

## **The structure of wider-regional sharing of the social infrastructure element<sup>1</sup>**

### **Daisuke Nakamura**

The International Centre for the Study of East Asian Development, Kitakyushu (ICSEAD),  
11-4 Otemachi, Kokurakita, Kitakyushu, 803-0814, Japan, +81 93 583 6202, fax +81 93  
583 4202

**Email:** nakamura@icsead.or.jp

**Abstract** There are two types of regional development elements those are namely economic and social terms. While both developed and developing countries initially need to establish regional economic infrastructure, the next concern should be given to the social infrastructure. In local areas, the presence of sufficient social infrastructure may hold regional population which is the essential condition for a self-sustained regional economic system. In this paper, a consideration is given to the roles played by public sector for coordinating wider-regional sharing of the social infrastructure element. The analysis limits the scope to reveal the fundamental relationship between the wider-regional sharing and the economies of scale. The outcome also addresses potential issues on consumer accessibility by the integration of economic activity among different neighbour regions.

**JEL Classification:** D62, H71, O18, R58

**Key Words:** Regional infrastructure development, economies of scale; self-sustained regional policy

## **1 INTRODUCTION**

For regional development policy, there are two types of infrastructure elements and these

---

<sup>1</sup> This paper is presented at the 51th European Congress of the Regional Science Association International (ERSA) at Barcelona, Spain in August 2011. The preliminary research has been conducted under the ICSEAD Research Project 2011/12.

are namely economic and social infrastructure elements (Nakamura, 2011). The former is directly related to productions or producers, while the latter can be relevant to consumptions or households. As investigated by Rostow (1956), economic growth in a country has several stages of development. During the process of economic growth, the principal objective of the central government is to coordinate economic infrastructure development across the nation. When the economic development reaches at a mature stage, the impact of effects in economic infrastructure investment on the national economic growth gradually declines.

Also, the heavy consideration to the economic infrastructure brings an insufficient social infrastructure development. An enhancement of the social infrastructure element can be mandatory for sustainable regional economy, since this type of infrastructure development directly reflects the convenience of living within that region. Such elements include, for instance, availabilities of better educational, medical, cultural and landscape attainments. Without these arrangements, local consumers as residents would prefer to move away from that region in the long run. The decay of local population may cause centrifugal force of the regional economic activity through insufficient opportunities of the economies of scale. As revealed by Glaeser et al. (2001), it is important not only to be convenient for the producer but also to be attractive for households for sustainable regional development and growth. The latter case is referred to consumption amenities which include lower transportation costs in cities according to their investigations.

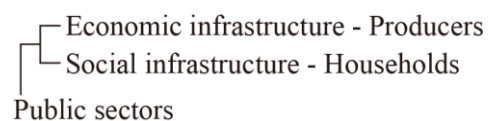
The main purpose of this paper is to examine a situation where local population level is not enough to maintain the economies of scale with respect to the social

infrastructure element. The outcome shows that interregional cooperative behaviour may be able to solve such problems. In the following section, a hypothetical spatial model is built within the framework of central-place theory. A case study is then given to the case of population declining developed countries, and finally, policy implication is provided with the description of the limitation of scope of the analysis in terms of the trade-off interaction between efficiency and equity in spatial terms.

## 2 THE MODEL

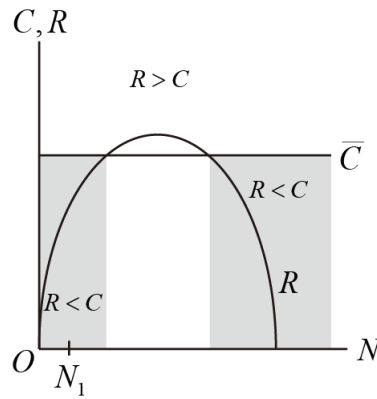
Three types of economic agents are considered in this analysis; namely, producers, households and public sectors. First, producers engage processes of goods or provide services which are consumed within the region. Secondly, households consume regional goods and services as well as supply labour force to the local producer. Finally, public sectors provide necessary services which are not available within the market mechanism. The principal objective of the region is assumed to sustain the long-run regional economic development and growth.

