NO REGRET LAND-USE AND TRANSPORT STRATEGIES TO MEET FUTURE STAGES OF ECONOMIC DEVELOPMENT, URBANIZATION, AND AUTOMOBILIZATION

Yoshitsugu Hayashi

INTRODUCTION

Population, traffic congestion, and air pollution continue to increase, disturbing the growth dynamics in developing countries. Everything happens very rapidly in an expanding economy. Accordingly, the boundary conditions change year by year. In contrast, Japan, with its near stagnant economy, is starting to be saturated. What is required is to shift the paradigm from massive construction of transport infrastructure to an efficient use of it. This has also been experienced by West European countries, except the change has been too rapid. China's population is expected to decline rapidly — as projected for Japan — because of the country's one child policy. In this way, the stages of economic development of different countries definitely change.

Despite wide variations in culture and history in different countries, and also despite different land-use and transport arrangements, there are clearly common underlying mechanisms in urbanization (and the resulting urban form), "automobilization", the environment and financial situations that manifest themselves according to the stage of economic development. It is therefore important to examine what has occurred with the phenomena of the environment and finance, and the interaction between land-use and transport in other countries.

This article examines the causes of problems which have occurred in land-use and transport in developed and developing countries and then advances a mechanism to derive a common theory. First, it relates automobilization to the stages of economic development, then urbanization to the stages of economic development. The article then goes on to explain transport as a determinant of urban form before introducing urban form as a determining factor in urban sustainability. This then allows strategies towards sustainable land-use transport in the countries with different stages of economic development to be set formulated.

STAGES OF ECONOMIC DEVELOPMENT AND AUTOMOBILIZATION

Stages of Economic Development
In the nineteenth and twentieth centuries, the UK and the Western European countries were the first to fully industrialize. Then came the US and Japan, and the developing countries
are now in the process of modernizing their economies. Japan grew the fastest during the latter half of the twentieth century. But it has already saturated its economy and population began to decline around 2005 and continues to decline at a higher rate than ever before (see figure 1).

Figure 1. Population Forecasts for Europe, the US, and Japan

![Population Graph]


### Progressive Car Ownership Resulting from Income Growth

It is found that car ownership increases as income grows, as shown in figure 2. This figure represents the time serial changes in income-car ownership relations. Up to an income level of US$5,000 per capita, car ownership increases similarly in every city. However, levels will shift differently beyond US$5,000 even though the income levels will be the same. Average car ownership in Tokyo is much lower than in Nagoya because Tokyo has a much longer railway network while Nagoya has networks of wider streets without serious traffic congestion. London has shifted to much higher levels after the US$ 5,000 threshold than Tokyo and Nagoya because the level of rail service is much lower, despite the existence of longer networks than those of Japanese cities, particularly in centre-suburb connections. This means that car ownership shifts differently depending upon the comparative superiority of the service level of the road system to that of railways. Bangkok, having no urban rail transit system until 2001, looks to be exceeding the car ownership levels of Tokyo and Nagoya, and approaching those of London. Beijing looks likely to follow Bangkok.

Because the effect of railways and that of cars on road traffic bottlenecks and suburbanization are quite different, we need a clearer definition of motorization. Namely, we should call the phenomenon of increasing car ownership and usage of cars as “automobilization” rather than simply calling it motorization which means development of all motorized transport, including rail transit systems.
Figure 2. Increasing Car Ownership Due to Income Growth


Causes of Bottlenecks in Roads

Bottlenecks are created not only by local concentrations of traffic due to bad traffic management but also by travel demands within the urban area and from suburban areas which exceed the road capacity. A comparison between Tokyo and Seoul would provide a good example. Seoul is a more compact city than Tokyo, having a population of 9.9 million in an area of 606km² in 2000 while Tokyo has 8.33 million people in 621km². In addition, Seoul has expanded an underground railway network very rapidly since 1974 resulting in a total length of 280km which almost equal to Tokyo’s 286km in 2001. But Seoul faces far more serious road congestion than Tokyo. Why is this so? It is because Tokyo has an adequate suburban rail network, which is connected to the urban underground network with through-operations that assure commuters from the suburbs seamless travel directly to the business centres. The majority of commuters use railways. Seoul has a markedly inferior suburban rail network which makes inflowing commuters choose to use their cars.

