A FRAMEWORK FOR EVALUATION OF THE TRANSPORTATION IMPROVEMENT PROJECTS

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Summary: *A comprehensive evaluation framework for prioritizing transportation projects is presented. The proposed model first provides an in-depth analysis of factors that influence the performance of a transportation service, and then employs AHP to integrate all measures. The model evaluates the technical, economic, social, and environmental aspects and examines the problem quantitatively and qualitatively. The model is well-organized and practical, complementing the popular benefit/cost analysis. It is applicable to other decision-making levels, where policy and allocation issues are to be addressed.*

1. Introduction

This research was motivated by the problem encountered in Ningbo, an important harbor city in southeast China. Ningbo has a population of 7 million. Its metropolitan area stretches 9,365 square kilometers, including three municipalities, three counties, and five districts. After a decade of construction, the current transportation capacity remains insufficient in meeting the city's rapid growth and increasing demand. The municipal government is requesting proposals for transportation improvement. The objectives here are to improve the transportation facilities, reduce congestion, and meet increasing demand. It is important to develop common evaluation measures across different projects to compare the transportation networks from a system perspective, rather than from jurisdictional locus. In this paper we present an evaluation framework to aid the understanding of the alternatives, so that the pertinent criteria can be identified, priorities set, and alternatives compared.

The proposed framework consists of road, railway, river, air and pipe transport and their interactions. It evaluates the project's influence on economy, society, technology, and environment. When an influence can be measured, a quantitative method is applied. If impacts cannot be enumerated, a qualitative procedure is employed. The technology, economy, environment, and society modules provide the foundation for the evaluation framework.

2. Technical Evaluation

The four technical assessing models are described below.
<u>Path Density Model</u> It describes how close or dense the paths are. It demonstrates the scope and concentration of the transportation network, and is defined as the length of path per unit area.
<u>Connection Degree Model</u> It describes the state of the connection among different sites in a transportation network. The bigger the connection degree is, the easier one can travel from one city to another.
<u>Saturation Degree Model</u> Saturation degree describes how crowded a transportation network is. It is the ratio of the total traffic demand to the total traffic capacity. The bigger the ratio, the more congested the road, and the less the demand can be satisfactorily met.

Load Homogeneous Degree Model Load homogeneous degree describes the saturation differences among different paths. It is a natural extension of the saturation degree model. The smaller it is, the more comparable the road loads are to each other

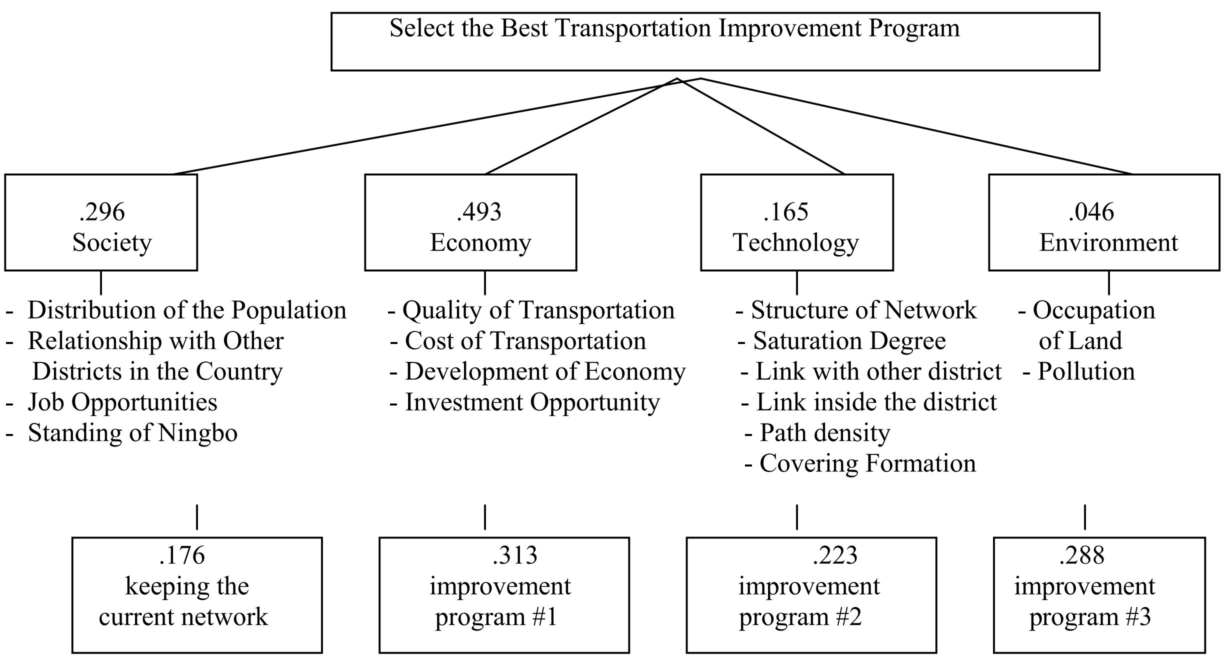
3. Economic Evaluation

The costs of transporting goods and service in the network can be calculated as: Total Cost = $C_1 + C_2 + C_3 + C_4$, where C_1=cost of operating vehicle, C_2=cost of vehicle time, C_3= cost of traveler time, and C_4 = cost of goods transportation time. After a new network is built, the speed of the vehicles will increase so that the transport cost and the time cost will be reduced. To calculate the cost improvement between the current and the new network, one uses transportation cost of the current network minus the transportation cost of the new network.

4. An Integrated Evaluation Approach

A transportation program exerts its influence not only on economy and technology, but also on society and the environment. Valuing the societal, psychological, and environmental consequences in common units represents a serious challenge. Their impacts tend to be subjective and less susceptible to quantitative analysis. Strategies and procedures for coping with these criteria are needed. An AHP Model is chosen to assess the alternatives. Its hierarchy is shown below.

A Hierarchy for Assessing the Transit Improvement Program



5. Summary and Conclusion

The proposed model integrates quantitative data with subjective judgments and is simple in construct and adaptable to both groups and individuals. It is useful for decision-making in different levels of government or administration and in many geographic areas. It is flexible and capable of integrating "islands of analysis" into one unified framework. We believe it is an effective decision-making aid for project prioritization.