

Information and Communication Technology: Trends and Challenges for Regional Policy

Whether ICT becomes a centralising force or a boon to the regions will depend on the distribution of technical and human infrastructure.

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Technology as socio-technical constructions

Few, if anybody at all will dispute that the Information and Communication Technology (ICT) developments have wide-reaching impacts on most parts of society. However, it is much harder, if possible at all to predict what type changes we are going to see. In fact, the technological developments offer the potential for a number of different patterns of changes in society, both at a local, regional and national level.

We have chosen to present two main scenarios: i) *The regionally grounded ICT future*, where there are many proactive regions finding their way into the 'information society', and ii) *the centralised ICT future*, where there are passive or reactive regions and local communities that are adapting to outside/externally defined structures and driving forces. These two scenarios will be comprised of alternative trends, whose difference can be found along a number of dimensions. The span between these 'cultivated' pictures will contain a wide range of possible scenarios.

Such systems will further enhance the potential for various types of work arrangements and collaboration spanning distance in time and space. One particular type of such applications are telemedicine, which is likely to dramatically change the way medical care is organised and administered. Another important area will be ICT-based teaching and learning systems, which are expected to revolutionise the educational institutions.

It is also believed that integrated systems and services for administrations and other public bodies will improve the access of businesses and citizens to information on regulations, leading to more contact, exchange and feedback between local, regional and national administrations and citizens, institutions and businesses. This is also expected to facilitate contact between citizens and elected representatives and thus further the understanding of how democratic institutions work.

ICT infrastructure as basis for innovation and business development.

We believe that the ICT infrastructure is one important element of regional and local innovation systems. In this context, the prediction is that the various characteristics of ICT are very influential on how ICT systems are developed, adopted and used in all parts of society. Traditionally,

infrastructure comprises the basis transportation and communications facilities in an organisation or a society. In this work the definition of an ICT infrastructure include technical and organisational elements, and in addition the knowledge, competence and skills that are necessary to develop, maintain and use the infrastructure. The characteristics of regional and local ICT infrastructure may strongly influence how regions and local communities will develop differently.

Centralisation versus decentralisation

Whether ICT promotes centralisation or decentralisation has been a hot issue for a long time. Extensive research give significant evidence to that ICT can support either, depending on what the most powerful groups want in the different cases, and the type of technical solutions that are implemented. We may see a strong tendency toward use of computing technology to reinforce the decision authority status quo: in other words, the ‘reinforcement political interpretation’ ”. Accordingly, we therefore need to ask; decentralisation for whom, where and for what purpose? It raises the questions of the number, location, power, diversity and vitality of centres, each one a key issue in regional politics.

An example of this duality is telemedicine. The Nordic telemedicine model is based on collaboration between central and local sites and the overall aim is to distribute medical expertise. A centralised model of telemedicine, on the other hand, has the primary objective of providing health services from highly competent centres (hospitals, telemedicine organisations, etc.) to the patients in rural areas, but not necessarily in co-operation with local health service personnel. A similar dichotomy may be seen in ICT-based learning systems and organisations. This illustrates that the regional consequences of ICT will be determined by different choices. They will not be exclusively determined by technological developments.

Networking versus integration

Many will think of networking as a method of decentralisation, entailing co-operation between parties which are more or less autonomous. As a result, centralisation and the need for standardisation may come into conflict with the request for locally developed solutions better suited to the individual organisation. The current trend of networking towards integration within and across organisational barriers implies involvement between an increasing number of actors from various groups and organisations. Networking is not just another word for co-operation. While co-operation is often based on working towards common goals, networking involves being faced with incompatible beliefs and values. It is important in this context to study how increased networking may change social and cultural structures in rural economies. ICT obviously has the possibilities to decentralise tasks and jobs, but until now it has mostly been used to centralise.

Automating or informing

It may seem that advances in the use of ICT is linked to the degree of automated work processes and other activities. ICT differs from earlier generations of "machine technologies." In addition to automating processes through transforming information to actions, ICT also generates a new flow of information. It is therefore characterised by a basic duality: it can be used to automate work operations and at the same time produce new data about the underlying administrative and production processes in the organisation. This can be called *informating*. This distinction illustrates how ICT represents both a continuation and a discontinuation of earlier industrial changes.

The implication of this duality of ICT is the revolutionary potential that may be realised, depending on the choices of technical solutions. Such choices will have a great impact on the design of production systems and work places, on service provision and the way ICT is applied in various settings.

These two opposing strategies for computerisation also have dramatic consequences for the working environment. Automation implies the use of ICT to collect information for surveillance and greater control of employees. Informating, on the other hand, means the distribution of information to individuals in an organisation to enhance their ability to work competently. Automation is a continuation of the Taylorist management style based on more advanced forms of control. Informating implies an increase in competence and skill, which may challenge such traditional patterns of hierarchical control. It is important to be aware that networking technologies may support both outcomes, depending on how they are implemented.

To make a choice one must have the possibility to choose. If the infrastructure does not exist in a region or local community, the public authorities, businesses and individuals will not have the opportunity to take advantage of developments in ICT. A general aspect of technical developments is that the demands for improved infrastructure will increase rapidly.

