METHODOLOGICAL ISSUES IN STAKEHOLDER-BASED EVALUATION OF URBAN AND RURAL INFRASTRUCTURE*

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1. Introduction

The past fifty years has witnessed enormous changes in the way that infrastructure has been planned and evaluated. The systems planning approach has remained a dominant methodology with its iterative steps that involve feedback loops between societal values leading to design objectives and assessment criteria. In the early 21st Century, sustainability goals drive the design process, and the assessment of numerous infrastructure alternatives is based on multiple, and often, conflicting attributes of an economic, social and environmental nature. Economic and financial analyses remain an important part of the methodology of the systems approach.

The shift in the evaluation paradigm - from professional judgment (technocratic dominance) to stakeholder (or agent) involvement – has prompted the search for more rigorous assessment tools based on multi-attribute decision making involving plural stakeholders. Multiple-criteria decision making methods require information about the relative importance (weights) of the attributes of each alternative infrastructure proposal, and all borrow their fundamental framework from von Neumann-Morgenstern utility theory. The focus of this paper is methodological issues on deliberative and inclusionary process in the determination of relevant attributes and their weightings by different stakeholders in the evaluation of infrastructure planning. By reviewing the stake-holder approaches as a precautionary methodology for risk and conflict, authors suggest some desirable approaches to infrastructure planning. These are the rural road development planning; and QoL assessment approach, with each study illustrating different methodological issues. The former is a methodology to capture the mutual value of diversified stakeholders; the latter is a comprehensive approach focusing on the end outcomes for citizens.

2. Reviews of previous stakeholder-based approaches and procedures of public participation

(1) Reviews of stakeholder involvement approaches in infrastructure planning

Infrastructure developments have significant economic, environmental and social impacts. During the past forty years changes have taken place in the way the community and other stakeholders are engaged in the public participation stage. The Skeffington Committee report of public participation into the planning process in the UK was largely responsible for opening the way for more participatory decision making that is common today. How the community might be engaged in this exercise was presented in a paper by Sherry Arnstein with the evocative theme of “ladders of participation”, ranging from tokenism at the bottom to shared decision making at the top. Best practice, corporate communication methods by proponents of infrastructure development engage in two-way symmetrical communication strategies with stakeholders (Black, 1998). Visualization is increasingly important in engaging stakeholders, such as the example of Route 26 Project in the Netherlands (Verroen et al., 2004). This approach consists of three stages, a) a preliminary phase, b) an orientation phase, and c) a planning phase. At each stage, tools for visualization are used to develop joint ideas and ambitions for consensus building.

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(2) Constitution of participatory systems

Today, most countries have legal requirements that the community (stakeholders) be involved in the planning process for major developments. In Japan, one of them is called Public Comment. This is the procedure to invite opinions on the alternatives prepared by national/local governments to be utilized for decision making. Sometimes local governments hold public hearings or workshops to explain local people and stakeholders about the proposed infrastructure development plans.

In the Republic of Indonesia, the legal requirement for a road proposal is to have an AMDAL (Analisis Mengenai Dampak Lingkungan), or an Environmental Impact Analysis, that specifies the major impacts of the proposed road on its surrounding environments. The report has also to be accompanied by two plans, namely a RKL (Rencana Pengelolaan Lingkungan), or an environmental management plan, and a RPL (Rencana Pemantauan Lingkungan), or environmental monitoring plan. The community must be consulted before the AMDAL is submitted to the Komisi AMDAL (EIA Commission) at the local office for Environmental Impact Control (BAPPEDAL). Both of Japan's and Indonesia's cases are one-way communication, not bottom-up and inclusive approaches.

Irrespective of the legislation and specific techniques of consultation, ultimately governments must make a determination on whether or not to proceed with the proposal. In addition to conventional economic tools, decisions in many advanced nations are being made against broad sustainability objectives that include economic, environmental and social criteria. An important element in the transparency of project appraisal is to make explicit the values of different stakeholders, and the numerical weights they may attach to the various evaluation criteria, and the difference of framing the problem amongst government representatives, experts, and the community, especially residents.

3. Agent survey – Case study of rural roads development

(1) Overview of Survey

In an attempt to improve urban-rural linkages in the recent de-centralization era, The Republic of Indonesia, with a land area of 1.9 million sq. km, has devoted substantial resources with the goal of connecting 66,000 isolated villages into the road network (local roads make up about 80 per cent of total road length). Research and development by the Indonesian Institute of Road Engineering into multi-attribute decision methods aimed to improve "bottom-up" planning mechanisms, where the Village Self-Reliance Organization under the Act on Village Government(1979) or local Public Works offices, were expected to come up with proposals. Widiantono and Black (1998) provide details of this study, and here only the methodological issues of surveying key stakeholders, the decision attributes and their weightings are presented. Institutional arrangements for the planning and implementation of any infrastructure project is all important in the identification of the agents to get involved – in this case, in rural road appraisal in Indonesia (see Widiantono and Black, 1998, Table 1, p. 852). The target population in the survey design were decision makers who were either directly or indirectly involved in the decision-making process of any kind of rural road project: planners and engineers from national and local government plus private-sector consultants; the executives who make the final decisions or who implement rural or regional development programs (Ministry of Home Affairs or local government engineers); and community representatives who are involved in the lobbying and proposal stage, transport operators, and non-government organizations. The principle is to ensure the agents cover the entire spectrum of stakeholder interests.