STAGES OF ECONOMIC DEVELOPMENT AND URBANIZATION

Product Cycle and Urbanization Stages

There are four stages of urbanization according to economic development stages,⁶ as illustrated in figure 3.

Stage 1: Urbanization. As secondary and tertiary industries grow in the cities, people migrate from the rural areas to urban areas to seek higher incomes, and in this way “urbanization” begins. During this stage, the income level of the country is low and the city is competitive only in secondary industries because of lower labour costs. Many Asian

⁶ Regional Development Dialogue, Vol. 27, No. 1, Spring 2006
developing countries remain at this stage.

**Stage 2: Suburbanization.** As more people migrate into urban areas, middle-class people move to the suburbs to avoid the deteriorating environment in the inner cities. For example, Japanese cities began a suburbanization process in the late 1950s and Bangkok began in the 1980s, when the national economies recorded their highest growth rates, at a time when their secondary industries were very competitive.

**Stage 3: De-urbanization.** As income grows, the competitiveness of secondary industries diminishes due to higher labour costs in production. Accordingly, these factories, mainly located in inner-city areas, are closed. At this stage, there is not much difference in income levels between cities and rural areas. Therefore, the one-way migration from rural to urban areas stops, though outer migration of people still continues. Then, the inner-city loses higher-income population and there remains a comparatively poor class of people who are sometimes unemployed and therefore cannot pay high rents. This will make the house-owners less likely to properly maintain the houses, which further creates typical inner-city problems, such as psychological depression and even crime. This is called "urban decay" in the UK.

**Stage 4: Reurbanization.** To regain the population in inner-city areas, governments have conducted schemes for their regeneration, such as slum clearance and construction of high quality houses. One of the typical examples is the London Docklands renewal project. The UK faced serious economic recession during the late 1970s due to the loss of its industrial base to other countries, for example, its motor industry was largely lost to Japan. The British Government introduced to the inner areas of big cities "Enterprise Zones" that gave the locating firms privileges of exemptions of rates (a kind of landownership tax) and easier planning permission, lessening the economic burden. At the same time, the government constructed high quality housing. Through these efforts the Docklands attracted such
tertiary industries as the Guardian newspaper company, and numerous printing and publishing companies by the mid-1980s. The process was helped by the recovery of the national economy in the early 1990s and the area has started to gain population once more. This is "reurbanization" which has been achieved in London by promoting a new type of production cycle and regentrification of housing, after a 10-year depressed period.

Changes in Life-style and Perception of Quality of Life Due to Income Growth and Space Demand
As income grows, people's life-styles change. In general, household size becomes smaller and as nuclear families increase, the required floor space will also increase. This places pressure on the need for suburbanization. At the same time, people tend to allocate more time to a variety of social activities, as shown in figure 4. This places more pressure on floor space demand and suburbanization.

Figure 4. Change in Time Allocation due to Economic Development

Source: DETR, "Towards an Urban Renaissance," (Urban Task Force, 1999); Hayashi and Sugiyama, "Dual Strategies for the Environmental and Financial Goals of Sustainable Cities".

More specifically, this can be explained by the shift of weight between the factors determining quality of life (QOL). Here, the author defines QOL as a composition of five factors: employment and income opportunity; cultural life opportunity; amenity of life; security and safety; and environmental sustainability, as shown in figure 5. In the early stage of economic development, people's interests are mainly in employment and income, as seen in the phenomenon of urbanization where people migrate from farming regions to cities to seek higher-income employment. But as incomes grow, people tend to have interests in other fields such as culture, amenity, security, and then environmental sustainability. Such a shift in perception of QOL progresses together with the surface physical phenomena associated with the progression of urbanization stages. This is the real cause for increasing demand for space.
Figure 5. Factors determining Quality of Life

