NETWORKED SCHOOLS AND EDUCATION INEQUALITIES IN BORDER AREAS

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Abstract
The focus of this paper is on network integration issues and their potential to support the development of ICTs applications in education in border and peripheral areas. The paper elaborates on the concept of 'networked school' as the core of educational applications in such areas, considered as a 'gate', through which they can get access to knowledge stock and information outside their frontiers. Such developments can complement traditional educational processes at the primary and secondary school level, but also enhance vocational training prospects in less privileged regions.

Keywords: *ICTs applications, education, training, networked school, peripheral regions*

JEL, **classification** R10, R40, R30

1. Introduction

Network integration is a crucial aspect in the context of the information economy, due to its potential to ensure 'connectivity' among regions, through integrated transport and communication networks. Especially the later is considered as the cornerstone of various telematic applications, applying in many fields of the economic and social environments e.g. e-commerce, e-training, virtual organization, teleworking, telemedicine.

Such applications provide a promising prospect especially for border areas (e.g. peripheral, isolated or less developed regions), due to their potential for removing various types of *barriers* established in these regions, strongly conditioning their development potential.

The focus of the present paper is on the role of ICT applications in the field of education in border areas. More specifically, the paper concentrates on the role of specific applications in education in these areas. In chapter 2 the main characteristics of the border areas are discussed, together with aspects relating to educational inequality. Chapter 3 focus is on the technical aspects of network integration – the 'technology' – in border areas. In Chapter 4, the prospects of education in a network environment are studied, where, among others, some basic definitions as well as issues involved are discussed. Chapter 5 concentrates on the concept of 'networked school' as the 'core' of potential educational applications in border areas – the 'users' of the technology. In this framework various network-based learning environments are presented, together with their prospects and limitations for educational purposes at the various levels. Finally, in chapter 5 conclusions and prospects are drawn.

2. Peripheral Areas and Educational Inequality

Various definitions of border areas can be found in the literature. In this context border areas are defined as peripheral areas – not necessarily lagging or underdeveloped, which are less oriented towards the center and more to the external economic world (Nijkamp [17]). Border areas can also be considered as countries or regions at the boundaries of the developed world, which also have the role of 'gateway function' between developing and developed countries (Giaoutzi and Stratigea [9], Giaoutzi et al. [10]). In the European context, the distinction between 'internal' and 'external' border regions has also been introduced, differentiating thus a frontier between two EC members from an EC member with a non-member respectively (Hitiris [14], Armstrong and Taylor [3], Geenhuizen et al. [7]). Border areas are also defined as regions distinguished by a certain type of *discontinuity* in terms of their specific geographical characteristics (Reichman [21], Ratti and Reichman [20]). Other studies perceive border areas as being equivalent to frontier between states (Anderson [2], Boot and Van der Veen [5], Corvers and Hassink [6]).

An important characteristic of border regions is discontinuity, which becomes much more evident in a network structure (Reichman [21], Rossera and Ratti [23]). They may include discontinuous communication infrastructures for transport, telecommunications, legal codes and procedures and missing or dissimilar institutional mechanisms that help regulate and enforce property rights, commercial transactions and contractual arrangements. These discontinuities usually account for *development lags*, which lead to significant *transboundary disparities* (Giaoutzi [8]).

In contrast with peripheral regions, border region barriers are more difficult to break down, since they are the product of both domestic and international political structures and of development lags. In most cases, border areas are having very little influence on the decision-making processes of the central government, even in matters that have a direct impact on them. Therefore these barriers are tending to be less permeable over the long term, especially on infrastructural development, innovation diffusion and public resource investments (Reichman [21]).

From their definition, it is evident that border regions can play a dual role in the spatial system, acting as both *barriers* in a spatial network and *contact points* for spatial flows. Border regions, in their 'barrier role', are hampering the smooth flow of goods, persons and information, while in their role as 'contact points' they partially allow this flow by applying a filter function (Blaas and Nijkamp [4]). The role assigned to a border region - namely barrier or contact point - is strongly dependent upon its connectivity to other regions, which refers to the region's network infrastructure and its performance.

It would be expected that border regions or peripheral regions in general would be more inclined towards the adoption of advanced communications systems, thus compensating for the physical distance drawback and its consequences. Various studies though, focusing upon the issue of variations in the up-take and adoption of advanced communications systems and their applications in border areas, have revealed a consistent pattern in the opposite direction. In fact, they have concluded that it is the *complexity*, which drives the demand for electronic communications and not the distance between communicating parties (ACCORDE [1]).