The issue of the generality or transferability of agent-based results is especially pertinent given the resource costs of conducting such surveys. One important aim of the research of national significance was to determine whether or not ,in such a diversified geographical country, there was commonality in decision-making criteria, and in the relative weights attached to the various decision-making attributes. Having piloted and refined a self-administered, mail-back questionnaire, the sample size by province (26 in Indonesia with metropolitan Jakarta excluded) and by the three agent groups was determined (n=400; response rate 32%).

(2) Development of Multi-attribute Utility Model

The working hypothesis is that there is no statistical difference between the preferences from one group to another (3 regions of Indonesia; 3 groups; developed and remote areas; and 2 road types – village and *kabupaten*). The statistical tests conducted varied depending on the data obtained from the survey on attributes mentioned, their ranking of attributes and on the weighting of attributes assigned by each respondent – nominal, ordinal or interval (Table 1). No statistically significant differences were found (Widiantono, 1995) which is an important finding that suggested it is possible to propose a general model for any local road project evaluation in Indonesia.

The transferability of a decision model that adds transparency to the decision-making process is desirable. Four

Table 1 : Statistical methods for data analysis

Data	Type	Analysis	Statistical Test
Determining attribute	Nominal	Comparing proportions between various groups	Chi-square test
Ranking	Ordinal	Measuring agreement within groups	Kendell's coefficient of concordance; chi square
Weighting	Interval	Comparing means of weighting between groups of respondents	Analysis of variance

Table 2 : Power of aspects associated for multi-attribute utility model for rural road appraisal in Indonesia

Attribute	Direct Weight	Rank	Weight based on Rank	Combined Power
Economic	0.33	1	0.45	0.39
Technical	0.25	2	0.26	0.26
Socio-political	0.22	3	0.16	0.19
Environmental	0.16	4	0.09	0.12
Remoteness	0.04	5	0.04	0.04

broad appraisal criteria are universally important in rural road planning in Indonesia (except Irian Jaya, where the response rate was too low) - economic, technical, socio-political; and environmental – each decomposed into several more specific sub-attributes (Widiantono and Black, 1998). The relative importance of each, as determined by the survey, is given in Table 2. Remoteness of the area in which the road may be built is the fifth attribute. The ranks shown in Table 2 are transformed into their expected values using a technique suggested by Rietveld (1982), with the combined power derived from the average of both direct and ranked weights. Thus, three slightly different utility models can be constructed from the information in this table. Given input data from real project proposals the model can score each project and provide an overall ranking based on the merits of each proposal.

(3) Identification of commonality of stakeholder's value

Values of diversified respondents are clarified to find the commonality in decision-making criteria. Then, a general multi-attribute utility model is developed. In the process of exploring the commonality, it is important to find the similarity and difference of the value of each stakeholder which will bring the contextual effects. The contextual effects are one of the potential positive effects of a bottom-up, inclusive approach for gathering and deliberation. This is likely to enhance the credibility of the decision-making processes. In addition to contextual effects, there are subjective effects and procedural effects (OECD, 2004). The higher level of involvement and consideration of the diversified value from the starting point of a plan increases the effects and their synergy. Especially, the contextual effects are brought by stakeholders' satisfaction on their contribution to decision making and of trust and understanding amongst them, which, in turn, promotes social capital building and sustainable relations.

4. Comprehensive approach based on QoL concept

(1) Application of QoL concept into decision making

The most important role of urban infrastructure is to enhance people's Quality of Life (QoL). Although QoL is basically a vague and elusive concept for applying decision making, numerous recent attempts have been made to define, measure, and monitor the QoL of places over time using a variety of indicators. Hayashi et al. (2004) and Sugiyama et al. (2005) provide a concept of QoL from the viewpoint of the end outcome for citizens. It consists of five fundamental elements, a) safety and security, b) economic opportunity, c) service and cultural opportunity, d) spatial amenity, and e) environmental benignity. If applied to infrastructure evaluation, the difference of impact by infrastructure development is shown as a positive or negative impact on QoL of residents. The difference in impact on QoL is due to the difference in value. It can be hypothesised that QoL assessment approaches will be more effective in preventing conflict than traditional economic evaluation tools.

