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DYNAMISM IN INDUSTRIAL LOCATION

—LOCATION THEORY REVISITED—

by

*K. Ramachandran***ABSTRACT**

Industrial location theory is broadly based on the economic arguments of optimum location, according to which firms locate where profits are maximised. It is now noticed that when infrastructure develops along with economic development, economic factors such as transport, raw materials and market become less critical; simultaneously, non-economic factors such as pleasant environment gain in importance. This shift in the relative importance of location factors according to changes in the level of economic development is called 'Location Dynamics'. This concept is developed in this paper, and the influence of industrial structure on it briefly discussed. Evidence collected from literature and a survey of small scale enterprises in the United Kingdom, Japan and India support the validity of the concept. Some of the implications of location dynamics on regional development policies are also discussed in this paper.

The theoretical literature on industrial location is broadly based on the economic arguments of optimum location. However, of late, many of the economic factors such as transport, raw materials, market and labour have begun to show a tendency to become less critical, freeing industries to become increasingly foot loose, especially in advanced countries. Simultaneously, the industrial structure of these countries has undergone rapid changes, a direct result of which is the shift in emphasis from some of the classical location factors to new factors. These emerging factors are non-economic and include a better environment, living conditions, entertainment facilities and stable political conditions. This dynamism in location factors is a function of the total 'development continuum' of the society.

In this paper, the major theories of industrial location, supported by some empirical research findings, are reviewed and a theoretical model to explain the process of the shifting significance of industrial location factors is developed. It can be called the "theory of location dynamics". Finally, the significance of this model in the context of regional development policies is discussed.

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1. Location Dynamics

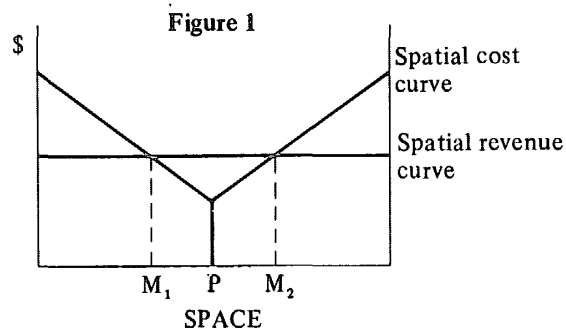
The central argument of this paper is that the importance of factors that influence industrial location decision varies not only from industry to industry, but also over time, showing a dynamism in location factors.

Early theoretical explanations of the industrial location process, starting with Alfred Weber (1928), tried to identify the least cost location factors. George Renner (1947, p.169) identified the major location factors as proximity to raw material, market, labour, power, transportation and capital, the relative importance of each of the factors, depending upon the characteristics of the industry. This concentration on the supply side arguments of least input cost functions continued until August Lösch (1954, p.29) filled the vacuum of demand analysis by introducing the concept of revenue to the existing theory. Thus came the idea that industry would be located where profits are maximised. There are obvious limitations of quantifying different characteristics of the demand side, and these weaken the practical applications of Lösch's arguments.

One of the important assumptions made in all the location theories is that the advantages in the supply of certain factors and the demand for output determine industrial location. The question to be raised here is what happens to the classical location factors when the supply of the input factors is reasonably developed, considerably removing spatial disadvantages. What criteria are applied to select a location when the economic input factors are equally developed, and there is no difference between any two locations?

The question about location becomes all the more important in the context of behaviourist location theories. Simon (1959, p.277) argued that the rational, profit maximising behaviour assumed of location decision makers is far from the reality. Luttrell's (1962) study of the movement of manufacturing industries in the UK brought ample evidence to support this argument. He noted (p.78) that it was so because the search was for a suitable location rather than an assessment of comparative operating costs and other factors at several possible locations. Peter Townroe (1971) found that a majority of companies do not evaluate locations on explicit cost grounds, rather the financial assessment comes after locational choice. Accordingly, the non-routine nature of site selection process and the lack of personal experience lead to imperfect decision making. In such circumstances, the decision maker chooses the first location that comes upto his aspiration level.