Apart from the complexity paradigm, which consists of a main barrier in adoption and use of advanced communications systems and their applications in border areas, certain other barriers are also applying in this respect, which can be summarized into the following categories:

- Barriers relating to the lack or inadequacy of the necessary *telecommunications infrastructure*; less favored regions are usually characterized by poor infrastructure, leading thus to restricted range of applications with poor quality and high costs (Giaoutzi and Stratigea [9]).
- Barriers relating to the lack of *sufficient information* on the potential role of various applications of advanced telecommunications systems towards increasing efficiency in border regions.
- Barriers in the *organizational system*, reflecting poor and ineffective organizational schemes (both public and private) present in border areas, which limit the ability to manage complex situations (Parker and Hudson [19]).
- Barriers in the *regional economic system*, relating to the 'resistance' of border economies in the transition from traditional to service or information economies. Culture, tradition, education and training facilities etc. are several of the main factors beyond this resistance (Giaoutzi and Stratigea [9]).

- Barriers at *adoption rates* of ICTs, relating to cost barriers involved in joining the network, qualification barriers associated with the existence of sufficient skills to effectively adopt such technologies and service provision barriers, linked to the limited support of potential users by skilled professionals in the field.

In order to overcome these barriers, two directions of action are of importance, namely the:

- Network integration aspects (the technology); and
- Promotion of user-oriented applications in various fields (the users).

The first relates to the provision of *cross border infrastructure* as a 'tool' supporting the introduction of various applications in border areas i.e. the 'technology' to be used. This is strongly related to available funds and political priorities of the central government in respect to regional development; and technical aspects of network integration, i.e. technological requirements of the necessary network infrastructure.

The second is focusing on the promotion of the *user-oriented applications* in the various fields of activity. This implies the 'use' of the specific technology in order to solve various types of problems. It is clear that the latter may consist of a very time-consuming process, especially in the context of border areas, as it is largely based on the cultural aspects of local communities, the existing stock of knowledge, the financial aspects involved for the adoption/use of these applications (e.g. proper equipment costs), the lack of skills for handling such applications, etc., which determine the demand for such kind of applications.

Evidence from various empirical studies shows that adoption and use of advanced communication systems and their application can, apart from the economic dimension, contribute also to the social dimension of border areas, improving social services such as education, health and administration of government services. The improvement of such services in border areas can have multiplier effects on local economies as a whole (Reichman [21]).

In the sequel, the role of such systems in the field of education will be considered. The reason for such an approach is that education, especially in the early stages of human's life, can largely contribute to the change of attitude against technology of a very dynamic component of the population of local communities, the young people, by increasing their knowledge and skills in respect to advanced services and by providing a 'gate' to the external world and opportunities. This, in turn, can affect the patterns of use of these technologies. It may also increase the knowledge stock of schools on behalf of the education process as well as their ability to interact with other school communities and exchange experiences on various educational issues. The latter is quite important in the context of border regions, where access inequality deprives schools from getting experiences and knowledge and interacting with school environments and other sources of knowledge and information outside their frontiers.

3. Aspects of Network Integration in Border Areas

Networks have long been discussed as a revolutionary technology that will drive the evolution of all aspects of human life in the future. The Internet, initially a military network (ARPANET), later an academic network and lately an integrated business and communication network has been expanding with amazingly high rates. Something that non-technical audiences often ignore is the fact that the technologies that today form the Internet are not initially developed with security and manageability in mind. In the real life, every user has some experience of bad or not stable lines and generally of poor quality of service, both at the network and the application level.

Nevertheless, the technical infrastructure of the Internet is neither homogeneous nor granted to be everywhere. It is quite clear that no dominant entity exists on the Internet. No single authority has the power to decide upon connectivity, technologies, security, or anything at all. There is a vast range of even competing technologies that co-exist and collaborate to form the global network, often drawn as a cloud that is perceived as the Internet.

Access to Internet requires the subscription to an Internet Service Provider (ISP). Becoming an ISP requires investments on expensive network and hardware infrastructure, which brings into discussion the issue of business viability and profitability. ISPs have never been and will never be social utility providers, such as power and water public-owned companies existing in various countries. If the critical market mass does not exist in one region, ISPs either do not offer their

services, or raise the prices. This goes along with telecom companies' policies. Since the liberation and privatization of telecommunications in Europe, almost everyone is connected to current digital networks offering voice telephony services. However, the technical infrastructure of such networks does not always permit high-speed Internet connectivity, according to the current perception of network bandwidth and to the requirements of advanced Internet applications.