<table>
<thead>
<tr>
<th>Evaluation Axes</th>
<th>Indicators</th>
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<tbody>
<tr>
<td>Economic Opportunity</td>
<td>Discretionary Income</td>
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<td></td>
<td>Transmission of Information</td>
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<td></td>
<td>Regional Unemployment Rate</td>
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<td>Service Opportunity</td>
<td>Number of department stores</td>
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<td></td>
<td>Number of advanced hospitals</td>
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<td></td>
<td>Number of day trip spots</td>
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<td>Number of universities</td>
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<tr>
<td>Amenity</td>
<td>Living Space</td>
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<td></td>
<td>Non Binding Hours</td>
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<td></td>
<td>Green Space(1)</td>
</tr>
<tr>
<td>Safe and Security</td>
<td>Number of Traffic Accidents</td>
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<tr>
<td></td>
<td>Number of Fire Disasters</td>
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<td></td>
<td>Number of C-line</td>
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<tr>
<td>Environmental Burden</td>
<td>Urban Area Per 1car</td>
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<td></td>
<td>Recycling Waste Rate</td>
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<td></td>
<td>Green Space(2)</td>
</tr>
</tbody>
</table>

Source: Hayashi and Sugiyama, “Dual Strategies for the Environmental and Financial Goals of Sustainable Cities.”

NETWORKING OF TRANSPORT AS A DETERMINING FACTOR OF URBAN FORM

Comparing Changes in Urban Form among Metropolises: London, Tokyo, Nagoya, and Bangkok

Figure 6 shows the processes of suburbanization in four metropolises represented by their built-up areas. In 1910, London had the largest built-up area of the four. After 55 years, Tokyo had expanded its territory linearly along railways. Nagoya consisted of several separate agglomerations, while Bangkok was still small. During the next 20 years until 1985, Tokyo had spread two dimensionally into the areas between the railways. Also, Bangkok had grown nearly ten times bigger by sprawling in a dispersed manner, also in two dimensions. Nagoya had lost the gaps in built-up areas. These phenomena had all been caused by increased use of automobiles. We learn from this comparison the obviously different effects of railways and roads on urban form - namely the way of using land resources.

Negative Feedback between Automobilization and Suburbanization

As seen in figure 7, the urban areas dependent upon road systems have suburbanized in an inefficient way, at lower densities. Those households that own cars have the freedom to live away from railway stations. The households that have moved to the suburbs must have cars to ensure the mobility of family members for commuting, shopping, and everything else.

Level of Railway Service as Determining Factor of Pattern of Suburbanization

Tokyo and Osaka are the only two exceptions in the world that had a good rail network system when the cities began to grow rapidly. They still maintain high standards of railway service.
system efficiency. This combined system of maintenance and operation has made the two cities expand linearly.

**URBAN FORM AS A DETERMINING FACTOR OF URBAN SUSTAINABILITY**

**Future Maintenance Cost of Spread-out Built-up Areas**

The cost of transport systems such as railways and roads resides not only in their construction cost but also in the maintenance cost of land incurred by the transport system. Because of this, the future potential costs are very different between railways and roads. In Nagoya, the average construction cost of a 1 km-length of two-lane road is about US$ 5 million while the annual budget for public works per km² is about US$ 5 million. If we assume a 1 km section of road may create a new built-up area of 1 km² on both sides,
US$ 10 million is necessary to maintain the newly-created built-up area. In reality, as the area of urban sprawl is far more than 2 km², we can imagine how much the external cost of road construction will be, particularly in the case of radial roads which connect the city centre with the suburbs.

**Difference in Traffic Volume and Environment Due to the Compact Urban Form**

To understand the difference in traffic volume and the emissions from traffic due to compactness of urban land use, an assessment of the effects of reconcentration was conducted in Nagoya. A land-use transport model system (a modified version of CALUTAS) is used for simulation. In 2000, only 70,000 inhabitants, 3 per cent of total population of the city’s 2.2 million people live in the central area (see figure 8).

**Figure 8. Population Landscape of Nagoya in 1995**

- Total Population: 2.17 million
- Central Business District: 73,000
- Rail Interchanges: 302,000

**Figure 9. Population Landscape of Nagoya in 2020 (CBD reconcentration case)**

- Total Population: 2.17 million
- Central Business District: 215,000 (X3)
Comparing the two cases: (a) BAU in 2020; and (b) migrating the suburban population to central areas so as to increase the population to 10 per cent of the total population (see figure 9). Case (b) can reduce the total traffic volume to 211 million vehicle-km, which is 41 per cent lower than case (a) at 359 million vehicle-km (compare figures 10 and 11). Likewise, the total amount of NOx is reduced to 36 per cent as shown in figure 12. These are the results of concentration of population, considering locational interactions between different business/commercial activities and inhabitants.