With the help of a spatial cost analysis, David Smith (1971, p.183) explained the proposition of the behaviourist school. In Figure 1, space or distance is shown on the X-axis and cost/revenue on the Y-axis. The spatial cost curve represents the total cost input at different locations, and the horizontal spatial revenue curve represents the



uniform nature of revenue wherever the business is located. Costs are the lowest at point P. In cases such as this business would be profitable on any point of location between the points M_1 and M_2 , with the maximum profit at P where the distance between the cost and revenue curves is the maximum. It could be said that the business would generate profit so long as it is located somewhere between M_1 and M_2 (the area of profit). Townroe's (1971) study shows that in such cases the location need not always be at the maximum profit point P in Figure 1. As entrepreneurs are pleased to employ the 'principles of least effort', a satisfactory location could be any point between M_1 and M_2 . Accordingly, entrepreneurs are very often 'satisficers' and not 'optimisers' (Simon 1959, p.277).

It is hypothesised in this paper that non-economic factors heavily influence industrial location decisions when two conditions are satisfied:

- (1) when economic factors are satisfactorily developed, and hence
- (2) a wide range of locations are to be found within the space of profitability (between M_1 and M_2 in Figure 1) of investment.

In these circumstances, empirical evidence suggests that many industrialists (both small and large) choose locations not only because of their economic attractions, but also for their social advantages. In a large number of cases, decisions have tilted in favour of locations offering non-economic factors such as a pleasant environment, beautiful living conditions, attractive countryside and political stability (see for example. Keeble, D and Gould, A, (1986). An explanation for this shift in factor importance is attempted next.

2. *Structural Changes*

The growing importance of non-economic location factors is a result of the structural changes on both the demand and supply sides of location analysis.

It should be noted that location factors are important when their supply is constrained and as a result, their costs rise both directly and indirectly. Some of these constraints are exemplified by undeveloped or underdeveloped infrastructure, shortages in the supply of skilled labour, and limited market size. Consequently, the cumulative effects of the indirect incremental costs arising out of excess stock, reduced market information, and other uncertainties and the direct incremental transport costs could be considerable. What happens when the constraints are significantly reduced or removed altogether? Improvements in transportation through a network of road, rail and air services, along with better infrastructure in other allied areas such as communication and power supply have effectively removed many of the constraints to industrial location in more developed countries. Decentralisation of industries to some extent in advanced countries such as the UK was made possible by the removal of the constraints to transport and communication; industry in general becomes mobile (Smith 1971, p.493). Indeed, W. F. Lutrell (1962, p.78) noted that something like two-thirds of British manufacturing industry could operate successfully in any of the main regions of the country.

It is argued in this paper that with the removal of economic constraints, at least partially, non-economic factors become important in the location decision process.

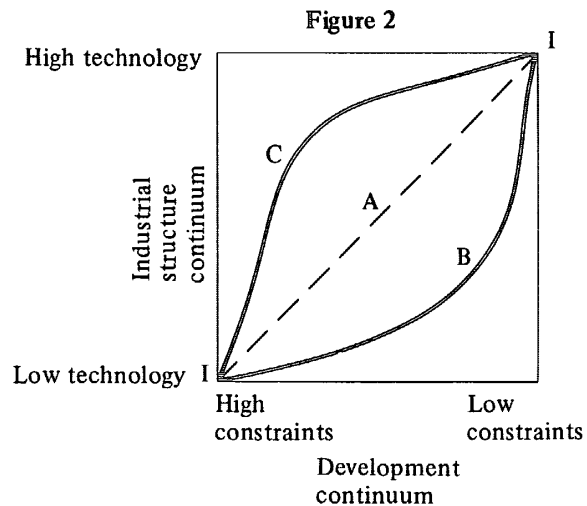
This transposition in factor importance in favour of non-economic factors is noticed in economically advanced societies. Thus, factors that were of secondary importance earlier are of primary importance now in these economies. It cannot be because of decreasing importance of economic factors in the absolute sense that non-economic factors become important; rather, the change is possible in the relative importance attached to factors that create constraints. This results in a dynamism in location factors.

Changes on the demand side bring the dynamism in industrial location into a new focus. Studies in industrial structure suggest that industries in advanced economies are dominated by the so called 'late industries'* , such as electrical and non-electrical machinery, metal products, transport equipment, paper and plastics. Many of these industries are, in general, capital intensive and foot loose; consequently, the demand for input factors such as transport, raw materials and labour is undergoing drastic changes in advanced economies. By contrast, the demand for input factors remains the same in developing countries having the 'early' and 'middle' industries (as per Chenery and Taylor).

The relationship between the changing industrial structure and the declining importance of the classical location factors is explained here with the help of Figure 2.

