TELEMATICS AND REGIONAL DEVELOPMENT: A RESEARCH LITERATURE REVIEW*

Lars Qvortrup

This research literature review reflects the historical development of research in telematics and regional development, focusing particularly on the inherent research paradigms. In an early phase (the 1960s and 1970s), research was dominated by correlation analyses based on a communication model paradigm with communication as a cause-and-effect process. However, during the 1980s a large number of micro causational analyses were performed. This then led to a new paradigm, according to which communication is a process of interference among complex social systems. This literature review concludes that although the complexity of the relation between telecommunication and regional development must indeed be recognised, currently, there is a need to assist policy making by trying to classify the "myriad of factors" identified during the "complex systems paradigm" tradition into a less complicated typology, and thus to reduce the numerous policy recommendations into a manageable number of integrated strategies.

Keywords: telecommunications, telematics, development, literature

INTRODUCTION AND SUMMARY

The Aim of the review

This article summarises the research literature on telematics (telecommunications and computers) and regional development. The aim is to identify what we already know about telematics and regional development. What can we learn from existing research literature? What need not be repeated, so avoiding time wasted on re-inventing the wheel? In which areas do we still, at best, possess only well-argued hypotheses, and where should knowledge already gained lead our current and future research?

In adopting this approach I try to trace the *avant garde* of research. My aim is not to summarise every report within the domain, but to reconstruct an ideal line of research progress by referring mainly to the pioneers and by avoiding all those projects and analyses which repeat already well-established findings.

* This article is based on a study undertaken within the ACCORDE project which is part of the European Commission's "Telework programme". I wish to acknowledge the considerable assistance provided by my colleagues in the ACCORDE project, particularly by Seán Ó Siochrú and Andrew Gillespie. I stress, however, that the views expressed in this article are my own, and not necessarily those of the institutions or of any of the people named above

It is, however, also important that I specify those paradigms that have implicitly or explicitly guided research activities in telecommunications and development. It is well known that research is not a totally rational business, where open minds (tabulae rasae) discover new facts and structure them into neat conclusions. It is rather the other way round, that we as researchers already have ideas about the structure of the outside world, and that we — consciously or unconsciously — are guided by these ideas — or paradigms — when we select relevant from irrelevant facts, and when we construct relations (sometimes called causations) between these facts. Consequently, it is important to identify the basic paradigms which inherently guide the research findings.[1] In telecommunications and development research, it seems to me that the guiding paradigms are quite simple — but nonetheless strong — metaphors for communication.

In pursuit of these considerations, I will not provide a comprehensive literature list. Rather, I will summarise selected examples with the intention of identifying the basic paradigms and of outlining the historical development of our understanding of the contribution of telematics to regional development.

I will normally use the broad concept "telematics" to represent not only all types of telecommunications, but also computers in so far as they are connected to and used in local, regional, national or international electronic networks.

Summary

In its basic structure, this research literature review reflects the historical development of research in telematics and regional development. Yet it is not strictly chronological: in order to reduce complexity, contributions from different times sometimes appear in the same section.

In an early phase (the 1960s and 1970s), research was dominated by correlation analyses. Later, more sophisticated work added a temporal dimension, with the so-called time series analyses. Often, the implicit guiding metaphor is that of the "golden bullet". The inherent understanding is based on the traditional communication model according to which information is carried from one place (the sender) to another (the receiver). Consequently, information provided through electronic networks is expected to have a direct effect, like a bullet hitting the target. Furthermore, a basic concern is to identify the "winning" type of information, or the potentially successful type of application, that is: the golden bullet.

Gradually, however, it became clear that there exists no simple cause-and-effect relationship between telecommunications and development. Similarly, positive statistical correlations cannot necessarily be interpreted as proofs of causation. As a reaction, during the 1980s a large number of micro causational analyses were performed in order to identify the specific economic, social, organisational and technological causes of development, among which of course the availability of telecommunications services is one important factor.

This then led to a new paradigm in which the complexity of telematics and social development was recognised. Here, communication is not a simple cause-and-effect process. Rather, communication is considered to be a process of interference

among complex social systems. During this phase, complex systems analyses were performed, and a number of aspects of telecommunications and development were considered, such as: the identification of barriers to benefiting from telecommunications, discussion of how to actually define development, and articulation of integrated strategies which, while recognising the positive impact of telecommunication, also include other economic, social and cultural factors within a coherent development strategy.

Finally, during the 1990s the first studies regarding the impact of advanced communications on regional development emerged. So far, however, no clear results regarding the particular effects of advanced communications have been attained.

This literature review concludes that although the complexity of the relation between telecommunication and regional development must indeed be recognised, there has been a tendency to be too specific, and to take every regional case as unique. Currently, there is a need to assist policy making by trying to classify the myriad of factors identified during the complex systems paradigm tradition into a less complicated typology, and thus to reduce the numerous policy recommendations into a manageable number of integrated strategies.

However, any literature review on telematics and regional development should recognise the significant influence of the International Telecommunications Union's *The Missing Link* report. Consequently, the review begins in the next section by summarising this report.

First, however, a brief mention of existing literature overviews is in order.

Some Existing Literature Overviews

The early literature and the most important theoretical and analytical findings on telematics and development up to the mid 1980s were summarised by Hudson *et al.* (1979), by Saunders, Warford and Wellenius (1983) and by IDATE (1984).

Later on, as one of the results of the International Geographical Union's Study Group S9 (1984-1988) and the International Geographical Union's Commission C18 on Telecommunication and Communication (1988-1992), Henry Bakis published his bibliography on the geography of communication networks and telecommunications (Bakis 1992). It is divided into three sections, a traditional bibliography based on authors, a list of works structured by place, and a list of works structured by subject. Of course, the bibliography is much broader and more exhaustive than the present study. However, one section provides a list of 31 books and papers in the field of telecommunications and economic and regional development (Bakis 1992 p. 369f).

More recently, the literature on telematics and geographical development has been summarised in Aharon Kellerman (1993), who provides 278 references from a variety of technical, popular, economic, policy and social science backgrounds. Part Two of the book reviews the role of telecommunications in urban concentration and dispersion, telecommunications in regional development, national differences in telecommunications and international telecommunications.

