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**Interactions between new technologies
and the job market, flexicurity and
training/vocational training**

Study

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Executive Summary

The following report provides a conceptual framework for the interaction between new technologies and job markets. It focuses on the importance of vocational training in these processes and on integrating the flexicurity concept as a policy instrument which is gaining more and more importance in public debate.

Basically the report follows the common argumentation logic that the introduction of technological innovations usually leads to a change in work profiles and therefore to new demands on qualifications and skills. Following this argumentation logic those technologies which are considered as ‘future technologies’ in academic and public debates are analysed, such as, Information and Communication Technologies (IT), Nanotechnology, Biotechnology and Converging Technologies. Except for IT, these technologies represent the most intensive research and development sectors, which have experienced the highest growth rate since the 1990s. For the nearest future, the demand for a highly qualified labour force is expected to be predominantly in these technological fields. Due to the importance of research and development, the need for university graduates, especially in natural sciences and engineering, will increase, whereas the positive effects on less qualified people will be less significant.

Information technologies, however, play a central role when reflecting the change of work patterns and organisation in the last decades. Especially with regard to changes in work organisation, IT may be considered as crucial for the restructuring of global value chains and for changes in global working patterns. Closely connected with the processes of codification, standardisation and fragmentation, and the related decrease in transaction costs, the diversification of products and services implies the multiplication of tasks and skills all over the world. Whereas the industrial sector, e.g. the automotive sector or the clothing industry, has already established globalised production patterns, business functions, such as administrative activities, consultancy, or even management tasks, are being increasingly distributed organisationally and geographically. The emerging service economy is potentially becoming dualistic. On the one hand there is an increase in skilled and highly-skilled jobs in industrialised societies, on the other hand there is a growing market for low-end, routine services emerging in industrialised as well as in developing countries.

Taking these developments and increasing unemployment in nearly all European countries into account, training and vocational training activities have been launched as innovative practices in the field of employment on the European level. The concept of “Lifelong Learning” has an especially important role in achieving the economic, employment and social goals which have been defined by the European Union (EU). Based on the Lisbon Strategy agreement, the EU puts a clear emphasis on the role of vocational education and training methods in all Member States, alongside general and higher education.

Coming from a technological perspective there is a need to bridge the gap between the introduction of new technologies (with special regard to IT) and the need for training and vocational training in a changing organisational working environment. Basically these strategies focus on specific issues such as, the empowerment of men and women on the different labour markets, institutional security as well as the avoidance of social exclusion. Social dialogue to enhance the awareness of workers regarding the increasing demands for greater flexibility, as well as to create common agreements seems to be the precondition for the success of vocational training policies. The flexicurity concept can therefore be considered as one approach for reconciling the market demands and the social needs of workers.

The historical shift towards globalised working patterns with its strong demand for flexibility, on the one hand, and the need for social security, on the other, is reflected in the orientation of the EU policy. Together with the Member States the Commission has reached a consensus that flexibility policies can be designed and implemented across four policy components:

- Flexible and reliable contractual arrangements through modern labour laws, collective agreements and work organisation;
- Comprehensive lifelong learning (LLL) strategies to ensure the continual adaptability and employability of workers, particularly of those most vulnerable;
- Effective active labour market policies (ALMP) that help people cope with rapid change, reduce unemployment spells and ease transitions to new jobs;
- Modern social security systems that provide adequate income support, encourage employment and facilitate labour market mobility. This includes broad coverage of social protection provisions that help people combine work with private and family responsibilities such as childcare, etc.

Vocational training and lifelong learning systems are considered as central objectives by European policy but also by national strategies in order to achieve and to maintain the integration of specific working groups in the labour markets. As many empirical findings show, there is no single strategy which fits the same social problems everywhere. Labour market policies should vary by nation, sector and type of institutional framework. As regards the actual European employment (and unemployment) structure, the situation still varies among countries.

Thus, the policy recommendations of this report are oriented mainly towards the specific situation of the creation of knowledge-based economies in Europe. The complexity of these processes implies that the impact of technologies on labour markets and the labour force varies among different branches, sectors and institutional settings. Political programmes enhancing the “employability” of workers, therefore, should take into account a wide range of social risks, but also should offer a wide range of possibilities to integrate workers into working processes.

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1. Introduction

Since the industrialisation phase, economic growth has been based on technological innovations, which in all industrialised countries entered into an institutional system of market/company - family/household – public/state (Kocka, Offe 2000). How these three pillars historically have created different institutional patterns has been analysed through different types of welfare systems (Esping-Andersen 1990). In the literature there is agreement that the institutional underpinnings of welfare capitalism aimed to safeguard its full employment commitment to collective bargaining, labour market regulation, and social protection. The ‘standard’ production worker constituted the nexus between economy and family, between production and consumption. The balance between the three pillars ‘market – family – state’ has been guaranteed for some time by an accelerating demographic development, the demand for employment and the demand for manpower by employers. Although a steady elimination of jobs has been caused by technological innovations, the creation of new labour supply could compensate for this. This system worked for nearly two centuries, and in politics as well as in economic discourse, technological change was still considered the driving force for economic growth as well as for the creation of new jobs.

Since the 1970s, the countries of Western Europe have had to face a growing rate of unemployment. Whilst in those earlier years the production sector was mainly affected by the loss of jobs, nowadays all sectors and branches are widely involved in a process of work change. Especially the development of information and communication technologies (for this report in the following denoted IT) had particularly great influence on the reorganisation of work at different levels. But also other technological innovations such as robotics in the manufacturing industry or technological innovations in agriculture have changed the organisation of work as well as job profiles substantially. This process is still ongoing and affects the balance between the three pillars mentioned above in a sustainable way.

The project with the title “Interaction between new technologies and the job market, flexicurity and training / vocational training” focuses on different topics: first on the complex interaction between new technologies and changes on the job market. The perspective here concentrates on new demands on qualifications and skills on the individual level of job profiles. Generally there is widespread agreement that the ongoing technological process in highly industrialised societies is leading to an increasing demand for a skilled and qualified workforce. Problems regarding the integration of the less qualified workforce have been considered as one result of the rapidly changing demands on qualifications and skills in different sectors. Therefore, second, the perspective on training and vocational training strategies seems to constitute one central goal for public policy in order to improve the adaptability of the workers' force to the changing demands of the labour markets¹.

But the whole process can also be analysed in more contradictory terms, especially when taking into account changes in work on a global scale. Through re-structuring of global value chains, the economic pressure on national economies as well as on regional labour markets has increased and created a new pattern of an international division of labour. This development has led to more competition not only between economic markets but also within the labour markets. Off-shoring processes, takeovers, mergers and demergers are announced continuously and have created a high demand of flexibility not only on all organisational levels but also at the individual level.

¹ As it is usual in industry sociology, the report is using the plural of the term ‘labour market’. Based on differences of sectors and branches also big differences on working pattern as well as on employment structures can be analysed. These differences are pointed out when referring to ‘labour markets’.

Thus, third, the concept of flexicurity is considered as one political strategy to enhance the flexibility of labour markets, work organisation and employment relations on the one hand, and social and employment security on the other (Wilthagen, Tros 2004). The normative idea of the concept is to encourage flexible labour markets and ensure high levels of security. The main principle of the strategy is that flexibility and security should not be seen as opposites, but can be considered as mutually supportive. The flexicurity strategy as a political strategy was founded in specific national institutional contexts, and it seems important to explore its potentials not only for other national contexts but also for future concepts of work.

The focus on qualifications and skills has been considered along the way whereas strategies for vocational training will strengthen the idea of the individual empowerment of the workers in the labour markets. Much more on an institutional level, the flexicurity strategy also should be able to bridge the gap between the market demands for flexibility and the social demands for security and stability. Especially within an increasingly globalised working pattern and its different consequences for the workers, the balance between flexibility and social security seems more and more important. Not only in terms of social coherence but also in terms of reflecting the function of different patterns of the welfare state in Europe.

The present final report is based on the interim report which was submitted in June 2007 as the first deliverable of the project. Basically the interim report has developed a thematic framework for understanding the interrelationship of the three topics: interaction of new technologies and their impact on the labour markets, the importance of vocational training and the flexicurity concept itself. For this purpose, available academic literature has been evaluated as well as five expert interviews on the European level. The interim report also served as the thematic input for the STOA expert workshop of the same title which was held on the 9th of October 2007 at the European Parliament in Brussels.

The final report sums up the whole process of the project. During summer 2007, the thematic framework was enriched and widened by constructive comments from colleagues both from ITAS and from the STOA panel. The workshop summary gives an idea about the need not only for the intensification of the topics but also for further discussion. All participants, here, offered a profound and mostly critical expertise on their topics. The policy recommendations at the end, therefore, can be considered as proposals not only encouraging the 'good' balance between flexibility and security, but also encouraging the intensive and open discussion about the active creation of future labour markets.

2. Interaction between new technologies and job markets

Coming from a technology-driven perspective, the interaction between new technologies and job markets often appears in a linear economic argumentation. “This implies a modification in the productive combination of factors, the evolution of the relative productivity of each factor, and a change in the demand for each factor” (Ramioul 2006:100). Thus, technological changes are analysed basically in terms of economic growth, job creation and job destruction in different sectoral changes. Whereas in the economic literature of the 1950s and 1960s technological changes produced exogenous shocks on the production function, in the 1980s and 1990s the debate shifted to the development of inequalities between skilled and unskilled workers.

In industrialised countries technological change historically implied an increase in the relative demand for skilled workers. In different empirical studies based on macro, sectoral and individual data, the shift towards skill-based technological change has been confirmed. In these studies, skills are measured with occupational and educational breakdowns (e.g. between manual and non-manual workers) (Ramioul 2006).

The following section describes the interaction between new technologies and the labour markets from the perspective of technological changes, whereas the demands for skills and qualifications basically result from a technology-driven perspective which means the technological changes are measured by the economic outcome (productivity, economic growth).

2.1 Methodological problems regarding the interaction between technical innovation and effects on the labour markets

Without doubt technological change is an important factor for changes in different labour markets. This is true both for the quantitative development of employment and for the qualitative development in terms of the changing demands on qualifications and the organisation of working processes. The extent to which new technologies lead to more jobs and better working conditions is, however, a subject of debate. And, furthermore, it does not seem easy to assess to what extent ongoing quantitative as well as qualitative changes in the labour markets can be regarded as effects of technological changes.

On the one hand, new technologies – such as modern IT – have often been called ‘job killers’, causing jobless economic growth. On the other hand, technological innovation is considered a means to improve the competitiveness of the European economy and offers new economic markets with new job opportunities. However, high structural unemployment rates in the 1980s and 1990s (European Commission 2002) in the European labour markets have often been regarded as the result of a rationalisation of the labour force induced by the spread of IT in the workplace. Discussions in the early 1980s of the effects of IT often came to the conclusion that “post-industrial societies” (Bell) are running out of jobs and that the society of the future would be a ‘jobless society’, where great parts of the employable population structurally would have no chance of getting permanent jobs. This prognosis has not in fact come true on this single plane, but the processes can be described in a more contradictory and complex fashion (see Sect. 2.3).

Without doubt, the technological revolution of IT systems has had a tremendous influence on the time frame of work processes. The acceleration of work processes based technically on IT means that work can be organised much more effectively with fewer workers involved. As a consequence the demands on the workforce increase and higher qualifications at nearly all job levels are required (see Sect. 3). However, mostly unqualified, older and young people in European countries have reduced access to the labour markets.

Tendencies of social exclusion are already considered a serious social problem in many European countries (for Germany see Bude, Willisich 2006).

The most obvious problem in assessing the actual effects of technological changes on qualitative and quantitative features of the labour markets relates to the fact that it is impossible to isolate the ‘net effects’ of technological change from the effects of other factors influencing the labour markets (and which to some extent are bound up with technological innovation). Such factors include, for instance, market developments that affect labour in terms of changing demands on qualifications and skills. One recent, central example is the ongoing division of labour worldwide which affects both unskilled and highly qualified workers. Another major effect is the growing demand for knowledge-based work in advanced economies (see Sect. 2.4).

Studies assessing the effects of technology on employment must take into account the fact that technological change works in two directions. On the one hand, according to the economist Joseph Schumpeter (1942), radical innovation, such as technological change, must be regarded as “creative destruction”. Innovation ensures long-term economic growth by *creating new* products and markets and – as a consequence – new jobs. On the other hand, any economic innovation makes old products or production processes obsolete and thus destroys existing markets as well as the related jobs and devalues the skills and qualifications of that workforce.

This two-pronged effect of technological innovation makes it difficult to predict, even for a single technical product, how big its market potential is and to analyse the extent to which it affects existing markets with regard to creating new or destroying existing jobs. Thus for ubiquitous types of technology like IT, an assessment is almost impossible, since these types of technology have instigated a broad range of both product and process innovations. IT has and is still introducing new products to the markets; some of them have established entirely new applications and needs, e.g. Internet applications and mobile phones, while others have replaced existing technology and work routines such as typewriters in offices (see Sect. 2.3).

Negative effects of technological change on employment are usually associated with process innovation at the workplace. On the one hand, technological change enhances the productivity of labour by increasing the efficiency of production processes and the value of products. On the other hand, however, an increase in productivity may lead to a reduction in product costs, which in turn might stimulate additional demand and as a consequence, additional employment. This (at least) can counterbalance the reduced labour requirement instigated by increased productivity. Moreover, the product innovation aspect of technological change can compensate for negative effects of increased productivity on the labour markets by establishing new markets and sales. The number of jobs created by introducing new products must, however, be weighed against the displacement of workers possibly induced by product innovation when new products replace existing production lines, leading to a loss of jobs in existing branches.

To what extent the loss of jobs induced by increased productivity can be compensated is highly dependent on market structures. If there is no competition in markets, a decrease in production costs might not lead to reduced product prices (which may result in growing demand and employment) but to higher profits or wages. A report on the impact of technological and structural change on employment prepared for the Committee on Employment and Social Affairs of the European Parliament discerns several ‘compensation routes’ that under certain conditions (such as competitive markets) “may alleviate the labour saving effects of technology-induced productivity enhancements” (e.g. new machines needed for new production processes, decrease in product prices, new investments, new consumption, new products, decrease in wages) and concludes:

“The actual difference between the labour-saving effects of on-going process innovations and the employment-creating impacts of product innovations varies considerably according to prevailing conditions of competition, price and wage rigidities, investment climate” (IPTSESTO 2002:31).

The complexity of labour markets offers a broad range of factors which have to be taken into account when trying to assess and forecast the effects of technology on employment; these include non-wage labour costs, labour productivity, education and qualification of workforce, mobility and flexibility of workforce, employability, and investment climate. As the academic debate about these effects has shown, it seems nearly impossible to simulate all these factors simultaneously in the computer models applied in economic forecasting.

Input-output models that are mainly used to forecast the effects of implementing new technologies on the labour markets cannot be expected to anticipate the future number of jobs. They are rather means for suggesting the possible effects and identifying potential influencing factors that have to be taken into account in policy making. Economic modelling usually relies on ‘input-output tables’ based on statistical information on interrelations and reciprocal buying between branches of national economies. These are usually provided by national statistics offices. Computational modelling makes it possible to simulate how, for example, assumptions about changes in productivity rates in one branch affect other branches and thus cause alterations in the demand for labour. This allows, of course, only a rough picture of real interferences. Obviously, assumptions about the interrelations between branches are derived from statistics, and future changes in these relations cannot be built into the model itself. Plausible assumptions regarding the actual effects of technological change on productivity have also to be made – especially regarding the degree and the pace at which corporations adopt technology (TAB 2001).

2.2 Future technologies and effects on the labour markets

As mentioned above, the interaction between new technological innovation and its impact on labour markets cannot adequately be predicted either by economic models or by empirically based concepts. There are many factors and social constellations which must be pieced together to obtain a picture of the job statistics. Nevertheless, one central argument for new technologies in public debates is the expected ‘job growth’ ensuing from future technologies. In fact, a whole range of technologies are expected to form the basis of new economic markets in the very near future.

These technologies include information technology, biotechnology and nanotechnology as well as converging technologies as the culmination of different types of technology and life sciences. Generally it can be assumed that the immediate effects of possible technological innovations on labour markets cannot be identified. Furthermore, it seems important to realise that the gap between the development of a technological prototype and its adoption in the market can be as long as 10 to 20 years. Or, as shown by past experience, the expected effects turn out to be less important than the unexpected ones. For example, the economic success of mobile technology was practically unpredictable, as were its social and cultural effects. The introduction of the Internet at the beginning of the 1990s offered a change in the technological paradigm of production and distribution patterns, and the various and complex effects it had on the labour markets were not foreseen either. Therefore, major technological developments continue, although their potential and full impact on labour markets as well as on society is less clear-cut. Very often this depends on external factors such as organisational structures and cultural biases (ETEPS-NET 2007:103).

Besides these general ideas about the impact of technological innovations on labour markets, from a technology-driven perspective some topics have been identified as ‘important’ for new economic markets (Schirrmeister, 2004:87):

- The development of new materials and the relevant production processes;
- The increasing application of microtechnology and fibre sensors;
- The management of organisation by software tools in companies;
- The application of simulation with regard to products and production processes;
- The ongoing process of increasing the flexibility of the production process.

