EVALUATION OF TRANSPORTATION SYSTEM IMPROVEMENT PROJECTS: ASSESSMENT OF IMPACT ON LAND-USE AND POPULATION WELFARE

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Introduction

Transportation system improvement projects have potentiality to affect in several levels and intensities population welfare. Besides, these projects and actions spend a large amount of financial resources, which an inadequate use may carry the public finances to serious consequences. In this sense, such kind of public actions should be based on an efficient evaluation methodology. Therefore, decision makers need to be provided for a set of understandable information and parameters to judge which project or alternative is more adequate to achieve societies' goals and objectives.

This paper presents a brief description of our research conducted with objective to evaluate impacts caused by transportation projects in Toyohashi city – Aichi prefecture – and their ripple effect, having as main topic an analysis of how changes on accessibility and attractiveness could affect land value and population welfare, building a model to the assessment of interaction among market agents (i.e. households, firms, landlords and government) based on their utility maximization behavior

Effects of Transportation Project

The first and important step in project evaluation process is the assessment of impacts. Figure 1 shows a scheme of ripple effect from transportation market to land use and activity patterns changes. Considering, for instance, a construction of a new road, it would affect directly the trip patterns for users (i.e. transportation demand and network flow), causing instability until reach the system equilibrium once again (i.e. congestion interaction). We'll consider impacts rose until this stage as *Direct Impacts*. As an intermediate effect, changes on Accessibility and Attractiveness might appear as result of transportation patterns' changes described above, besides environmental impacts caused by changes in traffic flow and project construction itself. Impacts caused by ripple effect from this stage will be called *Indirect Impacts*. Firstly, households try to improve their utility (e.g. income saving, time saving, etc.) and firms improve their profit (e.g. reduction of production costs), causing demand-supply instability in land market. Consequently, landlords try to increase their gains by rental or land selling. These land market agents will interact each other until the achievement of a new land value pattern (i.e. location externality). Secondly, economical impacts will appear as a consequence of productivity increase. The computation of merits and/or demerits of project implementation will be analyzed through these economical impacts. Some authors, like Hidano (1997), focus changes on land value to assess project impacts, considering in last analysis the transfer of benefit from resident or firms to landlords. However, our research will consider land value as a factor in the process of Land Use patterns' dynamics. Thirdly, changes on population characteristics and number of firms would occur as a result of interactions with external areas. Consequently, land market will be affected with demand increase. Therefore, land use pattern, socio-economical pattern, and demographical characteristics will interact each other until the achievement of a state of equilibrium, i.e. define location of households and firms, and their activities patterns (e.g. OD patterns). Finally, a general equilibrium in system as a whole should be achieved.