The level of economic development of countries is shown as a continuum on the horizontal axis with two extreme points of high level of constraints and low level of constraints. On the vertical axis is shown the industrial structure continuum represented by low technology at the bottom and high technology at the top. It is argued that initially, all countries have high constraints and a low level of technology (for example, many countries in Africa are currently at or near this phase). At the other end, when constraints are low and the country is at a high level of development, the level of technology also will be high (for example, the USA is near this phase). The ideal path that any country would like to follow is the course of the diagonal straight line IAI, because this would balance the developments in technology with the process of constraints removal, assuring the best use of resources and quickest returns.

However, most countries are likely to follow the path IBI in Figure 2 wherein there are three main phases: first, the constraints are high and technology low and backward;



* Chenery and Taylor (1968, pp. 409-15) distinguished between industries in terms of the relative changes in income elasticities that occurred as income rose. They considered the per capita income at which each industry makes its main contribution to the growth of manufacturing sector. Accordingly, 'early industries' meet essential demands in poor countries, 'middle industries' contribute the maximum at intermediate levels, and 'late industries' take over as the most rapidly expanding form of manufacturing activity in advanced countries.

second, constraints are removed to some extent but the technology is still not developed; and finally, the constraints are removed to a great extent and technology is better developed. However, reaching the final phase of low constraints and high technology is not easy. Since international competitiveness has been changing rapidly, countries very often slip behind, for instance, in terms of technological leadership.

Many Western European countries are trying to adjust and recapture technological competitiveness from other countries including Japan and the USA (Ballance and Sinclair 1983, chapters 1 and 5). This would affect the level of constraints because of the circular relationship between technology, competitiveness, economic growth and infrastructure. Therefore, reaching a point of low-constraints and high technology, if not impossible, is at least difficult to realise. Countries taking the path ICI will have another phase wherein the high technology (possibly imported) will co-exist with high constraints. This is an unstable equilibrium position because high technology cannot survive and grow when constraints are high; for instance, computer application in countries with unreliable power supply, and sophisticated cars in poor countries without good roads.

The deviation of curve IBI from the ideal straight line IAI should be the minimum for faster economic development. In other words, it appears that the coefficient of this deviation can be used to derive the factor productivity in any country, although no such attempt has been made here.

Apart from its own importance in development economics, the above model is significant in location dynamics. In the course of a gradual switch over from a stage of high constraints and low technology to a stage of low constraints and high technology, location factors tend to be dynamic due to changes on both the supply side by way of constraints removal and on the demand side by way of industrial structural changes. The movement from basic economic factors to non-economic factors of industrial location during this transformation is called 'location dynamics'. This shift in factor weighting is a function of economic development. In other words, as economies develop, non-economic factors become important location factors.

3. Development Continuum and Location Dynamics

The relationship between location dynamics and economic development is examined here. The concept of a 'development continuum' is defined here as the continuous movement of all countries from a state of underdevelopment to that of development, by removing constraints. In practice, however, it is observed that countries move back and forth on this continuum, according to changing economic fortunes.

The drop in the relative importance of economic factors simultaneous with a rise in that of non-economic factors when economies develop is illustrated in Figure 3. When development continues further, the supply of some of the non-economic factors such as pollution-free atmosphere and clubs and parks are likely to rise in all places. The supply of other non-economic factors such as pleasant environment, and attractive countryside, however, cannot be changed. Therefore variations in the availability of these factors come to be valued much more highly by firm location decision-makers. The concept of

location dynamics is similar to the hierarchy of needs theory of Maslow (1954). He argued that employee motivation has to consider the hierarchical nature of the needs to be satisfied, starting from the basic physiological needs and reaching the need for self-actualisation. The shift in emphasis from economic factors to non-economic factors can be compared to the hierarchy of needs.

It is to be emphasised here that this model is likely to be more important in the case of completely foot loose industries than completely resource based industries such as steel manufacturing using coal. A firm is foot loose if its location is not determined by the supply of any of the classical location factors. Thus, in advanced countries, the relative importance of factors such as infrastructure, supply of skilled labour and proximity to market and raw materials is on the decline. The growing efficiency in transportation and the increasing possibilities of factor substitution make industry increasingly foot loose (Economic Commission for Europe 1967, p.34).