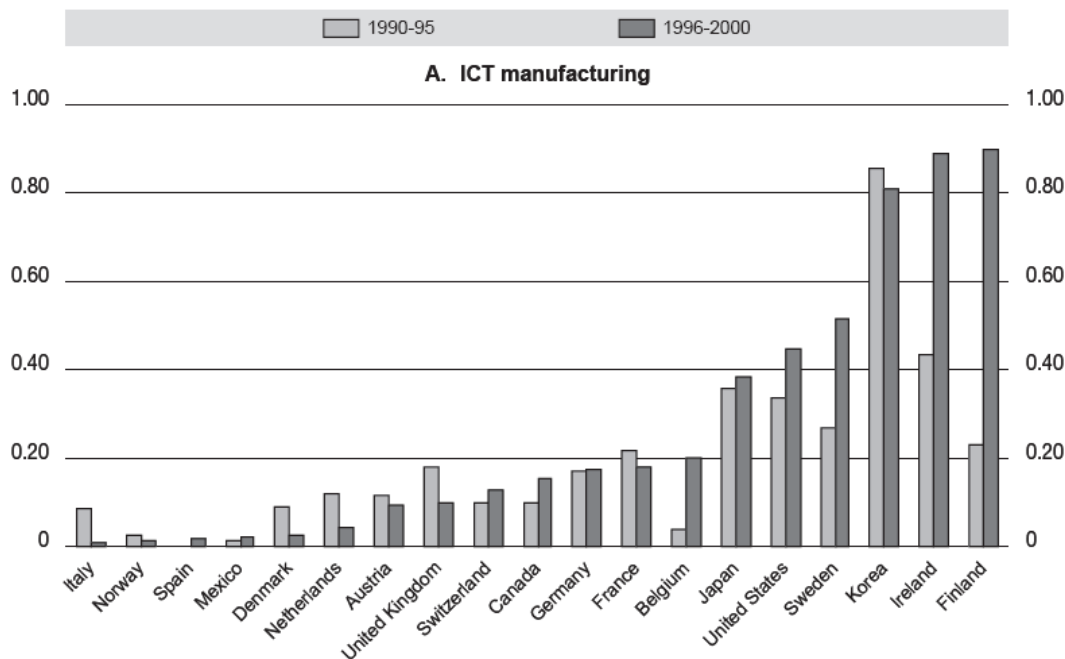
These aspects focus on developments which are widely considered as ongoing processes with some remarkable effects on labour markets and working structures. Two aspects seem important: first technological ‘breakthroughs’ cannot be predicted, and second every analysis about the interaction of new technologies and effects on labour markets must focus on current technology debates.²

2.2.1 Information Technology

The scenario of networked computers is often compared to that of electricity. As the electricity grid links every office, every home, and every factory in order to provide electricity, the information grid now offers information wherever it is needed (Webster 1995:7). The Internet is therefore often cited in the literature as an example of technological innovation when the rapid and profound impact of technology is described at all levels of society (Schmiede 1996, Baukowitz et al. 2006). As the following figure shows since 1990 also the economic impact of IT on labour productivity was significant in some relevant countries e.g. Finland, Ireland etc.

Figure 1: Contribution of ICT-producing industries to aggregate labour productivity growth

Total economy, value added per person employed, annual average contribution in percentage points



Source: OECD (2002)

² For the problem of prediction and prognosis in the concept of Technology Assessment, see Grunwald 2003, 2007.

Considering future aspects of IT, issues such as the improvement of communication systems, speed and new technological environments are mentioned in the literature. For instance, RAND (2005) has suggested that wireless communication will be an important trend for the very near future. In this context, wireless communication technology is considered to be the cornerstone of connectivity, and bandwidth seems to be the key measure of success (Institute for the Future 2003).

Some years ago it was supposed that third-generation wireless – using a high bandwidth, media-oriented standard known as wide-band code division multiple accesses – would create a future of ubiquitous broadband access to the Internet. Thus speed and connectivity would be improved. But developments have actually progressed more rapidly than expected.

With regard to IT, one might say the question is today whether there is enough time for anything to become a standard, or whether it will be replaced by something more powerful before it reaches that stage (RAND 2005).

Generally speaking, IT is a complex and widespread field which is still spreading to reach out to more and more fields of science, technology and even everyday life. For example, almost all fields of the labour markets, such as research and development, the sciences, engineering, retailing and commerce, services, transportation and logistics, health, household, education and learning, environment, etc., are penetrated or strongly influenced by IT. The application of its tools has become such a basic premise for many branches of science and industry that the ongoing process of innovation within the field of IT itself will not even be noticed immediately.

In other areas, however, new technical combinations with IT reveal new derivatives of products, processes, and development directions. Even the ambient living environment is strongly influenced by IT by the ways it interacts with humans or assists in daily activities. For example, information can be sent and received using the simplest form of embedded devices in functional clothes (ubiquitous, pervasive computing). Or with regard to energy supplied by solar cells, processes can be controlled and supervised using IT. The same can be considered at least for the development of the surface of smart materials or of lower layers for control purposes (e.g. for climate control or structural strength against mechanical stress).

In the literature the most promising research fields and economic sectors for IT in the very near future can be considered to be:

- 1. Artificial intelligence:** The main goal of artificial intelligence is, generally speaking, to create machines displaying some kind of ‘intelligent behaviour’. Today this means the core capabilities of problem solving and strategic development, self-learning and -advancement (self-optimisation/error reduction) and additional cognitive functionality (recognition, sensing, perception, and manipulation). In addition to much simpler technologies in many areas, these functions can be brought together in robots. Practically useful applications are, for example, household robots, intelligent support for the increasingly large older generations or more flexible prosthetics devices (Bibel 2005, Christaller et al. 2001). One example in the area of health is “PEARL”³, the electronic nurse, which was developed at Carnegie Mellon University in Pittsburgh. “PEARL” is able to understand some English language sentences and to take a patient’s pulse.

In the field of medical health with biotechnology or bionic technology, the consequences of new developments are directly linked to the technical innovations in the field of converging technologies (see Sect. 2.2.4).

³ Soroka M, A “Pearl” of a Nurse. Personal robotic assistant should improve quality of life for elderly people in the nearest future (Christaller et al. 2001:174).

Knowledge from biology and engineering can be used, for example, to develop elastic joints to replace rigid joints in robots, permitting elastic and faster movements. In this sense, the feedback regarding control, sense and force feedback is in many ways supported by IT techniques.

- 2. Human-computer interaction:** Research in human-computer interaction is generating more user-friendly systems for controlling and displaying data and information. The usual ways in which humans generate, recognize and manipulate data and information are being extended (e.g. 'data gloves' are expected to be available in the very near future; in the more distant future are direct eye-retina or brain interfaces).

Concrete applications are the improved security of data transactions (e.g. bank transfer, government), controlling and steering traffic, guaranteeing privacy and data protection with an unbroken chain of encryption, and intrusion prevention.

- 3. Smart materials:** According to the literature, the field of material sciences will be revolutionised (see Chap. 2.2.2). The current trends in research and development will lead to 'active' material structures that change their own properties in reaction to data detected by them. They operate as sensors and actuators, detecting changes in the environment, reacting and providing status reports. One good example is 'smart materials' that will act as a kind of artificial skin. The ambient temperature is measured and compared to normal parameters, a decision is made and actions are automatically induced. Autonomous controlling circuits can be built into very tiny structures in many places, even those we have not yet thought of. These materials will be applied in many branches and sectors (Bibel 2005).
- 4. Radio frequency identification (RFID):** The application of RFID tags will be widely used in logistic and commercial applications, for instance to improve processes or to reduce costs. Short-range future examples are real-time information, automatic price tagging and fast cashing procedures for goods in European retail shops. Therefore 'smart shopping assistants' should aim to accommodate the customer with 'helpful' information such as price comparisons, quality evaluations, and health suggestions. Furthermore, the customer does not even have to take the goods from the trolley to put them on the conveyor belt at the checkout. Everything is scanned within seconds without being touched, and the customer knows the actual cost of the purchase at all times.

The principle of saving and providing data has been widely adopted in the industrial sector, as have all other applications where information is provided to permit immediate and rapid decision-making processes. These techniques will allow a control of material flow or automatic management of complex actions from manufacturing to end-users or stores with monitoring of all the stations. But this technology is still waiting for its breakthrough. The rollout into the mass market is optimistically expected to take place around 2015 (Bibel 2005).

- 5. Wireless communication and data transfer:** As mentioned above, wireless communication and data transfer are foreseen to essentially change the technical environment of IT in the very near future. Some first steps have already been taken, mainly in network applications, but wireless communication is recognised as a field of work in which many applications are unpredictable. Not only human-to-human or human-to-machine interaction is expected, but also machine-to-machine information transfer within autonomous, miniaturised networks with wireless interfaces could be the precursors to big changes. Many different network topologies or architectures will be used, depending on the concrete application.

Whether a peer-to-peer connection or a server-client structure or some other as yet undeveloped technique will be used depends on increasingly shared information and/or shared computing requirements. In this context, bandwidth must always be considered in comparison to information density. But for mass data processing, e.g. scientific data analysis generated in the range of terabytes per second, bandwidth is considered as widely essential for future developments (Institute for the Future 2003).

As the issues above show, the fields of application of IT strongly diverge. IT as a ubiquitous technology is applied in many fields and is developed both from the information science but also from the applied disciplines such as physics, engineering, and medicine. However, today an increasing rate of transfer and a higher data processing speed are required and taken for granted in every technology.

It thus seems difficult to identify central branches and sectors of outstanding importance for IT development. Although many examples have been discussed in public, it has to be assumed that many of the intended technological advances may not be realized for several decades (EFMN 2005).

Basically, IT has been recognized for decades as the most important among the key technologies, due to its processing and controlling function in all other areas. IT is omnipresent in almost all other sciences, technologies and sectors of society. The annual market for IT in the European Union is more than 600 billion Euro and accounts for the employment of over 2 million persons across Europe (Bibel 2005:5). The budget for IT research in the 7th framework programme of the European Commission will be about 9.1 billion Euro for the years 2007 to 2013.

For many experts the important role played by IT and its impact on productivity and economic growth during the recent periods of strong economic expansion in many European countries is considered as an empirical fact. The investment (capital deepening and binding in technological values) and adaptation of various techniques have increased efficiency through reorganising activities with IT support, above all in human resource management (see Sect. 3). Based on this technology, the mode of production and different employment levels can be adjusted more flexibly, rapidly and thus productively.

In terms of job destruction and job creation, in the 1980s there was a broad discussion about the consequences of IT on the labour markets. The hypothesis: 'unemployment based on technological changes' was discussed highly controversially (Wingert et al. 1984). For example, in the British telecommunications sector between 1980 and 1993 there was a loss of about 40,000 jobs. These losses were not compensated by new suppliers of telecommunication systems (Bosch 1997). Similar figures can be given for Germany or other European countries. Nowadays there is a broad agreement that IT is, on average, biased in favour of skilled labour. Because of its strong bias in favour of information and knowledge, the application of IT is strongly connected with learning and communication processes.

2.2.2 Nanotechnology

For the past decade, nanotechnology has appeared in public and scientific debates as one of the most prominent future technologies. This goes hand in hand with strong financial support from national governments all over the world. The term 'nanotechnology' is used here as a generic term to denote a wide spectrum of different technology types which have one thing in common: they deal with structures and processes at the nanometre scale.⁴

⁴ A nanometre is a thousand millionth of a metre and refers to a borderline area in which matter can no longer be described according to the laws of classical physics but rather increasingly effects from quantum physics play an important role (e.g. explanation of terminology Paschen et al. 2004).

Its potential to generally change entire technological areas led nanotechnology to be regarded as a key or future technology already at the end of the 1990s. “The impact of nanotechnology on health, wealth and the standard of living for people will be at least the equivalent of the combined influences of microelectronics, medical imaging, computer-aided engineering, and man-made polymers in this century” (Smalley 1999 in Paschen et al. 2004:30, Grunwald, Fleischer 2007).

It is expected that in the near future this will influence not only technological development but will also entail substantial economic, ecological and social implications (Paschen et al. 2004). Overall, the stages of development of products, product ideas, and concepts in nanotechnology vary greatly. A whole set of applications are already in the realisation phase and have already achieved considerable profits in the economy (Luther, Malanowski 2004).

Luther and Malanowski, e.g., estimate that there are currently approximately 450 companies in Germany which focus on nanotechnology. In this study, so-called ‘nanotechnology companies’ are those which regard themselves as companies active in nanotechnology, those participating in nanotechnology projects from the Federal Ministry for Education and Research (Bundesministerium für Bildung und Forschung), or those thus classified because of their activities in the nanotechnology field (Luther, Malanowski 2004).

Another German study called Nanotec (Henn, 2004) examines cluster development of nanotechnology in Germany. A company questionnaire survey among others attempted to find out how the demand for personnel is distributed over institutions of nanotechnology at several levels of skills and qualification. 42 companies provided answers to this question (Table 1).

Table 1: Manpower requirement by companies in nanotechnology in Germany in 2007

Staff	Mean	Scientists	Engineers	Qualified personnel	Unskilled labour
<10	7.04	2.24	1.86	1.64	0.50
10-50	18.82	1.60	1.50	1.60	0.50
50-250	11.60	1.80	1.60	1.00	0.50
>250	11.27	0.70	0.70	0.70	0
Total	11.44	1.60	1.60	1.50	0.60

Source: Abicht, Freikamp, Schumann (2006)

The number of companies worldwide in the field of nanotechnology has been estimated at 1500 whereas 1200 actually are start-ups. The private investments in this technological field in the year 2004 were 4 billion \$ worldwide, at the same level as public investments. These figures show, however, that the economic engagement in the US and in Japan is much higher than in Europe. This consideration is also reflected by the number of patents in that field. Of all patents worldwide (80 000), about 57% belong to the United States, about 24% to Japan and only 16% to the European countries (European Patent Office in: Luther 2007:50).

In spite of these considerable numbers it seems difficult to extrapolate from these developments to future job markets or market prognoses. Generally, it is not clear what is recognised as a nanotechnology product. Are these stand-alone products or are they components of final products? Assessments here diverge widely. Another problem is the fact that there are strong variations in temporal horizons regarding prognoses so that it is practically impossible to make binding forecasts.

A comparison of different market prognoses for nanotechnology shows that the impact of this technology serves a world market worth approx. 100 billion Euro (Luther, Malanowski 2004, Luther 2007). This number is admittedly very controversial methodologically speaking, but is designed to illustrate that the perspectives of nanotechnology are overall very positively assessed for a wide spectrum of products and development. Altogether, the prognoses refer to the following fields of application (Paschen et al. 2004:4 ff):

- **Surface functionalisation and finishing** (To some extent already in industrial use are nano-multicoatings and nano-composite coatings which demonstrate improved mechanical attributes. Further examples are ‘self-cleaning’ surfaces or optically functional surfaces for façades, motor vehicles, solar cells, etc.).
- **Catalysis, chemistry, and material synthesis** (In the chemical industry, nanoparticles are already being used. Particularly in the nano-field, completely new materials are developed as catalysts. This is a large field with great scope for further developments in the future on many levels).
- **Energy conversion and use** (Using this technology, the efficiency of energy conversion can be increased here. The improvements are chiefly in terms of materials. A further focus is the low-wastage storage of energy).
- **Construction** (Crucial material variables such as rigidity, wear-resistance, etc. can be specifically improved by introducing characteristic structural variables in the nanometre range).
- **Information processing and communication** (The most important areas of application of nanoelectronics in the field of information processing and communication are electronic and optical/optoelectronic components. These include far-reaching ideas from product security to the integration of IT in many areas of everyday life (‘intelligent house, ubiquitous computing’)).
- **Automobile industry** (The spectrum of nanotechnological development here includes components that are already in use with far-reaching effects in coating, adhesion techniques, fuel additives or in filter technology).

This list could be continued here at some length for other sectors such as the textile industry. In all sectors and branches – as shown above – developments are being realised and future far-reaching developments can be discerned. To what extent these developments in fact correspond to the future visions of nanotechnology, however, remains an open question.⁵ Scientific and public expectations of its economic potential seem high. “The competitiveness of numerous industrial branches will strongly depend on the exploitation of the nano cosmos. Nanotechnology opens up commercial opportunities by creating smaller, faster and more ‘intelligent’ components for new products with enhanced performance or entirely new functionalities” (Luther 2007:39). With regard to job markets or specific demands on professional qualifications, the above examples show that new applications always continue on from existing fields of application and sectors and that which is specifically new is shown in the continuity of product innovation.

⁵ The widespread response to nanotechnology as a ‘technology of the future’ can be traced back to these future visions which were particularly developed around the US “National Nanotechnology Initiative (NNI)”. Perspectives of far-reaching, comprehensive changes in human existence were formulated in this context (Drexler, Peterson 1991).

The above-mentioned study which conducted company surveys with regard to the relevance of nanotechnology in Germany demonstrated that the field of chemistry is at the forefront of applications in Germany, just ahead of life sciences (medicine/health) and IT (Luther, Malanowski 2004). In this sense, professional qualifications in chemistry are in high demand. This demand usually means academically educated qualified personnel.

2.2.3 Biotechnology

Biotechnology and in particular modern biotechnology⁶ is said to be one of the key enabling technologies of the 21st century. Scientific and industrial representatives claim it could have a huge impact on almost all major sectors of industrial production. Basically, the technology is considered pervasive, infiltrating almost all areas of human life.

After the outstanding discoveries in the research field of molecular biology in the early 1970s, many national governments started sponsoring the scientific development of biotechnology.⁷

Biotechnology implies the capacity to change production processes fundamentally in completely or partly replacing biotechnical operations. One sector where these operations can be considered as widely advanced is the pharmaceutical industry. Here chemicals are increasingly being replaced by biological components. According to the European Association for Biotechnological Companies already 20% of all pharmaceuticals on the market and 50% of all components are 'bio based' (TAB 2007:184).