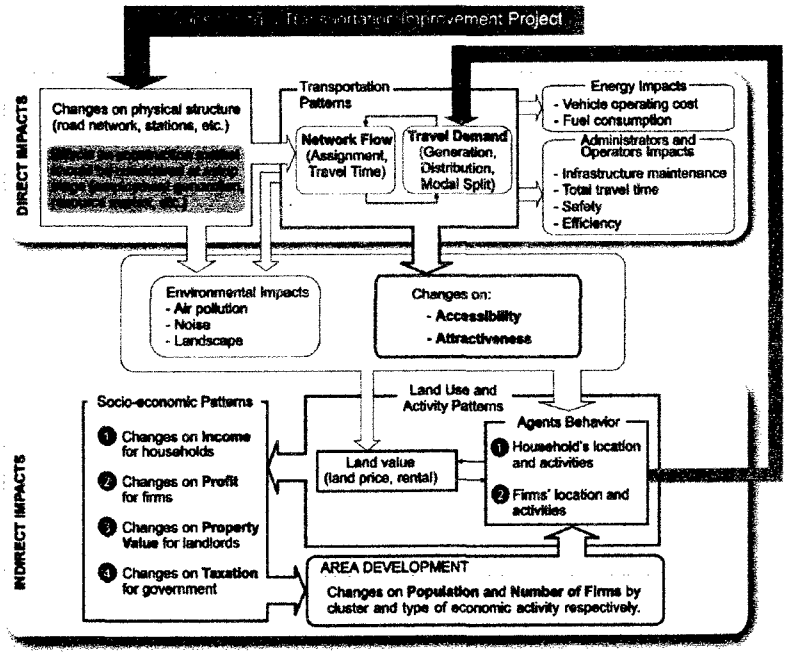

Fig. 1 – Ripple Effect of Transportation Project

Accessibility/Attractiveness and Land use/Activity Patterns Interaction Model

The assessment of accessibility and attractiveness will be conducted in 100m meshes scale. Therefore, as part of our research, we have developed a methodology to breakdown data available for zones to meshes, defining the weight to each mesh according to land occupation and land use. Figure 2 shows the result of population breakdown that presented a good approximation to actual land occupation patterns. However, as showed in figure 3, the results presented in the breakdown of workers' number reveal the necessity to calibrate the weight used for industrial and commercial zones. Index of accessibility for each mesh will be takes in function of: distance to access transit system (i.e. nearest station and nearest bus stop); distance to workplaces; distance to leisure areas; distance to hospitals; and distance to shopping centers. In the same way, meshes' index of attractiveness will be reached through measures of distance to nearest station, nearest parking lot, residential areas, and density of units with same activity characteristics. In both cases, distances will be measured in terms of trip time to achieve each destination. Based on these indexes, summed to environmental parameters; and regarding the utility required by income level for households, profit for firms, and property value increase for landlords; market equilibrium on land price must be reached. Land price database was computed in GIS software, with location of data collection according to land use, and their respective land price variation since 1975 until 2002 (Figure 4).

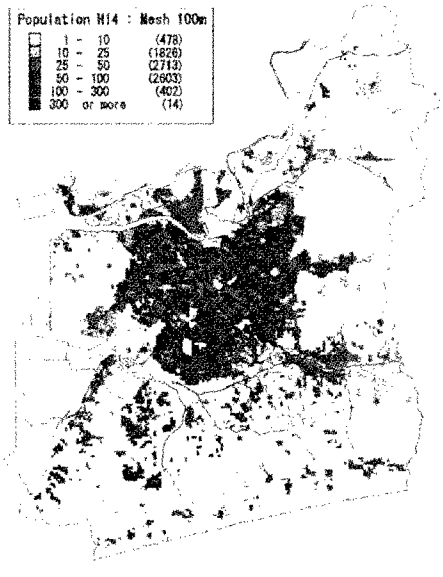

Fig. 2 – Population by 100m meshes

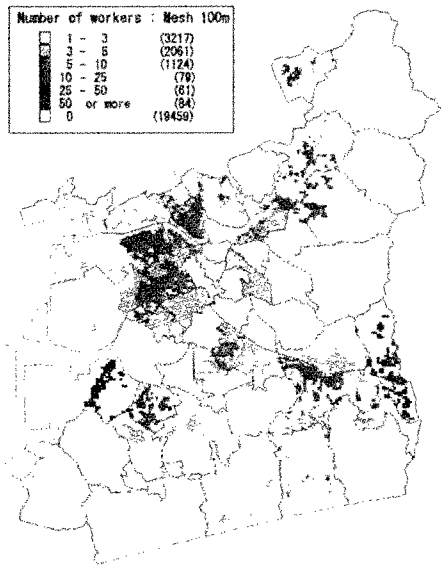

Fig. 3 – Number of workers by 100m meshes

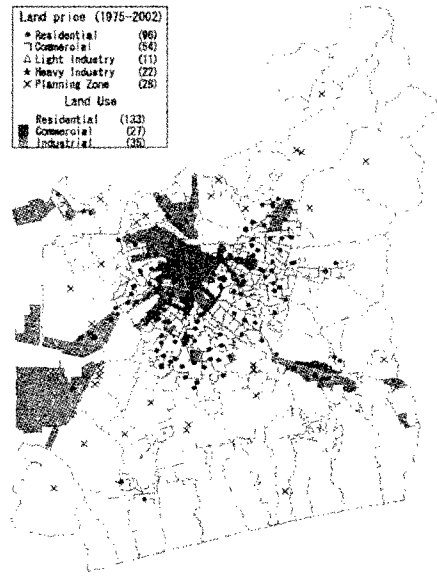

Fig. 4 – Land price collection points

Conclusion

After conclusion of the analysis presented above, we expert to explain in a clear manner the mechanism and intensity of relations among involved factors, defining the most appropriate model form to evaluate ripple effect, and define and calibrate its parameters. Furthermore, observing the outputs generated after reach an equilibrium state inner transportation, land use/activity, and inter-regional markets, and among them, we'll evaluate the general benefit and cost relation of Transportation improvement projects.

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Reference

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