THE MISSING LINK REPORT: A TURNING POINT

Regarding the general realisation among governments and public administrations of the role of telecommunications for social and economic development the important symbolic event was the publication in 1984 of ITU's *The Missing Link* (ITU 1984). With a special focus on developing countries, the role of telecommunications for economic and social development was outlined. Not only did the report recognise a correlation between the number of telephones per capita and economic development measured by gross domestic development; it also — with some reservations — stated that telecommunication contributes to economic growth. Thus, the contribution that telecommunications offers to social and economic development was presented as an indispensable element of development policy. The extremely uneven global distribution of telephone lines was thus recognised as a significant barrier to development. As an example, the report pointed out that although the world telecommunications network at that time served 600 million telephones (instruments, corresponding to about 400 million main telephone lines), more than half of the world's population lived in countries with fewer than 10 million telephones. And most of these were in the main cities, so that the situation of remote regions of developing countries was particularly bad. The report further documented that two-thirds of the world's population had no access to telephone services at all (ITU 1984 p. 13; see also Saunders, Warford and Wellenius 1983). In concluding, the report emphasised that "...no development programme of any country should be regarded as balanced, properly integrated or likely to be effective unless it includes a full and appropriate role for telecommunications, and accords a corresponding priority to the improvement and expansion of telecommunications" (ITU 1984 p. 11).

Prior to the writing of *The Missing Link*, ITU and the OECD development centre had sponsored a number of research projects, primarily case studies and literature overviews. They are briefly summarised in Pierce and Jéquier (1983). In addition, the report was inspired and informed by the research and literature overviews which were written between 1979 and 1984; they are listed in the following section. Other important general studies were Hardy (1980), and Hudson (1984).

CORRELATION AND TIME SERIES ANALYSIS

Macro-economic correlational analyses

Although the establishment of telecommunication networks began more than a hundred years ago it was probably only in the early 1960s that people started systematically to analyse the role of telecommunications in social and economic development (and particularly, of course, in regional development). For instance, a special working group set up within the ITU in 1964 initiated some basic thinking on the topic, and published a series of documents (CCITT 1972, CCITT 1976, CCITT 1982). In 1979 the first document devoted specifically to rural communication was published (CCITT 1979).

In the same period the first correlational analysis was completed (Jipp 1963). Here, the relationship between per capita GDP and telephone density was shown to

follow a certain rule which became known as "Jipp's law". In the following years a large number of such correlational studies were performed. As Hudson *et al.* (1979, p. 29) at the end of the 1970s stated, "most studies which have explored the role of telecommunications in development are limited by their correlational nature."

The "Golden Bullet" Paradigm

The correlational analyses were theoretically closely related to traditional communication models and thus to the mathematical theory of information and communication (cf. Shannon and Weaver 1948[2]).

The basic idea — the dominating metaphor — is that information is a "thing" or "substance" (i.e., bits or bullets) which is transported from a source (the information provider) to a receiver through a channel. The communication model is thus known as the "pipeline model". When this model is applied to social theories of telematics and social development, the basic hypothesis is that transportation of information into a region will transform the region. A number of sub-hypotheses can be developed:

1. The model of telematics and social development is a linear model in which information goes from the supplier through a number of intermediators before finally arriving at the so-called "end-user".
2. The implicit theory behind this model is behaviouristic, where the "behaviour" of a social unit — for instance, a region — is directly affected by an input of information transmitted through a telecommunications system.
3. Thus also the model of social usage and impact of telematics is linear with for instance the following stages of development:

$$\text{supply} \rightarrow \text{adoption} \rightarrow \text{use} \rightarrow \text{regional development}$$

4. There is a correlation between the *amount* of information (the number of "bullets") brought into a region and the social effects caused by the information input. This is sometimes translated into tele-technical terms, implying a correlation between band-width and social effects: for instance, broadband communication would be expected to be more effective than plain narrowband telephony.
5. Also, the type of information — quite often translated into the type of application — is considered to be important. One has to identify the "right" types of applications and to avoid the "wrong" ones, i.e., to identify the "golden bullet" that will shift the social situation of a region in a positive direction. Typically, different applications are put in order of priority, and catalogues of relevant applications developed.
6. Finally, the problem of gatekeepers and resistance is emphasised. Information must pass through a number of gates (technical, social, institutional, etc.), and steps must be taken to ensure that relevant and beneficial information passes the gatekeepers, sorting out irrelevant and harmful information. A special problem is represented by the inherent gatekeeper of the end-user, for instance the end-user's "resistance" to benefiting from external information.

Correlation Versus Causality

During the 1970s it became evident that although correlations may be clearly documented, they should not be interpreted as proof of causation. As in a popular example: although the number of Salvation Army members and the crime rate in London are both growing, it does not necessarily follow that Salvation Army members are thieves or that they stimulate crime. One answer to this problem was more sophisticated correlational studies, the so-called "time series analyses".

Time Series Analysis

The explicit ambition of the time series approach is to advance from the correlation study to the determination of a causal connection. We know that telecommunications development and general social and economic development often proceed together; but we do not know whether telecommunications investment promotes economic development, or economic development creates demand for more telecommunications services. Thus, the next step must be to add a direction to the correlation, i.e., to determine the causational relationship.

As early as 1980 Andrew P. Hardy had published a paper in which time series were used to determine the causal relationship. Using data from 45 countries for the period 1960-73, Hardy (1980) studied the relationship between GDP and the number of telephones per capita with time-lagged offsets of one year, and showed that although increases in output of GNP lead to increases in investment in telecommunications, the converse is also true: increases in telecommunications investment stimulate overall economic growth.

The same result was achieved by Cronin *et al.* in 1991. Here, they measured the level of US economic activity annually over a 31-year interval from 1958 to 1988, and using two standard statistical tests for direction of causality — the Granger test and the Modified Sims test — they clearly demonstrated a feedback process in which telecommunications investment enhances economic activity and growth while economic activity and growth stimulate demands for telecommunications infrastructure investment.

While the 1991 project was a study at US national level, in 1993 Cronin *et al.* published a similar study (Cronin *et al.* 1993) of the state of Pennsylvania and two counties: (1) York which is a relatively urban economy with several large companies and within commuting distance of Baltimore, and (2) Somerset which is a small, rural community in the Allegheny Mountains relying on tourism and agriculture.

Again, they tested two hypotheses: Does telecommunications investment lead to economic activity, and does economic activity lead to telecommunications investment? Telecommunications investment was subsequently divided into central office equipment (COE) and cable and wire (C&W) investments, and economic figures from the period from 1965 to 1991 were used.