The classification of modern biotechnology shows that the main application areas can be divided into three sectoral groups: medical and pharmaceutical applications, biotechnology applications in primary production and the agro food sector, and biotechnology in industrial manufacturing, energy and the environment (IPTS 2007:6 ff):

- Applications of biotechnology in the **medical and pharmaceutical sector**, including new drugs and therapies, new diagnostics and vaccines. The share of turnover from all EU pharmaceuticals in 2005 was 9%.
- Biotechnology applications in **primary production and the agro food sector**, comprising animal husbandry, fisheries and aquaculture, crop production and forestry, and the production of pharmaceuticals in plants and animals, as well as the use of molecular diagnostics throughout the production chain. Europe is the largest food producer with an overall turnover close to €800 billion per year.
- Biotechnology in **industrial manufacturing, energy and environment**, ranging from bio-based feed stock for fuels, materials and chemicals, the use of biocatalysts in downstream sectors, such as the food and feed industries, textile and leather, pulp and paper, and bioremediation approaches for water, air and effluent gas, soil and solid waste. In the area of chemicals, Europe is the world largest producer, with an overall turnover of around € 580 billion per year (European Commission 2007a:5, IPTS 2007:5 ff).

⁶ The definition of modern biotechnology includes the use of cellular, molecular and genetic processes in the production of goods and services. Since the 1970s, when recombinant DNA technology was developed, modern biotechnology has involved a different set of technologies, including industrial use of recombinant DNA, cell fusion and tissue engineering.

⁷ Despite its enormous future potential and range, the expectations of the policy makers for biotechnology fell short. From the very beginning, the commercialisation of biotechnology in agriculture met with social resistance in nearly all European countries. The risks of genetic manipulation remained largely hypothetical and created a long history of biotechnology as a political issue (Jasanoff 1995).

Data on the acceptance of modern biotechnology by various sectors and its socio-economic consequences in Europe are scarce. The report by the European Commission entitled “Life Sciences & Biotechnology for Europe” specifies that the “biotechnology industry directly employs 96 500 people, mostly in Small and Medium-sized Enterprise (SMEs). Employment in industries that use biotechnology products is many times higher. The industry is highly research intensive, with 44% of its employees involved in Research and Development activities. In 2004, the 2163 dedicated biotechnology companies spent € 7.6 billion on Research and Development. The EU accounted for 34.8% of bio-technology patents filed at the European Patent Office in 2002-2004, compared to 41.1% for the US” (European Commission 2007a:5).

The most significant sector is currently the medical and pharmaceutical sector. With regard to market values, modern biotechnology is strongest in biopharmaceuticals, followed by in vitro diagnostics and vaccines. The contribution to employment is primarily seen in the creation of highly qualified jobs. The quantitative impact is difficult to measure, because reliable data is not available and indirect employment effects are difficult to detect. But direct employment effects are likely to correspond to the overall spread of modern biotechnology applications. Furthermore, biotechnology provides powerful tools for research and development work on biopharmaceuticals as well as small molecular drugs, vaccines and diagnostics. These and other indirect effects and the potentially improved state of health of European citizens would add to the contribution to gross value added (GVA) (IPTS 2007:6).

In the agro food sector, the recent application of biotechnology is in genetically modified (GM) crops. GM crops offer many advantages, in terms of reduced use of weed killer, resistance to drought or salinity, greater yield, and better, more nutritious food. But the possible risks of impact on the environment or human health still have not been assessed. GM crops have not been tested adequately for their safety as food, and they will ‘contaminate’ neighbouring crops, particularly those of organic farmers. Therefore, the legal coordination between GM crops and organic farming is still a matter of political negotiation.⁸

Biotechnology applications are currently not widespread in the industrial sector. In the next ten to fifteen years, this is likely to change. As a cross-cutting technology, applications in industrial procedures are widely expected. But as with nanotechnology, there are no defined products on the markets which refer to these technologies. Thus it has so far been impossible to gather data on job creation (TAB 2007:185). One important alternative energy source is biomass, and bio-based fuels have received wide attention. Bioethanol, which is produced by conversion of plant biomass into ethanol by bio catalysis and can be used as a transport fuel, is the most important use of modern biotechnology. For all energy production from biomass, modern biotechnology could also play a role on the biomass production side, with an impact on the development of energy crops (IPTS 2007:103). The industrial sector will gain the most attention due to rising energy prices compared with the growing need to reduce the environmental influences of all technologies. Additionally, biotechnology can have positive effects on employment and growth and contribute to improving human health.

⁸ Biotechnology always seemed to be a technology offering visions about the improvement of the global alimentation. “Other crops grown commercially or field-tested are a sweet potato resistant to a virus that should decimate most of the African harvest, rice with increased iron and vitamins that may alleviate chronic malnutrition in Asian countries, and a variety of plants able to survive weather extremes. On the horizon are bananas that produce human vaccines against infectious diseases such as hepatitis B; fish that mature more quickly; fruit and nut trees that yield years earlier, and plants that produce new plastics with unique properties. Food plants with novel functionalities could involve a wide range of partners – plant scientists, nutritionists, food scientists, flavour manufacturers. This offers many perspectives for new job profiles and employment”. (http://www.ornl.gov/sci/techresources/Human_Genome/elsi/gmfood.shtml).

And lastly, if biomass production takes place, this should improve the energy balance in European regions. By the year 2050, oil and gas reserves will be almost exhausted. The challenge will be to replace fossil fuels and non-renewable electrical, mechanical or chemical processes with renewable biological ones. Assuming that a 'bio-based economy' will be established in the time to come, where non-biological processes are replaced by biological ones, its scope will be great, because other 'bio-products' can be assumed to be invented such as fine chemicals, bio-plastics, solvents, bio-pesticides, enzymes, and bio-fuels. Experts predict that by the year 2010 biomass will account for 20% of chemical production, 5% more than today. The percentage of energy from biomass is expected to grow from 5.8% in 2002 to 14% in 2010 (European Commission 2005a:33).

Currently, a general shift from the utilisation of non-renewable resources to biologically renewable ones can be noted. But this process is moving slowly and will take a long time. The maximum impact will only be seen in the long run. So future work is expected to focus on the internal specialisation of biotechnology, contributions from other disciplines (IT, physics, chemistry), and targeting particular diseases.

The EU strategy on Life Sciences and Biotechnology for 2002-2010 sets a specific emphasis on five priority actions (European Commission 2007a:6):

- Promote research and market development for bio-based products,
- Facilitate knowledge transfer and innovation from the science base to industry,
- Encourage informed societal debates on the benefits and risks of life sciences and biotechnology,
- Ensure a sustainable contribution of modern biotechnology to agriculture,
- Improve the implementation of legislation.

In Germany, a survey was conducted according to OECD guidelines on the future potential of biotechnology. The findings are that 495 biotech companies operate with biotechnology processes. The most important sector is the pharmaceutical/medical sector, comprising 43% of the companies. A total of 40% operate in the service business or as a supplier for other biotech firms. In the field of employment, the number of jobholders has been raised by 22%. The growth potential of the sector is considerable. The global market for biotechnology is expected to grow at 12% to 20% per year (BMBF 2007). In terms of figures in biotech industry there are about 24 000 people employed in Germany. This figure must be increased to include 620 000 employees (approx. 1.7% of the whole workforce in Germany) in Research and Development and affiliated branches (public and private), as well as in subordinated work activities (TAB 2007:185). Nevertheless, in terms of method it seems difficult to obtain figures on the job level within these technological fields because the biotech companies are not regarded as one branch or as one sector.

To sum up, the scientific development of biotechnology proceeded through several stages in the past. From the Human Genome Project, it progressed to a post-genomics era where specialised areas such functional genomics or proteomics emerged. Since the beginning of 'new' biotechnology, the pharmaceutical and agro-chemical industries have been radically transformed by the use of recombinant and cell technologies. As a result, a process of differentiation and specialisation in biotechnology took place. The result was a division into three components – internal differentiation, specialisation as well as convergence of previously separate disciplines, for example biology and information technology merged to form bioinformatics.

Biotechnology and its applications on the markets are strongly research-based and multidisciplinary. Therefore, biotechnology can only be successfully applied if a broad research and knowledge base exists in several disciplines such as biology, biochemistry, microbiology and molecular biology. With regard to the labour markets, we may compare this technology with nanotechnology where the demand for labour force is mainly concentrated in research and development (also in private companies). Here too, the demand for qualified and highly qualified professionals is considerable.

2.2.4 Converging Technologies

Converging Technologies (CT) emerged as an issue of scientific and political debate in the US and developed the notion of ‘convergence in the digital world’ which was created in the IT, multimedia and entertainment industries in the 1990s.

On the basis of a number of reports, the term ‘convergent technologies’ refers to the synergistic combination of four major provinces of science and technology, each of which is currently progressing at a rapid rate (Coenen et al. 2004:118, Roco, Bainbridge 2002):

1. Nanoscience and Nanotechnology;
2. Biotechnology and Biomedicine, including genetic engineering;
3. Information technology, including advanced computing and communications;
4. Cognitive Science, including cognitive neuroscience.

Combining these different approaches, technological progress is expected by many scientists to engineer natural processes to new materials, biological products, and machines from the nanoscale up to the scale of metres. But because of their very early stage of scientific development, converging technologies still have to be explored with regard to their technological and scientific challenges or economic potential on the labour markets.

From 2003 on, the field of converging technologies also started to be an important topic of the European Commission. The Commission began its foresight activities by setting up a High Level Expert Group ‘Foresighting the New Technology Wave’ which published its final report in autumn 2004. In 2004, another High Level Expert Group dedicated its expertise to the topic ‘Key Technologies’ where the concept of converging technologies was reflected at different levels (Rader et al. 2006).

Although the concept is mentioned in a number of reports, debates and press releases, its relevance for societal and technological development is still not adequately reflected in concrete scientific projects that are funded by European RTD institutions. “However, the concept is incorporated in research agendas for the 7th Framework Programme, e.g. in the fields of nanotechnology and information and communication technologies. Furthermore, special emphasis is put on research and perspectives of social sciences and humanities, the role of cognitive science and the identification of ‘converging clusters’ where specific Converging Technologies projects have already been funded” (Rader et al. 2006:12 ff).

To summarise scientific activities on converging technologies, the main fields of application have been identified in the following topics (Andler et al. 2006:13 ff):

1. **Neuro/brain enhancement** (The main goal of neuroscience research is to understand how the human brain works in order to be able to treat neurodegenerative diseases and to replace lost senses like vision or hearing. In addition, some research projects directly aim at stimulation and enhancement of the brain with the help of pharmaceuticals, genetic modifications and technical devices that could act as surrogate brain structures or even as ‘external memory extensions’).

2. **Physical enhancement and biomedicine** (On the basis of recent advances in bio- and nanotechnology, several new approaches and visions have emerged, focussing on novel therapy methods and enhancement possibilities of physical capabilities of humans. These include nanotechnology-based drug delivery, gene therapies, pharmaco-genomics and pharmaco-genetics as well as nano-coatings for implants).
3. **Human-machine interfaces** (Another field which plays an important role in the CT debate is human-machine interfaces. The main research goal in this area is to develop interfaces that enable direct connections between the human brain and artificial limbs as well as between humans and computers or other machines).

The envisioned interfaces will possibly enable a large set of applications – ranging from the restoration (e.g. artificial hands) to the augmentation of human performance by direct neural control of complex machines, connecting the brain to sensors for UV light and ultrasound or to external memory extensions).
4. **Sensors** (Apart from the more general goals of sensor R&D, such as the miniaturisation of components or the improvement of sensor sensitivity and specificity, a set of very diverse visions is connected to this field: wearable sensors for medical self-monitoring, nano-sized imaging-/diagnostics agents and biochips - ‘lab-on-a-chip’ - as well as wireless sensor-networks).
5. **Computational modelling of the world** (The visions and ideas in this area are based on a large set of different technologies and research fields: virtual and augmented reality, bioinformatics and computational biology as well as bio-inspired logical systems).

As these application fields show, the concept of converging technologies is embedded in existing research fields such as ‘neuro/brain enhancement’ or the ‘human-machine interfaces’. Furthermore, the expectations of the concept regarding ‘improving human performance’ have still not been realised. As a result, the concept still seems to be more a research discipline than an advance in science and technology. With regard to economic markets it has been described as an “umbrella concept that has much overlap and little focus” (ETEPS-NET 2007:29). Therefore, at this stage it seems rarely possible to make solid statements about future labour markets in the field of converging technologies.

2.2.5 Résumé

The short state-of-the-art descriptions of technologies which are considered as ‘future technologies’ in public and academic debates focus on the most intensive research and development sectors which have experienced the highest growth rate since the 1990s. In all technological fields for the very near future, the demand for a highly qualified labour force is expected. Through the importance of research and development, the need for academics especially in natural sciences and engineering will increase. But also the demand for technical assistance will increase whereas the positive effects on less qualified people will be less significant (TAB 2007).

This result is already reflected by some studies. In the last years the increasing reliance on human resources for science and technology already has demanded a skilled labour force of scientists and engineers. From 1995 to 2000, employment in human resources for science and technology has grown twice as fast as total employment, while in several countries the number of science and engineering graduates has declined (OECD 2004)⁹.

⁹ See also the debate on knowledge-based societies where the increase of experts and knowledge-based workers also has an impact on political decision-making processes (Stehr 2001b).

This figure shows that knowledge-intensive sectors are becoming more important to national economies and to international trade. At the latest since processes have been accelerated by globalisation, the dynamics of competition and economic pressure brought about by technological innovations have become more and more important for national economies.

In many countries, the concern exists that in the future a limited and highly unpredictable domestic supply of human resources for science and technology will set constraints on the potential for economic growth at least in the OECD countries. Assessing and retaining skilled labour is increasingly important for companies which want to build up their internal resources and capabilities.

Without a doubt, the growing knowledge-intensive sector in the past decades has demanded a highly skilled labour force which is not only employed in universities but also in companies, non-profit organisations and research institutes. Reflecting these developments, there is agreement between experts that educational as well as vocational training of students and employees has to take place to some extent in companies.

Experience in the technological fields of bio- and nanotechnology has especially shown that the formal qualifications of academics often do not conform to the demands for skills and qualifications within companies (TAB 2007, BMBF 2000). Therefore, on the political level different strategies have been devised in order to support vocational training programmes (see Chap. 4.3).

Besides the analysis of 'future technologies', the historical perspective on IT focuses very much on the impact of the work and employment structure. This example of interaction between technology and labour markets shows how IT penetrated and still penetrates the whole production and working pattern on a quantitative but also on a qualitative level.

2.3 Historical perspective: experience with information technology

In dealing with the societal experiences of the interaction between new technologies and changes in the labour markets, it makes sense to take a look at historical experience. In an ex-post perspective these real experiences reveal highly complex and different processes. And there are many technological examples, such as the automobile or the telephone, whose social and cultural effects were widely invasive without having been detected before.

With regard to the impact on working conditions, the most prominent technology in recent times has been IT and especially the introduction of the Internet at the beginning of the 1990s. The impact of this technology has not only changed the whole production and work organisation, its impact on the change of work on all levels having been discussed intensively in the literature (Boes, Baukowitz 2002). In addition, the societal impact of this technology was already a topic of discussion forty years ago when the introduction of computers led to the notion of a transformation of the whole of society.

In the late 1960s, IT was considered as a technology which would change the societal pattern. One of the first authors who introduced the concept of an 'information society' was the economist Fritz Machlup. With his pioneering study "The Production and Distribution of Knowledge in the United States" in 1962, he initiated an intensive debate about the impact of information technology on the knowledge industry (Machlup 1962). Later, in the 1970s, Marc Porat (1977) distinguished between a 'primary' (computer manufacture, mass media, education, advertising), a 'secondary' (knowledge-based industry, research and development, governmental departments) and a 'non-information' sector (agriculture, service sector) in the 'information economy' (Webster 1995:11 ff). While the information goods and services were directly used in the production and distribution processes, at a second level information services were also produced for internal consumption by government and firms.

Porat used the total value added by the primary and secondary information sector to the GNP as an indicator for the 'information economy'. This concept was widely adopted by OECD studies.

Whereas Machlup and Porat focused their theoretical concepts on the economic structure of their country, other authors concentrated their work on the occupational effects of IT. The shift from the economic structure towards the distribution of occupations can be considered to lie at the core of the most influential theory of the 'information society', namely that of Daniel Bell (Webster 1995). For Daniel Bell, the number of employees producing services and information described the informational character of a society. "A post-industrial society is based on services. (...) What counts is not raw muscle power, or energy, but information. (...) A post-industrial society is one in which the majority of those employed are not involved in the production of tangible goods" (Bell 1976:127).

According to Bell, the industrialised societies turned into 'post-industrial societies', which he described as follows (Bell in: Webster 1995:35 ff):

- A decline in the number of workers employed in industry, ultimately reaching a situation where few people find work in industry (the era of 'robots factories', 'total automation');
- A decline in industrial employment, accompanying continuing and sustained increases in industrial output because of unrelenting rationalisation;
- Continued increases in wealth, translated from industry's output, which may be spent on 'new' needs of people (anything from hospital facilities to masseurs);
- Creation of a never-ending supply of new job opportunities in services aimed at fulfilling the new needs that more wealth generates.