STRATEGIES FOR SUSTAINABLE CITIES

Land Legal System to Realise the Potential Benefits Created by Urban Space

In setting land-use transport strategies, to realise the potential maximum benefit is important. In this respect, Sun Wen’s theory of equal to use land gives a useful fundamental concept. The theory consists of two main principles and six processes. The first principal is to utilize the land to make the maximum profit; the second principle is to share the profit among all citizens. The six processes are as follows: (a) taking the timing of governance shift from military to civilian control; (b) to establish land cadastre system before industrialisation; (c) to induce a self-declaration of land values by landowners; (d) to tax exponentially to the total value of owned land (by land value tax); (e) to give the right of compulsory purchase to the local government at the owner-declared price; and (f) to return the capital gains to the public (by land capital gain tax).

This is an excellent system of urban space management introducing competition among landowners by giving incentives to utilize the owned land to pay for the land value and land capital gain taxes.

A Combined Strategy Seeking Economic Agglomeration Effects, Quality-assured Residential Areas, and Maintenance Cost Minimization of Urban Space

In Sun Wen’s days there was very little car traffic congestion on urban roads. Therefore, the theory considered neither transport (and its related energy consumption and environmental burdens) nor quality of housing. Therefore, I would propose to promote in parallel the following three theories: (a) Sun Wen’s competitive system which always changes the economic player to the one most appropriate for the proceeding stage of development on the basis of the ability to pay the land price/rent; (b) social capitalization of buildings to assure the quality of inner-city residential areas; and (c) de-suburbanization, namely provision of incentives to migrate from suburbs to inner-city areas to minimize the total cost of maintenance of urban areas.
Figure 10. Distribution of Traffic Volume in 2020 (BAU case)

Figure 11. Distribution of Traffic Volume in 2020 (CBD Re-concentration case)
CONCLUDING STATEMENTS

To summarize the main points of this article, the following key messages are emphasized:

1. Land use-transport strategies must be carefully prepared by governments which must anticipate and consider the coming stages of economic development.

2. The rate of increasing car ownership will be different depending on the comparative superiority of service of railways to that of roads.

3. Seamlessness in rail transport, in terms of both network shape and through-operations from suburbs to the centre, is one of the crucial factors for bottleneck congestion in inner cities.

4. Understanding the relationships between product cycle and urbanization stages is essential for foreseeing the future economic conditions and space demand.

5. Changes in life-style and perception of QOL influence space demand, which tend to push suburbanization if QOL in inner-city areas is low.

6. We should learn from policy failures that have caused extremely serious road traffic congestions and air pollution damages in developing mega-cities, such as Bangkok, where urban railway systems have been neglected.

7. The external cost of roads is considerably higher than that of railways because a much bigger sprawl must be serviced by infrastructure in the future.

8. Compact city can reduce considerably road traffic volume and also emissions from transport, according to a simulation conducted in Nagoya.

9. It is important to improve urban railway systems to supply a basic capacity for urban travel demand to avoid excess automobilization.

10. Strategies to attract people to live in inner-city areas by combining Sun Wen's equal to use land theory, social capitalization of buildings and de-suburbanization are recommended to meet the stages of economic development and to control urbanization.
and automobilization with a minimum of regret.

NOTES
* The author is deeply indebted to John Black, a Japan Society for the Promotion of Science (JSPS) Invitation Fellow to Nagoya University (2003-2004) for his invaluable comments on the article.
1/ L. H. Klasser (1981). (incomplete citation)

ADDITIONAL REFERENCES
Yoshitsugu Hayashi’s article has a provoking title which arouses the reader’s curiosity, “No Regret Land-Use and Transport Strategies to Meet Future Stages of Economic Development, Urbanization, and Automobilization”. The article elaborates on the challenge of how to understand processes of urbanization and how to confront the problematic issue of urban sprawl and its close relationship to personal mobility issues. Interestingly enough, Hayashi starts from the supposition that economic growth and the overwhelming momentum of the car culture reshapes urban form and promotes it’s delinkage from goals of sustainable development. According to the author “[t]he article explains transport as a determinant of urban form, then introduces urban form as a determining factor in urban sustainability.”

