11. Technology, Globalisation and Employment: Analytical and Policy Challenges

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1 INTRODUCTION

Increasingly technology is viewed today as a major force and a central concern regarding employment and unemployment in our highly developed, open economies. The rapid introduction of new technologies as well as the often technology driven globalisation process are often singled out as the main causes of widespread job losses in individual industries or among workers with particular skills. They are also held responsible for increased wage and income disparities and work insecurity.

At the same time and increasingly so, politicians both at national and European level, businessmen and many technology experts and economists appear to have great expectations with respect to the longer term growth and employment creation potential of new technologies, particularly information and communication technologies. These expectations are built partly on the historical record of the positive employment impact of previous waves of technological change and partly on the special features of present information and communication technologies. The growing consensus amongst policy makers, businessmen and even academic economists on the particular importance of these new information and communication technologies for growth and employment appears based on three features: the dramatic decline in the price of information processing, the convergence between communication and computer technology and the rapid growth in international electronic networking. While different concepts or terms are still used — electronic highways, the knowledge-based economy, the global information society —, they all point to a rapid increase in the information and knowledge base of the economy closely associated with electronic networking. There appears a
policy consensus that societies are on the eve of a major breakthrough in the widespread use and application of new information and communication technologies (ICT) throughout all parts of the economy.¹

The contrast between the above view and the increasing fear and in some instances disillusion amongst the public at large about the benefits of such changes to individual and social welfare, is striking. Thus, a large and growing majority of the European public is convinced that 'the computer' will ultimately reduce employment opportunities and threaten job security. Similar concerns about the 'end to work', deskilling and employment relocation to low wage regions have been raised by a number of popular writers both in the US and Europe (Rifkin, 1995; Handy, 1996). Even Greenspan (1996) in his address at the Boston Fed's 40th Annual Conference on Technology and Growth, discussed what he referred to as a 'truly puzzling phenomenon: the pervasiveness of job insecurity' in the context of an increasingly impressive and historically unprecedented economic recovery in the US.² Perhaps it is not too surprising within the European context of high unemployment, that 'many people', as the Danish Prime Minister pointed out at an OECD Conference on the Knowledge Based Economy (Foray and Lundvall, 1996), 'rightly or wrongly – associate technological progress and globalisation with threats to their social position and not with a wider set of opportunities'.

These growing concerns about the employment and distributional implications of technology are, as has been emphasized in many reports, not really based on any historical precedents. Concerns about so-called 'technological unemployment' have a long track record and one which has not been supported by much evidence. Those predicting the employment implications of a particular set of technologies have tended to overestimate the visible, direct employment displacement effects of the substitution of labour for capital and underestimate the various indirect employment 'compensation' effects which are likely to operate in the economy at large.³ On the other hand, most macro-economic analyses simply assume the issue away: with proper functioning labour and capital markets, there can only be positive growth and employment effects.⁴ The introduction of new technology will increase productivity and hence real wages. If, since the late 70's and 80's productivity growth has slowed down, it is rather the result of a slowing down of technical progress or the lack of new innovations (see a.o. Englander and Mittelstadt, 1988).

Along many others, I do not share such a 'general equilibrium', incremental approach to technology, growth and employment. For me the present day debate surrounding the emerging 'Information Society' or 'Knowledge-based Economy' signals the fact that the widespread diffu-
sion of new Information and Communication Technologies (ICT) is ushering society into a new era or 'post-industrial' society. As Chris Freeman put it most forcefully:

'Today everyone accepts that the extraordinary reduction in costs associated with micro-electronics in successive generations of integrated circuits, of telecommunications and of electronic computers is having great effects on almost every branch of the economy, whether in primary, secondary or tertiary sectors. Earlier new technology systems, such as steam power or electricity had similar pervasive effects, but ICT is unique in affecting every function within the firm as well as every industry and service. Scientific and market research, design and development, machinery, instruments and process plant, production systems and delivery systems, marketing, distribution and general administration are all deeply affected by this revolutionary technology. Moreover, the counter-inflationary effects of falling costs and prices in micro-electronics, computers and telecommunications affect a widening range of products and services.'