The less-favored areas with respect to high-speed Internet connectivity are the border areas, where investments both from ISPs and telecom companies are still considered of high risk and low profit, compared to alternative options. There are several reasons for this, ranging from the number of non-urban and border residents, to the educational level and cultural characteristics of such populations, which do not push citizens to consider Internet access as a necessity. Of course this gradually changes, however not with the rates that would be required for the creation of the critical mass mentioned above.

Investments made in backbone networks usually concern the connectivity of large urban centers at very high speeds. New mid-level high speed technologies, such as optical metropolitan area networks are also commercially available. Yet, in most cases they are not available to border areas, where the dial-up connection is the most common case of Internet connectivity for both individuals and organizations. Hence, it would be realistic not to consider the availability of high-speed Internet connectivity of border schools as granted.

In the light of the liberalization of the telecommunications market, the goal of reaching the status of effective and equitable infrastructure provision, especially for border or disadvantaged areas, can be succeeded through several schemes such as (Hudson, [15]):

- Provision of incentives, through competition or concession to telecommunications operators;
- Policies to foster investments and competition in the telecommunication industry in order to assure continuous innovation and aggressive pricing of services;
- Requirements of licenses or franchises, like the *U*niversal *S*ervice *O*bligation (USO) condition, as a prerequisite of license provision to operators, applied by many countries; or the carrier of last resort model, via which the dominant carrier, entitled to a subsidy, has the obligation to provide the service if no other carrier will;
- Various forms of subsidization of services in areas, which are thought as less profitable to serve. Subsidies may apply in both high cost areas (isolated areas, areas with very low population etc.) and disadvantaged areas or customers, relating to areas or groups, which cannot afford the costs of getting access to and use of such services. Some countries are applying the route-averaging model, which requires all rates to be averaged so that every customer is paying uniform distance charges, regardless the location.

4. Education in Network Environments

The use of Internet and particularly the World Wide Web has widened the potential of information gathering and exchange. 'Netizens' have access to vast information sources; learners have access to experts-based learning resources, widely dispersed in the cyberspace, which would, otherwise, not be accessible. At the same time, networks offer many broadcasting possibilities. Practically everyone can set up a web page and distribute information worldwide. Computer-mediated communication is rapidly expanding, enabling people with shared interests to create and sustain relationships and virtual communities. Put in the context of education, despite the lack of physical contact, CMC facilities allow students to support the exchange of knowledge and information and to *'realize' a sense of belonging* [Hiltz and Wellman [13], McConnell [16]).

Network technologies are used as the cornerstones of the new learning environments within educational systems. Such environments support or even partially automate the instructional process. The use of new pedagogical frameworks in network environments is encouraged. It is desirable and in some cases common case that collaborative learning and peer learning co-exist within the new pedagogical frameworks.

Hiltz and Wellman [13] defines collaborative learning as '… a learning that emphasizes group or cooperative efforts among faculty and students. It stresses the importance of active participation and interaction on both the students and the instructors' side. Knowledge is viewed as a *social construct*,

and therefore the educational process is facilitated by social interaction in an environment that facilitates peer interaction, evaluation and cooperation'.

In order to discuss the issue of education in a network environment, it is essential to clarify the meaning of three key terms, namely culture, training and education.

Culture is used to denote all kinds of stimulations that people receive from their social environment throughout their whole life. It is what a social environment 'broadcasts' in terms of social behaviour codes, ethics, customs, and values. Culture is by no means a collection of knowledge. It relates to the conception of the historical evolution by the individual, which partly corresponds to a non-determined amount of knowledge.

The second key term is *training*, which refers to the process of delivering knowledge from one part to another, so that a defined goal can be achieved. For example, in vocational training the objective of the knowledge delivery process is to support persons in obtaining the skills required to enter a specific job market.

Education, the third key term, as a notion and a social activity, relates both to culture and training. It is offered starting from the first years of a person's life, as an organized social process for delivering culture, ethics and values, as well as some knowledge, in case of vocational training. However, the provision of skills required to find a job is not its main objective. Education is a social service that primarily aims at reproducing and evolving the society itself.