The results can be summarised in the following table:

Hypothesis level	State	Urban county 1.	Rural county 2.
Investment in COE causes economic activity	Yes	Yes	—
Investment in C&W causes economic activity	—	Yes	Yes
Economic activity causes investment in COE	Yes	Yes	—
Economic activity causes investment in C&W	Yes	—	—

Of particular interest in the present context, it confirms the hypothesis that investment in cable and wire causes economic activity in both the urban and the rural county.[3]

MICRO-ECONOMIC CAUSATIONAL ANALYSIS

Micro-economic Case-studies

As already emphasised, simple correlations should not be interpreted as proof of causation. But what about the sophisticated time series analyses? Do they solve the problem of identifying causation? The answer depends, for a start, on our definition of causation, and in the early 1990s it was argued that even time series analyses identify only what might be called statistical causational relations. In Parker *et al.* (1992), Edwin B. Parker (i.e., one of the authors of the above-mentioned time series analyses) and Heather E. Hudson together with Don A. Dillman, Sharon Strover and Frederick Williams emphasise this quite clearly: "The relationship between telecommunications and economic development does not fit a simple linear cause-and-effect model. That is to say, new investment in telecommunications infrastructure unaccompanied by complementary development activities will not automatically result in economic development. Telecommunications is a catalyst and facilitator, not a magic solution. Its success in stimulating development depends critically upon how well individuals, businesses and communities use telecommunications networks to improve their economic prospects" (Parker *et al.* 1992, p. 161; cf. also *ibid.* p. 166 and p. 14).

However, by the early 1980s many researchers had abandoned the macro-economic correlation studies in favour of micro-economic causational analyses, in the belief that only by studying in detail the processes related to the introduction of telecommunciations could the actual cause and effect be identified. In order to answer this question a number of microeconomic studies were carried out, focusing on single nations, certain regions, or groups or branches of firms. For instance, between 1980 and 1983 a number of such studies were made within a joint ITU-OECD research programme (cf. Hudson 1983, Jonscher and Tyler 1983, and Kamal 1983).The great advantage of such studies is that, at least theoretically, causation can be proved: in principle, the benefits of telecommunications can be singled out, its costs can be computed and a comparison of costs to benefits can be made. In

fact, some contemporary theoretical studies considered such micro-economic studies to be the most useful, (cf. Jéquier and Jipguep 1983).

Practical and Theoretical Considerations

Soon, however, a number of practical problems arose. First, how should the benefits of telecommunications be defined? Are they identical to economic growth, i.e., the growth of "gross regional or national product"? Or should other welfare aspects be considered?

Second, how should the telecommunications costs be measured? While this may be possible for a whole nation (and even for a specific region), it is actually quite difficult to specify where a study focuses on a specific group of firms. Are they the costs paid by those firms? Or is it the costs of establishing the whole electronic infrastructure used by the firms in question?

A third, and delicate problem is how to isolate the inpact of telecommmunications in contrast to that of other factors. In reality, development within a certain period might result from literally thousands of other factors.

However, more theoretical concerns were also identified (cf. Gille 1986). The micro-economic analyses rarely attempted to depart from their practical and concrete concerns, to make more general assessments of the contributions of telecommunications to development. This is a problem since macro-economic effects are not just sums of micro-economic events, and the problem becomes particularly serious since a telecommunication network is inherently a macroeconomic unit. For example, from a micro-economic point of view a new telecommunications infrastructure may support the companies in a given region. But if a wider perspective is taken, the same telecommunications network also supports other regions' enterprises, i.e., in addition to the initial support to local companies the network attracts competitors from the outside. Exactly the same problem is repeated in some of the current telework projects, where job creation is used as the label of what is actually the relocation of already existing jobs from one region to another.

Teleservice Usage Studies

One way to tackle some of the problems of micro-economic analyses was proposed in the doctoral thesis of Lars Engvall (1984). In order to isolate the input of telecommunications (as distinct from other factors) in a number of case studies in Thailand, Sri Lanka, Malaysia and Singapore, he examined the actual usage of telephone, television and radio services, and from these studies developed more sophisticated mathematical functions for the relation between teleservices and usage. In addition, this study established the understanding that instead of focusing on telecommunications as an electronic infrastructure one should look at telecommunications services. Thus, focus was moved from network bandwidth to telecommunications services, and from telecommunications supply to user demands, and the first steps towards a more integrated approach (telecommunications as part of an integrated service provision programme) were taken. Yet some of the additional macro-economic problems still remained to be solved.

COMPLEX SYSTEMS CAUSALITY

Toward a New Paradigm

During the 1980s an understanding of the need for a more integrated approach began to emerge. The micro-economic analyses clearly demonstrated that telecommunication is only one of a large number of economic and social development factors. Similarly, in focusing on the usage of teleservices instead of the provision of new technical infrastructures, Lars Engvall stimulated our understanding of all the "small" aspects of how to benefit from telecommunications. Consequently, both paved the way for a more user oriented (and thus integrated) approach. However, these studies did not in themselves constitute a new paradigm.

A means to solve the problems of micro-economic analysis, but without repeating the simplifications of macro-economic correlational analysis, was proposed by Laurent Gille from IDATE. In the early 1980s he undertook an extensive study based on data from 29 countries over a period of 16 years, published in full in Gille (1984), and in a summary version in Gille (1986).

The basic theoretical innovation — inspired by such authors as Oury (1983) and Porat (1982) — which actually made it possible for Laurent Gille to take into account the observations from his case studies was that the essential reason for the growth of information activities in our societies lies in the growing complexity of our economic and social organisation. In addition to the technical problem of producing and distributing goods and services there is a problem of organisation, which consists of coordinating and organising the manifold individual and local activities of production and distribution. The precondition to resolving the latter problem is availability of information. "Thus, it appears that telecommunication is linked to the degree of complexity of the organisation of the economic system" (Gille 1986 p. 38). From here, a mathematical model of the interrelations between telecommunications and economic development is outlined.

The "Complex Systems" Paradigm

The theory and analysis of telecommunications and regional development as a case of complex systems is, implicitly, closely related to a theory of information and communication totally different from the above-mentioned mathematical and behaviouristic information and communication theory.

In the case of telecommunications and complex systems, communication is defined as perturbation of two or more complex social systems (perturbation being a neutral term): one system communicates with another system if the second system is perturbed by the first system in such a way that the second system's internal state has been changed or modified. Telecommunications — and other media — is the tool for such inter-systemic perturbations.