Many of these latter effects are not even 'recorded' in official statistics. What brings undoubtedly the employment concerns about technology back to the forefront, despite the reassuring historical arguments and macro-economic compensation arguments, are the particular features and characteristics of the new information and communication technologies. I will emphasize four.

- First, there is the particular impact of new ICT on employment in the service sectors, particularly in those sectors and occupations hitherto largely 'protected' from automation or 'informationisation'. In so far as such 'sheltered' service employment has acted as the main absorber of employment displacement in manufacturing and agriculture, there is concern about the impact of ICT on service employment and whether new services will provide sufficient new employment opportunities.

- Second, concerning user demands, so-called 'killer applications' have been recognized as being essential for driving the new demand for information products and services and in the end even defining the future 'information society' marketplace. Both the overall macro-economic climate and regulatory institutional environment appear to be of utmost importance in creating the appropriate conditions for a rapid diffusion and use of new information products and services. Particularly in Europe, there is concern that on both accounts these conditions are not being fulfilled.
- Third, since ICT is an ‘information’ technology – the essence of which consists of increased memorisation and storage, speed, manipulation and interpretation of data and information –, it has and will further increase the possibilities to ‘codify’ large parts of human skills. Hence, the ability to codify relevant knowledge in creative ways as well as the competence to sort out relevant information and to use it efficiently are becoming of much greater importance. By the same token though, an increasing number of routine skills are becoming totally codifiable and their importance dramatically reduced. As large parts of employment in our societies do involve such routine tasks, there is increasing concern about the distributional employment impact of the Information Society.

- Fourth, as a consequence of the increased potential for further international codification and transferability, ICT could be considered as the first truly ‘global’ technology. The possibility of ICT to codify information and knowledge over both distance and time, not only brings about more global access, it also enables firms/organisations to relocate the sort of routine activities which can be codified and thus also internationally traded. ICT contributes in other words to economic transparency and, in so far as it brings to the forefront the cost advantages of alternative locations, to international capital mobility and international ‘outsourcing’ of particular activities. While the benefits to the world as a whole of such a more transparent, borderless world, are undisputed, there is concern about the world-wide distribution of those benefits. For the poorest, most peripheral countries/regions there is concern of becoming excluded, for the richer, technologically leading countries/regions, there is concern about the increasing erosion of the monopoly rents associated with innovation, and their implications for employment and wages.

Below I discuss in more detail the well-foundedness of these concerns, focusing in particular on the role of services both as user of ICT and as main employment provider in our society. It is generally acknowledged that employment in our economies is increasingly dependent on services. Neither agriculture nor manufacturing have been able to generate sufficient output growth to offset the rapid productivity growth following the introduction of labour saving machinery and the increasing international competition. And while some high tech manufacturing sectors have succeeded through the introduction of new and improved high income elastic consumer goods to generate new employment opportunities, their
number has been falling steadily over time. Particularly in Europe, high tech manufacturing sectors have no longer witnessed any employment growth over the 90s.

2 NEW INFORMATION AND COMMUNICATION TECHNOLOGIES: CODIFYING KNOWLEDGE WHILE BRIDGING TIME AND DISTANCE

ICTs are in the real sense of the word an ‘information’ technology, the essence of which consists of the increased memorisation and storage, speed, manipulation and interpretation of data and information: in short what has been characterized as the ‘codification’ of information and knowledge. This particular impact of ‘information’ technology has been described most extensively in the context of industrial (or agricultural) production processes. Pre-dating even the early ‘Information Technology’ literature, the so-called ‘automation debate’, popular in the US in the mid-sixties, described for instance how labour saving ‘robotics’ would raise industrial productivity and bring about major organisational changes. In line with this literature, many IT analyses have always wondered how confronted with such pervasive cost-reducing technologies, economies would be able to generate sufficient new employment (the various price and substitution elasticities being too low to bring about sufficient employment compensation). More recently, the specific impact of new information technology on services has re-entered this debate. It could be argued that the impact on services will be more of an opposite nature compared to the impact on manufacturing.