Culture is 'broadcasted' by everything in a social environment: family, school, personal relations, media, computers, fashion, music, etc. Paradigms and messages of any kind are 'transmitted' by society in general to every single individual, and vice versa. Their perception depends on economical, geographical, historical, and cultural conditions. This diversity in perception generates the powers that push the wheel of social evolution. Bearing this in mind, it is important to distinguish between the means and the purpose. The same means can be used either to favour one purpose, or equally well to harm another, depending on the nature and the characteristics of the parties involved. It is the use, not the tool itself, which makes the difference between 'good' and 'bad'.

New computer and network-based tools (hypermedia, Internet, World Wide Web) have stimulated a vast number of investigations into the opportunities and challenges of putting these tools into the field of education (Retalis et al. [22]). Their adoption in the education field can lead to the effective removal of various types of constraints, which can be properly crossed by using computer networks. This fact is quite essential in the context of peripheral and border areas.

Theoretically speaking, one would expect that the education community defines the way computer networks are used in education. However, this is not usually the case. Although the 'marriage' between the 'technology push' and the 'learning pull' is desired to be dominated by the latter, educators are seldom the policy makers for incorporating computer networks in the learning process. Thus, in many cases, the driving force for putting computers into schools is the 'technological determinism'.

Integrated global computer networks are certainly a catalyst for change, which could bring about a new revolution in education. A revolution that deals with the philosophy of how one teaches, the relationship between teacher and student, the classroom structure, the relationship of the networked school and its external environment and the nature of curriculum.

Network deployments in the education field are enabling technologies for the collapse of several barriers existing today in terms of providing access to knowledge and opportunity, especially in geographically dispersed schools. Technology can also be a barometer of that change, providing of what is working and what is not. However, the definition of the networked school that provides equal access to culture, knowledge and social awareness, has still a long way to go.

Networked learning environments, as being time and space independent, have brought up new possibilities for collaborative learning (McConnell [16] in all scales: individual, classroom and school-wide (Collis and Smith [11]). The effectiveness of collaborative learning does not depend on the networks themselves, but on the definition and understanding of the roles of teachers and students in such learning contexts. Operating in a network-based educational context may generate a feeling of 'virtual symbiosis', although real social contact may never take place. However, networks are thought as the *prerequisite* for the realization of learning environments.

Networks also facilitate learners to become 'peer tutors'. Fellow students (peers) can ask individual or small group of students to present assignments to one another for discussion and

criticism. One exemplar case could be that all the assignments (different for each group of students) are on-line in order to enable the easy access to this material, the easy commenting by other students or groups of students and the exchange of ideas on the problem solving process.

5. Networked-based Learning Schemes

Controversial issues concerning the educational philosophy of different learning environments lie on the dilemma about teacher's role: '*A sage on the stage or a guide on the side?*' Figure 1 presents this concept, as well as the learning environment characteristics in each case.

In the case of traditional classroom (1a), the learning environment is homogeneous and learners have actual social contact with the tutor and their colleagues. The single handbook, the restrictions imposed by location, and of course the weaknesses of the tutor are usually mentioned as important shortcomings of this paradigm (Norman and Spoher [18]).

Figure 1b illustrates the 'learner-centered' approach, where by using network infrastructure and educational software, students benefit by accessing knowledge from many sources and thus many points of view (experts, virtual tutors, remote tutors etc.).