How the distribution of the infrastructure is managed is an important and still controversial political issue. The current trend in most countries is deregulation, which means leaving most infrastructure building to private companies and limiting government intervention. In the past, however, infrastructure building was seen as primarily the responsibility of the government. We believe that both strategies may be likely in the future.

It is important to point out that in the future, there may be different ways of distributing infrastructure. In one scenario the *technical* infrastructure is rather even distributed geographically. In the other scenario infrastructure is more unevenly distributed, which is to say that its availability will mainly depend on market mechanisms. Rural regions are likely to have a weaker infrastructure.

However, the distribution of the organisational and human infrastructure is even more crucial but more difficult to manage by political decision. It is not self-evident that a region with modern technical infrastructure will be sufficiently attractive to competent individuals and organisations. What is needed is particularly knowledge of how to utilise and maintain the infrastructure.

Figure 1 presents four possible future scenarios.

		Distribution of technical infrastructure	
		Centralised	Regionally distributed
Distribution of human infrastructure	Centralised	The conditions for developing competitiveness through ICT will be much better in urban than in the rural areas. Possibilities for exclusion of rural regions.	Infrastructure will be available in rural and peripheral regions, but the latter will be dependent on human infrastructure in the urban regions and will tend to play a subordinate role in the information society.
	Regionally distributed	This scenario quite different. If the human infrastructure are well distributed while technical infrastructure is not, this implies a sort of 'stay of the world' ideology.	This situation will create the best conditions for developing competitiveness in urban and rural areas.

If both the technical and human infrastructure is centralised in urban regions, it will obviously result in a situation where the ability to utilise the infrastructure also is centralised. It will be difficult for businesses and public organisations in urban regions to collaborate with enterprises and

the public sector in the rural regions. This is specifically true for business opportunities which are based on the application of advanced technology and infrastructure.

If the technical infrastructure is present in rural regions, businesses and public sector institutions in these regions will be able to participate in collaboration. The driving forces will probably be located in urban regions while the enterprises located in rural regions will have a more subordinate role.

The best situation for both urban and rural regions is that both the technical and human infrastructure is geographically distributed. This will create the best conditions for businesses to develop and use ICT as a tool in the competition between enterprises and public sector institutions. Some may claim that this development will be damaging to the urban regions and that their international competitiveness will be weakened because the development in the rural regions will demand both economic and human resources.

It may also be claimed that the ability to collaborate over distance will stimulate an innovative environment and that distance collaboration will improve the organisation of businesses and society in general. Finally, choosing a development strategy for the rural regions is a matter of political choice.

The innovation challenge

Clearly, the application of ICT implies shifts in societal development. The possibilities for collaboration and interaction over distance will cause major changes in the near future. So far we have mainly observed improvements in storing, retrieving, processing and communicating as isolated phenomena. Recently there has been more integration of different media and a convergence of systems.

Data and information networks have existed for a long time, but only recently have they been used to create knowledge networks between educational institutions, within industry and businesses and public organisations. In these networks knowledge is exchanged through the new media and thus creates a basis for co-operation over distance.

In a more developed information economy, information is the core resource that firms exploit in order to create the value their customers are seeking. It is not sufficient to invest in the information infrastructure alone. What is needed is to create new forms of organisations and to develop the human infrastructure (the people and organisational culture) to be able to exploit the new infrastructure for business purposes. The changes in infrastructure and globalisation processes change the structure of the markets, increase the competition and change the way business is done. They alter the operational and managerial systems of the enterprises and transform the nature of work at all levels of the organisation. The new way of working depends upon a different approach to the distribution of knowledge and to knowledge exchange in the organisation based on the principles of equal access and equal opportunity.

The future challenge is to distribute knowledge and innovation systems within and between organisations. In such organisations the members not only share knowledge and co-operate in solving isolated tasks. The members share a vision, are able to use each other's imagination and to share even tacit knowledge. In other words, the challenge is to create learning organisations that span distance and can collaborate and interact both synchronously and asynchronously to deliver products and services.

There will surely be regional differences in how society, industry and individuals manage these challenges. Without a technical and human infrastructure there will be few possibilities to develop the necessary new organisational structures. There will also be regional differences in how the innovation challenge is being met. One of the important future tasks will be to increase our knowledge of how to stimulate the creation of innovation systems.

The regionally grounded ICT future

A regionally grounded ICT future will entail a situation where the services made possible by the new technology are widely accessible, both geographically and in terms of social groups and people with special needs. Located around the regions will be public service centres giving access for people who do not have access to the net from their home or workplace. These service centres are manned by a service person.

Improvement in the technical quality of telemedicine, have increased remote consultations. Through a network access patients can keep themselves updated on illnesses and other problems and participate in prevention, treatment and rehabilitation of illnesses. The use of video conferencing technology no longer frustrates employees. Video conferencing equipment is integrated with the workstations and the quality of sound and images is excellent.