In many ways services can be defined as those activities (sectors) where output is essentially consumed when produced. While this might well be considered a rather narrow definition and one which covers only a limited number of sectors presently falling under the statistical definition of service sectors, it is an analytically useful definition because it highlights the intrinsic immaterial, intangible nature of many service activities whether they are personal services, such as hair-cutting; entertainment such as an opera performance; education such as teaching; health such as a doctor’s visit; or public services such as applying for welfare services. With intermediary services such as transport, communication, finance and trade, this simultaneity still holds but is partially altered. Intermediary services are effectively delivered more or less on a permanent or fixed basis, whether they are used or not. The frequency of provision may vary, but in a scheduled way (time table of services need to be available). The
logistic support it gives is independent, in the short run of demand. It follows that services range from activities where production and consumption cannot be dissociated to all kind of loose linkages between production and consumption. Still it is this similarity feature of production and consumption which has generally limited productivity improvements in such activities.

2.1 Increasing Tradeability of Services

Information and communication technologies, almost by definition, allow for the increased tradeability of service activities, particularly those which have been most constrained by the geographical or time proximity of production and consumption. By bringing in a space or time/storage dimension, information technology will make possible the separation of production from consumption in a large number of such activities, hence increasing the possible trade of such activities.⁸

Tradeability of any given product finally depends on two dimensions: the facility of its provision and the transparency of its specific content. An (incremental) innovation can thus enhance the tradeability of a product by improving either the context of provision or the specific nature of the product.

To come back to the characterization given above on services, namely that they are produced and consumed at the same time and on the same spot, we see that it implies a low tradeability with respect to the two dimensions. In the first place services cannot be stored, otherwise production and consumption could easily be separated. The market provision of services is therefore severely constrained. For the Classics (and Smith in particular) this non storability prevented drastically service activities to take part in the accumulation process and therefore services were considered as not creating value. Secondly, the fact that the service is consumed while produced leaves some uncertainty on its very content; the transactions are thus more open to asymmetries of information and hazards of different kinds.

On the whole this simultaneity of production and consumption clearly render services less tradeable than goods. Still the border between the two types of production is not so clearly cut. Some goods such as some equipment goods, highly customized or done upon specific order, have a low tradeability according to the principle mentioned above. In that case a clear and specific content goes altogether most of the times with a more difficult type of provision (implying delays, special requirements for transportation).
At given time and space the set of products available thus displays a wide spectrum of tradeability indexes, where goods depending to some extent on their degree of ‘standardisation’ have on average a higher rating than services. Moreover these tradeability characteristics change over time. Even in the absence of any technological change and of any change in the logistics of service provision, simple learning processes would lead to some steady increases in tradeability. Not to forget in this context the role of regulation and deregulation.

Changes in the context of provision and in the content of products which are produced by the diffusion of ICTs can therefore radically modify the tradeability pattern of products.

Considering the new facilities brought about by ICTs, services can be delivered in various places simultaneously with their production. The concept of production itself is spread over time when deliveries are automated (pushing a button in various automated tellers or alike). If services are also something you get in indefinite amount, providing you show up at some counter (to get information, training) the space simultaneity of production and consumption of services is also altered. Moreover not only the provision of services is changed but also the problems raised in appraising the content are reduced as ICTs can help as in the case of manufactured commodities to standardize and diffuse information on products. On both dimensions, content and provision, the tradeability of services is thus improved.

Figure 11.1 suggests how the tradeability of a whole range of services can become improved. Both the time/storage and space dimensions of the new IC technologies are in other words likely to bring about the further opening-up of many service activities, increasing domestic and international tradeability of services.