This theory has been developed by Gregory Bateson and others in reaction to both behaviourism and the simple theory of cybernetics represented by Norbert Wiener and others. It has been fully articulated by, amongst others, the German sociologist and philosopher Niklas Luhmann. "In the context of the autopoietical reproduction, the environment exists as irritation, disturbance, noise, and it only

becomes meaningful when it can be related to the system's decision-making connections. This is only the case when the system can understand which difference it makes for its decision-activity when the environment changes or does not change in one or the other respect. Such a difference which exists for the system in the environment and which for the system may imply a difference for the system itself, i.e. a different decision, in accordance with Gregory Bateson we would call information. ... The system is continuously perturbed by the environment, and with its decision-network it seeks out perturbations so as to transform them into information and to use them as a guide for decision-making" (Luhmann 1988b p. 173, my translation; cf. also 1988a and 1992).

This paradigm has a number of implications that radically distinguish it from the the linear communications model mentioned above.

1. Communications is not a linear process from a source to a receiver through a channnel, but an interaction or perturbation among complex systems causing a change in one or both systems.
2. The impact of communication does not necessarily depend on the amount of information. Either little or a lot of information may change a complex system.
3. The same amount and type of information may have totally different effects in different systemic contexts.
4. Communications effects depend primarily on the state of the receiving (or perturbed) system.
5. Basically, a system which perturbs another system is also irritated (or changed) itself.

In order to apply this paradigm, a matrix of the receiving system (the organisation or region) may be elaborated, e.g.:

— labour force (skills, qualifications)
— access to markets
— access to suppliers
— access to specialist business services (finance, etc.)
— access to key decision makers (institutional support environment)
— internal integration coordination.

Also, analysis of telecommunications and regional development may be based on so-called regional SWOT analysis, i.e., regional strengths/weaknesses, and opportunities/threats. A guiding analytical question is: What is the role of telematics in maximising strengths and opportunities and minimising weaknesses and threats?

Literature of the 1980s and 1990s: Elaborations of the Complexity Paradigm

In focusing on the structural complexity of the economy as the reason for the growing demand for telecommunications Gille established the precondition for understanding that the causation between telecommunications and economic development is not a simple function, but a complex function of a set of interrelated, complex factors. Furthermore, it can be implicitly derived from his analysis that

there is no clear division between micro-economic qualitative analyses and macro-economic quantitative analyses. Rather, these two approaches should supplement each other. Finally, based on practical experience from practical telecommunications projects, it became more and more obvious that nothing is automatically achieved just by providing new electronic infrastrucutures. Telecommunications is a necessary, not a sufficient, precondition for development, and a number of supplementary political measures must be taken in such development projects.

During the late 1980s and early 1990s research has not radically challenged these findings, but has tried to further elaborate the social complexity paradigm. However, within the field, a number of research trends can be identified and will be briefly summarised below.

1. The complexity paradigm inherently implies that there is no direct causation between telematics and development. In order to understand the reason why telematics has no direct impact, a number of barriers to benefiting from telematics have been identified.
2. More radically, the complex systems paradigm inherently implies that the impacts of telematics on regional development are not necessarily positive, but may affect certain regions negatively as well. This research can be summarised under the heading of the dual causality of telecommunications and development.
3. Also, within a complex systems approach the term development itself becomes questionable. In fact, development is a normative concept, and within a complex social system different actors may define development in different ways. Thus, the literature has discussed what is actually meant by development.
4. In summary, I think it is fair to say that all these approaches aim at further developing research the groundwork for which was laid in the 1980s. There is also general consensus that if we are to understand the relation between telematics and social development, then all these approaches must be combined in analyses of integrated and complex social systems in which telematics is seen as but one of several factors. And the object of such analyses is not primarily to prove the positive effects of telematics, but rather to help refining integrated strategies for complex social systems.

Barriers to Benefiting from Telecommunications

There is a growing understanding of the difficulties of helping remote regions through telecommunications, and this is reflected through the identification and analysis of different types of barriers to development, such as:

— barriers in the organisational system of telecommucations

— barriers in the rural economic system

— barriers at the user-level

Recent years' liberalisation and deregulation of telecommunications companies have stimulated quite a number of analyses regarding the impact on development, particularly regional development. It is commonly agreed that although telematics

is beneficial for regional development, often long term investments are needed that may not attract profit oriented telephone companies. For instance, Parker *et al.* (1992) provide detailed analyses of telecommunication players, focusing both on the culture of telecom players in opposition to policy and regional interest players, and on their different interests. In addition they provide detailed policy recommendations for state governments, regulatory commissions, etc. Although the approach is relevant, the concrete analytical results and recommendations are very much related to the North American context.

They also mention examples of barriers in the rural economic system. Often, the demand profile for rural telecommunications services is different and poorly understood by telecom representatives. In addition, knowledge about potential benefits from telematics among rural policy and grassroot players is limited.

In addition to identifying macro-sociological barriers (economic and organisational barriers), it has been realised that at the micro-level there are additional barriers to the fundamental potential lack of access in some parts of the world to benefiting from telecommunications. Some of these barriers are (cf. Lars Qvortrup 1994):

The *service barrier:* Even though the connection to the telephone network has been established, the variety of services available is sometimes limited, and the teleservices available are very often based on the demands of the urban population, and are unrelated to the demands of rural users. For example, in England the new value added network services are dominated by advanced services serving the needs of, for instance, the finance sector in London, but with less relevance to small industries in rural communities.

The *cost barrier:* For a small farm or a small, family-based enterprise, computers, including software, technical support, continuous upgrading etc., are still quite costly, and the cost of access and of teleservice terminals is often too high for infrequent users to justify individual connection.

The *qualification barrier:* Even now, skills required to use computer programmes effectively are high, and are not always met by people in rural regions, where the general attitude to telematics is very often quite sceptical.

The Dual Causality of Telecommunications and Development

It is inherently implied in the complex systems hypothesis that the impact of telecommunications on regional development is not only uni-directional, but goes both ways. Telecommunication does not transport information into a region, but it mediates systemic interaction between a region and its environment. The first step towards the realisation of this fact was represented by the so-called "dual causality of telecommunications and development". It had already been discussed by Gille. The problem was also clearly mentioned in the discussion of the problems of isolated micro-analyses (cf. ITU 1986), emphasising the ambiguous effects of telecommunications. "This highly ambivalent yet frequently discounted feature probably helps to explain why the supply of telecommunication networks and services has not achieved the level expected from specific impact studies" (ITU 1986 p. 10).