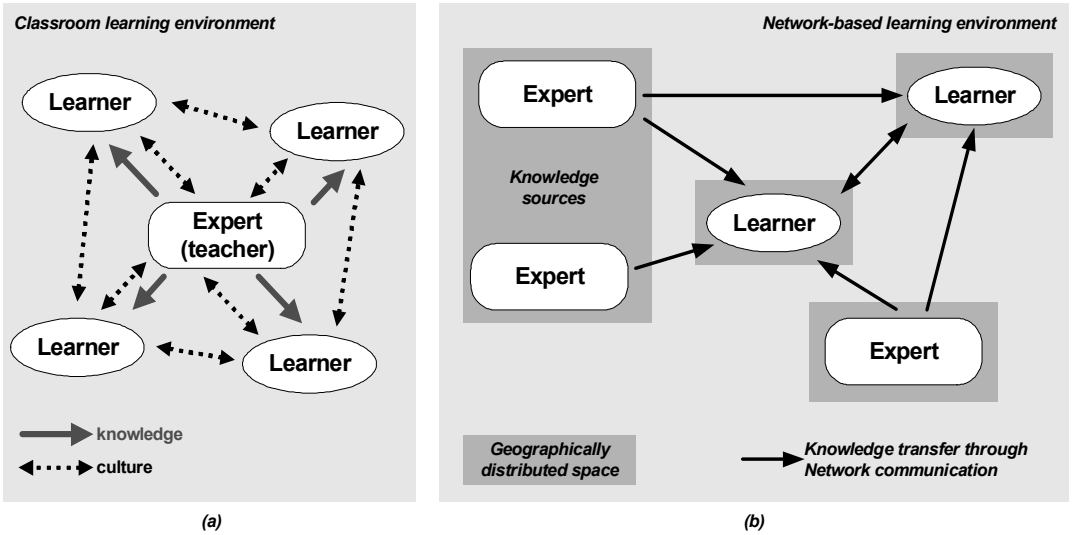

Figure 1: The traditional and the network-based learning space

Networked schools eliminate indeed time and geographical barriers, which is necessary in order to remove or reduce educational inequalities. They provide learners with access to information and learning resources 'when, where, how and as much as they want'. One extreme perception of the networked school is a 'wall-less' and 'paper-less' set of virtual, geographically distributed classrooms, 'open' to a wide population of learners (Graziadeli [12]). Disadvantaged children and other groups of non-privileged population (due to geographical, financial, socially and health reasons) can have access to school at their own convenient way.

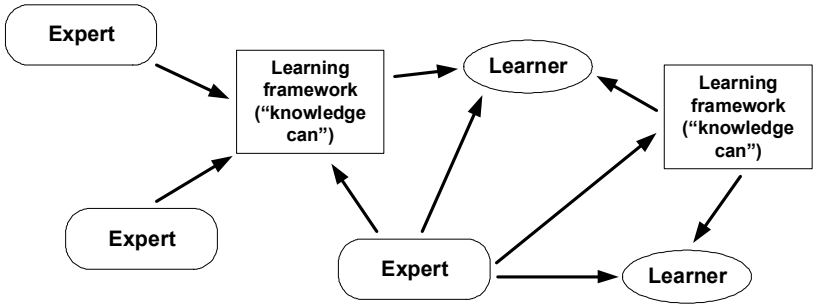

Figure 2: Modern network learning spaces involve both experts and software

Moreover, tutors and learners can communicate asynchronously at their preferable time of the day, having, as a result, more time for other creative activities. It is also stated that off-line interaction between teacher and students has better results in the quality of messages exchanged, than when they interact on-line or in person. Main reasons for this are that all parts have more time to think before sending a message as well as that, in some cases, students are reluctant to participate in classroom conversations. Modern learning frameworks incorporate learning material in 'knowledge cans'. By making such services available through the Internet, even asynchronous interaction between tutors and learners is not needed (Figure 2). Instead, all the work is done by software in the 'knowledge cans'.

As expected, there are not only pros in the networked school paradigm. In a traditional classroom learning environment, tutors give students their own ethical and cultural paradigm, which students, influenced from other stimuli as well, can decide whether to follow or not. In such a process, a young person learns how to be a member of a community, not of a virtual community, but of a real one. On the other hand, the networked learning environment is quite *heterogeneous*. Although perhaps 'bare' knowledge can be communicated better, the live paradigm of the inspiring tutor cannot be communicated to students. Independence from time and place might be a 'plus', but it has little to do with the fundamental nature of the educational process in elementary and secondary schools.

Researchers involved in this field, often have a strong technical background that guides them to invent new learning approaches in order to better exploit networks. Attention is focused on 'how to stress current educational practice in order to heavily use new technologies'. To support such positions, numerous references to current practice shortcomings are made.

However, since the educational process is a highly social process, involving 'real time' face to face interaction among the different actors, it seems that problems related to that process in border regions could not be solved by simply replacing classrooms with networks, teachers with multimedia databases and media streaming, and social interaction with computer messaging. The way young people learn highly depends on the unique characteristics of the social environment they belong to. Diversity is a source of evolution in nature as well as in society and this diversity is clearly reflected in both structures and contents of educational systems around the world. What seems to work under certain conditions is not guaranteed to do so anywhere else. Current network-based learning approaches do not seem to take this into consideration. Therefore they prove to be useful only under certain conditions.