2.2 A Possible Paradox: a Reverse ICT Effect on Manufacturing

With regard to more traditional production processes, typical of industrial production, but also common in traditional service sectors such as transport, wholesale and retail trade, the impact of ICTs could well be characterised as exactly of the opposite kind. Rather than bringing time/storage between production and consumption as in services, ICTs will in the first instance aim at reducing the time/storage dimension between production
and consumption. Many of the most distinctive characteristics of the new information and communication technologies are related directly to the potential of the new technology to link-up networks of component and material suppliers, thus allowing for reductions in storage and production time costs – typified in the so-called Just-in-Time production system. At the same time, the increased flexibility associated with the new technology allows for a closer integration of production with demand, thus reducing the firm’s own storage and inventory costs – which could be typified as Just-in-Time selling. Both features seem to work in the opposite direction from what was said above, that is they aim at reducing the time/storage
dimension between production and consumption. They might therefore well reduce the 'tradeability' of products.

In fact more customized products, delivered just in time, transform the tradeability pattern of goods, increasing to some extent the uncertainty on the content of a number of products while improving their 'provisionability'. Such shift in the pattern of tradeability is schematized in Figure 11.1. It depends obviously also on transport costs and in particular on the trend in their costs relative to communication costs. While transport costs have fallen systematically over the post war period, they have risen significantly in relation to communication costs over the last decade. The paradox of opposed effects of ICTs on goods and services production disappears if one admits that ICTs have eventually an impact on two different things: the nature of the product itself and its provision. It stresses that what matters in a product market is what the intrinsic nature is of the product and how it is provided.

Tradeability also appears to be useful in relative terms. ICTs in improving the logistics of intermediaries activities which are organizing markets, have shifted upwards the general level of tradeability but, much like the notion of competitiveness, it is the relative level of tradeability which matters to assess the potential of development of their markets.

We are used to think that new products lead to the discarding of old ones. Not only innovation brings scrapping of old equipments and accelerates replacements but, according to the standard view, old varieties, often after a last fight (see e.g. Rosenberg's 'sailing ship effect') disappear. Basically this stylized fact applies more accurately to innovation in goods than to innovation in services. In some services, and especially in personal and social services as well as in intermediate services, it is quite characteristic that the new does not chase the old to the extent that it does with goods. Services, modernized by some automatization process, are not only modernized but offer in first instance different services, which enlarge the range of services available. A similar process happened with goods and 'antiques' but this remained a fairly marginal activity, while the decoupling of services by the modernization, partial or total, of their process of production contributes in the case of final services (in distribution, catering and leisure activities) to enlarge the basket of activities at the consumer's disposal. Another way to look at this phenomenon is once again to note that, to the extent that in services production and consumption are tied, any process innovation will also be a product innovation; enlarging the variety of services available. As far as manufacturing activities have gained similar service characteristics, they will further enlarge a priori the basket of commodities.
3 SERVICES: A NEW ECONOMIC DRIVING FACTOR?

Manufacturing has long been considered as an engine of growth for its capacity to organize and restructure production in ways allowing steady productivity gains. Economies of scale, e.g. replication at larger scale of production processes have been a favorite means to sustain this dynamic. It went altogether with the old classical Smith principle that large market allowed bigger scale of production, which in turn permitted a broader division of labour. Allyn Young (1928) insisted on the fact that such division occurred both within firms and between firms and that it stimulated in all cases technological change which in turn impelled demand so that economic growth propagated itself in cumulative ways. This was basically the mechanism referred to by Kaldor when speaking of manufacturing as an engine of growth.

Can one identify a similar cumulative dynamics in service activities? Certainly not in the pre-ICT period. Service activities were then seen in the cumulative causation model as necessary conditions, complementary to the manufacturing engine of growth in order to organize markets (the provision or market access was a function of intermediary service activities). Meanwhile personal services were looked upon basically in relation to the prevailing conditions on the labour market (see the spunge effect in the presentation by Kaldor of the determinants of employment in personal services).