However, this important realisation that telecommunications does not just provide information to a particular region or give access to external markets for this region but also provides information to outsiders about this particular region and gives access for new external competitors, has been emphasised by a number of critical authors. In some cases, they have concluded that telecommunications may even become counter-productive in relation to the intended objectives. In 1985 Cees Hamelink in his paper 'Selling the Canoe without the Paddle' (Hamelink 1985) pointed out that it is over-optimistic to believe that new and better social structures will automatically be created, or that local economies of relatively isolated rural regions will be strengthened, just by introducing new information technology. It must be kept in mind that telecommunications is a means for two-way communications. It may help a small rural enterprise to increase sales abroad, but it certainly also enables foreign firms to penetrate the local rural markets.

An example from the USA can illustrate the problem. The penetration of fast food chains at the expense of local restaurants has been based partly on the availability of good telecommunications facilities, because such chains depend on coordinated goods delivery, centralised economic administration etc. (Dillman *et al.* 1988) Here, telecommunications has been a tool for competing with the local rural economy and for changing local cultural habits. Similarly, rural branches of national or international banks are processing most of their economic transactions in centralised, automatised locations, thus eliminating jobs from many rural communities. Such examples suggest that the adoption of information technologies in rural communities is not a guarantee of economic growth or of strengthening of sociocultural conditions. On the contrary, these technologies can, in the words of Dillman *et al.*, as easily be used to ship jobs out of a community as to bring them in.

In 1987, W. H. Melody once more emphasised that it is both superficial and counterproductive to think that economic development and social benefit will automatically be achieved if new information and communication technologies are introduced into less developed regions (Melody 1987).

An additional critical consideration has been outlined. Not only may new telecommunication infrastructures and teleservices act against the interests of local actors, they may also increase the influence of telecommunication network providers and information providers (hardware and software) on the structure and contents of information and communication channels. This theme has been elaborated by Herbert Schiller in particular (cf. Schiller 1981).

What is "Development"?

Adding to the above mentioned aspects of complexity and reflecting the critical literature of the 1970s and 1980s, the important issue of what is actually meant by "rural or regional development" is raised. In his contributions from the 1980s on the relation between telecommunications and development, Gille has already raised this question: "When we try to establish a connection between 'telecommunications' and 'development', the first question that comes up is 'What is development?'" (Gille 1986, p. 27)

The discussion of the meaning of development was brought deeper by Andrew Calabrese in his review of Parker *et al.* (1992) (cf. Calabrese 1993). He argues that in Parker *et al.* (1992) the concept of development is "...presented uncritically as a worthy goal and a levelling effect." However, beyond the surface of this concept two questions must be asked: First, how is development actually defined (as economic development in a narrow sense, as social development, as cultural development) and how is it decided what is actually better and worse, i.e. more and less developed? This must be specified in order to identify which data are actually indicators of success of telecommunication programmes. But no discussion of the meaning of development can be found in Parker *et al.* Second, a note of warning is given on the use of macro-economic quantitative data, since such data often represent very uneven distributions of benefits in the regions analysed.

In one of the recent projects within the ORA programme, a list of explicit development goals was proposed. Four different types of development goals — or scenarios for telecommunication programmes for regional development — were suggested:

Indigenous development. Here the aim is to support local communities and enhance their control over the development process. This strategy demands a long term process of change, requires institution building, cultural animation, educational and training facilities, investment and a host of other factors. Basic telecommunications are seen as a necessary part of this approach, but provided as part of an integrated strategy. Few would suggest that the process is straightforward and painless, but most would agree that it is the only long term solution to rural decline and regeneration.

Transition management. Here the intention is to enable communities to cope with sudden changes in their economic fortunes. Normally, this strategy is a response to rural areas that face decline. While accepting that decline is inevitable, the intention is to leave the region better equipped to create new activities, while minimising the pain.

Urbanisation. Here the intention is to bring rural life as close as possible to urban norms. Often, this is less a strategy than a *post hoc* attempt to minimise the effects on rural regions surrounding major industrial centres and conurbations. The strategy attempts to introduce balanced evolution by attracting services and setting up businesses. Telecommunications here plays a role through the provision of both basic and advanced services to industry and service companies locally. Telecommuting could contribute in these areas.

Dependent development. Here the policy is to attract external industry to locate in a rural area, encouraged by generous grants and tax breaks. In reality, the rural labour force is seen as a resource which can be deployed by urban-based organisations. Good basic and often advanced telecom services have been recognised as a key element in such strategies.

Analyses of Integrated and Complex Economic and Organisational Systems

As a result of the above-mentioned methodological considerations and empirical

findings, during the late 1980s and the early 1990s more focus has been put on integrated analyses, combining quantitative and qualitative studies, and on the understanding of systemic complexity both as regards the regional economies and the telecommunication policies. One important example of such "analyses and strategies of the 1990s" is provided by Parker *et al.* (1989 and 1992), where policies for rural development through telecommunications are analysed and suggested.

In Parker *et al.* (1989) focus is put on the changing economic structures of rural society. The role of agriculture in rural employment has declined, yet few rural communities have diverse economies and are largely dependent on a single industry. Thus, the general aim is to help rural economies to diversify, that is to achieve the state of "post-agricultural diversity of rural economies" (Parker *et al.* 1989 p. 23).

Only after analysing the changing economic trends, is the role of telecommunications considered. However, it is obvious that telecommunications is a necessary precondition for realising the state of rural economic diversity, partly in order to bridge the distances, but partly — referring to Gille — because economic diversity means organisational complexity, which again necessitates good communication facilities.

However, according to Parker *et al.* every concrete situation is unique. Based on studies of four different rural communities in the US they discovered that each faces unique development challenges, with distinctive opportunities for telecommunications to make a difference (Parker *et al.* 1992 p. 113). There is no single process by which a region can use telecommunications for enhancing rural development. So much depends on the specific region's political culture, economic base, existing telecommunications infrastructure, "...and myriad other factors" (*ibid.* p. 139).

One very interesting example of such integrated analyses is provided by Seamus Grimes from University College Galway in Ireland. One of the particular challenges for rural and remote regions is that these regions have been dominated by extractive industries (agriculture, mining, fishing, forestry), and that they need to diversify their economy. However, almost all operations in these regions are small-scale enterprises. How can they connect into the information economy? (cf. Grimes 1992).