(2) Effective application of QoL assessment approach

As a precautionary approach to social appraisal of technological risk, multi-criteria mapping (MCM) is applied to combine openness and qualitative flexibility of participatory deliberations with the clarity and focus of quantitative assessment. It has been applied in the field of agriculture. MCM postulates risk and uncertainty and its criteria vary

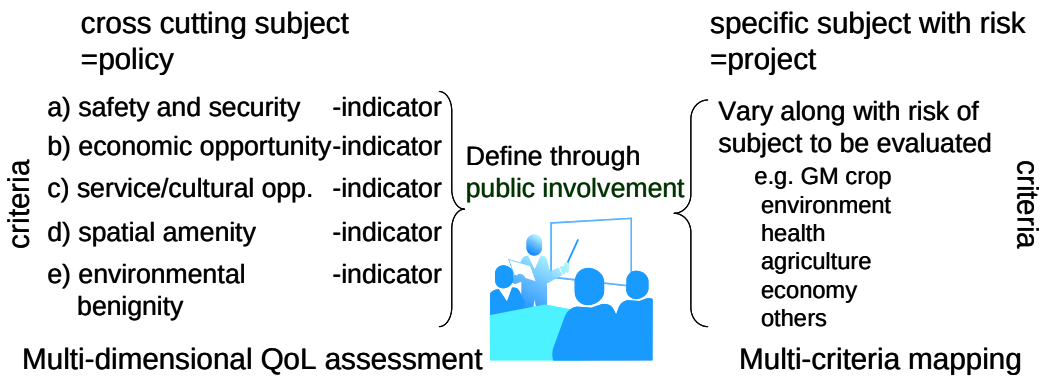

Figure 1 Difference between QoL assessment approach and Multi-criteria mapping

case by case. On the other hand, the QoL assessment approach deals with risk as one component in a multi-dimensional evaluation that consists of the 5 elements mentioned above. Indicators of each of the 5 elements defined through public involvement are case by case. The important distinction in multi-dimensionality of QoL is that it includes a hierarchical structure from personal interests to common and public interests in infrastructure planning. Therefore, QoL assessment approach is the most appropriate for the evaluation of cross-cutting subjects and contributes to prevent conflict. MCM is the most appropriate for specific subjects in which risk is problematic. For these reasons, QoL assessment approaches are to be applied to evaluations at the policy level; MCM at the project level.

5. Conclusion

Economic and financial appraisal remains the cornerstone of infrastructure decision making. But inter- and intra-generational equity requirements raise the importance of distributional issues amongst different segments of the population. Stakeholder-based approaches to the planning, evaluation and decision-making of infrastructure proposals require methods to engage agents and visualize alternatives. This study focused on methodological issues in the determination of relevant attributes of infrastructure and their weightings by different stakeholders. The case study of rural road development clarifies the possibility and process of finding commonality in values among stakeholders. This process increases the transparency and credibility in decision making. QoL assessment approach is suggested as a comprehensive method for evaluation at the policy level by defining 5 elements as end outcomes for citizens.

Development of stakeholder-based approach in other fields, such as radio active waste management or risk management in agriculture, is ahead of infrastructure planning which provides the basic stock for residents. Conflicts among governments and citizens, or among citizens, has never really ceased. In addition, selective investment in infrastructure is necessary in the depopulation era, that Japan is facing now. The development of comprehensive stakeholder-based approaches for infrastructure planning is strongly recommended to secure high QoL for future generations.

References

1) Black J.A. :Policy processes and noise and air quality management plans at Sydney Airport: The value of research into organisational communication strategies, *21st ATRF, Adelaide, September 1997, Papers of the Australasian Transport Research Forum*, Vol. 21, Part 2, pp. 663-676. 1997.
2) Verroen, E. J., et al.:ROUTE 26, a pilot application of a new approach for interactive decision-making in Transport Planning, 10th World Conference on Transport Research, 2004.
3) Rietveld, P: *Multiple Objective Decision Methods and Regional Planning*, North Holland Publishing Company, Amsterdam, 1982.
4) Widiantono, D.: Screening of Rural Road Projects in Indonesia: Application of Multi-attribute Utility Theory, unpublished MEngSc Thesis, School of Civil Engineering, University of New South Wales, 1995.
5) Widiantono, D. and Black, J.: The screening of rural road projects in Indonesia: An analysis of stakeholder decision-making *criteria, Papers of the Australasian Transport Research Forum, Vol. 22, pp.849 – 864, 1998.*
6) *OECD: Stakeholder Involvement Techniques Short Guide and Annotated Bibliography*, OECD, Paris, 2004.
7) Hayashi, Y., Doi K. and Sugiyama, I.:Evaluating infrastructure projects by means of measures of the Quality of Life, *Journal of Infrastructure Planning and Management*, 751/62, pp.55-70., 2004.
8) Sugiyama, I., Kuroda, K., Doi, K., Nakanishi, H. et al.. A rating system for realizing sustainable urban space with a focus on quality of life and quality of space, The 2005 World Sustainable Building Conference in Tokyo, pp.3708-3715, 2005.
9) Stirling, A. and Mayer, S.: A precautionary approach to technology appraisal? –A multi-criteria mapping of genetic modification in UK agriculture, TA-Datenbank-Nachrichten, Nr.3,9. 2000.