The idea of a numerical shift of jobs from the production sector towards the service sector was featured strongly in the scientific and political debates in the 1970s and 1980s. The empirical finding in all Western industrial societies in fact showed an increase in information-based work, which itself was based on IT. These information-based activities were characterised as (1) white collar employment which brings greater job satisfaction than blue collar employment. Within the service sector (2) professionals flourished, what means that people provided the kind of skills which were increasingly in demand in post-industrial society (Bell 1976). The heart of the post-industrial society would be (3) its professional technical services, that means scientists and engineers. Furthermore, a new professional group would be developed which can be described as (4) the "expansion of the new intelligentsia – in the universities, research organisations, professions and government" (Bell 1976:15).

There were many authors who agreed on the concept of the new mode of work, which especially in the 1990s entered into the debate of the 'knowledge-based society'. For Nico Stehr, in a knowledge-based society the majority of jobs involve working with knowledge. "Contemporary society may be described as a knowledge society based on the extensive penetration of all its spheres of life and institutions by scientific and technological knowledge" (Stehr 2001b: 18). The application of science to working profiles would become an immediate productive force. Knowledge would thus no longer be primarily embodied in machines, but would be rearranged according to certain production designs and social programs. According to Stehr, the economy of a knowledge society is largely driven not by material inputs, but by symbolic or knowledge-based inputs. There would be a large number of professions that involve working with knowledge, and a declining number of jobs that demand low cognitive skills particularly in manufacturing (Stehr 2001a).

In the 1990s the concept of the network society gained importance in information society theory. The most relevant author of network logic, Manuel Castells, considers information, pervasiveness, flexibility, and convergence a central feature of the information technology paradigm (Castells 2000:69 ff). “As an historical trend, dominant functions and processes in the information society are increasingly organized around networks. Networks constitute the new social morphology of our societies, and the diffusion of networking logic substantially modifies the operation and outcomes in processes of production, experience, power, and culture” (Castells 2000:500). In this sense, according to Castells, the network society was the result of ‘informatisation of work’, which was based on a new technological paradigm.

As the whole range of debates about the impact of IT shows, there was agreement on a transformation toward the theoretical idea of the ‘informatisation of work’. This process started early in the 1960s and can be considered a continuous process based on the application of IT. It can also be analysed as an historic shift towards a new qualitative mode of work, which today penetrates all economic sectors and branches (Boes, Pfeiffer 2006:20):

- 1) The Internet creates a ‘space of limitless data’ as a new frame of social action. For the first time in history the use of general information becomes compatible with complex technical information systems. Thus information at different standardised levels can be joined in a common media system.
- 2) Information creates new space and time structures: thus the internationalisation of production has led to a new quality. The re-organisation of global value chains as well as new production and distribution patterns can be seen as the result of these structures.
- 3) The scope of autonomy of the companies changes dramatically. Through ‘informatisation of work’ the logic of financial markets and the global strategies of the companies have effects on the external (mergers, demergers, off-shoring processes etc.) and internal re-organisation of the firms (trends towards decentralisation, project-oriented work organisation etc.). As a result the companies are no longer autonomous actors in the rationalisation process but its own object. They depend more and more strongly on the financial market structure.
- 4) The qualitative feature of work increases strongly. Independent of the sector in which the positions are situated, the job profiles become more complex. This means that the professional, social and cultural demands are increasing on the workplace level.

Although the historical description offers a linear process of the impact of IT on the labour markets, one may state that it was also a process of social contradictions. The introduction of computer systems in the 1950s into companies and administrative institutions did not assign a qualitative jump of the change of work. But on the basis of these developments, the introduction of the Internet was made possible in principle, which can be taken into account for the global information and communication networks.

Whereas in the 1960s and 1970s the debates focussed greatly on the creation of a service sector as a counterpart to agriculture and industry, today information-based activities have penetrated nearly all economic sectors and branches in advanced industrialised societies. Basically the notion of “informatisation of work” (Schmiede 1996) indicates that the different functions of organisation, administration, distribution, control as well as management based on information and data, nowadays can be analysed in all sectors and branches. They are a strong feature of the increase in knowledge-based activities in advanced industrialised societies (Kocyba 2003, 2007).

But the increase of knowledge in production and working processes did not lead to “symbolic work” becoming more important for the production processes than working with physical materials. Basically, the relationship between work and knowledge has been connected to the model of a “scientific-organised management” (Kocyba 2007:45). That means that information and data are increasingly disconnected organisationally *and* geographically from substantial and energetic processes. Thus the standardisation of many business processes combined with the digitisation of data and information and the development of high-capacity telecommunication networks has made it possible to outsource and/or relocate (Huws 2006).

Related to the processes of codification, standardisation and fragmentation, and the related decrease in transaction costs, the diversification of products and services implies the multiplication of tasks and skills. Outsourcing seems, therefore, to be a managerial solution that accommodates increased organisational complexity while maintaining cost effectiveness.

“In the constant dynamics of capitalist restructuring, specialisation and standardisation, companies identify the strategically important tasks and competences and focus in-house production on these. Non-core tasks are purchased from outside suppliers. The observable historical trend is that an increasing number of business functions are considered non-core. The current trend of outsourcing of services can also be put in historical perspective of growing specialisation and diversification of products and services, and thus on the shift of activities from the core to the periphery of organisations” (Huws 2006:21).

From this perspective, the increased importance of the service sector has become a different notion. The shift towards globalised economies is continuously re-organising the products and working patterns along the global value chain. Whereas the industrial sector (e.g. automotive sector, clothing industry, food sector) has already established globalised production patterns, nowadays business functions such as administrative activities, consultancy, or even management tasks etc. are increasingly distributed organisationally and geographically. The unfolding service economy therefore is potentially dualistic. The overwhelming thrust is in favour of skilled and professional jobs but a sizeable market of low-end, routine services has emerged (Esping-Andersen 2002).

2.4 The two faces of the Service Sector

At the beginning of the 1980s, the service or tertiary sector still seemed to compensate for the high job losses in the production sector. Through new technological innovation worldwide, labour in the production sector has been diminished, and a high rate of unemployment in nearly all Western industrial societies has resulted. At the same time, the tertiary sector has been growing and offering an increasing number of jobs. Public and scientific debates therefore have focused strongly on the historic shift from an “industrial economy” towards a “service economy” (Gershuny 1983, Offe 1983). As the debate showed, there are various technical and social developments which have to be taken into account when focusing on the importance of the service sector. On the one hand, the nature of service-oriented work is changing due to societal developments. On the other hand, as described above, the “informatisation of work” (Schmiede 1996) has changed the whole mode of production. Also in the literature, when the service sector is referred to, the concept mainly relates to the growing sector of information-based activities. But through the continuous differentiation of global value chains, the service sector is also a growing sector of informal work, unpaid work or even black economy. This shift represents a visible aspect of the service sector based on its increasing social mobility within the European borders and worldwide.

1. **Change of services:** Traditionally the service sector was (and still is to some extent) informal work. The International Labour Organisation (ILO) from the very beginning uses the term ‘informal’, while the European Commission has introduced the concept ‘undeclared labour’, relating to economy, work, employment, activities, income.

The ILO defines informal economy as “comprising informal employment (without secure contracts, worker benefits, or social protection), both inside and outside informal enterprises” (ILO 2002b). In the context of the Commission, the term ‘undeclared work’ includes work “that is not prohibited by law and is not deemed criminal under the law, but deviates from the law or simply does not come within the purview of a statute, as neither do the operations in concealing such activities” (Dimova 2007:21). These work activities imply activities which support or improve the quality of life of the people performing them. This includes both income generating (farming) and non-income generating work such as caring for children, as well as for the ill, elderly or disabled (Dimova 2007). In all European countries these activities are widely performed by women, which mean that they are more outside the formal labour force. Basically the work activities are focused on the following sectors (Renoy et al 2004 especially for Central and Eastern European countries):

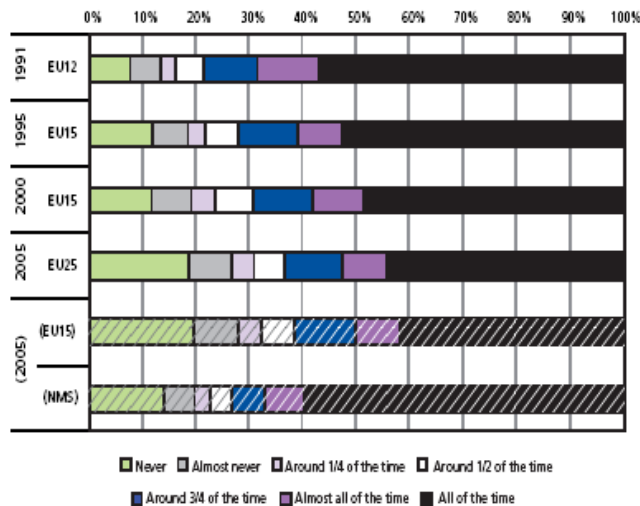
- 1 Retail and hotel / restaurant sectors;
- 2 Construction sector;
- 3 Relatively high importance of professional (social) services (caring activities);
- 4 Relatively low incidence of informal work in most sectors of manufacturing;
- 5 The presence of a subsistence economy with a focus on agriculture.

When joining the informal sector, women usually rely on skills and experience they already have – mainly in the sectors of food processing and trading, sewing, domestic and personal services. “That is why women are mostly found in sectors with lots of ‘female tasks’ – in personal services, the care economy, the trade, hotel and restaurant branch, catering, health care, education, commercial cleaning. Male workers are usually found in transport and construction” (Dimova 2007:25).

Through the demographic development (decreased birth rate in many European countries), the increasing percentage of women in qualified and highly qualified job profiles and the continuing shortage of state funds in social services, the need for these activities is increasing strongly. From an international perspective, many people, mostly young men and women, have emigrated from Eastern countries of Europe to Germany, France or the UK looking for better living and working conditions. Being immigrants in Western European countries, many women join the informal care sector, while men usually accept informal work in construction. These people enter into the service sector and face a higher poverty risk than workers in the formal economy. Very often they are over-worked, under-paid and under-protected. They also have limited time for their families and less opportunity to improve their skills and are less competitive on the labour markets (Chen et al. 2005, ILO 2002a).

2. **Informatisation of Work:** Very early on, a second layer of reference for production processes developed alongside the material one, namely that of “informatised information” (Boes, Pfeiffer 2006:23). For example, in construction engineering the operating information system was transformed bottom up, from computerisation of control processes in component manufacturing to computerisation of intangible work in the technical offices. These processes were increasingly informatised. This led to advancement of the ‘scientification of work’ in order to increase its control and efficiency. Information and data became the actual subject of work for an increasing number of employees. The proportion of workers who use computers at least a quarter of the time in Europe has increased from 31% in 1991 to 47% in 2005. But it has to be noted that there is still a very significant proportion of EU workers who do not use computers at their work at all (44%).

Figure 2: Working with computers in main job



Source: European Foundation for the Improvement of Living and Working Conditions (2006b)

Today, the majority of information-supported jobs and thus the so-called service sector relates directly and indirectly to goods production. These comprise a whole range of activities and occupations, which can be described as “producer services” (Schmiede 1996:112, Krings 2007). The increase in employment and occupations in informatised jobs continues without interruption and is still taking place in many branches and sectors (TAB 2007). The many various functions of information and organisation, of planning and forecasting processes, but also of administration and management are based on specialised professional areas. Overall, they also point to the strong growth of knowledge-based activities in advanced industrial societies. For Germany, a recent study showed that in 1998 approx. 40% of employees involved in production had service sector jobs. These include primary service sector activities such as trade and office work, cleaning, catering, and warehousing (25.6%). They also include so-called secondary service sector activities (14.3%) such as research and development, organisation, management or consulting. Further development shows that the proportions of production and service-sector oriented jobs in the manufacturing sector do not remain constant. In the short period between 1998 and 2005, the number of production-oriented jobs already continually decreased; falling by about 3% - 4%, and this was mirrored by a corresponding increase in service sector oriented jobs. These numbers support the hypothesis that “work in industry is increasingly service sector work” (TAB 2007:75 ff).

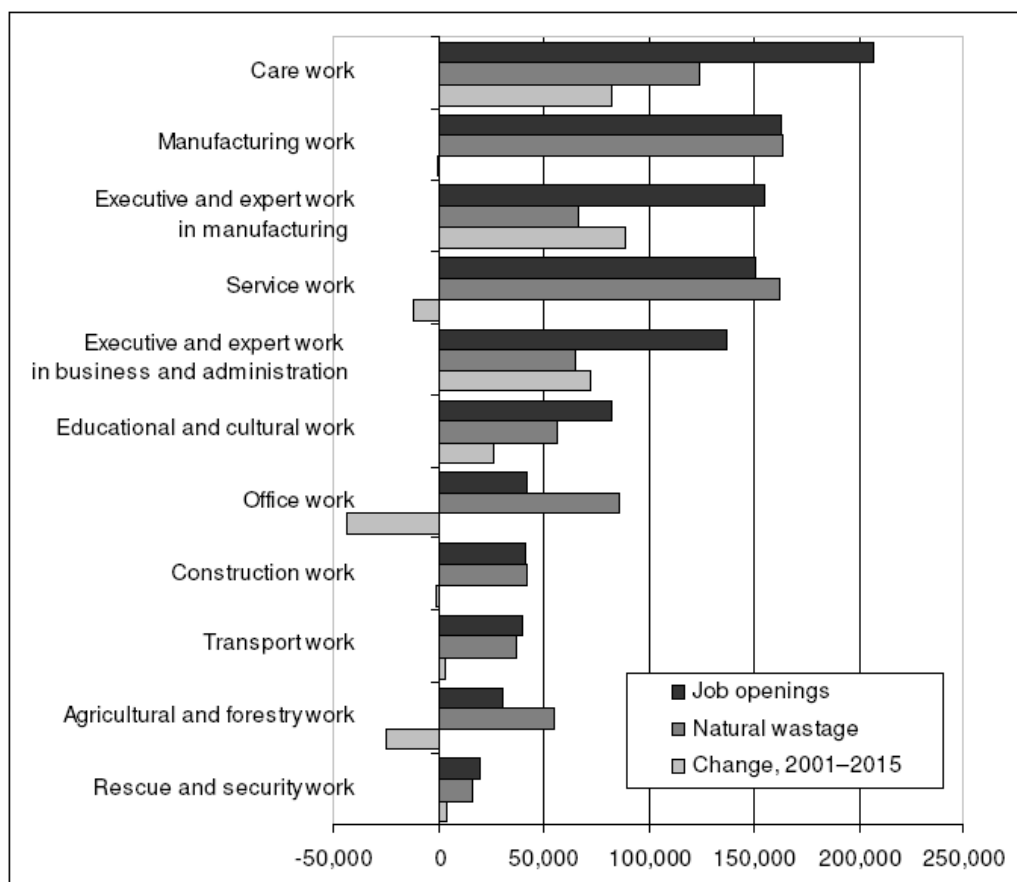
There are several aspects in the debate about changes in the service sector in the Western industrial societies. On the one hand, there is the long-running discussion about the development of information societies where information-based work has become a new mode of work that today reaches into all economic sectors and branches. From a theoretical perspective, it thus still seems difficult to differentiate clearly between the three sectors (agriculture, industry and service sector). As described above, the penetration of information-based work into all sectors has entailed an increasing amount of work that can be described as ‘service sector’ work according to the classical three-sector scheme. If the “informatisation of work” approach (Schmiede 1996) is taken into account, the shift towards “globalised work structures” can be observed empirically (Huws 2003a).

On the other hand, the service sector did not become less important historically. Owing to demographic changes, the increasing participation of women in the labour markets as well as the liberalisation of international trade have led to a growing demand for ‘service’ activities, e.g. in care work in private households or less qualified work in construction or health organisations. This demand is still growing and is organically tied to regulated economic activities. Its size and manifestation depends largely on the state and development of the ‘formal’ economy as well as on governmental regulation.

Because of these developments as well as of the demographic change in many European countries, the need for person-related services will increase continuously in the nearest future. Having a look on future employment markets (see Figure 3), the service sector plays a dominant role. According to national estimates, the number of jobs becoming available in Finland over the period 2001–2015 is 1,069,000 in the target development scenario. This means 71,000 jobs becoming available each year. Growth in industries creates new jobs, which can be seen in industrial forecasts. The target development scenario estimates the total growth in employment over the 15-year period to be 166,000 jobs. In addition, new jobs will be created within industries due to changes in the occupational structure.

The target development scenario predicts that, in relative terms, the highest number of jobs will open up in executive and expert work in manufacturing and transport and in business and administration. 207,000 jobs will become available in health and social work, which is the highest number within the major occupational groups, equivalent to a 70% growth on 2000. New jobs would account for 40% of all openings. The supply of jobs will be distributed evenly across the entire forecasting period.

Figure 3: Number of jobs becoming available in Finland over the period 2001-2015 in descending order by occupational group in the target development scenario



Source: Government Paper, Finland (Saijets 2006)

Both sides of the 'service economy' are based on technological transformation as well as on the national labour market policies. The basic requisites for a secure and good life are growing and changing for different social groups at the same time. "Those with insufficient skills or cultural and social resources may easily slide into a life course marked by low pay, unemployment, and precarious jobs" (Esping-Andersen 2002:2). And skilled and highly skilled professional groups generally have good chances of improving their welfare conditions. In order to avoid this process of social polarisation, in some European countries (Scandinavian countries, UK) the idea is to adapt and empower citizens in terms of training and vocational training. There is a supply-driven policy attempting to furnish citizens with the requisites for individual success. "Hence its flagship policies are training and lifelong learning. The assumption seems to be that the social risks and class inequalities that emanate from markets can be overridden if we target policy so that all compete on a more equal footing" (Esping-Andersen 2002:5).