One way of connecting to the information economy is in fact found in Ireland, where a number of rural SMEs are subcontractors to big multinational companies, and where telematics have been widely used for establishing linkages between branch plants in Ireland and their overseas corporate headquarters in insurance, bank and tax transaction processing. The attractions of these local branch plants to the American headquarters have included lower operating costs, low staff-turnover rates and a beneficial time difference between Ireland and the US which permits US overnight processing in Ireland at overnight computer charge rates (Grimes and Lyons 1993).

However, although this model of regional development may, during a first phase, stimulate rural employment and development, it is not recommended by Grimes.

On the contrary, it clearly represents the above-mentioned dependency model, and the aim of Grimes is to identify a strategy based on indigenous development. Thus, his suggestion is to foster the development of networks of collaboration between SMEs. Through networking, SMEs can share excessive costs for services such as R&D and marketing, and they can develop more flexible production patterns. While one precondition is access to advanced communications, others are access to high quality business information, continuous training and education, and assistance from professional animateurs. However, although Grimes mentions a number of examples from Europe, it remains to critically examine these, and more specifically to identify how cultures of networking among SMEs can be created, and how big the impact is in economic and employment terms.

Recommendation of Integrated Strategies

The current transition of rural economies is difficult and complicated, as are the political organisation and diversified interests of the telecommunications players. Thus, one cannot suggest simple communication policy measures; one has to develop indirect political initiatives to encourage telecom services for rural regions. Particularly in Parker *et al.* 1992 the complex situation of state telecommunications with its myriad of players, policies, and competitive interests is analysed from a rural development perspective. In both Parker *et al.* 1989 and 1992 goals and recommendations are proposed, emphasising the need to combine electronic infrastructure policies with policies for economic development, educational, health care etc.

Also in Europe the need for integrated analyses and strategies has been reflected, and the ORA programme represented one example of this kind of integration. As early as 1988 the same understanding was expressed by the European Commission in its bulletin to the Parliament and the Council (cf. Commission 1988).

On a critical note one might add that although Parker *et al.* actually build on the results of telecommunication analyses of the 1970s and 1980s, they are perhaps a little too optimistic in their recommendations. There is a tendency both to underestimate the problems of the necessary economic transition of rural economies and the problems for rural regions created by the deregulation and liberalisation of telecommunications.

At the micro-level, the same idea of integrated strategies has been reflected within a number of services, one example being the so-called Community Teleservice Centres, CTSCs. Instead of providing access just to an electronic infrastructure, the idea is to provide an integrated service, combining communication facilities, computers and a variety of human services. Thus, CTSCs are multi-purpose centres, containing an office, a public area with access to computers and telecom services, a class-room providing both computer training and general training and education supported by computers and telecom, a meeting-room, work facilities for users (pupils, teleworkers, local farmers, businessmen), etc. The most successful CTSCs are the centres with a high degree of such service and organisational integration. In Brazil, the pilot CTSCs are run by the telephone company, while the services are provided by independent public or private entities. Thus, the owner-

ship model can best be described as an association of partners with governmental support. As a result, they provide a wider range of services and serve a larger number of potential users than do most similar centres in Europe, and the number of users in the Brazilian centres has been much higher than what has normally been achieved in similar European centres (cf. Lars Qvortrup 1994).

NEW, BROADBAND AND INTELLIGENT NETWORK SYSTEMS

Another aspect of the late 1980s and the 1990s is that new telecommunications systems are being developed: partly broadband networks, adding high-speed data transmission and video transmission to the existing voice and data networks; partly intelligent systems, combining telecommunications with computers and databases. This creates a new situation as regards the supply of services, but also as regards the demand for services and the gradual emergence of a new economic sector: the delivery from remote regions of value-added services, and particular the development of different forms of information-based businesses, e.g., telework.

Broadband Systems and Integrated Services Systems

In the 1990s one can no longer regard telecommunications infrastructures as simply neutral carriers of any kind of information. In addition to talking about POTS, ISDN, broadband etc. one also has to consider service-oriented systems such as: distance learning systems, telemedicine systems etc., i.e., systems where the integration of telecommunications, computers and databases is reflected.

Advanced Communication Systems and Regional Development

Still, very little literature is available about advanced communication systems and regional development, and Peter Shields *et al.* (1993 p. 584) are accurate when they say that "policy makers are currently making decisions about upgrading the PSTN with little or no empirical evidence concerning residential users' use and uses of POTS-plus products and services."

In their analysis of who needs POTS-plus services, Shields *et al.* conclude that the existing rural/urban distinction employed in the policy literature obscures a complex pattern of differences and similarities within and between urban and rural areas. However, their study offers little evidence that there exists the level of actual and potential residential user demand for network POTS-plus services needed to persuade the residential user to bear the cost of accelerating the upgrade of the PSTN. Instead, they suggest that new technologies should be targeted at those markets where demand is relatively proven.

In another analysis of broadband networks for regional development (Ó Siochrú 1991) the same point of departure is implicitly taken, that the existing rural/urban distinction is too simple for analysing the potential use of broadband communication. However, the focus is on business users, and consequently the conclusions are different. In addition to identifying what new applications can be supported by broadband systems, and which economic sectors will benefit, the book concludes that unless social and regional policy aspects are addressed, then EC telecommuni-

cation policy is likely to hinder the development and establishment of advanced communication systems in less economically developed regions. In its final chapter, the publication identifies three types of regions in relation to the potential use of broadband communication:

- —regions with high density populations, high GDP, etc. which can reasonably expect to see the introduction of integrated broadband systems on a commercial basis
- —declining industrial regions or fast-growing, but less developed regions. Here, integrated broadband systems could play a role in a regional development strategy, but only if such systems are given public financial sypport
- —regions with low density populations, difficult terrain, low GDP etc. Here, introduction of integrated broadband systems has a low priority compared with the need for establishment of traditional infrastructures, better educational facilities etc.

CONCLUSION

In summary of the above literature review, there is a general consensus that in statistical terms a two-way causality exists between economic development and telematics. Economic development stimulates investments in telematics, but it is equally true that the establishment of electronic infrastructures stimulates economic development.