The interaction between the public sector and inhabitants has become easier, faster and seen from the user's point of view less bureaucratic. The public sector is perceived as efficient, useful and oriented towards collaboration. The basis for this is an organisation of services across administrative levels and sectors and a standardisation of technical and organisational solutions.

By collaborating with other regions in a network, each region is able to specialise in one or more fields. In this way a region will be delivering services both to its own inhabitants and to the inhabitants of other networked regions. Such networks may also be created at a national and in some cases Nordic or European level. As a consequence national borders need not limit a region.

At the Nordic level there is now collaboration between the environmental surveillance agencies, and several remote sensing projects have been initiated as a part of an environmental protection initiative. Advanced communication applications, remote sensing equipment and satellite image analysis permit several regional specialist groups to collaborate. The focus has been on early detection of oil spills and geological incidents such as floods and forest fires. Traffic control systems that can re-route traffic are in place to help urban regions fight pollution as a result of traffic congestion.

Sharing knowledge resources in networks.

Regional businesses no longer depend on local human resources and competencies alone. Successful enterprises have access to a network of skilled human resources outside the region. It is important that outside resource persons identify with the region and its enterprises and that this loyalty is maintained as an important competitive advantage both for enterprises, organisations and regions.

As a result of the distribution of functions in education, health, public administration and business, good professional opportunities are maintained in the regions.

The education system has been dramatically modernised through use of ICT. This does not imply, however, that the local teachers have been replaced. New technologies are complementing ordinary classroom teaching, and teachers are becoming more like tutors than lecturers. Regional and local educational institutions have been strengthened through participation in educational

networks between similar institutions. Even small remote schools exist because of collaboration with other similar schools or a central school.

The public library has been modernised to become a centre of competence with regard to information dissemination and access to and development of knowledge bases. It is closely integrated with the educational network and provides services to all categories of citizens.

The centralised ICT future.

It may come about as a result of decisions by national authorities in the Nordic countries that it is an essential aim of the national ICT policies to enhance the international competitiveness within the ICT industries and businesses. The public authorities may then decide to concentrate efforts in the capital and university cities.

The concentration of professional environments might in turn hamper the demand for infrastructure in the rural areas, except for regional centres with colleges or a well-developed educational system.

This development would not necessarily mean that the rural areas would be left behind in the ICT development. Small firms, the tourism business, farmers, the health care sector and private households might well become as frequent users of Internet and basic ICT solutions as the rest of the country. But network content would mainly be produced internationally and in the central regions. ICT would mainly be a centralising force.

Different patterns of regional developments

The successful rural regions would use ICT but base their strategies on the successful exploitation of natural resources and tourism and create alternatives to the urban way of life.

Due to a lack of resources and competent personnel, the public sector has had to rationalise its operation as a result of an increased demand for efficiency and the reactive attitude towards use of ICT. This has led to privatisation of services in some places or to their consolidation into larger entities.

The basic job opportunities in the public sector within administration, health care and social services are still there, also in rural regions, but the professional environments are small and people do not stay in their jobs for long. Most of the inhabitants in rural regions are still quite satisfied with the public services. After all it is possible to get access to most of the expertise via the networks. But people who depend on personal, professional assistance for longer periods will experience problems.

Rural regions are losing employment opportunities to urban regions as a result of the reorganisation of tasks and the need to meet the demands for a more robust work environment with regard to specialisation. Public and private service providers as well as industry are relocating to more urban regions in order to secure access to a good professional network and human and technical infrastructure.

Distance work and telecommuting are mainly used in the regions surrounding the larger towns or regional centres. The driving force is personal needs and the need to reduce traffic congestion. People live where they want, commute to the centres or to rural regions for hectic working periods, and then take a week or two off in the periods between. This is of course not possible in all types of work.

The most advanced infrastructure is mainly available in the densely populated regions, but the rural regions do have a technical infrastructure which makes electronic commerce and service provision possible. These services are unlimited with regard to access and overview, the only limitation is the physical ability to deliver; distance and time. But few service providers are located in rural regions.

In the rural regions the smallest schools have been closed down though some are run as distance education centres. The regional colleges have had to scale down their operation as they have had problems recruiting both professional staff and qualified students.

The rural regions remain good places to live, especially for healthy people who seek an alternative way of life. It is more and more common for the elderly and people who need special care to move to central areas.

Ending remarks

A general assumption in this report has been that new technology will make it easier to participate in both job-related, social, political and cultural activities independently of geographic location. This does not imply that the importance of distance and geography will disappear, but it will be different. Electronic communication may not replace physical meetings, but be rather complementary in the way that our interaction patterns are altered. Changes in organisation of work are already taking place. It may be that such continuous changes will challenge our traditional understanding of regions.

Today functional regions are geographically defined. The increasing use of ICT in economic and social activities, however, may reduce the significance of the territorial boundaries. An example is co-operation between Denmark and Portugal in shoe production.

New forms of administrative co-operation and sharing of work within the public sector may also challenge the traditional concept of administrative regions. The same may be said of identity regions. Today this concept covers geographically limited regions that are held together by common culture, language and feeling of identity. The new technology offers new ways of participation in cultural activities and feeling of identity over distance