3.1 Innovation and Growth in Services

The question is thus whether innovation in services, and especially the dynamics impelled by ICTs, can launch a cumulative mechanism somehow similar to the one experienced in the past in manufacturing. Another way to rephrase this, following the previous definition, is to appreciate how innovation processes in services effectively enhance their tradeability and therefore help to the expansion of their markets. The conditions for such a growth principle to be effective can be seen in the organisational issues raised by the diffusion of ICTs in services, in particular in the relation between processed information, knowledge accumulation and elaborated routines. There is thus a need to compare the schemes of innovation in manufacturing and in services. The learning processes implied in cases of innovation in goods and in services are as argued above with respect to the different impact of ‘codification’ rather different. They characterize to some extent the various patterns of cumulative growth that can occur.
In the cases of goods the learning process is centered around the product itself. Producers are learning how to adapt the new product to tastes and how to take advantage of expanding markets to make productivity gains which in turn will help to increase the market and improve the product. It corresponds to the first phase of a Vernon product cycle. Users have of course their say in the process but that say is by and large limited to a process of adjusting to the quality of the product. One could even go a step further: the main driving factor for innovation is performance or quality improvement with the aim of trying to convince the average consumer that what he needs is the best, professional quality. In doing so the innovating firms can avoid at least for some time price competition. When the second phase of maturing product is reached and standardisation and imitation is taking place (e.g. when competitors with low wage costs take over a stabilized production process), productivity growth is the only answer but will heavily depend on the extent to which economies of scale have been reached. Conditions for sustained innovation and market expansion may thus depend on adequate demand policies. By contrast the similar dynamics in services tend to start from the opposite process innovation side as suggested by Barras (1986). ICT's help to transform parts of the production process of services, mainly by codifying knowledge and processing accordingly information in one part of the old process. The drive behind this substitution is in the first instance an increase in tradeability and market for an existing product. While it isn't meant to modify the product, it of course will and contrary to manufacturing this will often imply a product with lower quality characteristics, compensated for by faster delivery. The driving force behind service innovation is thus not just process innovation it is also cheap mass provision of a possible lower quality product. However, parallel to what was said above about manufacturing, the second phase will involve an explosion of new product innovation involving high quality often personalised services using the new process technology for the specific aims and needs of particular users. It is through the combined effects of learning by doing and learning by using that the innovative content of the 'old' product, produced with the new automated process is progressively enlarged. Electronic networks have often evolved this way as well as a lot of new telecommunication products.

In other words, in this reverse product cycle productivity gains are to come mainly from improvement in the quality of the products. It turns out that this is a much more hazardous way to fuel a process of cumulative growth. It requires skills from the producers to enlarge the process into a meaningful product innovation but it requires also some learning from the
consumer to direct and legitimize the quality improvement of the services. A mismatch can occur which would lead to a disturbing underestimation of productivity gains.

This continuous shift in value from manufactured goods embodying increasing amounts of 'codifiable' knowledge towards service based 'tacit' knowledge activities is typical of the new emerging Information Society. It explains the attempts of electronic and computing manufacturing firms to enter information content activities. Within services, it explains the move of 'carrier' operating firms being most directly confronted with the codification of knowledge and its distribution, to enter content sectors (media, education, culture). This difference between innovation schemes in manufacturing and in services is much enhanced by the upstream dynamics of ICTs impelled by the on-going miniaturization of micro-processors. It re-enforces in all activities the process driven dimension of technological change.

