated design as collaborative result in urban heritage selection. This indicator is constructed by adopting the theoretical framework of collaborative practices (Kvan, 2000; Lu et al., 2007).

2.3 Economic, Adaptive, and Spatial Value in Urban Heritage Design

As reported by Torre (2002), the investment on cultural, heritage, and conservation properties have been difficult to be realized since their contradiction with the economic value. Major consideration to heritage value has capability to carry limitation in adapting the economic value and vise versa, in which it can be major issue in developing the conservative area. Related with this, Mourato & Mazzanti (2002) had described that in fact people had applied the value of the conservation in developing their neighborhood but the result itself had never been visited. Furthermore, the limitation is not only expressed in the application of economic value but also to the adaptive value of the property to its surroundings, which is in this case is the cultural/heritage area.

There are three critical values that are essentially needed to be concerned in selecting best-fit design for developing the urban heritage properties. The values are economic (Heras et al, 2011), adaptive (Bullen & Love, 2011), and spatial (Royo et al, 2011). Economic value is required due to its major benefit for achieving highest return from the investment of urban heritage development. This first value is apparently becoming main concerned for developers and owners in every project investment. The second value is the adaptive. The adaptive value becomes main concern because of the essential need to keep the development plan/design suitable with urban heritage regulations. Spatial is the third value that is critical as well, especially if the development is considering the value of sustainability. Spatial value related with the use of suitable design between property's

plans with the master plan of the urban heritage surroundings. Based on those three values, there are six alternatives that can be developed for selections in urban heritage development.

2.4 Conceptual Decision Model of Collaborative Urban Heritage

Derived from the previous description of empirical and theoretical framework, the conceptual decision model of collaborative urban heritage selection in design process can be depicted in Figure 1. The main goal of the decision is to select the collaborative-based urban heritage development in design process. The goal can be chosen through three collaborative criteria and six alternatives of urban heritage selection. The criteria are shared-understanding, best design achievement, and also integration. High adaptive value is concerned in the first, third, and sixth alternatives; and low adaptive value is considered in the second, fourth, and fifth alternative. Economic value is not considered in the third and fifth alternative, but it is highly considered in the second alternative. The spatial value is not considered in the first, third, and fourth alternative and low considered in the second alternative.

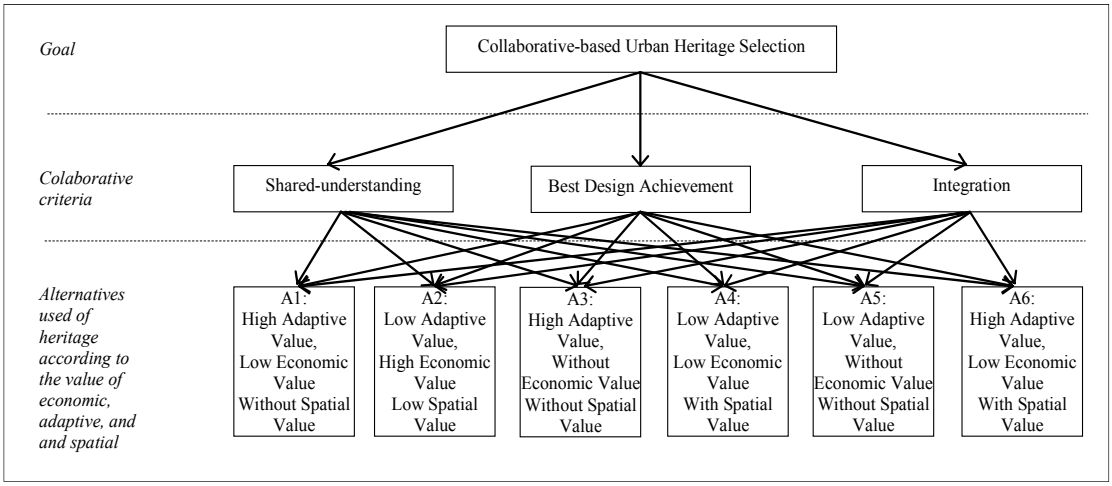

Figure 1. The Concept of collaborative urban heritage selection

3. Decisions Support Model

This research applies AHP (Saaty, 1996) for decision process. It is a powerful and flexible method by reducing complex decisions to a series of one-on-one comparison, then synthesizing the result. This method is a framework of logic and it provides a clear rationale for best decision by organizing perceptions, feelings, judgments, and memories into a hierarchy of forces that influences decision result (Dey, 2006). The AHP also can be used successfully for a group decision (Wanyama, 2006), collaboration (Wang & Zionts, 2008), and negotiation (Utomo et al, 2014)