Equity in access to the instructional process is a topic where actual progress is made indeed by using networks in education. However, this progress is rather quantitative than qualitative. The common denominator of those who have access to some instructional process increases, but so does the diversity between 'best' and 'some' education. The smoothing of social inequalities is fairly behind the numerical increase of those who have access to some elementary education.

Although education network environments may prove useful in reducing various barriers, applying in specific types of regions, and more specifically in peripheral and border areas, this seems to be accomplished by the adoption of the necessary scheme, relative to the type of educational level. It seems that the 'truth' lies neither on the unconditional acceptance of the proper technological applications, nor on the complete denial of them in the education field. It lies on the *proper use* of technology as a tool, under certain conditions, in every single educational context.

Culture is not something an educational structure can communicate by using impersonal tools. Tutors have been and will always be sources of inspiration and living examples for their students. Network-based technology cannot change that. The multi-faceted crisis of our era has its causes, among other things, in the lack of young people visions for the future, in the consumer-centered world, in the lack of historic consciousness etc. It is common knowledge that the most important role in the resolution of this crisis is to be played by the content of culture and education - not by the tools used to deliver knowledge.

These tools can be used effectively by assigning to them a complementary supporting role, while education retains its cultural, social and training role. Putting the two paradigms work together, as illustrated in Figure 3, can defeat several shortcomings of improper or unconditional usage of networks in education. The traditional classroom keeps its role in educating social-aware and responsible citizens, whereas network-based tools provide access to knowledge resources and services that would otherwise be unavailable. Schools located in border or other non-privileged areas can, by properly incorporating network technologies in the educational process, have access to a useful tool

for narrowing the gap of opportunities they offer to students, compared to those offered to students of schools in urban areas.

Networks in primary and secondary education continue to be seen as a bolt rather than an integral structure to quality provision in education. The networked school is not a panacea for the problems that are faced by the educational systems, but can add significant value to the learning process and cope with physical or other kinds of 'isolation' problems of students in border and peripheral regions, to the extent that they keep their role in culture provision. Particularly in border areas, the networked school is an opportunity for fighting educational inequalities and unequal access to educational opportunities, keeping always in mind that networks are just media - not social environments.

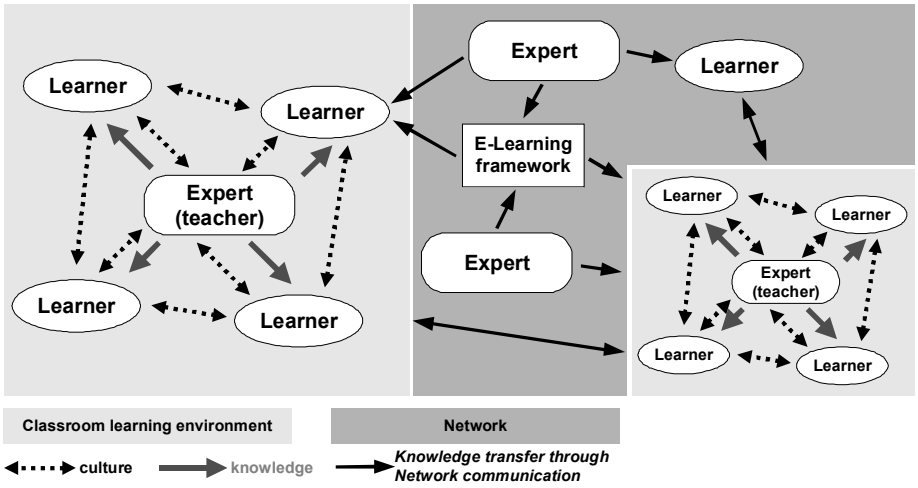

Figure 3: A synthesis of educational paradigms towards the networked elementary and secondary school

6. Conclusions and Prospects

The issue of network integration is a crucial aspect in the context of the network economy in terms of ensuring equal and efficient access of border and peripheral regions to knowledge, resources and opportunities. Nevertheless, advanced communications and their applications are not sufficient to overcome problems of peripherality and lagging development faced by border regions. Although they provide the 'core' for the development of various applications, they still have to be combined with a broader bundle of strategies that address problems of uneven regional development and opportunity in order to effectively support such regions.

Policy initiatives therefore focusing on the creation of an environment in which advanced services are offered should be combined with other policies as well, aiming at developing and diffusing these services among users (e.g. education, training, incentives to adopt such services, subsidization of costs involved in early adopters).

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