Figure 11.2a and 11.2b try to summarize these two schemes of innovation predominant, respectively in goods and in services and to relate them with the specific effect of ICTs. It stresses that the outcome of innovation processes depends more extensively on learning processes on the side of the users in the case of services than on the ready made quality improvements of the supplier in the case of manufacturing. It also brings to the forefront the need for a shift in policies to sustain the innovation process. In the first case policies to reflate demand, whereby the gains in productivity are reflected in gains in wages and domestic consumption are essential to keep the virtuous circle between productivity gains and new demand. The employment compensation mechanisms operate primarily through income elastic demand for new and improved goods. The focus of innovation policy will shift away from supply dominated science and technology support policies to policies aimed at the translation of new scientific and technological breakthroughs into new innovations. Typically most of the current EU innovation policies, as their name indicates (VALUE) correspond to this aim.

In the second case, policies will be much more diversified, helping in the first instance users to coordinate themselves, deregulating particular service markets and breaking up where necessary cartel agreements and providing incentives to new firms to develop services using the new provision channels of old services.

The above assessment of what would be the main characteristics of a growth process more centered on service activities leads us to stress the new role devoted to users in the learning processes. On one side the choices of products and activities for all users (final or intermediate) have
been enlarged and consist of more time consuming products. Therefore choices between alternatives within the time budget constraint are more 'competitive'. On the other side the dynamics of innovation which starts more often from process innovations directly impulsed by the diffusion of regularly improved ICTs, relies more largely for its expansion on positive feed backs from potential users. The development of these learning effects modify the content and the provision of new services. A networking effect with positive externalities sustains the diffusion of radically new services.

**Figure 11.2a** Innovation scheme in manufacturing

However, we know little on these learning processes. The productivity slowdown, much more marked in services than in manufacturing activities (see Roach 1991) suggests that organizational mismatches and market failures may be more important in service activities than elsewhere. Moreover all service activities are not in the same position, if only because their tradeability differs. In all cases the above implies that the dynamics of cumulative growth may depend to a larger extent than previously experienced on the quality of the labour force.
3.2 Global Structural Change and Services

As a consequence of the increased potential for international codification and transferability, the new information and communication technologies can to some extent be considered as the first truly 'global' technology. The possibility of ICTs to codify information and knowledge over both distance and time, brings about more global access. Knowledge, including economic knowledge becomes world-wide available. While the local capacities to use or have the competence to access such knowledge will vary widely, the access potential is there. ICTs in other words bring to the forefront the enormous potential for catching-up, based upon the economic transparency of advantages, while stressing at the same time the crucial 'tacit' and other competence elements in the capacity to access international codified knowledge. For technologically leading countries or firms this implies, increasing erosion of monopoly rents associated with innovation and shortening of product life cycles.

At the same time, the ability to codify relevant knowledge in creative ways acquires more and more strategic value and will affect competitiveness at all levels. Network access as well as the competence to sort out the
relevant information and to use it for economic purposes become of critical importance for performance and income distribution. Specific skills referring to the use of information become of strategic importance. More routine skills by contrast might become largely codifiable and their importance dramatically reduced.

For services this might imply significant relocalisation possibilities for many routine functions. There is indeed no reason why the increased potential for tele-working should stop at the border. Already today, the rapid growth in teleservices in less favoured regions, such as Ireland, is illustrative of this potential for relocalisation of hitherto untradeable service functions. In essence this is a process of international division of labour whereby service sectors are discovering the advantages of international relocation. The impact of the decline in communication costs following the widespread use of global ICTs on the international trade of services can be compared with the impact of the decline over the last thirty years in transportation costs on the international trade of commodities and manufactured goods.

3.3 Interdependence of Technological Change, Skill and Culture

The ability to codify knowledge in creative ways, mentioned above as a factor of competitiveness in a world where service activities are internationalizing seems to imply that technological change will lead to upgrade the average skill level in the activities concerned. Therefore one would find in services that the technological change that ICTs represent is skill biased, as it has been proposed concerning manufacturing industries (see Griliches et al., 1994). Still the argument might run somewhat differently considering the whole range of services.