3.1 First Step: Constructing Decision Hierarchy

The goal of the problem (G) is to select the best alternative of collaborative decision for urban heritage. It is addressed by some alternatives as possible solutions (a1, a2, a3, a4, a5, a6). There are three indicators for the basis of alternative determination. An alternative is presenting of its combination that are + means good, - means bad and 0 means average. In this decision, +V1 means that the alternative is adaptively good for the goal of heritage, +V2 means that the alternative is giving high economics value, and +V3 means that implementation of the alternative will give good spatial value. The problem is split into sub-problems (C1; C2; C3) which are collaborative criteria evaluating alternatives. To obtain a good representation of a problem, it has to be structured into different components called activities. Figure 2 shows the decision hierarchy.

3.2 Second Step: Making Judgments

Based on AHP, the eigenvector and the maximum eigenvalue can be calculated from the pair-wise comparison matrix. It is show the relative importance of pairwise comparison. The value could be: equal (1), moderate (3), strong (5), very strong, demonstrated (7) or extreme (9). Sometimes it is needed to give compromise judgments (2; 4; 6; 8). AHP uses reciprocal values (1/9; 1/8; 1/7; 1/6; 1/5; 1/4; 1/3; 1/2) for another pairwise. In the process, a total of $n(n\text{-}1)/2$ judgments are needed and a matrix of pair-wise comparison can be derived. The judgment from all stakeholders (SH1, SH2, SH3, SH4, and SH5) can be measured its consistency $CRA_{ck} = CIA_{ck} = RC_n$. It means a consistency ratio that the higher is the less consistent of the preferences. The priorities of alternatives

can be calculated if the value of consistency ratio is 10% or less. The results of the judgment are presented on Table 1.