From the perspective of technological transformation, however, the concept of vocational learning is more than merely training an individual in technical skills; it is also the development of a competent individual with the knowledge and understanding to perform a job role professionally. That includes the necessary competences which have been described in literature as general trends in individual skills and qualification (Petersen et. al 2005).

3. General trends in individual skills and qualifications

The literature and other relevant documents on the general trends in skills and qualifications usually focus strongly on the relationship between new technologies and the increasing demand for more qualified staff, especially in highly industrialised societies. Similarly, a decreasing demand for a less qualified workforce has been taken as an indication of technological change. Indeed, since industrialisation, the decreasing reliance on labour has been an indication of the technological changes in manufacturing or later in many other sectors and branches (Castel 2000).

As the preceding section indicates, qualification and skills became a key feature of knowledge-based work. While earlier debates focused strongly on control and automation aspects of modern IT and assumed a deskilling tendency, “there seems to be a widespread agreement nowadays that new technologies add rather than subtract from the skills of workers. However, the skills and competencies aspect is discussed controversially depending on whether modern IT or information is seen as the dominant characteristic of work” (Schienstock 2003:20).

A technically oriented perspective undoubtedly gives priority to skills and qualifications. An interpretation that in contrast focuses on the degree to which information activities penetrate work stresses the importance of social and particularly communicative competence (Bechmann et al. 2003). Whether the perspective is technology-driven or includes the entire range of work processes strongly defines the approach to new forms of work. These forms are determined by economic, social and political imperatives and take different forms in different contexts (see Sect. 4). As a prototype of a new technology, IT plays the role of an enabler, but not the determinant of change. Nevertheless, its introduction is associated with changes that can be divided into six broad categories (Huws 2003:143 ff.):

- Changes in the nature of tasks carried out and, hence, of the skills required to do them (e.g. the decline of traditional occupations like typesetting, pattern-cutting or filing, and the rise of new ones like web-site designer, call-centre operator, etc.).
- Changes in the organisation of work and hence in the structure of organisations (e.g. the growth of outsourcing, strategic alliances between companies, the disaggregation of large corporations into smaller profit centres).
- Changes in the contractual relationship between workers and employers (e.g. growth of ‘atypical’ contracts such as zero hours contracts, annual hours contracts etc.).
- Changes in management methods, including a move away from time-based management to management by results.
- Changes in the location at which work is carried out (e.g. introduction of telehomeworking, the relocation of activities to remote regions, or outsourcing to other countries).
- Changes in the organisation of work in time (e.g. the use of voice-mail and e-mail to ‘time shift’ activities which previously required synchronous communication).

Consideration of new demands for skills and qualifications must take these changes into account. They are complex, imply enormous shifts in the working culture and are linked intimately with the issue of skills.

The following table (Table 2) shows the trends in the employment situation in 2003, distributed by sectors and countries. It is worth noting that services accounted for 62.4% of total employment in the European Union, which represents a little more than 120 million people. Among these, one half are employed in knowledge-intensive services — KIS and the other half in less knowledge-intensive services — LKIS.

In other terms, each of these sectors accounted for approximately 31% of total employment in 2003, or close to 60 million employed people.

These outcomes have to be taken into account additionally, when considering the country differences of new demands for skills and qualifications. For example, employment in manufacturing accounted for more than 25% of total employment in the Czech Republic, Slovenia and Slovakia (EU-25 average = 17.7%). Other countries are more active in services. This is the case for Belgium, Denmark, France, Cyprus, Luxembourg, Sweden and the United Kingdom, where services accounted for more than 70% of total employment in 2003. Whereas, at EU-25 level, employment in the manufacturing sector decreased between 2000 and 2003, it increased for some countries such as the Czech Republic, Spain, Hungary, Italy and Slovakia. Services, meanwhile, increased in the EU-25 in general, but decreased in Belgium and Lithuania. However, services increased with an annual average growth rate of over 3% in Estonia, Spain, Cyprus and Ireland.

Table 2: Total employment in manufacturing, high tech and medium high tech, manufacturing, services, knowledge-intensive and less knowledge-intensive services, in 1000s and as a % of total employment – 2003 and Average Annual Growth Rate (AAGR) – 2000-2003 (1²)

Country	Manufacturing			High and medium high technology manufacturing			Services			Knowledge-intensive services			Less knowledge-intensive services		
	1000s	% of employment	AAGR 2000-2003	1000s	% of employment	AAGR 2000-2003	1000s	% of employment	AAGR 2000-2003	1000s	% of employment	AAGR 2000-2003	1000s	% of employment	AAGR 2000-2003
EU-25	34 069	17.69	-1.24	12 714	6.60	-1.19	120 104	62.36	1.66	59 009	30.64	2.28	61 095	31.72	1.08
EU-15	30 381	18.56	-1.40	11 631	7.10	-1.42	111 303	67.99	1.70	55 107	33.66	2.35	56 197	34.33	1.08
BE	720	17.76	-2.32	260	6.42	-2.89	2 974	73.36	-0.04	1 570	38.71	1.17	1 405	34.65	-1.32
CZ	1 306	27.76	0.67	410	8.71	-0.78	2 615	55.61	0.70	1 151	24.47	0.78	1 464	31.14	0.63
DK	425	15.72	-4.62	165	6.12	-1.88	1 985	73.41	1.09	1 169	43.21	0.70	817	30.20	1.65
DE	8 257	22.98	-1.46	3 966	11.04	-0.80	23 782	66.20	0.85	11 852	32.99	2.42	11 930	33.21	-0.62
EE	130	22.05	-0.17	20	3.35	-6.50	368	62.48	3.35	186	31.61	6.81	182	30.87	0.23
EL	514	12.80	-2.64	80	1.99	-2.95	2 479	61.75	1.27	909	22.65	1.30	1 570	39.11	1.25
ES	2 969	17.81	0.98	858	5.15	1.32	10 594	63.56	3.54	4 317	25.90	4.75	6 277	37.66	2.74
FR	4 075	16.95	-2.04	1 562	6.50	-2.24	16 965	70.57	1.80	8 540	35.52	2.12	8 425	35.04	1.47
IE	283	15.93	-1.03	112	6.28	-1.30	1 166	65.54	3.48	595	33.43	3.95	571	32.11	2.99
IT	4 949	22.44	0.85	1 637	7.42	0.86	14 010	63.52	2.05	6 051	27.43	2.73	7 960	36.09	1.55
CY	36	10.97	-0.07	4	1.24	7.85	235	71.94	6.12	88	26.97	7.87	147	44.97	5.13
LV	164	16.37	-2.89	19	1.85	44.09	588	58.58	1.12	241	23.97	0.10	347	34.61	1.85
LT	266	18.05	-2.12	45	3.03	-2.30	796	54.05	-1.24	357	24.22	-3.77	439	29.83	1.03
LU	18	9.69	-4.44	3	1.36	-11.36	147	78.00	1.87	72	38.59	4.13	74	39.41	-0.16
HU	926	23.59	0.13	324	8.27	1.82	2 402	61.22	1.83	1 097	27.95	2.83	1 306	33.28	1.03
MT	29	19.33	:	9	6.14	:	101	67.66	:	43	28.77	:	58	38.88	:
NL	1 031	12.61	-2.96	332	4.06	-2.57	5 637	68.95	0.94	3 168	38.75	1.37	2 469	30.20	0.39
AT	713	19.31	-2.01	230	6.21	-2.71	2 428	65.74	1.03	1 118	30.26	2.55	1 310	35.48	-0.20
PL	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
PT	1 016	20.05	-1.77	159	3.14	-3.86	2 748	54.23	2.18	1 007	19.88	2.90	1 740	34.35	1.78
SI	264	29.47	-0.58	80	8.94	1.07	485	54.07	1.15	217	24.19	2.25	268	29.87	0.30
SK	568	26.20	1.82	173	8.00	6.60	1 210	55.82	1.35	524	24.16	0.91	686	31.66	1.70
FI	454	18.91	-1.89	165	6.85	-1.30	1 626	67.75	1.51	954	39.72	2.04	673	28.03	0.78
SE	702	16.14	-1.86	306	7.03	-2.09	3 254	74.77	2.77	2 055	47.23	2.91	1 199	27.54	2.52
UK	4 254	14.85	-3.57	1 797	6.27	-4.19	21 507	75.10	1.91	11 730	40.96	2.00	9 777	34.14	1.81
IS	22	14.09	-3.21	3	2.02	16.41	109	89.97	0.54	66	41.93	3.29	44	28.03	-3.18
NO	282	12.47	-1.48	103	4.53	0.24	1 685	74.41	0.15	1 009	44.55	1.68	676	29.87	-1.96
CH	603	15.27	-1.77	280	7.09	-2.12	2 782	70.42	2.06	1 537	38.91	3.14	1 245	31.51	0.79
BG	671	23.34	-0.08	134	4.66	-5.95	1 630	56.69	1.87	634	22.06	1.44	996	34.63	2.16
RO	1 964	20.96	-1.09	499	5.32	-2.81	3 108	33.18	-0.55	1 219	13.02	1.07	1 889	20.17	-1.55

(1) Exceptions to the reference year 2003 — NL and IS: 2002.

(2) EU-25 excludes Poland. Eurostat estimate.

Source: Statistics in focus, Science and Technology 10/2004 (Götzfried 2004)

3.1 New trends in qualifications and skills

The transition to information-based and knowledge-based work confronts the national educational systems with the challenge of raising their educational standards and adapting them to the demands of the labour markets. The importance of knowledge as a precondition of economic progress within companies has led governments and educational institutions to take a greater interest in the formation of a highly skilled work force (Kirov et al. 2006).

This is also reflected in the documents of the European Commission. Since the Lisbon Summit, public and private training courses for a 'coherent skills and qualification framework' have continuously been demanded by policy-makers as well as in the scientific debate.

As Ramioul pointed out, there is a huge number of studies analysing the relationship between the spread of information-based work and the related service-based character on the one hand and the skills or 'knowledge structure' of (regional) labour markets on the other. On the basis of these studies, "it is not obvious how to disentangle the real causes of increased 'skill- or knowledge-intensity' of organisations. The growing skill-intensity of organisations can (at least partially) be supply-side induced, caused by the steady increase in the educational attainment level of the workforce, while another 'part' is caused by an increase in the skills and qualifications required to perform the job adequately" (Ramioul 2006:101).

With regard to the upskilling and deskilling tendencies on the basis of different technologies, developments vary. In the industrial sector, some studies have come to the conclusion that computer technologies are a substitute for workers performing routine tasks that can be described with programmed rules and can easily be digitised and codified, but on the other hand they can also act as a complement to workers that perform non-routine tasks (Welsum, Vickery 2006). These tasks are thus "demanding flexibility, creativity, generalised problem-solving capabilities and complex communications" (Ramioul 2006:106).

The shift to 'soft skills' (e.g. communication skills) has been made at lower qualified job levels as well as at more highly qualified ones. Working activities in call centres, customer-related work or data processing generally require skills that are comparable with former job profiles. But at the same time, soft competences are a precondition for these jobs. Especially in lower-qualified job profiles, increased performance monitoring and control systems are observed. These networked organisations are basically supported by IT. As different studies show, the impact of this technology clearly limits the chances employees have to develop technical and professional skills (Grugulis, Vincent 2005).

With regard to new skills, the greatest impact of IT is that it shifts the border between tacit and codified knowledge (Soete 2001, Polanyi 1958). This distinction has become classical for the debate on knowledge-based management. According to Polanyi, tacit knowledge refers to the knowledge a person has and which has to do with his or her experiences, his or her biography in the wider sense of 'know-how'. Codified knowledge, however, is formal, an individual knowledge, which is markedly conscious and functional. The increasing demands to transform tacit into codified knowledge can be extremely cumbersome for many people. Many are incapable of making their tacit knowledge explicit, and this is described as a specific problem in modern organisations (Krings et al. 2006).

The debate of knowledge-intensive work is empirically based on the remarkable increase in knowledge-intensive jobs in industrialised societies (see Sect. 2.4). Knowledge-intensive jobs are those "where the active and independent acquisition, processing and development of knowledge and information plays a dominant role, this implies that these jobs are by nature complex" (Ramioul 2006:110). The challenge for knowledge-based work is that the employees should have easy access to complex knowledge in order to distribute information immediately and to make strategic decisions. They are in a continuous learning process and have to be qualified to use formal and abstract information. The work places are organised in a specific way and can be characterised by non-standardised and non-routine working patterns. Generally, they are based on project- and team-oriented work organisation and require autonomy as well as problem-solving requirements.

As a general rule, this kind of requirement is what is referred to by ‘new demands of work’, as documented in many policy reports: “the importance of widening the tertiary-educated labour supply to promote the knowledge-based economy as the matrix of future productivity growth has been demonstrated by the recent trends in differentials in employment growth according to educational level. Promoting the mobilisation of existing reserves and the extension of the supply should therefore be a first priority in labour markets policy” (IPTS 2005:35).

The demand for better ‘mobilisation of existing reserves’ of the labour force focuses greatly on these tacit and soft skills, which have changed the character of work significantly. The rise of these ‘soft skills’, such as language, communication skills, and self-management has encouraged a blurring of the boundaries between occupations and the emergence of new work roles. Also work-life balances are strongly affected by these tendencies and have led to excessive demands at the job level (Hochschild 1997).

The shift towards new skills and qualifications is based on a concept of technology-in-use, organisational models, strategic company goals, and the cultural pattern of different countries (Bechmann et al. 2003). With regard to the complexity of the labour markets, it is difficult to speak generally about skills and qualifications. Considering the new demands on qualifications and skills for many occupations, the relationship between generalisation and specialisation effects, deskilling and upskilling processes, soft and technical skills is still an open question. Careful analysis of these relationships “requires sector specific and occupational, longitudinal approaches” (Ramioul 2006:108).

3.2 Organisational changes and their impact on the job profile

The demand for new skills and qualifications is closely connected to the internal organisation of companies and institutions. In the academic literature, there is agreement about the shift from Taylorism to post-Taylorist forms of work organisation in the past decades (Flecker et al. 2006:46):

- From narrowly defined, routine tasks to re-integration of tasks and multitasking;
- From direct control to relative autonomy and devolution of management functions to workers;
- From deskilling to multiskilling and upskilling;
- A shift in the unit of production from the individual to the group;
- A shift from (technical and bureaucratic) system integration to social integration through communicative action and co-operation in self-directed teams.

In recent political debates, a wider concept of work organisation has been used. The European Commission for instance suggested in its Green Paper “Partnership for a new organisation of work” the implementation of new forms of work organisation to enhance competitiveness and to increase human potential. But at the same time, the Green Paper suggested improving working conditions, working time arrangements and the employment relationship, the inclusion of terms and conditions of the labour contract (European Commission 1997).

In this perspective, new forms of organisation very often appear as a ‘high road’ to innovation and competitiveness. The counterpart of such a strategy is ‘participation’ and ‘team work’ as well as ‘flexible working pattern’.

These normative terms have also widened the concept of work organisation in academic debates. The topics ‘temporal flexibility’ or ‘blurring boundaries of work-life balance’ have become major concerns of research, as has the dimension of ‘industrial relations’.

Research on work organisation can no longer take for granted the standard employment relationship as contractual framework. “The employment contract (fixed-term or permanent, own employee or temporary agency worker, own employment or temporary agency worker, employment or contractual work, etc.) has often become a variable of organisational design closely linked with questions of tasks structures and flexibility. This may result in ‘fragmentation of work’” (Flecker et al. 2006:48).

The application of IT together with the crisis of mass production on a global scale has led to new forms of global division of work. Since the beginning of the 1990s, corporate restructuring has taken place at a very rapid speed of change, including changes in the ownership structure and control of many organisations. In the main, five forms of restructuring processes can be identified: buyout, outsourcing, relocation, downsizing and bankruptcy (Lazonick 2004:579). Takeovers, mergers and demergers are being announced continuously.

In view of these developments, corporations can no longer be considered as stable and homogeneous organisations. “These processes of internal and external restructuring have led to decentralisation, outsourcing and networking. However, they also have led to processes of concentration, consolidation and centralisation” (Huws 2006:19, Flecker, Kirschenhofer 2002).

The orientation towards global markets requires adapted new modes of coordination and control between companies and employees and/or workers. In practice, most companies are able to define what activities are strategically important and to decide how these should be organised. As Ramioul points out, corporate control over business processes is directly linked to their competitive advantages on the markets (Ramioul 2007, Ramioul, Huws, Kirschenhofer 2005). These processes had and still have a tremendous impact on the organisational level of work. The main changes are described in the following topics (Ramioul 2007:16 ff):

- 1. Cross-boundary work** (Work can be both fragmented and regulated across the boundaries of organisations. One example is virtual teams composed of workers from different organisations, or tasks that can be assigned internally or provided by employees operating on the firm’s instructions (subcontractor) or supplied from outside (suppliers). In these ‘network economies’, the economic power is organised transnationally, while the legal power is still bound to the national and sectoral regulation context.)
- 2. New forms of control** (There are new modes of control and coordination that go beyond the bureaucratic, vertically integrated firm. To reduce the risks related to the quality and quantity of performance, the relationship between employees and organisations on the one hand is increasingly dependent on legal contracts - e.g., outsourcing contracts - explicit procedures, and performance monitoring, and on the other hand, the growing importance of market-forms of coordination including a pertinent role of the customer, introduces market-logic, target-setting, and self-rationalisation into the relationship of the workplace.)
- 3. New forms of flexibility** (Functional and numerical flexibility must be considered as a result of the global restructuring of the value chains. The employment contract may be stable and undetermined, but the guarantee extends only to employment and not precisely to a particular job or task. This might also imply more flexible contractual relations with different employers: there are tendencies towards project work, virtual teams, forms of eWork, mostly applied to core workers, etc. The same structure occurs with regard to temporal flexibility, where just-in-time production is also linked to the individual level of employment.