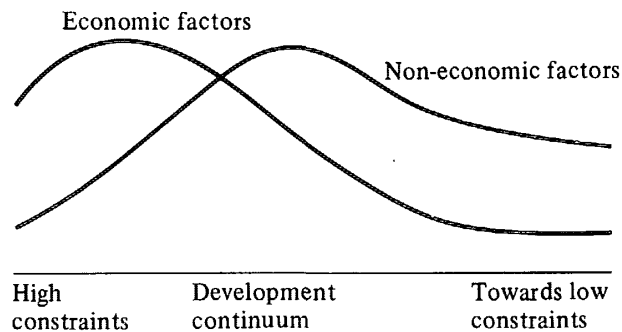
When the supply of economic factors is satisfactory, entrepreneurs look for the supply of non-economic factors. However, if the industry is tied to a location by one of the economic factors, say a high percentage of value added by transport cost to the value of coal, it may not be economically viable to give priority to the supply of non-economic factors in the coal based industry's location. Thus, a 'new' high technology electronic industry is more foot loose (and so can consider non-economic location factors), than an 'old' industry such as steel manufacturing.

Between large and small industries, the former is generally likely to be more foot loose mainly because of scale advantages. For instance, large business has better access to the facilities of large scale mass transport (Economic Commission for Europe 1967, p.25). Also, unlike small firms, large firms tend to be less dependent on one individual, and so are more foot loose. As mentioned above, this cannot be generalised across industries. The argument that small firms are increasingly becoming foot loose is important in the context of regional development. The nature of incentives should be formulated considering the extent to which firms are foot loose.

4. *Some Evidence*

An attempt is made here to provide some empirical support to the theoretical arguments made so far. The validity of the model on location dynamics is tested by analysing the data collected from small manufacturing firms in the UK, Japan and India. Other evidence come from small and large firms in the UK and elsewhere. Thus, the purpose

Figure 3



is to pool some evidence together, and a modest attempt is made to demonstrate the general relevance of the model.

Data were collected from 42 firms in the UK, 35 each in Japan and India, employing between 5 and 50 people and belonging to different industries classified as 'footloose'. The importance of location factors to small manufacturing firms in the UK, Japan and India as represented by weighted average ranks is shown in Table 1. The three factors that were ranked the most important were weighted by factors of 3, 2 and 1 to arrive at their average ranks. The existence of an industrial estate is considered to be one of the most important factors, partly because all the samples were drawn from estates and partly because they offer external economies, and reduce project implementation time for businessmen.

Table 1 Important Location Factors

Factors	UK	Japan	India
Proximity to raw materials	1.3	4.7	1.3
Proximity to market	5.3*	6.0*	4.3
Supply of skilled labour	3.0	1.0	0.5
Infrastructure	2.7	7.5**	6.2**
Industrial estate	10.3***	8.3***	6.2**
Other government incentives	8.2**	1.5	2.8
Home/own business proximity	4.2	2.2	9.3***
Social facilities	2.0	—	0.3
Pleasant environment	3.0	3.7	—
Industrial unrest	0.3	—	0.8
Others	1.0	—	2.5

(weighted average ranking: 3 for first rank, 2 for second rank and 1 for third rank)

*** Most important

** Second most important

* Third most important

Infrastructure such as transport, power and water facilities is not an important factor for the UK firms, while it is important in Japan and India. It was, however, realised during this author's personal visits to the respondent firms that the supply of infrastructure such as transport, communication, power and water in Japan is comparable with those in the UK. So, why infrastructure is a highly important factor to Japanese firms need to be examined. The Japanese industrial estates studied here were formed as cooperative ventures by the entrepreneurs. They were involved in the process of creating infrastructure as well. They decided to locate these estates in their present premises on the promise that the government would simultaneously create the necessary transport,

communication and other facilities. It could be because of the simultaneous nature of these two activities that infrastructure supply was an important factor in their location decision.

In the UK, industrial estates and infrastructure were created in advance for firms to locate and so none of the UK respondents have experienced a situation of undeveloped infrastructure. Respondents in the UK said that with the development of a network of motorways, transport is no longer a problem to industrial location. Similarly, power, water and communication facilities are available satisfactorily. In other words, the constraints caused by these infrastructural factors have been removed to a great extent so as to make them considerably less important in industrial location decisions.

In India, physical infrastructure is not yet adequately developed and constraints remain, making factors such as transport, power, water and communication important. Another factor of importance in India, but not in the UK and Japan is proximity to home/own business. This is partly for economic reasons such as difficulties in transport and communication, cost of relocation, imperfect information about a new place, and difficulties in simultaneously selling and buying/building residential and living premises at two different places. There are socio-cultural reasons such as attachment to native place, and social status also.