As revealed by Nakamura (2011), the elements of economic and social infrastructure are respectively related to producers and households within a region. Also, these are arranged by public sectors whenever it is necessary as illustrated in Fig. 1.



**Fig. 1 Economic and social infrastructure elements with public sectors**

The economic and social infrastructure elements need to be invested in a well-balanced proportion so that the much securer long-run sustainable regional economy is attained. However, social infrastructure element tends to be unable to absorb costs in small-scale regions due to insufficient economies of scale. The situation is illustrated in Fig. 2 where a representative region has a population level at  $\bar{N}$ . Here, the constant cost level  $\bar{C}$  exceeds the revenue curve  $R$ .



**Fig. 2 Social infrastructure and the economies of scale**

A small size of the region implies that there is no huge distance to the neighbour regions. If the same situation is faced at these neighbour regions, it may be possible to establish a sharable social infrastructure element in a single region within that area.

The shared behaviour can utilize the economies of scale as expressed in the following equations.

$$\max R - C < \frac{n(R - C)}{n^{1-b}} \quad (1)$$

$$\text{s.t.} \quad m = TrC > 0 \quad (2)$$

where  $R$  = revenue,  $C$  = cost,  $n$  = the number of regions,  $b$  ( $0 < b < 1$ ) = the extent of economies of scale,  $m$  = constraint and  $TrC$  = interregional transportation costs. The equations imply that regional revenue increases as the wider-regional cooperation works through the improvement of the economies of scale. As the index  $b$  increases, the economies of scale approach to the optimal level.

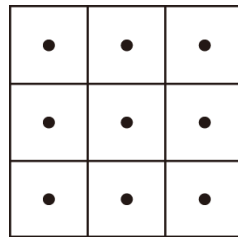
However, there is also a trade-off relationship between the wider-regional cooperation and the interregional accessibility. This can be referred to the conventional location theory term in Weber (1909 [1928]) as the trade-off interaction between agglomeration economies and transportation costs. Isard (1956: 176-182) explained a negotiation behaviour between three neighbour producers to agglomerate in a single location using the critical isodapanes methods. If the negotiation is for social infrastructure elements, the subject is replaced by the regional government instead of representative private firms.

### **3 HYPOTHETICAL ANALYSIS**

There is a little concern to the interregional economic growth on the discussion of public policy. This may be caused by the reason that each region is assumed to provide sufficient services such as public libraries, higher-education facilities and advanced medical centres. However, such arrangement cannot be fully-utilized in local regions, while the core region owns various highly-qualified services. One of the main differences between the core and local regions is the density of demand. There are two ways for enhancing local regions;

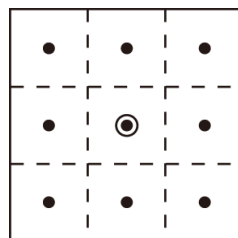
namely, either normalising national population distribution or forming wider-regional cooperative structures. In this paper, the focus is solely limited to the wider-regional cooperative perspective for sustainable regional economic growth, and a concern is given to specify the required elements to achieve such alternative interregional structures.

Applying the fundamental model framework that is provided in the previous section, the following square spatial configuration is considered in Fig. 3.



**Fig. 3 Independent regional management**

This situation reflects the left-hand side of equation (1) where 9 regions own individual social infrastructure element and each region faces diseconomies of scale due to insufficient intraregional demand level. The alternative situation as the right-hand side of the equation can be illustrated in Fig. 4.



**Fig. 4 An integrated centre**

The single-centre form provides sufficient economies of scale and the index  $b$  may be closer to 1. However, this configuration also needs an improvement of interregional accessibility improvement as stated by expression (2). The dashed lines in the figure imply that interregional transportation network is enhanced in order to ease access to the central region from different neighbour regions.

#### **4 POLICY IMPLICATIONS**

In the previous sections, the social infrastructure development as a wider-regional coordination is examined in terms of economies of scale and interregional accessibility. It can be particularly important to consider the wider-regional social infrastructure coordination for developed nations those which observe constant national population declines with aging issues. If the national population decrease is predicted, the spatial integration of economic activities may be unavoidable to consider for efficiency and cost-reduction purposes. However, there is a potential issue with respect to equity in spatial economy.