Thus the internalised market leads to self-regulation and self-imposed rationalisation of working time.)

The demand for new skills and qualifications has been explored in relation to its meaning, both for organisations and individuals. On the level of individuals, the basic skills have been summarised below (Petersen et al. 2005:51):

- (a) *Behavioural and personal skills*: flexibility, self-learning, motivation and commitment, stress resistance and emotion, responsibility, managing risks, decision-making, negotiation, initiative and attention, persuasiveness, professional attitude;
- (b) *Cross-section and basic work skills*: quality awareness, commercial and market awareness, entrepreneurship, customer orientation and relationship, company and business organisation, work and project organisation, business and work process knowledge, work safety and health protection, labour law and data privacy, environmental and resource awareness;
- (c) *Soft and method skills*: communication and moderation, languages and culture, collaboration and interaction, teamwork and mentoring, conflict and consensus, creativity and innovation, analytical and reasoning, problem analysis and solving, strategy, conception and planning, context and causal connection thinking, information handling, documentation and presentation.

The work organisation of knowledge-based activities has been characterised by non-standardised jobs, requiring autonomy and opportunities for learning and intensive co-operation with others. Nevertheless the questions remain as to what is the spread of such knowledge-intensive jobs in companies and under what conditions this type of work is a more dominant type of work in Europe (Ramioul 2006:110). These questions still have to be analysed carefully especially for New Member States.

Taking into account the organisational level, internal and external restructuring processes of corporations have a visible impact on the employment conditions (see Sect. 2.3). “Questions about autonomy and control as well as skill formations need to be linked with the analysis of labour contracts as organisational variables. In this context the analysis should not only describe changes in employment relationship but also shed light on the effects of outsourcing and other forms of external flexibility on the working conditions” (Flecker et al. 2006:61).

To sum up, the discourse on new demands on skills and qualifications is deemed important in terms of technological as well as organisational changes. Policy strategies, therefore, emphasise very much the empowerment of the workers. The priority in most European countries is to upskill workers through either vocational training or education. In face of the high rate of unemployment of the less qualified workforce, the key problem actually seems to be how to ensure training opportunities for those workers who mostly become marginalized, such as those in low-skilled jobs or part-time jobs as well as immigrants or older workers (Hemerijck 2002).

3.3 The role of public policy

From a European perspective, employment policies have stressed issues related to work organisation since the early 1990s. The structural nature of the high rate of unemployment in Europe brought about the need to develop the employment intensity of growth. As formulated in the Lisbon Strategy (2000), a central goal is to achieve changes in work which increase competitiveness and improve employment. That means that the European social model implies the normative idea of quality of work and social cohesion (Meil, Tengblad 2006). However, it is still unclear how these goals can be reached and which conceptual models are needed to move towards ‘knowledge-based economies’. Still the importance of the ‘participation’ of the Member States plays a central role in the document.

In 2003, the EU updated its Employment Strategy with new guidelines, which could be considered a clear shift from technology-driven approaches and new forms of work towards creating employment, promoting equality for men and women and for elderly employees and workers. Another new strategy was to develop targets (e.g. different training strategies, National Action Plans for Social Inclusion) in order to achieve more concrete results (Watt 2004).

However, looking at the employment rates by skill levels gives a different picture (Table 3): for the lowest of the three skill levels considered here the employment rate has actually declined. The decline has been very small, but there has definitely been no improvement as for the overall rate. The conclusion is clear: the overall employment rate has increased mainly because the share of the lower skills in the population has declined over this period.

Labour market reforms inspired by the Lisbon agenda should have increased the employment rates of the lowest skills, but the opposite has been the case.

Table 3: Education and employment: What has improved since Lisbon?

	Share of population			Employment rates		
	1999	2004	Change	1999	2004	Change
Below upper secondary	39.4	35.6	-3.8	49.6	49.2	-0.4
Upper secondary	42.3	43.8	+1.5	69.0	70.1	+1.1
Tertiary	18.3	20.6	+2.3	81.8	82.5	+0.7
Overall	NA	NA	NA	62.0	64.5	+2.5

Source: Centre for European Policy Studies (CEPS) (2006a)

Generally, there are big differences in the institutional setting of employment policies which range from the market-mediated flexibility measures in the British national action plan to more policy-oriented instruments in Scandinavian countries (Meil, Tengblad 2006). In the late 1980s and 1990s, nation states developed very different policies and employment strategies for addressing the problem of low-skilled workers. The ‘neo-liberal’ solution, e.g. in the UK, favoured increasing wage differences and at the same time reducing collective bargaining controls on employers. The ‘Nordic’ solution involved an effort to improve the quality of work of low-skilled employees and to provide more skill enhancement. Both policy strategies can have similar short-term consequences in terms of economic competitiveness and effectiveness in combating unemployment. But - according to the national experiences - “they have radically different implications for the quality of life of those affected, both in terms of immediate well-being and of long-term opportunities” (Gallie 2002:98). Under the pressure of economic competitiveness and the efforts of improving national conditions of welfare, national policies nowadays seem far from achieving equal distribution of income, combating unemployment or finding common solutions.

In the last decade in the great majority of the European countries, the principal emphasis in social policy has been on tackling the risk of social exclusion if people have entered unemployment. “Basically there has been a mixture of short-term training and activation policies, together with a concern to ensure clear financial work incentives. These attempts have proved inadequate for ensuring longer-term employability. The attempt to re-skill the unemployment in a relatively short period of time can only have limited results in a context in which people have spent long periods of their working lives without learning new skills or maintaining their basic learning capacities” (Gallie 2002:97).

Efforts of vocational training or training activities on different levels can be considered as the (necessary) counterpart to new demands of qualifications and skills. Especially for low-skilled employment, longer-term preventive strategies minimise the processes within work that create risks of social exclusion. According to their different work profiles and demands, they vary between sectors and branches and, therefore, are strongly connected to the national institutional labour markets. Although organisational changes (see Sect. 3.2) have a remarkable influence on new working conditions, international comparison shows that the direct impact on the individual worker or employee depends very much on the institutional framework.

The following issues thus seem important in evaluating this impact (Meil, Tengblad 2006:33):

- **Working conditions** encompass all aspects of work and the contractual relationship between employer and employees, form of employment, the way in which wages are determined and distributed, working time arrangements, etc.
- **Education and training** are institutional solutions for developing and adapting the work force. They include systematic arrangements such as basic school systems, vocational training and academic education, on-the-job training, and skill development.
- **Social Security System** refers to those ‘safety nets’ set up primarily at a societal level, but also by unions or employers in the workplace. They include pension systems, unemployment benefits, parental leave, sickness benefits and rehabilitation.
- **Growth and Innovation Systems** relate to how market and production conditions are regulated and/or supported (laws on competition, degree of public/private ownership, regulation/privatisation/innovation/RTD systems). They also include taxation systems.
- **Management Strategies** refer to the settings in which negotiations on various issues take place. Such strategies can span a variety of orientations that reflect the institutional context, sector, or labour markets, for instance, from highly market-based strategies to more long-term investment orientations or from lifelong employment to highly flexible labour deployment.

The new international pattern of division of labour, the external and internal re-organisation of companies and the increasing economic pressure on labour markets generally are described by the term ‘globalisation’ (Huws 2006). With these changes the demand for flexibility has been increased profoundly in different ways (see Sect. 3.2). The notion of flexibility summarises various forms of the modernisation of work, with the replacement of standard full-time work contracts and of regulated working conditions at its centre. In the perspective of working conditions there is a trend toward social segmentation recognisable, given by the dimension and the conditions in which employees are affected by flexibility demands with their particular chances and risks (Hielscher 2003, Krings 2003).

3.4 Training / vocational training as innovative practice in the field of employment

Vocational training is important to enhance adaptability to the demands both of formal qualifications and for flexibility. Especially on the basis of the development of IT, the European Ministers of Vocational Education and Training and the European Commission stated: “The development of high quality vocational education and training is crucial and integral part of this strategy, notably in terms of promoting social inclusion, cohesion, mobility, employability and competitiveness” (The Copenhagen Declaration 2002:1 in: Petersen et al. 2005:20).

But also in general terms the importance of education and vocational training has been reflected in the Conclusions of the Council of the European Union (2006):

“Education and training are critical factors to develop the EU's long term potential for competitiveness as well as for social cohesion. The search for excellence and innovation at all levels of education and training, in particular through better links between higher education, research and enterprises is crucial. Reforms must also be stepped up to ensure high quality education systems which are both efficient and equitable.

National lifelong learning strategies should provide all citizens with the competences and qualifications they need, increasingly assisted at Community level by educational and training programmes such as Erasmus and Leonardo. To support greater mobility and an efficient labour market, progress on a European Qualifications Framework (EQF) should also be achieved.”¹⁰

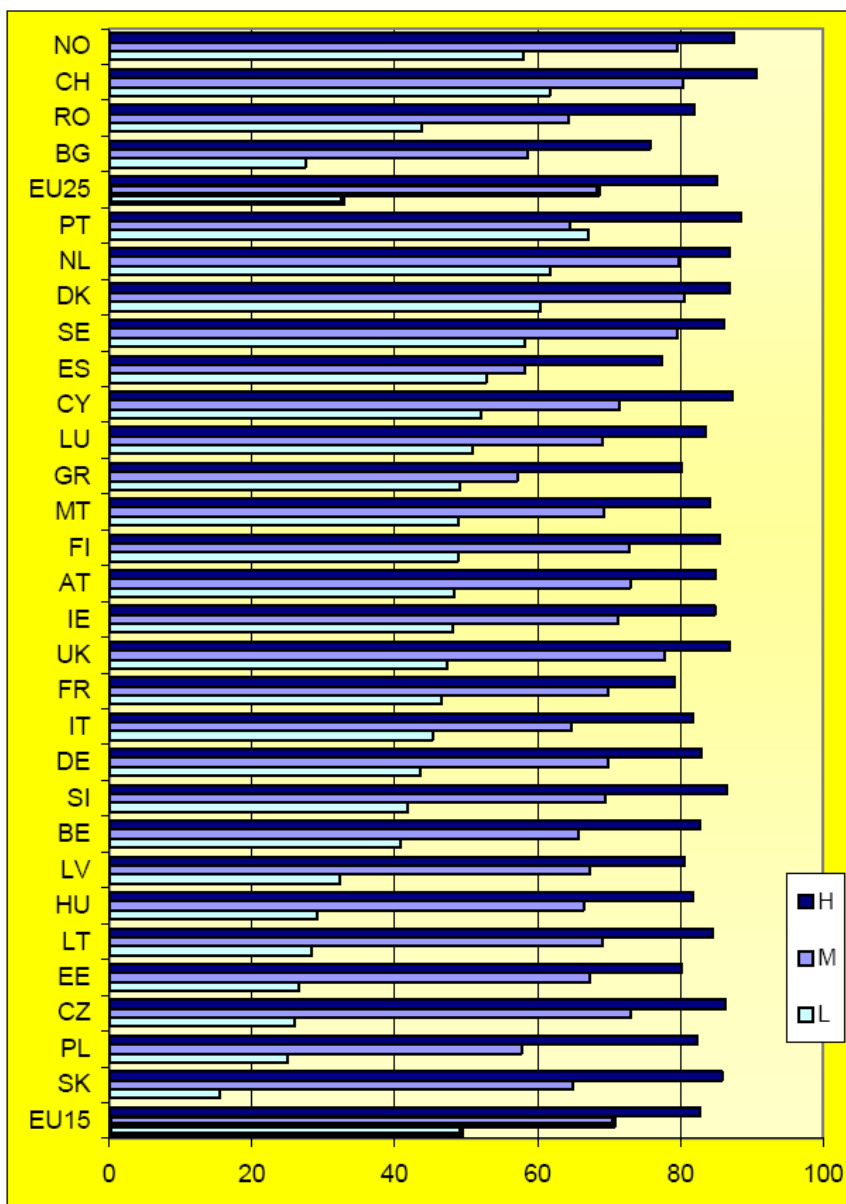
¹⁰ The Lifelong Learning Programme is the flagship European funding programme in the field of education and training. For the first time a single programme will cover learning opportunities from childhood to old age. The Lifelong Learning Programme covers the period 2007-2013, and is the successor to the Socrates, Leonardo da Vinci and eLearning programmes (<http://ec.europa.eu/education/policies/111/life/Index-en.html>).

Figure 4:

Employment rate per educational level

2002 (except 2003 LT and MT)

L=Low; M=Medium; H=High



Source: European Commission (2005b)

As national experiences as well as many studies widely show, the link between educational attainments and employment rates are usually straightforward: the higher the educational attainment the higher the employment rate of that category. The chart above illustrates this relation for employment rates of the 25-64 age group per level of education (2002) in 28 European countries and ranks the countries of EU25 per share of employment among the low educated.

Especially the concept of ‘Lifelong Learning’ has an important role in achieving the economic, employment and social goals which have been defined by the European Union. The Lisbon Strategy confirms the importance of well-developed lifelong learning concepts in Member States.

This includes an effective implementation for achieving the agreed goals and puts a clear emphasis on the role of vocational education and training methods, alongside general and higher education.

Bearing globalisation processes in mind, the policy recommendations in the second Report on Vocational Research in Europe are based on a “transition from instructional to constructive learning-teaching concepts as well as from other to self-direction in learning” (Descy, Tessaring 2001:38 ff). This shift has consequences on the strategies of vocational training within and outside the companies. Growing competitiveness requirements in the form of cost economies, higher quality and shorter timing, are at present compelling companies to undertake permanent learning and innovation processes in order to compete on the markets. The role of IT is considered crucial for the changes in the labour markets as well as in the field of work organisation.

In the last ten years, around 30% of the EU workforce has been involved in training provided by the employer in the last 10 years, according to the responses to the EWCS (European Working Condition Survey). This proportion seems to have diminished slightly from 2000 to 2005. In 2005, some new indicators of training were included in the survey that enrich the information previously available on this issue. It is interesting to note that around 6% of EU workers report having undergone training paid for by themselves.

Table 4: Levels of training

<i>In the last 12 months, have you undergone ...?</i>	1995	2000	2005	2005	
	EU15	EU15	EU25	(EU15)	(NMS)
Training paid for or provided by your employer, or by yourself if you are self-employed?	30.0%	30.6%	27.1%	27.3%	25.6%
Average number of days per worker	13.5	14.3	11.2	11.4	10.6
Training paid for by yourself	n.a.	n.a.	6.0%	6.0%	6.5%
Average number of days per worker	n.a.	n.a.	25.2	25.9	22.6
On-the-job training (co-workers, supervisors, etc.)	n.a.	n.a.	27.1%	26.8%	29.0%
Other forms of on-site training	n.a.	n.a.	17.5%	17.0%	20.5%

Source: European Foundation for the Improvement of Living and Working Conditions (2006b)

In a more conceptual approach, the following policy recommendations give an idea about the specific challenges for vocational training strategies in Europe (Dejonckheere, Van Hootegem 2001:39 ff):

1. There is still an empirical gap in the theoretical hypotheses about the changes of work organisations in different sectors and branches. Permanent observation should be introduced in the field of work organisation to log common practise and trace change processes with regard to the use of technology, division of labour and employment relationship within different industrial and service sectors. This would allow the challenges faced by vocational training to be formulated more precisely.
2. Within the vocational training system, IT applications and qualification needs should receive major attention because IT has increased in importance in an increasing number of sectors and functions. Further, IT faces quantitative and qualitative labour market shortages. Vocational training should contribute to the qualitative ones.
3. The widespread use of IT not only creates additional qualifications but also training needs. At the same time, IT can have an impact on the delivery of training.
4. There is a general trend towards social polarisation with increasingly knowledge-based jobs on the one hand and more repetitive and less information and knowledge-based work on the other hand. This contains a major challenge for vocational and educational training systems. It should avoid the exclusion of those outside the upper segment of highly qualified personnel.

5. Due to global processes, local labour markets can suffer from large 'shocks'. As life-long employment and job security are gradually fading and more and more employees have to accept flexible jobs, employability gains in importance. Vocational training systems should enhance employability so that employees are less vulnerable to the immediate consequences of globalisation.
6. Learning opportunities not only presuppose varied work, with different and new task requirements, but also the ability to deal with task requirements, the necessity to develop one's own strategies and to change and to improve them. Increasing learning opportunities for workers must go hand in hand with organisational restructuring towards less division of labour.
7. Vocational training policies should be able to engage employees and to facilitate re-organisation processes for them, thereby stimulating organisational learning. Therefore, efforts should go towards the active promotion and distribution of information on the advantages of a new organisational logic, better use of human capital and organisational learning.

Coming from a technological perspective, these recommendations conceptually bridge the gap between the introduction of new technologies (here IT) and the need for training and vocational training in a changing organisational environment. They focus very much on issues, such as individual empowerment, institutional security as well as the avoidance of social exclusion. The social dialogue in order to enhance awareness of workers towards the demands for flexibility, as well as to create common agreements seems to be the precondition for the success of vocational training policies. The flexicurity concept can, therefore, be considered one approach to finding a strategy between the market demands and the social needs of the workers.