The idea presented in Hayashi’s article has great merit in that it deals with complex issues and seemingly irreversible trends. Moreover the role of rail-based transport systems in dense urban areas and their environmental benefits are presented as one way of improving access while reducing the emissions of CO₂. The author states that ordinary roads are very expensive whereas rail in a long-term perspective is less expensive and more environmentally friendly. Another important merit is that he focuses not only on urban form and its influence on traffic development but also on the management of environmental issues. This is a particularly important point.

Reading this part of the article, however, I wished there had been additional information about the way in which sustainable urbanization is defined in relation to the elevated consumer-oriented life-style of which automobility today is a pillar. Related to the problems of the western life-style and extensive car-driving is also the predicted energy crisis in transport leading to probable changes in urban trip patterns. This is not commented on but these observations would have strengthened Hayashi’s argument about the superiority of rail in urban transport compared to unrestrained automobility.

The author calls for a clearer definition of motorization and I do agree with him since such a definition will shed light on the social and economic roles of private cars. Knowing more about the societal character of mass motorization on the one hand and mass automobility on the other will be most helpful when it comes to finding measures to regulate it. Looking in the rear-view mirror, it is clear that politicians did not take the opportunity to manage mass automobility at the right time. The car and road system is today a self re-enforced large-scale technological system that has attracted important support from a number of institutions, both public and private, and today’s failure to control the effects of
mass automobility is a fact.

In this article, economic development seems to be a “black box” and is dealt with only at aggregated levels. Therefore the reader would benefit from some elaborations regarding the user’s perspective as well as the consequences of socioeconomic relations on transport and sustainability. We do know that raised levels of income have a bearing on the growing length of person/km as well as on the increase in square metres for living space. For instance, in European cities, these trends seem to be part of the modern life-style independent of whether there is a car in the household or not. Although higher incomes often lead to more cars and increased travelling, the intricate relations between income, car use, and life-styles are still not well researched. The travel patterns of the various age and income groups develop differently. Whereas high-income women tend to travel in the same way as high-income men, this is not the case for middle-income women. Some of the findings have shown that in urban areas middle-income women make trips to other destinations than men and often use different means of transport than men do. When it comes to travel habits the cultural and economic conditions have an important bearing and therefore the generic wisdom can only be complementary to the local findings. During certain conditions the age, sex, and social roles have an important influence. If these trends of the various socioeconomic groups also prevail in the future, they will have an impact on emissions as well as on economic growth. One of the hypotheses in Hayashi’s article is that economic development will decline in the future due to demographic reduction. This might very well be the case but further information about the effects of the restructuring of business and social change would be needed in order to understand the impact that this reduction would have on the demand for transport and the ensuing emissions.

The analysis is well taken and therefore while reading this the reader should also be told more about the methodology behind the selection of theoretical concepts and empirical cases. The empirical part of the study consists of three Asian cities and one European city. What was the reason behind the selection of these four cases? All of them have been, and still are, important “motors” in regional economic development and have grown rapidly during recent years. But the cultural and socioeconomic relations differ substantially among the empirical cases. The same can be said about the political order and urban governance during the selected time span of 1910-1985.

Having come so far there are some formal and other comments to be made:

Firstly, references are made to a number of affiliated researchers. This commentator would like to know more about this research area and therefore references to other researchers outside of Japan using other western or developing cities as cases would be helpful. In the article, source material is surprisingly short.

Secondly, the choice of theory is not motivated or discussed.

Thirdly, according to the author urban development has a certain pattern of impoverishment at a given time in the history of a city. Assuredly this is not so for all kinds of cities. The development of Stockholm, Rome, and Paris represents an alternative development to the one described in referring to Asian cities.

Summarizing my impressions of Hayashi’s interesting article I would add the following. Some hypotheses are presented and discussed and economic growth is presented as one such unproblematic but dominating aspect in urban development. The impression from reading the article is that the role of economic growth on urban design is taken for granted.
and leading to an "inefficient suburbanization". The article does not contest the current socially constructed views on traditional mainstream economic development. Having read the article this commentator would like to have become wiser regarding the important concept of "urban sustainability" because this notion is not discussed in any depth.

The article talks about managing transport changes by means of increasing rail-based transport but there are also other means that can be applied. The car culture is a socio-economic and modern product that could be given another character. Over time, mass automobility has been taken for granted and achieved tremendous momentum globally. But the role of the car can be changed and car-driving can be actively controlled. Additionally, individual travelling by other private operators in collective vehicles, by public buses and so on has not been explored at all in this article.

