

Research Notes/Notes de recherche

**HIGH TECHNOLOGY, TELECOMMUNICATIONS
AND REGIONAL DEVELOPMENT: A SURVEY
OF THE LITERATURE**

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Introduction

Traditional approaches to regional development problems have increasingly come under strong criticism for failing to reduce regional disparities [24]. A variety of explanations have been put forward to account for the persistence of regional disparities. Some authors believe that market adjustment mechanisms have been made inoperative through government payment transfers, tariff protection [4], and conflicting place versus people welfare functions [13], and that there could well be a fundamental conflict between regional development and national efficiency [4]. Other authors claim that investments specifically made to reduce regional disparities have been far too dispersed to have a lasting impact on the regions [24]. Others claim that effective regional planning could bring about greater national welfare [11]. Still others believe that the economic recession of the late 1970s and early 1980s have so altered the perception of regional problems that the old paradigms of regional development no longer suffice to describe the present situation [1;25].

These conflicting interpretations of the persistence of regional disparities have had a threefold effect. First, central governments have had a tendency to reduce funds for regional programs for fear of throwing good money after bad [24]. Second, considerable effort is

being made to develop more sophisticated models of regional analysis [21]. Third, within the research community a growing interest in evaluating the impact of new technology on regional development has emerged. The researchers engaged in this work [3;9] feel that the economic structure of advanced nations could be altered by high technology and new information systems; that solutions to regional disparities in the coming decades will be related to this post-industrial organizational structure [6;20]; and that new indices to measure regional development and new solutions to regional problems must be developed [24]. There is a belief that, as increases in productivity for a number of industries will rely heavily on high technology and telecommunications networks, regional development in the coming years will be in some instances largely determined by the capacity of the peripheral areas to attract high technology [1] and to gain access to the growth axes of modern urban systems [19]. Rubin holds that the economic and social changes brought on by these new technologies will be so pervasive that regions lacking in information services will be in a situation akin to one of "disenfranchisement" [23].

The purpose of this paper is to review the work that has recently been published on the impact of high technology and telecommunications on the economic development of peripheral regions in advanced countries. It is also the objective of this paper to suggest that the structure of the labour force with regard to information production and processing should be a major component of any definition of regional development.

High tech¹ and telecommunications are intimately related through their dependency on microelectronic technology. A few authors [3;20] see the introduction of a few high tech establishments into peripheral areas as the beginning of their economic revitalization and an immediate solution to their unemployment problems. It is unlikely, however, that these installations alone will constitute a long term solution to regional disparities. Just as isolated establishments failed to become growth poles, isolated high tech firms cannot be expected to generate a complete turnaround of a region's economy. In the final analysis, there is a much better chance of development in the regions if they become capable of building up strong information services and networks, as well as telecommunications infrastructures [18;23]. Some authors believe that telecommunications have had limited spatial effects in the past because the industry was demand responsive. It seems to us, however, that regional planning should provide telecom-

¹High tech industries share three characteristics: they are labour-intensive in their production processes, they thrive on the application of developments in science, and they are dependent on R&D programs [20].

munication services within a supply framework, so great is the role of information in this new economic structure.

High Technology and Regional Development

There are a number of reasons for the intense interest in high technology and the role it could play in regional development. The profusion of innovative products with their high-risk, high-productivity profiles, the perception of high tech as evidence of the coming of the "post-industrial society", and the interest generated by a number of well-known new products such as microcomputers and fibre optics might explain the interest of the general public. For the regional development policy-makers, technology is sometimes considered as the next engine of regional development [20], the cornerstone of the new information society, and the means whereby some peripheral regions could gain comparative advantage within the national urban system. Research on the interrelationship between high tech and regional development has centred on one of two themes: the search for new theories and models, and the analysis of the converging or diverging effects of high tech on peripheral areas.