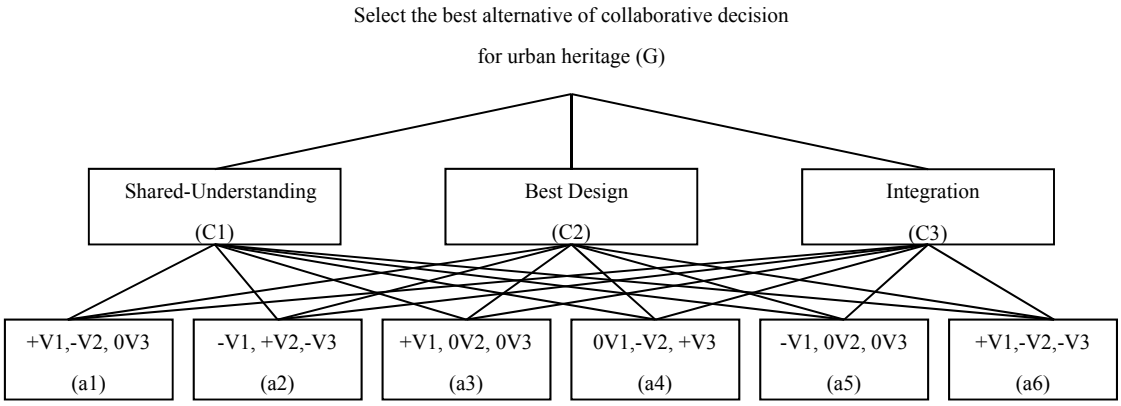

Figure 2. The decision hierarchy

Table 1. Alternatives rank for each stakeholder

	Stakeholder (SH)1	Alternatives					
	weighting criteria	a1	a2	a3	a4	a5	a6
C1	0.709338	0.19317	0.01682	0.12153	0.140868	0.04625	0.1907
C2	0.21409	0.011466	0.111578	0.035296	0.012102	0.031202	0.012445
C3	0.076572	0.011234	0.002546	0.011606	0.037743	0.010022	0.003421
	SH1 alternatives	0.21587	0.130944	0.168433	0.190713	0.087474	0.206566
		1st	5th	4th	3rd	6th	2nd
	SH 2	Alternatives					
	weighting criteria	a1	a2	a3	a4	a5	a6
C1	0.231614	0.063074	0.005492	0.039682	0.045996	0.015102	0.062267
C2	0.071855	0.003848	0.037449	0.011846	0.004062	0.010472	0.004177
C3	0.696531	0.10219	0.023156	0.105575	0.343326	0.091167	0.031118
	SH2 alternatives	0.169113	0.066097	0.157104	0.393384	0.116741	0.097562
		2nd	6th	3rd	1st	4th	5th
	SH 3	Alternatives					
	weighting criteria	a1	a2	a3	a4	a5	a6
C1	0.083308	0.022687	0.001975	0.014273	0.016544	0.005432	0.022397
C2	0.723506	0.038749	0.377073	0.119283	0.040898	0.105444	0.042059
C3	0.193186	0.028343	0.006422	0.029282	0.095223	0.025286	0.008631
	SH3 alternatives	0.089779	0.385471	0.162837	0.152665	0.136162	0.073086
		5th	1st	2nd	3rd	4th	6th
	SH 4	Alternatives					
	weighting criteria	a1	a2	a3	a4	a5	a6
C1	0.348304	0.094852	0.008259	0.059675	0.06917	0.02271	0.093639
C2	0.148449	0.007951	0.077368	0.024474	0.008391	0.021635	0.00863
C3	0.503247	0.073833	0.01673	0.076279	0.248054	0.065869	0.022483
	SH4 alternatives	0.176635	0.102357	0.160427	0.325616	0.110214	0.124751
		2nd	6th	3rd	1st	5th	4th
	SH 5	Alternatives					
	weighting criteria	a1	a2	a3	a4	a5	a6
C1	0.167946	0.045736	0.003982	0.028774	0.033352	0.01095	0.045151
C2	0.080673	0.004321	0.042045	0.0133	0.00456	0.011757	0.00469
C3	0.75138	0.110237	0.024979	0.113889	0.370361	0.098346	0.033568
	SH5 alternatives	0.160294	0.071007	0.155963	0.408274	0.121054	0.083409
		2nd	6th	3rd	1st	4th	5th

3.3 Third step: Collaborative Process

Decision support is the interactive communication to facilitate a distributed search process. It can be used to effectively coordinate the behavior of stakeholder. This group decision is involving Five Stakeholders by giving their own preference. There are two approaches that used to develop of theorems relating to the negotiation process which are informal theory and formal theory Kraus (2001). The difference among those two approaches is the first attempts to identify possible strategies, while the second is attempts to construct formal models of negotiation. Stakeholders present different side of preference. Nevertheless the protocol of collaboration in this group decision was developed as a cooperative environment (Idrus & Utomo, 2010).

In this system, collaborative consists in an exchange of proposals between Stakeholders (Utomo et al, 2009a). The SH *i* propose its alternative to SH *j*. Agreement options need three stages to be determined, which are; weighting factor of criteria for each decision-maker; grade of alternative for each evaluation criteria; and score of every decision-maker for alternative that the most preferred alternative. With the respect to the goal this alternative is immediately accepted. If not, SH *j* tries to change the preference order of alternatives by adjusting judgments in pairwise comparison matrixes. If the proposal is not accepted, it will send a counter-proposal. The decision will be stopped, when an alternative is approved unanimously. The Stakeholder preferences of the evaluation criteria can be changed in the decision progress. it will change the score of alternative solution, and change of the agreement options (Utomo et al, 2009b).

4. Conclusion

The concept of collaborative-based decision making in the multiple parties' design process of urban heritage development is developed. It is conceptually built by literature review to previous researches on economic, adaptive, and spatial value of urban heritage development. The model is confirmed to five stakeholders by giving their own preferences. It based on three critical values that are the values of economic, adaptive, and spatial. A case study is used to verify the model. The result of verification is based on the goal of the problem "to select the best alternative of collaborative decision for urban heritage" that is addressed by five alternatives as the possible solutions. Each alternative is presenting combination of preference. The agreement option of the Stakeholders is changed in term of membership and size. It is happen in the decision progress and result in changing score, moreover the group decision process will be stopped or deadlock.

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