If we follow the argument presented above, technological change in services should be assumed to depend on the skill structure of both the producers of the services as well as the 'skill structure' or cultural background of the consumers of these services. Such reverse causality, if compared with manufacturing, seems effectively to stem directly from the reverse product cycle that we identified as an important pattern of innovation in service activities.

If such is the case, the link between technological change and the skill structure in services will depend on the importance of the reverse cycle effect in the dynamic of the diffusion of ICTs in service activities as well as on the responsiveness of the consumers. One way to look at this last issue is to consider that the potential for the application of ICTs to services often depends on cultural factors. Again it is tempting to start from a
simple dichotomy in which manufacturing production processes would typically be characterized by 'skill biased' technical change, the introduction of new technologies typically requiring more skilled personnel. In most service sectors using intensively ICT equipment it is likely that similar 'skill bias' trends would exist. However, as we move in the direction of the labour intensive parts of these and other services activities, a more direct process of deskillning is also likely to operate. Whereby the codified knowledge part includes the main skill component of the service activity.

A positive way to appraise the situation would be to consider that the ability to codify in the first place should take into account the cultural backgrounds of the potential users. The ability to differentiate products accordingly may well be a key factor towards expansion of markets. Conversely if one looks to differentiate products in accordance with the capabilities of the consumers, then the need for the skill bias of technological change affecting the labour force of the trade under view may itself be reduced.

All of which suggest that successful learning processes (able to expand markets) could require more balanced (more realistic in a way) approaches to the skill requirements in a lot of service trades.

4 BY WAY OF CONCLUSION: POLICIES AND PERSPECTIVES

In this short chapter only some of the key dimensions and questions raised by the combined impact of new ICTs – combining both features of rapid technological change and globalisation – on employment were discussed. The possible basis for a new virtuous growth circle appears still rather unclear. Even if one might observe a convergence between manufacturing and service activities, it does not follow that the forms of industrial organization have converged towards some best practice form of organization. Services have always been very country specific due to the set of institutional arrangements that their market provision requires; the fact that ICTs have transformed their content and their 'provisionability', which partially shows in the fact that they are more sensitive to the business cycle, does not radically alter this feature. National institutional contexts matter. Regionalization processes as experienced in Europe, or the liberalization of trade and foreign investments have also contributed to some convergence among the production processes; still we are far from having industrial fabrics in service activities which can be easily internationally
compared. This implies that if any new growth model is emerging there is a strong likelihood that such model will differ between countries. The fact that users learning processes were more directly concerned with the emergence of new markets, that the cultural backgrounds of consumers were important conditions featuring the growth path of national economies, is also an important reason to affirm that the 'new' growth model is likely to be less homogenous and more diversified and plural.

Even if our knowledge and assessment of these new schemes remain patchy, if only because changes are not over yet and may well extend over long periods of time (see David's comparison with the diffusion of electric power), some policy conclusions are in order.

One may retain three policy orientations, regarding respectively investment and related 'industrial' policies, then labour market policies and finally education and training policies.

Many of the specific organizational difficulties raised by the market provision of services, using the facilities of ICTs, were stressed in this chapter. Asymmetries of information and externalities remain numerous in these new networks and hinder some of the growth potential of this new fabric. Therefore public interventions to coordinate actions, certificate intangible productions, internalize positive externalities are all essential and particularly worthwhile. These public investments can take many forms. Still this public intervention is hindered by trends towards deregulation precisely in the intermediate services such as banking, telecommunications, transport where appropriate new 'industrial' (the inappropriate word par excellence) policies should help to develop the logistics and normative framework required to coordinate the actions of private agents and internalize their effects. While the deregulations have been largely provoked by the obsolescence of the old regulatory frameworks, often inherited from the 30s and 40s, they have been too often viewed as a necessary withdrawal of public intervention. Though new regulatory frameworks need to be elaborated (and ICTs open new possibilities in that respect) in order to take full benefits of the ongoing structural changes, this can be done all the more easily when it will be accompanied by appropriate infrastructural investments, which can be tangible (especially in telecommunications networks for instance) or intangible (in the form of specialized training schemes or broader intermediation institution, social networks, to facilitate the access of populations with various cultural levels to new services).