Similarly, it is generally agreed that the simple, linear model of telematics and development must be discarded. Currently, the dominating paradigm is the social complexity paradigm in which telecommunications is one among several interrelated development factors.

However, within this complexity paradigm there is a trend in current research to be too specific, i.e., to see every regional case as unique. Thus, the relevant research question is whether it is possible to generalise about ways and means for successfully using telematics as a catalyst and facilitator for economic and social development in rural regions.

In order to do so, a framework must be provided by carefully conducted time series analyses; but the most important contribution will come from comparative telematics policy and usage studies, where different socio-economic contexts and policies are considered. Specifically, what is needed is:

- —to classify a number of social, geographical and economic contexts;
- —to classify a number of political strategies;
- — to go deeper into the consideration of different definitions of development, e.g., dependency vs. indigenous development models, and their social and economic impacts;
- —and to undertake further specification within the field of telecommunications. Even still, most analyses of telematics and development define telematics as one single factor, instead of identifying the contribution of different technologies and services.

Already, we know that the contribution of telematics to regional development is not a simple function, but rather depends on a myriad of factors. However, this really constitutes the weak point of Parker et al (1992): their policy recommendations become so specific, that they are difficult to implement in any other context. Consequently, it is time to assist policy making by trying to classify these myriads of factors into a less complicated social typology, and thus to reduce the numerous policy recommendations into a manageable number of integrated strategies.

BIBLIOGRAPHY

Bakis, Henry: 'Geographie des reseaux de communication et de telecommunications: Bibliographie (1980-1992),' *Netcom* 6, 2, April 1992, pp. 309-395.

Calabrese, Andrew: 'A rich compilation of details.' A review of Parker *et al.* 1992, *Telecommunications Policy*, 17, 1, January/February 1993, pp. 88-91.

Carlsson, Rolf: *Tredje generationens distansutbildning (Third Generation distance education)*, Teldok, Stockholm, 1989.

CCITT (Manuel du Gas 5): *Etudes économiques à l'échelle nationale dans le domaine des télécommunications (1964-1972)*, 1972.

CCITT: *Etudes économiques à l'échelle nationale dans le domaine des télécommunications (1973-1976)*, 1976.

CCITT: *Rural Telecommunications.*, Geneva, 1979.

CCITT: *Etudes économiques à l'échelle nationale dans le domaine des télécommunications (1977-1980)*, 1982.

Commission of the European Communities: *The future of rural society*, Bulletin of the European Communities, Supplement 4/88, Commission communication to Parliament and the Council, Belgium, 1988.

Cronin, Francis J., Edwin B. Parker, Elisabeth K. Colleran and Mark A. Gold: 'Telecommunications infrastructure and economic growth; an analysis of causality,' *Telecommunications Policy*, 15, 6, December 1991, pp. 529-535.

Cronin, Francis J., Edwin B. Parker, Elisabeth K. Colleran and Mark A. Gold, 'Telecommunications infrastructure and economic development,' *Telecommunications Policy*, 17, 6, August 1993, pp. 415-430.

Dillman, Don A., Donald M. Beck, and John C. Allen: 'Rural Barriers to Job Creation Remain, Even in Information Age', Unpublished paper, Washington State University, 1988.

Engström, Mats-G., Hilka Paavonen and Bengt Sahlberg: *Grannskap 90. Närarbete på distans i informationssamhället (Neighbourhood 90. Neighbourhood-work on distance in the information society)*, Teldok, Stockholm, 1985.

Engvall, Lars, *A Socio-Economic Study on the Usage of Telephone, Television and Radio Services.* Report Np. TRITA-TTDS-8402. Royal Institute of Technology, Stockholm, 1984.

Gille, Laurent, 'Croissance et télécommunications,' *Information, communication et croissance, le bulletin de l'IDATE*, No. 16, Montpellier, 1984.

Gille, Laurent, 'Growth and Telecommunications', ITU, *Information, Telecommunications and Development.* ITU, Geneva, 1986.

Grimes, Seamus, 'Exploiting information and communication technologies for rural development,' *Journal of Rural Studies*, 8, 3, 1992, pp. 269-278.

Grimes, Seamus, 'Indigenous entrepreneurship in a branch plant economy: the case of Ireland,' *Regional Studies*, 27, 5, 1993, pp. 484-489.

Grimes, Seamus and G. Lyons, 'Information technology and rural development: opportunity or agent of decline?', Second International Summer School on Rural Development, University College, Galway, 1993.

Hamelink, Cees, 'High-tech transfer: Selling the canoe without the paddle', *Development: Seeds of Change*, 1985: 1, pp. 28-37.

Hansen, Suella, David Cleevely, Simon Wadsworth, Hilary Bailey and Oliver Bakewell, 'Telecommunications in rural Europe. Economic implications,' *Telecommunications Policy,* 14, 3, June 1990, pp. 207-222.

Hardy, Andrew P., 'The role of the telephone in economic development,' *Telecommunications Policy,* 4, 4, December 1980, pp. 278-86.

Hetland, Per, Petter Knutzen, Rudolf Meissner, and Odd Einar Olsen, *Nært, men likevel fjernt. Telematik og lokal utvikling (Close, but still far away. Telematics and local development),* Rogalandsforskning, 1989.

Hudson, Heather E., *Three Case-Studies on the Benefits of Telecommunications in Socio-Economic Development,* Case Study No. 9. Etude UIT-OCDE, ITU, Geneva, 1983.

Hudson, Heather E., *When Telephones Reach the Village: The Role of Telecommunications in Rural Development,* Ablex, Norwood N.J., 1984.

Hudson, Heather E., Douglas Goldschmidt, Edwin B. Parker, and Andrew P. Hardy, *The Role of Telecommunications in Socio-Economic Development: A Review of the Literature with Guidelines for Further Investigations.* Report prepared for the ITU by Keewatin Communications, Washington D.C., ITU, Geneva, 1979.

IDATE: *Growth and Telecommunications: A Summary of Research,* Montpellier, 1984.

ITU, *Information, Telecommunications and Development,* ITU, Geneva, 1986.

ITU, *The Missing Link,* Report of the Independent Commission for World-Wide Telecommunications Development, ITU, Geneva, 1984.

Jéquier, N. and J. Jiguep,, 'Un programme de nouvelles recherches sur le thème: Télécommunications et dévéloppement,' *Les télécommunications au service du dévéloppement,* Séminaire/Réunions Lomé, ITU, 1983.