A pleasant environment is ranked the fifth in both the UK and Japan, but the last in India. This trend could be because of changing factor importance from economic factors to non-economic factors in advanced economies with developed infrastructure, and continuing importance of economic factors in under developed economies. The changing nature of infrastructure and pleasant environment as location factors supports the arguments of location dynamics in the case of small firms. Evidence collected from other research supports the findings of the three-country study.

Keeble and Gould (1986) provide interesting comparison of entrepreneur migration pattern in Great Britain. Referring to various studies, they noted that about 10-20 percent of entrepreneurs presently operating in Manchester-Merseyside, Northern England and East Midland migrated to these regions as active or potential entrepreneurs. But studies on entrepreneurship by them in East Anglia and by C.M. Mason in Hampshire (referred to by Keeble and Gould) have shown that the corresponding figures for these regions are 56 percent and 46 percent. The region's attraction for residential environment is rated as the most important reason for this migration pattern in East Anglia.

Keeble and Gould go on to report that national population migration surveys have shown that job related variables such as unemployment and earnings level fail to account for the migration pattern; rather the quality of life is a more important factor. They concluded (p.208) that "it would seem probable that this (pleasant environment) consideration has been of greater significance in increasing the pool of potential entrepreneurs in East Anglia – and hence firm formation rates – than is the case in the more urbanised areas of northern England, Manchester-Merseyside, the East Midlands or Scotland."

David Keeble (1976, p.83) provides additional evidence. Increasing affluence and living standards coupled with longer holidays and short work days all push up the demand

for attractive environment. For instance, referring to an Industrial Location Advisory Group study covering over 600 firms he has noted that good amenities and environment were reported as a factor in location choice more frequently (70 per cent of firms) than was the case with any other factor except labour availability (92 per cent).

Another survey in 1981-82 in the Swansea Enterprise Zone showed that the desire for improved environment was a factor of minor importance to 12 of the 27 respondents and of major importance to none. (Bromley and Morgan, 1985, p.411). As against this, it was found in another survey that in the period 1976-80 it was of major importance to one firm and of minor importance to another of the 17 firms surveyed then. Although environmental factor is not a factor of major importance yet, the survey clearly sets the trend; it indicates the gradually increasing importance of non-economic factors.

It appears that the promotional agencies have begun to recognise the shift in importance from economic factors to non-economic factors. Recently this author undertook a survey of publicity campaign publications of various industrial promotion agencies in the UK; it showed that non-economic factors are considered as a highly important location factor. The publicity literature of 10 promotion agencies spread all over the UK was studied, and all agencies without exception, have prominently mentioned the supply of non-economic factors as an attraction of their regions, apart from economic factors such as infrastructure. (It should be noted that this survey suffers from the weaknesses of simple random sampling.)

A similar trend is noticed elsewhere too. For instance, Hewlett – Packard decided to site their disk storage operation in Idaho (USA) because it was an attractive place for people to live and work (Rosenberg, 1985, p.30-37). The same study reported that the hiking and skiing opportunities of Ft. Collins and Colorado Springs attracted industries; similarly, Rosenberg noted that Austin's appeal over other places in Texas was her 'lakes, streams and verdant rolling hills'. In the US, competition between the states to offer better incentives has resulted in a large number of states offering the same incentives to investors. Consequently, companies tend to be swayed more by an area's quality of life than by monetary considerations (International Business Week, 1985, p.36-39).

The importance of pleasant living conditions was emphasised in a McGraw-Hill survey among 2,000 International Business Week subscriber organisations conducted in 1964 (McMillan, Jr., 1965, p.242). The respondents were asked, "If your company were selecting a new plant site, which of the following considerations would be of importance to you in selecting the specific area or site?". One of them, pleasant living conditions was considered important by 39 percent of the respondents, along with economic factors.

Referring to a study by M.L. Greenhut and M.R. Colberg, Svart (1976, p.323) said that manufacturing plants have been attracted to Florida by her natural environment. In some other cases environmental factors influenced decisions indirectly through skilled workers who have chosen to live in Florida. Also, according to him, Edward Ullman had noted that the environmental preferences of executives might have influenced the location of aerospace industry in California. To quote Svart (p.323), "Environmental preferences are clearly taken seriously by private corporations and by regional development groups and agencies".