As Richardson has pointed out, the two dominant theories of regional development at the present time are the neoclassic and the cumulative causation theories. Because recent developments in computer and telecommunications technologies could have somewhat decreased the importance of agglomeration economies, the determinants of growth could be increasingly less economic in nature [22]. Attempts to include high tech variables in the existing models have proved to be difficult, principally through the lack of adequate data; consequently the new large integrated multiregional models have yet to be tested. A number of researchers have outlined an alternative approach based on the concept of local development.

The concept of local development was first put forward by Friedmann and Weaver [8]. They proposed a model whereby a large region would develop to a point where it could supply most of its goods and services and become, to a large extent, a closed system. Stöhr envisioned a national integrated system built from the bottom up in a complete reversal of the core-periphery concept [25]. Perrin [16] proposed "la théorie de la dynamique locale". In essence this approximates the Stöhr approach, where national economic development is seen as an optimization of regional development, an approach that Higgins supports [11]. The Perrin theory is formulated in a systems and a multidisciplinary context. The theory shies away from regional specialization in favour of a more diversified distribution of economic activities. It is an attempt to fully integrate economic development and spatial

analysis. As Perrin points out, the main problem with this approach is the fact that a regional subsystem is a living system which would naturally tend to become more autonomous and open with the recurring problems of domination of some subsystems and the collapse of others, a situation that local development was intended to cure. The new developments in telecommunications and high technology might serve to maintain a larger set of viable subsystems. The capacity of a region to maintain itself will depend on its capacity to keep abreast of new technology and on the strength of its local small- and medium-size firms.

Aydalot observed a different, though somewhat related, trend which he labelled "le retournement". He sees this approach as a third option to the study of regional development, with the other two options being the neoclassical convergent and the cumulative causation divergent theories. Aydalot bases his comments on the new behavioural patterns with regard to migration, attitude towards work, social security, and living environment. These new behavioural patterns have been brought about by developments in high technology in conjunction with the devastating effects of the recession of the 1980s. The regional impact of this new approach will be to enhance regional participation and diversification within the context of national planning. Coffey and Polèse [2] also see local development as a third option of growth at least as valid as the migration-economic and growth-centre approaches. They, however, consider the "people development paradigm" only as "a necessary complement to investment in physical capital".

Planque [17] points out that a number of these local regional concepts can be better defined as doctrines rather than theories. He acknowledges that some new analytical approaches must be developed to identify the spatial reorganization that will follow the introduction of new production and communications technologies. Since federal states cannot accept the regional effects of a cumulative causation approach and since neoclassic theory opposes government intervention, there is no alternative but to search for new regional policies that would be more effective in promoting regional development, even though previous efforts have been perceived as largely ineffective [24].

In any event, a major effort has to be made to create new concepts and new models for a better understanding of regional development. It seems likely that technology plays a role which is greater and more complex than present models can handle, that past theories of locational decision-making are no longer completely valid, and that a new concept of distance will have to be created, one that incorporates the impact of new communications technology.

The spatial impact of innovative technology is generally discussed in terms of its convergent or divergent effect on personal income.

Convergence occurs when regional income converges on the national average, and divergence, when regional disparities increase. As was noted earlier, the dominant existing models of regional development assume either income convergence, as in the case of neoclassical theory, or divergence, for the cumulative causation theory. The more recent theory of local development [1] implicitly assumes that divergence will occur unless specific programs are created to support local entrepreneurship. Government policy cannot, however, create entrepreneurship, and regional policy for local development is much more demanding because of its focus on human resources [2]. Entrepreneurship and marketing are the greatest weaknesses of countries such as Canada, not research and development.

The new technologies will undoubtedly have some physical spatial effects as well. Although Webber [27] viewed telecommunications as being "spatially neutral", others [5] projected a new form of extended metropolitan physical organization known as the *wired city*. The wired city would be a form of spatial divergence on the physical location of the population rather than on income, but the concept has yet to resolve conflicting individual and societal human needs. The economics of urban organization would also tend to limit dispersal, so that we are faced with a push-pull effect, which would result in some new locational arrangement that would probably be best described by means of an information theory model.