It can be argued that the improvement of interregional transportation network may solve the problem of accessibility for integrated services. However, there should be a certain number of consumers those who have difficulty to travel long distance. If a clinic is only located at the central region as a result of efficiency evaluation, older people those who live at non-central regions have to attempt frequent day-return trip to the central region for the convenience of consumers. Under such circumstance, the clinic should situate

every region. By contrast, if a large concert hall is constructed in every small region, it may be unrealistic to sustain under the condition where the economies of scale do not work enough.

While conventional central-place theory, particularly market-area analysis, solely takes into account of mill price, distance and the demand conditions, the structure of market area also varies depend on the bulkiness of travel. Since market-area analysis uses f.o.b. transportation costs as a measurement of distance, transportation costs should be put certain weight of bulkiness. Hence, the conventional expression of f.o.b. price  $f(p+t) \cdot t$  in Lösch (1944 [1954]: 107) should be replaced by  $f(p+t) \cdot tk$ . Here,  $p$  = mill price,  $t$  = transportation cost,  $k$  ( $0 < k < 1$ ) = bulkiness of transportation.

## 5 AN EXTENSION

The bulkiness of interregional transportation has discussed in the precious section. The related examination was attempted by Nakamura (2010) as the term of spatial consumer exclusion. In order to reduce spatial consumer exclusion with sustaining efficiency of operation in social infrastructure elements, it can be suggested to employ the notion of hierarchical spatial structure in the central-place system. Namely, the following scenario may be considered. There are two types of group of goods and services; normal and luxury goods and services. First, normal goods and services are such as supermarket, day care service, clinic, general hospital, community centre and park. Others may be a large concert hall, specialized medical centre, international museum, science park and airport, which are categorized as the luxury goods and services.



This partition enables the spatial configuration to form two layer systems. For normal goods and services, an arrangement of lower-central hierarchy is required in order to maintain space-filling community-based structures. For luxury goods and services, by contrast, the central integrated system can be preferred to organize for the purpose of regional sustainability enhancing interregional coordination and cooperation. In this way, two-layer system may increase the efficiency as well as reduce the inequity to provide goods and services in local areas.

## **6 CONCLUDING COMMENTS**

This paper has examined an alternative spatial formation for the sustainable regional economic sustainability in local small-scale areas, examining the following three criteria. First, social infrastructure elements as mandatory facilities for local population sustainability need to be shared among several different neighbour regions, if each region has insufficient economies of scale in population term. Secondly, there is a trade-off relationship between the wider-regional cooperation and the interregional accessibility as an interpretation of agglomeration economies and transportation costs. Finally, an efficient spatial rearrangement may cause spatial consumer exclusion due to the necessity of additional interregional access. Under these situations, two-layer structure of the central-place system is considered as an extensional discussion. While these are beyond the scope of this paper, it should be left as further avenues of research to solve social-welfare issues in spatial terms.

*References*

Glaeser, E. L., Kolko, J., and Saiz, A. (2001) "Consumer city", *Journal of Economic Geography*, 1:27-50

Isard, W. (1956) *Location and Space-Economy*, M.I.T. Press, Cambridge, Massachusetts

Lösch, A. (1944 [1954]) *Die räumliche Ordnung der Wirtschaft*, Jena, Germany: Fischer, 1944 (2<sup>nd</sup> edn). English translation by W. H. Woglom and W. F. Stolper, *The Economics of Location*, Yale University Press, New Haven

Nakamura, D. (2010) "Spatial competition and consumer exclusion: social welfare perspectives in central-place system", *Letters in Spatial and Resource Sciences*, 3/3: 101-110

Nakamura, D. (2011) "Sustainable issues of economic growth in developed countries: regional infrastructure and social welfare", *Conference Proceedings of the 50<sup>th</sup> Annual Meeting of Western Regional Science Association*

Rostow, W. W. (1956) "The take-off into self-sustained growth", *Economic Journal*, 66/261: 25-48

Weber, A. (1909) *Über den Standort der Industrien*, Tübingen. Translated and edited by C. J. Friedrich as *Alfred Weber's Theory of the Location of Industries*: Chicago, 1928