The politics of transport is handled very differently in cities in various regions. The choice of means of transport is governed differently in different political contexts and it would therefore be interesting to have had some additional empirical cases presenting other ways of political leadership, urban governance, and increasing sustainable transport. Towards the end of the article a discussion on generic ways of handling urban development as well as more local ways would have been interesting to follow. From the perspectives of leadership and processes of implementation the findings of Hayashi would be crucial. Does urban governance have the political capacity or will to reverse the impoverishing urban processes?

The declaring of land value by landowners would work well in some countries but less well in others. Meanwhile, taxing exponentially to the total value of owned land (by land value tax) might be more problematic. The idea of giving the right of compulsory purchase to the local government at owner-declared prices presupposes strong political will as well as healthy municipality finances. The return of the capital gains to the public by means of the land capital gains tax requires a legitimate leadership and political capacity. It is an attractive idea but difficult to carry out in practice.

As for exploring these issues further, the next step would be to open up the black boxes of urban economics and individual urban travelling and continue the analysis beyond aggregated levels. In order to leave the general level and explore the local and specific urban contexts more examples from different kinds of urban areas and urban governance are required. In doing this it will also be possible to bring in civil society and social change regarding employment, working hours, professions, and gender-biased activities as well as leisure activities. The micro level in this case represented by the households needs to be analysed in order to have a proper understanding of urban mobility needs. All these aspects have a bearing on residential preferences as well as trip patterns and therefore provide important information in the making of models and future scenarios regarding urbanization and automobility.

The article finishes by saying that there is no regret — this mainstream trend is seen as irreversible — in case it is not controlled. Urban sprawl producing dependence on the use of private cars cannot be made sustainable. The role of private automobility in development needs to be redefined together with the traditional and socially-constructed ways of sustaining economic growth. This article is one of the best illustrations stressing the influence of mass automobility on urban design since the publication of *All That Is Solid Melts into Air: Experience of Modernity* by Marshall Berman, published in 1983.
COMMENT

Pannapa Herabat

The article “No Regret Land Use and Transport Strategies to Meet Future Stages of Economic Development, Urbanization, and Automobilization” provides an interesting discussion on the advantages and disadvantages of different transportation strategies and the effects on overall economic development. Different stages of urbanization are discussed in order to provide a complete picture of economic development and urbanization. The author, Yoshitsugu Hayashi, uses several examples to illustrate the impact of economic growth and its accompanying automobilization; for example, the increases in car ownership due to income growth. It is interesting to see how the article relates some of the transportation strategies such as rail network expansion to economic growth and population density in a compact city area.

The discussions on the “Networking of Transport as a Determining Factor of Urban Form” are particularly illuminating. This section identifies the potential causes of the problems and presents the effect of negative feedback from automobilization at different stages of urbanization.

The author focuses his discussion at the beginning of the article on the potential causes of economic development and economic growth and introduces a section on “Difference in Traffic Volume and Environment due to Compactness of City” which gives readers a brief overview on how the compactness of a city would impact the population landscape and the distribution of traffic volume. However, detailed discussion on the software used by the author does not provide sufficient information for readers to follow what type of impact was felt in Nagoya in 1995. Additional information on the city might have helped readers understand this concept. The comparison of the traffic volume distribution in 2020 for Nagoya is also demonstrated. It raises an interesting point as to how much well-planned transport strategies would affect the changes in the economic development of such a large city. The author also uses NOx emissions as one of the indicators to link the traffic volume distribution and how the city’s growth would affect the overall environment and population density. It can be clearly seen that the effect on the environment could be enormous.

The author bases his discussion for the transport strategies with the Sun Wen “theory of equal to use land” which consists of two main parts: (a) the maximization of the profit from land use; and (b) profit-sharing among all citizens. The author links these basic concepts and applies them to real problems, discussed above. Key messages are presented in the article to address transport strategies and land-use issues, the importance of the policy-making process, the relationship between product cycle and urbanization stages,
and others.

It can be seen that successful planning can enhance not only the economic development process, but also the quality of life for all citizens. It should be possible to further extend this article to address the issues in sustainable transportation. Indicators could be used to signify what are the actual problems that the city is currently facing or how successful the city becomes. Some strategies presented by the author could be combined to successfully develop sustainable transportation and balance different stages of urbanization and automobilization.