There are a number of studies that have attempted to assess the effects of new technology on regional economic and occupational structures. The impact of new technology in the semiconductor industry in Britain was found to vary according to the origin of the technology. Foreign technology tended to concentrate on production, while local innovators tended to establish innovative facilities as well as production units [3]. Government assistance to small new technology firms can be effective, but only if delivered by credible agents not overly hampered by bureaucratic regulations. This could, in turn, affect the employment structure of a region in the long run by changing its image from one of depressed region to one of innovation. Technology can promote regional development in peripheral areas, particularly when the local establishments have the capacity to produce and adopt innovations. Goddard and Thwaites [9] point out that small high tech firms have a relatively large impact on employment.

In the long run the spatial impacts of new technology, in general, and telecommunications, in particular, will depend on the local dynamism of the peripheral regions. Planque [17] foresees for France a new depolarization of activities. New regions with a highly skilled labour force will emerge. A number of regions will see their personal income level converge on the national average. This movement away from the

old industrial poles will in the beginning be based primarily on environmental considerations, but as the regional centres grow market considerations will also play a role. This new depolarization will favour small- and medium-sized metropolitan areas [10], and it will be made possible by innovations in high technology.

Telecommunications and Regional Development

Some researchers have predicted that new telecommunications technology could have important spatial impacts [14;18]. Just as the industrial revolution had induced a new economic structure, so would the combination of the telecommunications and computer technologies transform the interdependencies between the regions of a country and its major nodes [23]. Regional considerations, however, will have to remain the pivotal element of the development process. The degree to which a country will benefit will depend mainly on its internal dynamism, as it cannot be expected that government regional policy will convert easily and quickly from the promotion of enterprises to the development of the regional milieu [2].

A number of authors take a theoretical approach to the analysis of the spatial impacts of new telecommunications technology, while others have carried out some empirical studies. The combination of the telecommunications and computer technologies are considered to be the main elements of the post-industrial society [23]. The ever increasing role of telecommunications in innovation diffusion and financial and industrial decision-making as well as the increasingly larger proportion of the labour force engaged in the information field has spawned the terms "information revolution" and "information economy", and the main theoretical thrusts have centred on these concepts. Tornqvist made an important contribution to the discussion of information flows when he distinguished two types of information: general interaction, which keeps the present system operational; and decision-making interaction, in the form of personal contacts between decision-makers, which is more likely to be system transforming [26]. It is likely that higher transportation costs, on the one hand, and easier access to teleconferencing networks, on the other, will induce a degree of substitution of the second form of communication for the first. It is highly unlikely, however, that the decision-makers will forego direct face-to-face interaction on major issues.

Another important theoretical development was put forward by Pred [19]. In his study of the urban systems of developed countries, Pred attributes a major role to the information links developed over time as an explanation of the great stability of the urban hierarchy of these countries. Pred maintains that, although the engines of metro-

politan growth have changed over time from the early wholesale trade in the nineteenth century, followed by the industrial activities of the early twentieth century and the tertiary activities of the post-1950s, the overall most important determinant of growth through the whole period has been the existence of information links between the metropolitan areas along which growth-inducing activity is transmitted. He accounts for the stability of the urban hierarchy by the fact that these links are spatially biased in favour of the metropolitan areas. It is interesting that his theory encompasses a whole set of concepts of regional development.

In Pred's concept the communication links that bind large corporations form a network for the transmission of growth impulses, but the engine of growth is to be found within the decision-making process of large firms. The concept of "information economy" is in a way a major departure from Pred's theory. In the information economy concept the information infrastructure and occupational organization are the engines of growth and not simply the network along which growth is transmitted, as Pred would have it.