4. Flexicurity as a political instrument

Technological changes, the intensified global division of labour and geographical mobility offers on the one hand new living options and opportunities for individuals and societies. On the other hand risks at both the individual and collective levels are increasing worldwide. “At the job level employees and workers have more autonomy, but this autonomy will be framed; they may receive more responsibility, but this responsibility is monitored; they may have to prove more commitment, but that is not rewarded” (Ramioul 2007:18). The general trends towards flexible working structure show that acquired rights in terms of working time and wages, but also in terms of the right to unionise, negotiate and participate are under pressure in most European countries.

Regarding these risks, there is a need for labour market regulation and a social protection system as is widely reflected in the flexicurity concept. The concept principally tries to find a balance between the demand for flexibility on the labour markets on the one side and social security for the work force on the other side. According to the European Expert Group on Flexicurity the “trust of European citizens for future employment opportunities, in the development of human capital, in decent work and labour market developments urgently needs to be strengthened, while companies require a supportive business climate and a transparent and predictable legal framework in order to increase business potential and create employment” (European Expert Group on Flexicurity 2007:8).

Particular problem groups of the national European labour markets are e.g. the young and the old, less skilled or unskilled workers, women, and ethnic minorities who suffer from higher unemployment. Also here – according to the Expert Group – more effort is needed to offer them job opportunities. Facing inequalities on the labour markets, therefore, includes the age and ethnic dimensions, flexicurity strategies trying to aim at social cohesion and fighting poverty by spreading the benefits to all social groups (European Expert Group on Flexicurity 2007).

4.1. Historical background of the concept

The term flexicurity goes back to a political debate in the Netherlands, which arose in the mid 1990s. There the deregulation of the labour market coincided with the ‘Dutch Miracle’, where the unemployment rate decreased considerably. In a similar way Denmark practised successfully the deregulation of labour markets, which stimulated scholars and politicians to believe that employment flexibility improves competitiveness of firms as well as the production rate, which in turn animates labour markets (Tangian 2004, Gorter 2000, van Oorschot 2001).

On the European level the Green Paper (1997) mentioned above, promoted the idea of social partnership and balancing flexibility and security. This paper provoked very strong reactions especially from the French and German unions, because they feared a threat to the independence of unions and a denial of the workers’ position, especially at the enterprise level. Some doubts were also expressed in a report published by the International Labour Organisation (ILO), which concludes that “the flexibilization of the labour market has led to a significant erosion of workers’ rights in fundamentally important areas which concern their employment and income security and (relative) stability of their working and living conditions” (Ozaki 1999, cit. in Tangian 2004:11).

In order to deal with the problem that the increasing flexibility of employment relations leads to lower job security as well as to a decreasing eligibility to social benefits, the notion of flexicurity became an important political strategy. Representing the Dutch and the Danish experiences, the most cited definition of flexicurity is as follows:

“Flexicurity is a policy strategy that attempts, synchronically and in a deliberate way, to enhance the flexibility of labour markets, work organization and labour relations on the one hand, and to enhance security – employment security and social security – notably for weak groups in and outside the labour market on the other hand” (Wilthagen, Tros 2004:169). “Its objective is to combine employment and income security with flexible labour markets, work organisation and labour relations” (European Expert Group on Flexicurity 2007:11).

Examples like Denmark or the Netherlands can be discussed as ‘best cases’ within the European countries, because they have developed a coordinated combination of flexible labour markets without creating problems of social exclusion on different levels. Especially representatives from the Netherlands and Denmark have initiated the international flexicurity debate, but the idea of balancing flexibility and security spread all over Europe. The concept also was recognised in the “Lisbon Strategy for Growth and Jobs”¹¹, where the European Commission already referred to this concept in 2000 (Vielle, Walthery 2003).

4.2 The balance of social security and flexibility

From a political point of view, the flexicurity approach tries to promote flexibility within the firms and at the same time diminish social risks for the employees. Thereby win-win situations should be created, because the firms as well as the employees should benefit from the production stimuli. From an academic point of view, the relationship between flexibility and security is described as complex and has been discussed controversially.

In a broader sense this distinction has already been analysed when describing the differences between welfare states in Europe. Esping-Andersen's famous study of welfare regimes had an enormous impact on the discussion of social policy. His classifications of European countries according to the contemporary conditions of social policy were discussed broadly (Esping-Andersen 1990). The question to what extent the ‘liberal’, ‘conservative’, and ‘social’ democratic regime-types allow decommodified labour can still be considered as one of the central questions of the flexicurity debate. Following this debate the concept focuses on the redefinition of the functions of social welfare and therefore benchmarks of social justice and solidarity have to be taken in account (Kronauer, Linne 2005).

On a micro level, the theoretical and empirical discussion of flexibility shows the wide range of models of flexibility. Since the end of the 1980s the distinction between external and internal flexibility has been developed and elaborated by an intensive scientific discussion (OECD 1986): An indicator for *external* flexibility is labour turnover, which means that employees (voluntarily or not voluntarily) change their employment or become unemployed for a certain time frame. The other indicator is job turnover, which measures the creation of jobs and the job losses within the different labour markets. Collecting data on both indicators is difficult and implies a complex methodology. Most of the studies and their results are based on firm surveys (European Commission 2004a, Gómez-Salvador et al. 2004).

According to the OECD, *internal* flexibility implies strategies within the enterprise or the existing contract structure of the enterprise (Vickery, Wurzburg 1996). Flexibility here is mainly considered as the result of human resource allocation. In the literature, there is a distinction between functional, qualitative, quantitative and numerical flexibility. The ILO also distinguishes between functional flexibility, skills flexibility, numerical flexibility, flexible working patterns, wage flexibility and geographical flexibility (ILO 1998). Especially the addition of wage and geographical flexibility, which tend to be an important indicator within developed countries, is observed strongly.

¹¹ Council Recommendation of 12 July 2005 on the broad guidelines for economic policies of the Member States and the Community (2005 to 2008) (2005/601/EC) and Council Decision of 12 July 2005 on Guidelines for the employment policies of the Member States (2005/600/EC).

In assessing internal flexibility, the risks have to be taken into account. These risks emerge mainly for the employees on different levels (Flecker 2005).

Basically the connotation of flexibility has changed in the past three decades. In the 1970s there was emphasis on ‘functional flexibility’ of workers combined with the concept of “time sovereignty” (Teriet 1976) for employees. In the 1990s ‘flexibility’ became more and more the notion of a far-reaching deregulation of labour markets and protection rights (Zilian, Flecker 1998). This development was strongly connected with increased time flexibility. The actual claim for more flexibility has been postulated by employers and their organisations, and meanwhile it has been taken on by the majority of politicians in most political parties. Therefore trade unions have to face a triple pressure (Hielscher 2003:162):

- The demand to agree on flexibility, with the argument of increasing competitiveness of companies and job security of employees.
- The traditional trade union’s goal of avoiding a reduction in protection and workers’ rights.
- The employees’ need for better opportunities to combine working hours with family and private life.

Although the flexicurity concept has been introduced into political and academic debates, there is still no common outstanding pro-active strategy which is able to integrate these different and partially controversial demands. On the contrary, national and European studies have shown that the risks to health, the risks to income and the risks of unemployment have increased constantly for specific working groups in the last fifteen years (European Commission 2004a, Fink et al. 2003, Fink, Tálos 2005). Therefore, when analysing the relationship between flexibility and security, individual and collective risks have to be taken into account. This also implies a societal debate about solidarity, social justice and reasonability of working conditions (Kronauer, Linne 2005, Tangian 2004).

The analysis of the actual situation, the shift towards globalised work with its strong demand for flexibility on the one hand and the necessity of social security on the other hand is reflected by the European Commission (2007). The Commission together with the Member States have reached a consensus that flexicurity policies can be designed and implemented across four policy components (Commission of the European Communities 2007:6):

- **Flexible and reliable contractual arrangements** (from the perspective of the employer and the employee, of ‘insiders’ and ‘outsiders’) through modern labour laws, collective agreements and work organisation;
- **Comprehensive lifelong learning (LLL) strategies** to ensure the continual adaptability and employability of workers, particularly the most vulnerable;
- **Effective active labour market policies (ALMP)** that help people cope with rapid change, reduce unemployment spells and ease transitions to new jobs;
- **Modern social security systems** that provide adequate income support, encourage employment and facilitate labour market mobility. This includes broad coverage of social protection provisions (unemployment benefits, pensions and healthcare) that help people combine work with private and family responsibilities such as childcare etc.

From the perspective of the European Commission the rationale for an integrated flexicurity approach is “the need to achieve the objectives of the renewed Lisbon Strategy¹², in particular more and better jobs, and at the same time to modernise the European social models” (Commission of the European Communities 2007:5). Pathways towards flexicurity challenges have been developed by the European Expert Group on Flexicurity, which are sketched in the following section.

4.3 Flexicurity challenges and pathways

As described above it should be kept in mind that flexicurity strategies have to be pursued in a wider context of sound macro- and micro-economic politics. The report of the European Expert Group on Flexicurity therefore strengthened very much the interaction of macroeconomic policies with reform packages on a microeconomic level. Also the embedding into the institutional framework of labour market regulation plays an important role when thinking about flexicurity pathways as this is developed in the report (European Expert Group on Flexicurity 2007).

On the basis of the academic literature and ‘good’ practice in the Member States, the report proposes ‘pathways’ and steps toward enhanced flexicurity. These steps focus greatly on the development of alternative policy measures and less on the different national industrial relation cultures. Therefore, the idea is to reach a common understanding of flexicurity as well as to build up more institutional capacity for change within the Member States.

Four main flexicurity strategies have been identified for typical labour market situations, dealing with the employment opportunities and securities of various categories of workers. “Subsequently, four alternative flexicurity pathways have been mapped out across the four components of flexicurity thus distinguished - flexible and secure contractual arrangements, upgrading active labour market policies to strengthen transition security, systematic lifelong learning systems and modern social security systems - together with the need to develop a supportive and productive social dialogue” (European Expert Group on Flexicurity 2007:38). The pathways focus on the central problems the European labour market policies actually face.

The four ‘pathways’ are the following (European Expert Group on Flexicurity 2007:5 and 23 ff):

- **Pathway 1:** Reduce asymmetries between non-standard and standard employment by integrating non-standard contracts (e.g. part-time work, fixed-term work, agency work, etc.) fully into labour law, collective agreements, social security and life long learning, and consider making employment in standard contracts more attractive to firms.
- **Pathway 2:** Enhance companies’ and workers’ adaptability by developing and strengthening transition security (Here this pathway greatly emphasises safe and successful job-to-job transitions, which are contained in contractual guarantees and Human Resource Management policies within or outside the company. A strong system of lifelong learning as well as vocational training, both inside and outside companies, should allow a quick access to effective training funds and facilities at sector level).

¹² Annual Progress Reports of January and December 2006: Guideline 21

- **Pathway 3:** Address opportunities and skill gaps in the workforce by broadening and deepening investments in skills (This pathway greatly strengthens investments in skills and R&D. The employment and security opportunities of specific groups in the labour markets should hereby be enhanced and productivity growth boosted. A broad-ranging approach is needed to keep the labour market accessible to the low-skilled and other groups at risk of becoming unemployed long-term or excluded in other ways).
- **Pathway 4:** Enhance employment opportunities for benefit recipients, prevent long-term welfare dependence, regularise informal work and build up more institutional capacity for change (This pathway strengthens the need to increase the employment and job opportunities of persons who are currently depending on social security benefits or working in the informal sector. Active labour market policies and social security should offer sufficient opportunities and incentives, in terms of increased conditionality of benefits, to return to work and to facilitate this transition, e.g. working-time flexibility, improving work-life balance, child care, variable pay and skills requirements, notably for older workers).

Coming from the perspective of technological transformation, the proposals show significantly that vocational training and lifelong learning systems are considered as central objectives in order to offer and to maintain the integration of specific working groups in the labour markets. These pathways mainly refer to ‘risk groups’ (the elderly, women, ethnic minorities, those with few qualifications) in order to find good and timely labour market transitions and to reduce labour market segmentation (see Sect. 2.4).

5. Conclusions

As proposed in the title “Interaction between New Technologies and the Job Market, Flexicurity and Training/Vocational training”, the final report offers a thematic framework connecting these different topics to a coherent argumentation line.

Since the beginning of the 1970s the introduction of IT and its effects on the labour markets have been analysed intensively in academic debates and assessed empirically. On different levels, IT can be considered as a “revolutionary new technology, with the creation and application of knowledge about how to effect transformation in the world in dramatically new ways” (Miles 2003:70). Partially similar strong impacts are also expected from ‘future technologies’ like nanotechnology, biotechnology and converging technologies. The potentials of new applications and new economic markets have been retraced by the relevant literature in summarising sections. The results show that the application fields differ strongly between the technologies. All statements with future prospects can be regarded as highly ‘hypothetic’ without solid statements regarding the development of future labour markets. This result does not come as a surprise. In academic debate the chosen approach is to prioritise technology as the centrepiece of change and therefore also adopt ‘technology push approaches’ (Miles, Robins 1994).

Historical experience of IT as a “technological practice” (Schienstock 2003) has been developed along the theoretical approach of ‘informatisation of work’. According to this approach, empirically individual occupational changes can be described, as can general tendencies of change in work. In the literature there is agreement that IT has profoundly changed the whole organisation of work, though research is still needed in order to examine aspects of change in specific branches and sectors. The effects of IT on labour markets as well as on working structures are different and contradictory for different occupational and social groups. The changing demands on qualifications and skills have led to new patterns of segmentation on the labour markets as well as to different forms of polarisation.

Due to globalisation processes, internal and external flexibility modes have changed the acquisition of the required skills towards a demand for higher qualifications in nearly all sectors. This is crucial, however, for employees with lower initial qualifications. But upskilling and downskilling processes are embedded in organisational patterns which have to be taken into account when considering training and vocational training. Thus, in highly skilled occupational groups there is evidence that the increasing demands for further qualification as well as lifelong learning have become an integral part of the individual commitment on the job. In lower-qualified occupational groups the workers depend very much on the learning opportunities provided by the companies. The question for public policy remains how institutions can maximise opportunities and minimise risk in different working environments.

The flexicurity concept itself can be regarded as a common strategy of “renewal in which institutions are finding new ways to achieve collective responses to ever more flexible workplaces” (Meil, Tengblad 2006:44). But as the different national labour market policies show, the concepts vary by nation, sector and type of industrial regulation. Therefore, the tendency towards market-driven orientations across all countries is apparent and should be considered as an obstructive factor on the path towards attaining a balance between flexibility *and* security¹³. Nevertheless, the pathways developed by the European Experts on Flexicurity significantly show the role public social policy can play on a transnational level in order to learn from ‘best cases’ in Europe as well as to agree on common objectives of social cohesion and social integration.

¹³ See the European Project WORKS (The transformation of work in a global knowledge economy: towards a conceptual framework), <http://www.worksproject.be> (Huws 2006c).

6. Workshop summary

The STOA Workshop: “Interaction Between New Technologies and the Job Market, Flexicurity and Training / Vocational Training” was held on the 9th October 2007 at the European Parliament in Brussels. The basic objective of the workshop was to integrate expert statements in the hypotheses and statements of the interim report. Thus expert knowledge and critical interventions aimed to widen the thematic framework and indicate important topics in order to formulate policy recommendations.

Referring to the Lisbon Summit, *Pier Antonio Panzeri* (Member of the European Parliament and Supervisor of the STOA project) opened the workshop and reminded participants of the political dimension of this project. According to *Panzeri*, who went back to the political goals of the Lisbon Summit (23-24 March 2000), general agreement on the transition towards knowledge-based economies in Europe was primarily a decision for economic reforms. These reforms were strongly bound up with the support of technical innovations, and information and communication technologies. But as experience has shown in the past few years, the social and cultural effects on labour markets cannot be neglected within the whole transition process. Therefore, interaction between the technical innovations and labour markets should always be accompanied not only by political awareness but also by political programmes and strategies in order to attenuate the social risks and vulnerability of social groups. *Panzeri* highlighted several efforts at the European level to support the adaptation processes of social groups to new market demands as well as new work profiles within organisations.

After this introduction, the project manager *Bettina-Johanna Krings* (Institute for Technology Assessment and Systems Analysis, Germany) presented the state-of-the-art of the project. According to the hypotheses in the interim report, the argumentation logic of the three topics was constructed on the following issues (see presentation in the Annex):

- Technological approaches focus on the development of “knowledge and service economies” (Giddens 2007). This theoretical approach is based on the empirical fact that in highly industrialised countries international competition continues to push productivity. Here, a strong orientation to the “core competencies” such as knowledge-based activities and high-level service orientation have continuously changed production patterns on the one hand and working conditions on the other. Through technological innovations, new organisational patterns and skill requirements have been introduced. Thus, employment growth trends in Europe favour medium and high-skilled jobs, while the low-skilled jobs continue to shrink. Public employment is also stagnating in large part due to the fiscal constraints associated with the Stability and Growth Pact. For less skilled workers, employment opportunities are doubly constrained. On the one hand, well-paid public sector jobs are decreasing. On the other hand, the growth of private services, such as the retail trade, gastronomy, and personal services is restricted by prevailing levels of social protection and the level of minimum wage. Changes in working patterns become crucial when trying to understand the key word “flexibility”.
- The ubiquitous character of IT has transformed working patterns at all levels (global value chains, organisations, individuals). These changes have been analysed intensively by academics in the past two decades. Generally, from a technological perspective, the introduction of new technologies was and is still an important factor for changes in the different sectors and branches (quantitative and qualitative). Specific effects and consequences vary from sector to sector and have to be explored carefully.