Frankena and Koebernick's (1984, p.32-34) study in Osceola county in Michigan supports the earlier finding that the growth and distribution of nonmetropolitan populations are affected by a variety of locational factors including the natural environment. An OECD (1980, p.21) analysis of the regional policies in the US concluded that "there is growing evidence that decisions by people about where they want to live are playing an increasingly significant role in firm location decisions, particularly in those 'foot loose' industries not directly tied to resource or market locations".

In a study of industrial location in the Development Areas in the UK, Northcott (1977, p.37) observed that 84 percent of the firms did not see transport facilities as a major factor in their choice of location. He believes that this is because of well developed and maintained motorways. The Economic Commission for Europe (1967, p.5), summarising industrial location in the past 30 years, concluded that the role of transport cost was diminishing in industrial location decisions.

As expected in the model, economic factors continue to be extremely important in poor countries as facilities are not satisfactorily developed, and constraints are not removed. Development of basic infrastructure is a pre-requisite for rapid economic advancement of developing countries (Rosenstein-Rodan, 1961, p.205). In a study of industrialisation of backward areas of 13 states in India, the Planning Commission (1981, p.67) observed that the most important factors that determined industrial location were availability of finance, skilled labour and infrastructure, and proximity to market and raw materials. Although the ranking differs from state to state, these remain the prime factors.

In a study covering 292 firms in the backward areas of Uttar Pradesh (India), Papola (1980, p.74) identified the promotor's local origin as the most important industrial location factor. As explained earlier, this could be partly for economic and partly for cultural reasons.

Other important factors are proximity to raw materials and market. In both these studies, analysis on the basis of firm size was not available. Because of infrastructural constraints, nearness to raw materials and market, and nearness to home are important location factors for small firms in South India (NISIET, 1973, p.38).

In a study of industrial relocation in Sao Paulo (Brazil), Townroe (1983, p.70-80) noted the location factors as supply of labour, proximity to market, and infrastructure such as transport, power and water facilities. It appears from these findings that in developing countries the classical location factors continue to be extremely important.

Political instability very often adversely affects location decisions. In South Africa, for instance, foreign investments are reported to be declining in the wake of political unrest (The Economist, 27 July, various pages and 7 September of 1985, p.15-16). The decision of Ford Motors and the General Motors to withdraw investments from Philippines was based on the same reasoning. The same report in the Economist (9 November 1985, P.71-72) went on to say that US\$13-30 billions have been siphoned out of Philippines in the past 15 years. At the regional level, Punjab in India lost part of its investment attractions when rioting began (India Today, 1983 and 1984).

The evidence drawn from this author's survey of small firms in three countries, and

from the literature suggest that industrial location factors tend to be dynamic as countries change their place on the development continuum. As explained earlier, it is likely that location dynamics would be more clearly demonstrated by large than small firms.

5. Implications in Development Policies

The major advantage of the above analysis is that it explains the process of location dynamics in the context of the development continuum. An understanding of this relationship is very useful to regional planners. For instance, efforts of advanced countries to induce industrial investment to less developed areas may have better results, if in addition to economic infrastructure, non-economic factors are also developed. As economic factors are reasonably developed in these advanced countries, pleasant environment and other social facilities are likely to influence industrial location decisions.

On the other hand, in poor countries, who are at a lower level of development, the emphasis on economic factors is likely to continue. The influence of cultural factors is not considered here. Regional development policies should be designed to meet the location factor needs of firms. It is important to identify the location factors of small firms, and for policies to focus on them. Because of the influence of the level of economic development on firm location, no policy is applicable universally. It is difficult to transplant policies from one country or region to another without regard to location dynamics.

An understanding of the process of location dynamics would help reap better returns from regional development incentives. The impact of economic infrastructure, and fiscal and monetary incentives are likely to be more at the lower levels of development, but non-economic factors might exert influence at later stages. This could explain why the Japanese Government offers incentives to industries to create and preserve pleasant environment. In the UK, development agencies show considerable interest in the creation and preservation of non-economic factors in their efforts to attract industrial investments.

6. Conclusion

The above discussion indicates that a relationship between the level of socio-economic development and industrial location factors does exist. Here the concept of location dynamics was examined with the help of some empirical findings; this can only be a beginning. However, the intricacies of the interaction between these two variables are still not very clear. Further research is required to examine the relationship between location dynamics and regional development. It should be noted that the dynamism in industrial location factors indicates the need for changes in policies at different levels of development of the economy.

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