The first step in the development of the information economy concept has been to extend the Colin Clark occupational categories to include quaternary (information) and quinary (administration) activities. The first two categories of primary and secondary activities remain unchanged, while tertiary activities has been given a more restricted coverage with the removal of information and administration occupations. Another approach in the formulation of the information occupations has been put forward by Porat [18], who classifies information occupations under the following headings: information producers, processors, distributors and infrastructure personnel. A number of authors have adopted this classification. As initially put forward, this classification covers approximately 51 percent of the labour force [15].

Other authors have attempted to measure the relationship between telecommunications and productivity. For some, there is no doubt that telecommunications will promote productivity [7]; for others, because the information sector stems from the tertiary activities, they will inherently carry a low-productivity factor. The notion that the tertiary activities and bureaucratic occupations are by nature in the low-productivity category is subject to a growing debate [7] and the whole question as to the proper approach in measuring productivity is also subject to discussion. There is now ample evidence, however, at least in the field of computer software, that productivity is increasing through the use of higher levels of programming languages that are easier to write, to debug, and to apply to a larger variety of computers. The rate of output increases as each new generation of computers hits

the market. The issues of whether the new information technologies are labour-saving or capital-saving and of the consequent effects in productivity and employment are discussed in an interesting OECD publication [15].

Technology is generally labour-saving, but has been found to be labour-demanding in a few industries, mostly services to businesses. Technology generated an annual average drop of 1 percent in employment over the 1971-79 period in Canada [12]. Canada is in a particularly delicate position with regard to the new information economy. If productivity were the only priority, a large share of the country's growth should be geared towards the natural resource sector, and this would leave the country with a deficient industrial and occupational structure [6]. On the other hand, there will be some reduction in productivity if the country attempts to generate a more balanced economic development.

There is no doubt that the information sector is growing in all developed countries [18] but we are not as yet in danger of being information overloaded. The question of the regional impact of information and high tech industries is a pressing one, and it is highly related to the question of deregulation. In a deregulated context new firms, especially small innovative firms, could develop new products and enhance the development of a selected number of peripheral areas. Competition between regions to attract high technology establishments has already been responsible for a number of state initiatives in the United States. Some of these initiatives were geared at promoting greater interaction between universities and the private sector through the creation of research parks [14]. Similar programs have been set up in Canada and other countries. To be successful in promoting regional development, these initiatives must be given strong leadership and stable, long term funding. A staff study done for the Joint Economic Committee of the Congress of the United States reported that competition between states to attract high tech firms was neither destructive nor counterproductive. The study sees these initiatives as a major factor in promoting the technological and industrial revitalization of the United States [20].

Conclusion

From a survey of the literature it seems very likely that the technological innovations in telecommunications combined with a strong labour force participation in the information services and infrastructures could have a strong impact on the economic prospects of some peripheral areas. The regions with the greatest capability in producing and adopting innovations will obviously fare the best. This dynamism will

have to be supplied either by the local industrial entrepreneurs or by the astuteness and vigour of the area's political leadership in attracting outside involvement. Therein lie the main conditions for regional growth in the next decade. The few empirical studies that have been published so far also show that the absence of industrial traditions does not constitute in itself an obstacle to these new forces of growth; quite the contrary, the inertia associated with these old structures, such as invested capital and union resistance, can be viewed as a hindrance to the new growth structures, at least in their early stages of implementation.

At present regional models and concepts are inadequate to deal with the new technology economy. A major effort must be set in motion to provide a new paradigm of regional planning and policy. The impact of the information services and networks is so pervasive that the best models will have to include a Pred-like concept of growth transmission, where the new engine of growth will be information activities.

An important segment of the research will have to deal with the spatial impacts of deregulation in the telecommunications activities [23]. Total deregulation could lead to the centralization of economic control with a resultant decrease in the quantity of services and activities available in the peripheral areas, a condition which could lead to social problems. On the other hand, too strong a government hand could stifle innovation and reduce the competitiveness of the core as well as the peripheral areas on the domestic and international markets. The decisions that will have to be taken must be founded on a strong theoretical and empirical body of research on the effect of information and high tech activities on regional development.

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