A second set of policy issues concerns the labour market. Large amounts of public money are devoted, at least in European countries to cope with the rise and persistence of unemployment. These measures are
costly and their efficiency has been questioned; their main flaw is the important dead weight loss impact (most measures have little net incentive effect but possibly big distorting price effects). Keeping in mind the change towards a growth regime where services and time budgets play a different role may help to reconstruct these labour market policies along ways which provide the safety net (guaranteed income) while inserting people out of work in any of the training schemes that are part of some learning processes either on the consumer side (network accessing any of the big social systems) or on the production side (network retraining the labour force according to needs and wants) or both. Such a more comprehensive approach should be developed when setting up any scheme to reduce working time, where what the people out of work do, is as important as where and how the reduction will be implemented.

The third and last set of policies is the one most appropriate to conclude this chapter with as it concerns education and training policies. The fact that it should concern not so much initial formation but life long training scheme is now widely accepted. How it can be implemented or which principles are implied is less common. The analysis presented here suggests to look not only at the various types of learnings required at all stages of a working life but also at all stages of consumption life or time. That includes looking also at the rate of obsolescence of knowledge on one side, and at the cultural backgrounds and their evolution over time on the other side. Returns to illiteracy, rigidity of cultural patterns regarding the use of ICTs are also important features revealing the difficulties of maintaining certain levels of training. Deskilling, e.g. people engaged in jobs requiring lower qualification than they detained, is another component of the mismatch. However, such deskilling at work could be compensated for by 'reskilling' in consumption or other non-work activities. Policies have to take into account the poor performance of some groups and the barriers to access of some ICTs uses. If training policies only aim towards some general improvement they may well strengthen a tendency to discriminate that one finds at work (skill biased modernization) and at home (cultural barriers to access some service provisions).

NOTES

1. As Al Gore put it at the opening of the Brussels G-7 summit in 1995: 'Just as human beings once dreamed of steam ships, railroads and superhighways, we now dream of the global information infrastruc-
ture that can lead to a global information society'.

2. As Greenspan put it: 'Today, large numbers of people have become so demonstrably insecure about whether their skills will still be relevant in, say, five years that they fear for their jobs... This sense of job insecurity is so deep that many workers are truly scared. Some fear that their skills will no longer be appropriate for the future. Some fear their ability to make ends need the future. Many are truly concerned about a prospective decline in their standard of living'. (Greenspan, A., 1996, p. 173).

3. These include output compensation effects depending on price and income elasticities, indirect employment creation effects in the new machine, capital goods producing sector, as well as possible substitution effects following wage adjustments.

4. This view is the one most clearly reflected in the OECD Jobs Study (1994): it is the overregulation of European labour markets which is at the core of the present European unemployment problem.

5. The term 'killer application' refers to a particular application of the new technology opening up a new major market allowing the technology to take off.

6. Interestingly this is still the main argument of those studies in this area which limit their focus to manufacturing (Pianta, 1996; Reati, 1995, see also comments from the Commission on the OECD G-7 study).

7. For early analyses along these lines see Quinn (1986) and Soete (1987).

8. This was certainly the case with regard to the invention of printing in the Middle Ages and the impact this first new information technology had on the limited tradeable 'service' activity of monks copying manuscripts by hand. It was the time/storage dimension of the new printing technology which opened up access to information in the most dramatic and pervasive way and led, to use Marx's words, to the 'renaissance of science', the growth of universities, education, libraries, the spreading of culture, etc. This opening-up, 'tradeability' effect would become of far more importance to the future growth and development of Western society than the emergence of a new, in this case purely manufactured-based, printing industry.

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