Jipp, A., 'Wealth of nations and telephone density', *Telecommunications Journal,* July 1963, pp. 199-201.

Jonscher, C. and M. Tyler, *The Impact of Telecommunications on the Performance of a Sample of Business Enterprises in Kenya,* Case Study No. 18, Etude UIT-OCDE. ITU, Geneva, 1983

Jussawalla, M. and D. M. Lamberton (eds), *Communications, Economics and Development.* Pergamon, New York, 1982.

Kamal, A. A., *A Cost Benefit Analysis of Rural Telephone Service in Egypt.* Case Study No. 11, Etude UIT-OCDE, ITU, Geneva, 1983.

Kellerman, Aharon, *Telecommunications and Geography.* Belhaven Press, London, 1993.

Krippendorff, Klaus, 'Major Metaphors of Communication and some Constructivist Reflections on their Use', *Cybernetics & Human Knowing,* 2, 1, 1993.

Luhmann, Niklas, 'Wie ist Bewusstsein an Kommunikation beteiligt?' Gumbrecht, H. V. and K. L. Pfeiffer, (eds), *Materialität der Kommunikation,* Suhrkamp Verlag, Frankfurt a.M, 1988a.

Luhmann, Niklas, 'Organisation', Küpper, Willi and Günther Ortmann (eds), Mikropolitik, Westdeutscher Verlag, Opladen, 1988b.

Luhmann, Niklas, 'What is Communication?' *Communication Theory,* 2, 3, 1992.

Melody, W. H., 'Telecommunication implications for the structure of development', *5th World Telecommunication Forum, Part 4, Symposium on Economic & Financial Issues of Telecommunications,* ITU, Geneva 22-24 October 1987, pp. 65-69.

Nordqvist, Ivar, Elisabeth Öberg and Leif Åkehag (eds), Data — *og telekommunikationer — hur påverkas den regionale utvecklingen? (Data— and telecommunications — how is regional development influenced?),* Teldok, Stockholm, 1989.

Ó Siochrú, Seán (with the REVOLVE Consortium): *Europe Connected or Disconnected? Broadband Networks in Less Developed Regions,* Fundesco, Spain, 1991.

Oury, G. M., *Economie politique de la vigilance,* 1983.

Parker, Edwin B., Heather E. Hudson, Don A. Dillman and Andrew D. Roscoe, *Rural America in the Information Age: Telecommunications Policy for Rural Development,* The Aspen Institute and University Press of America, 1989.

Parker, Edwin B. and Heather E. Hudson, *Electronic Byways. State Policies for Rural Development Through Telecommunications,* The Aspen Institute, Westview Press, Boulder 1992.

Pierce, William B. and Nicolas Jéquier, *Telecommunications for Development,* ITU, Geneva, 1983.

Porat, Marc U., 'Information, communication and division of labor', Jussawalla and Lamberton (eds), *Communications Economics and Development.* Pergamon, New York, 1982.

Qvortrup, Lars, 'The Nordic telecottages: Community teleservice centres for rural regions', *Telecommunications Policy,* March, 1989.

Qvortrup, Lars, 'The controversy over the concept of information', *Cybernetics & Human Knowing,* 1, 4, 1993.

Qvortrup, Lars, 'Community TeleService Centres: A means to social, cultural and economic development of rural communities and low-income urban settlements', A document for the World Telecommunication Development Conference (WTDC), ITU, Buenos Aires, 1994.

Saunders, Robert J., Jeremy J. Warford, and Björn Wellenius, *Telecommunications and Economic Development,* John Hopkins University Press, 1983.

Schiller, Herbert, *Who knows? Information in the Age of the Fortune 500,* Ablex, Norwood N.J. 1981.

Shields, Peter, Brenda Dervin, Christopher Richter and Richard Soller, 'Who needs 'POTS-plus' services? A comparison of residential user needs along the rural-urban continuum', *Telecommunications Policy,* 17, 8, 1993.

NOTES

1 This is a classical problem in the philosophy of science and theory of knowledge, and was already outlined in 1690 by John Locke, cf. John Locke: *An Essay Concerning Human Understanding,* London 1977. Here, I am inspired by, for instance, Thomas S. Kuhn, George Lakoff and Mark Johnson, and Niklas Luhmann, cf. Thomas S. Kuhn, *The Structure of Scientific Revolutions,* 1962; George Lakoff and Mark Johnson, *Metaphors We Live By,* University of Chicago Press, Chicago, 1980; Niklas Luhmann, *Erkenntnis als Konstruktion,* Benteli Verlag, Bern, 1988; Niklas Luhmann, *Soziologische Aufklärung 5. Konstruktivistische Perspektiven,* Westdeutscher Verlag, Opladen, 1990.

2 A detailed review of the concept of information from Shannon via Bateson to current Second Order Cybernetics can be found in Qvortrup 1993. See also Krippendorff 1993

3 As I said in the introduction the literature review provides an idealised version of research in telematics and social development as a rationally progressing collective activity. I will however allow myself to give just one example that of course research does not represent a linear string of progress. Sometimes old methods are repeated, even though in new fancy clothes. One such example is represented by the *Analysys Ltd* study of telecommunications in rural Europe.

In a study undertaken on behalf of the Commission of the European Communities (summarised in *Telecommunications Policy,* cf. Hansen *et al.,* 1990) based on three microeconomic analyses in Norfolk, Donegal and Foggia, where they compared costs of using telecoms and IT with benefits of using telecoms and IT within a context of economic indicators of the three case study regions, it was concluded that "...if all the 'very rural' and 'rural' areas of the EC invested 1% of their GDP in telecommunications and IT, between 700 000 and 900 000 new jobs would be created. The cost of creating this new employment is approximately ECU 11 600 per job..." (Hansen *et al.* 1990 p. 207).

First, with data for only a single time period one can at most demonstrate an association and not a causal direction of the relationship between telematics and economic development.

Second, even though time series anayses had been performed, they could not provide specifically quantifiable answers which could be generalised for other and larger regions. Cronin *et al.* emphasise this important fact quite explicitly: "It is important to note that statistical measures of causality can only be used to accept (ie fail to reject) or reject the stated hypotheses. They provide no measures of the magnitude of the causal relationship. For example, causality tests themselves will *not* provide answers to such questions as: How much additional economic activity can be generated by investing an additional dollar in telecommunication." (Cronin *et al.* 1993 p. 416) The same is true of ECUs, of course!