- In an era of accelerating technological change, educational and vocational training are gaining in importance. Both on a national scale and at the European level, educational and vocational training can be considered the counterpart of the new demands on qualifications and skills. But the intensity of these changes has created a new degree of vulnerability for some social groups, i.e. young, unqualified men and women, older workers in manufacturing, men and women in long periods of unemployment etc.. Not only in the old Member States but increasing rapidly in the New Member States there is a general trend towards social polarisation. Political strategies, therefore, focus very strongly on efforts towards training and vocational learning in order to integrate the workforce into the labour markets.
- Highlighting the Flexicurity concept changes the perspective analytically from technological innovation towards “social innovation” (Wilthagen). With regard to technological changes, it becomes important to generally promote skills and aim at reducing educational under-achievement. These policies need to be both structural and personalised in order to diminish exclusion processes of workers in the labour markets.

These issues together with the main hypotheses of the interim report were explicitly confirmed and pursued by all experts who presented the topics in detail (see presentation in the Annex). The following experts contributed to the workshop:

1. **Interaction between technologies and labour markets: a critical perspective** (*Gérard Valenduc*, Work & Technology Research Centre, Fondation Travail-Université (FTU) Namur, Belgium).
2. **New demands for qualification and skills and the importance of vocational training** (*Monique Ramioul*, Higher Institute for Labour Studies, Katholieke Universiteit Leuven, Belgium).
3. **Demand for flexibility and social consequences from the perspective of the workers' representatives** (*Joël Decaillon*, European Trade Union Confederation, Brussels, Belgium)
4. **Demand for flexibility and social consequences from the perspective of the employers' association** (*Matthew Higham*, BusinessEurope, Brussels, Belgium)
5. **Flexicurity as a political strategy of social innovation** (*Ton Wilthagen*, Universiteit van Tilburg, The Netherlands)
6. **Future development of labour markets: the prominent role of public policy** (*Jörg Flecker*, Forschungs- und Beratungsstelle Arbeit Wien, Austria)

1) Interaction between technologies and labour markets: a critical perspective

Gérard Valenduc divided his contribution into two parts. Firstly, he presented theoretical considerations on the status of technology and its impact on the societal development in more general terms. With regard to the impact on labour markets and work changes, technology can play various roles which should be analysed differently. According to *Valenduc*, technology implies several functions in society such as the enabling factor for changes or – much more generally – it becomes the basic infrastructure for technically based systems. He pointed out that there are different levels of observation with regard to increasing structuring effects of technology. From the level of industrial organisation (sectoral benchmarks, industrial organisation) to organisational pattern (codification of management and administrative procedures, centralised or decentralised organisational pattern, etc.) and up to the individual level (skills, qualification), the question remains whether there is increasing or decreasing space for social dialogue in the social shaping of technology.

Considering IT and its impact on these different levels, it seems that the discussion on technological determinism should be newly scrutinized.

Secondly, *Valenduc* presented results of the STOA study “Technology-induced atypical work forms” which was conducted by FTU and CURS Newcastle, UK in 1999. Here, the key findings of the study have not changed very much compared with the findings in the current report (see *Valenduc* in the Annex):

- Development of a core and peripheral workforce;
- Decreasing effectiveness of existing regulation for new flexible work arrangements;
- A central concern for employability and lifelong learning;
- The uncertain future of the welfare state;
- The supporting, but not determining role of technology.

Although the original intention differs between the studies, he strongly highlighted the similarity of the outcome of both studies. According to *Valenduc*, the central developments between new technologies and its impact on work is that trends that were already defined eight years ago have now been intensified. These trends are to the disadvantage of many occupational groups and can be summarised as:

1. From flexibility to intensification of work (time constraints, distribution of individual risks and benefits);
2. Emerging “compatibility issues” (working time arrangements are less compatible with social time, unbalanced transfer of entrepreneurial risks, changing the balance between rationalising and innovative use of IT).

On the basis of these developments, *Valenduc* emphasised the increase in social risks over the past few years, which should be taken into account in the overall discourse on new technologies.

2) New demands for qualification and skills and the importance of vocational training

With a similar slant, *Monique Ramioul* provided her expertise on the new demands on qualification and skills required by the introduction of new technologies. From the perspective of skill-biased technological and organisational changes, *Ramioul* affirmed the tendency of slowing down job destruction and faster creation of new jobs in the development of highly industrialised societies. But at the same time, she suggested having a look at the other side of the coin. As also described in the interim report, technological and organisational changes are skill-based, but (see *Ramioul* in the Annex):

- they lead to a accelerated renewal of the workforce in favour of the skilled,
- they are inducing organisational changes which provoke an increase in required skills long term,
- they are inducing organisational innovation and training intensity which are ultimately reinforcing the effects.

Company restructuring (mergers, offshore and outsourcing processes etc.), based on the introduction of new technologies (mainly IT) are strongly related to new requirements at the working level. According to *Ramioul*, the increase in knowledge-based work can be described as a strong tendency when speaking about new job requirements. Therefore, *access* to new knowledge and learning seems the central aspect for learning opportunities and investment in skills. But restructuring processes like fragmentation and standardisation of work usually avoid learning and training processes for the workers.

In terms of vocational training in Europe, *Ramioul* distinguished between workplace training and informal training. Here, incidence, access and intensity differ widely among the European countries. The institutional framework as well as the importance of employment policies usually strongly define whether vocational training is also regarded as a preventive strategy against unemployment. The experiences in many Northern countries has shown that vocational training programmes have a visible impact on the employability of the work force.

In response to the question of whether Europe is moving towards a knowledge-based society, she stated that empirical findings show that highly skilled work is mainly concentrated in a few occupations. By contrast, there is an increasing proportion of ‘newly’ unskilled workers in the service sector. In specific sectors, increasingly negative working conditions, job insecurity and less training efforts and opportunities also have significantly risen.

Summing up the trends and tendencies, *Ramioul* focused very much on the impact technological and organisational changes have on skills and qualifications. In order to avoid the exclusion of low-skilled workers on the labour markets, specific and comprehensive efforts are needed. Therefore, the role of public policy seems crucial, as different examples from different countries show. Country effects account for almost half of the explained variation in training participation and more so than differences associated with industry, occupation, education, age, and firm size.

3) Demand for flexibility and social consequences from the perspective of the workers' representatives

Considering that there are 75 million unskilled workers in Europe, *Joël Decaillon* argued for a “realistic” perspective on the development of knowledge-based economies. Like the other experts, *Decaillon* strongly emphasised the differentiation according to sector, branches, and occupational groups when reflecting on the importance of technological innovation as well as knowledge-based work. Therefore, the debates should encompass the labour markets and the various working conditions in the European countries.

In the past few years, trends towards more flexible working places generally have increased the vulnerability of workers. The changes of global value chains have had a significant impact on the working conditions at an individual level. Young workers, less skilled women, and migrant workers are continuously coming under pressure. Faced with the demand for flexibility, very often workers come under pressure because of the lack of security. As the situation in many sectors shows – according to *Decaillon* - workers find it hard to stand up to employer pressure to cut wages, work unpaid overtime or work according to contracts of bogus self-employment which offer no or only reduced access to social security.

Taking these changes into account, the agreement on the “right to work and for active vocational training” is fully supported by the unions in order to improve the “employability” of the workers in the labour markets. But – according to *Decaillon* – this agreement should be accompanied by several activities and strategies such as an open dialogue at a territorial level, the clear definition of strong negotiation issues, and the establishment of active labour market policies at transitional levels. In this context, the need for active vocational training seems to be a central employment strategy on the trade union agenda. But this strategy must complement labour market policies promoting upward mobility.

From the perspective of ETUC the flexicurity debate cannot be seen separately from the agenda of “quality of work”. Therefore, job quality is indispensable in order to guarantee that the balance between flexibility and security will be real and not a one-sided balance in favour of employers and profits.

For *Decaillon*, with the present flexicurity approach, European business is trying to get away from any responsibility for its workforce (paying a decent wage, investing in the human capital of their workers, getting rid of workers as easily as possible, offering insecure contracts). With regard to this debate, ETUC has developed cornerstones to reflect the flexicurity concept from the worker's point of view:

1. Fight precarious jobs and promote the quality of work;¹⁴
2. Focus on upwards instead of downwards flexibility and improve work organisation;
3. Safeguard employment protection legislation and complement it with labour policies promoting upward mobility;
4. Maintain a broad approach to balancing flexibility with security;
5. Improve social welfare systems;
6. Integrate flexicurity policy with macro-economic policy;
7. Improve social dialogue and collective bargaining.

4) Demand for flexibility and social consequences from the perspective of the employers' association

Matthew Higham, the representative of BUSINESSEUROPE provided the perspective from the employers' association in Europe. In his presentation, he focused strongly on two topics which should be important when confronting fast technological change: firstly, vocational training has become a very important instrument for maximising resources. Here, he greatly emphasised efforts at the European level to support lifelong learning and vocational training programmes. These initiatives should be recognised as shared responsibilities between workers and companies. According to *Higham* only very few people in working processes participate in education and training programmes, while the requirements on the employer side are much higher. Secondly, "employability" should be regarded as one crucial aspect in considering flexibility strategies. As an effective active labour market policy, *Higham* stressed the need to encourage workers to increase their employability; that means that workers themselves should be able to develop individual options and chances on the labour markets.

According to the agenda of BUSINESSEUROPE, the flexicurity concept should be considered as part of the Lisbon Strategy and its objectives to maintain economic growth and jobs, the acceptance of change and adaptability, the way of maintaining the essence of social systems, and the definition of the role of the social partners. With regard to the balance between flexibility and security, the framework for flexibility should be guaranteed for the companies and at the same time security should be offered to the workers according to EU standards. But companies also need security in order to organise their economic growth, just as workers should have the option of flexibility in order to increase their employability.

5) Flexicurity as a political strategy of social innovation

According to *Ton Wilthagen* – who is the rapporteur of the *European Expert Group on Flexicurity* – technological innovation is a central driving force behind the development of knowledge economies. But, in turn, social innovation is the precondition for technical innovation.

14 See also ETUC (2007): The Flexicurity debate and the challenges for the trade union movement. <http://www.etuc.org/r/16> (26.10.07).

The *Dutch Social and Economic Council* has, therefore, defined social innovation as “innovation of the work organisation and maximum use of competencies, aimed at improving company performance and development of talent” (see Wilthagen in the Annex). When taking this definition into account, social innovation is urgently needed at four levels: namely, company, sector, national and European levels. Therefore, for Wilthagen, the Flexicurity concept should be considered as a multi-level concept.

According to him, Flexicurity as a policy strategy on the one hand aims to enhance the flexibility of the labour markets, labour relations and work organisation. On the other hand the concept protects employment and income security. Flexicurity in the work organisation should provide the following objectives (see Wilthagen in Annex):

- At a company level, performance and productivity should be developed best within work organisation with the right balance of flexibility and security.
- Without flexibility, the adaptability of work organisation and the combination of work and private responsibilities (for the worker) cannot be properly warranted.
- Without security, the commitment and involvement of the worker and the return on investment for the company will be less than adequate.

As already stated in the interim report, the *European Expert Group on Flexicurity* has identified four components of flexicurity: “flexible and reliable contracts, effective labour market policies, responsive and reliable life-long learning systems and modern social security – plus supportive and productive social dialogue on order to establish the right climate and setting for new technologies to gain maximum economic and social impact” (see Wilthagen in Annex).

With regard to the European employment and unemployment structure, Wilthagen presented the following Flexicurity pathways which are focused on vocation training and lifelong learning policies:

1. Portability and transferability of skills;
2. Better organisation of knowledge chains across company and sector borders;
3. New pacts between government, social partners and training institutions;
4. Development of sector level training funds that also provide for training across the borders;
5. Accreditation of prior learning;
6. Lifelong learning and career support/ life course incentives and facilities for all actors involved.

6) Future development of labour markets: the prominent role of public policy

Jörg Flecker performed the difficult task of summarising all the contributions from the experts. He divided his conclusion into three parts, finishing every part with relevant questions.

Starting with the **role of technology**, he pointed out that the impact of technology and particularly IT is crucial for changes in work. In the past two decades, it has become obvious that companies and organisations use IT to implement very different work designs and forms of work organisation: Automation and customer self-service, though they represent advances in many sectors, will spread further in the service sector in particular. Generally, the application of IT has rendered many jobs in manufacturing and service industries more complex, but IT has also simplified jobs and made them more repetitive.

According to *Flecker*, this wide variation is also true for employment contracts: While rising skill levels and the increased need for knowledge strengthens employers' preferences for long-term standard employment relationships in some sectors, codification of knowledge and means for control and surveillance of work are used to employ easily replaceable flexible labour.

Although technology can be seen as an enabling force both at the sectoral and the organisation level, the introduction of new technologies is often supported by public policy. This raises the question of who is involved in decision-making processes on the use of technologies. Empirically there is only little worker involvement in issues of technology and work organisation, and there are hardly any workers rights for negotiating these. The ongoing process of globalisation thus raises the question of whether such a lack of worker participation will be acceptable in the future.

Concerning the demand for **new skills and qualifications**, *Flecker* affirmed the main hypotheses in the interim report. However, he strongly emphasised the national differences in Europe when speaking about vocational training. Not only the fact that more highly educated workers receive more training, but there are also big differences among the European Member States: While an average of more than 60% of all companies in the EU provide further training, only 18%-36% do so in Southern European countries. In addition – according to *Flecker* – speaking about knowledge-based societies should be evaluated much more with regard to empirical evidence. CEDEFOP for instance forecasted that despite a decrease in jobs requiring only low levels of education and skills, by 2010, among all jobs in the European Union these will still constitute around 45%. There are important policy issues involved: What prospects do workers in these jobs have? Are there learning opportunities? Often developments are contradictory: While work is repetitive and does not require vocational training qualifications, high levels of “soft-skills” such as social skills, self-organisational skills, etc. may still be required in both manufacturing and service industries.

Related to these questions, *Flecker* mentioned another issue: the increasing importance of “employability”. Here, the debate often glosses over many actual conflicts and contradictions. Even the dynamics and complexity of restructuring processes on the labour markets may lead to a loss of a control over one’s career. Workers are losing confidence in their future perspective. This, in turn, often reduces instead of enhancing the motivation for further training. In general, education experts recommend the acquisition of comprehensive skills in order to be independent of specific sectors and labour markets.

Flecker cited the *European Expert Group on Flexicurity*, who defined the concept as a “unified concept”, meaning that different policy areas are put into practice simultaneously. However, actual developments do not seem to follow the concept. One important question here should be whether social security systems are fit for labour market flexibility.

In the debate, the need for more labour market flexibility is taken for granted. But are the flexibility needs of companies and their relationship issues well understood? Flexible labour is clearly not the only means of reaching higher levels of company flexibility. And where flexibility of companies relies on flexible labour with regard to time and contractual security, flexibility mostly is not embedded into socially acceptable labour market policies.

With the developments of wages and profits back on the policy agenda, the Flexicurity debate might also need to more clearly indicate the distribution aspects involved.

Taking this aspect into account, *Flecker* emphasised the empirical evidence that in many companies flexibility strategies make it more and more difficult for workers to reach a work-life balance. Thus, the intensification of work is an important issue of actual working conditions in most European countries.

Therefore, the balance between flexibility and security – according to *Flecker* – would be a useful objective. Historical analysis, however, focuses more on the rising level of insecurity for most workers in the European countries.

7. Policy recommendations

The summary of the workshop results shows importantly that the experts agreed on the argumentation logic and hypotheses of the interim report. All expert statements, however, underlined very much the need to focus more on the social and political dimension of the ongoing impact of technologies on labour markets. Not only the historical development of the labour markets in European highly industrialised countries but also empirical findings of specific labour markets in Europe indicate the decline of the manufacturing sector and an increase of the knowledge-based service sector. Based on these developments the demand for new skills and qualifications seems obvious from a political point of view but the emerging social differences in many European countries have to be taken into account. Basically these differences are represented by a high proportion of unemployed, mostly low-skilled workers, by an increasing rate of informal work as well as by a high rate of unskilled workers. Therefore, some experts in the workshop focussed very much on the actual creation of a core and a peripheral workforce which depends on the level of technological involvement on the working places, the institutional setting as well as along the level of social dialogue.

The encouragement of vocational training in order to improve the “employability” of the workers seems one important strategy which, however, should be embedded into the contextual and organisational framework of the working place. Especially with the objective of improving the “employability” of the workers, the flexicurity concept can be considered as a political strategy with a strong social bias. From the perspective of a multi-level concept, the strategy should on the one hand serve to enhance the flexibility of the labour markets, labour relations and work organisation. On the other hand – strongly influenced by the institutional pattern of Scandinavian countries – the concept should protect employment and income security.

Basically the creation of knowledge-based economies in Europe would not have been possible without the influence of technologies, essentially IT. Through the political orientation towards knowledge-based economies, the debate as well as political strategies, therefore, are focusing predominantly on the creation of a skilled and highly skilled workforce. Concerning the actual European employment (and unemployment) structure, however, the situation still seems different in many countries and – according to the experts – should be taken into account. Thus, the policy recommendations are oriented mainly according to the complexity of the three topics: interaction between new technologies and labour markets, vocational training as well as the flexicurity concept itself.

- 1) The impact of technologies on labour markets should be analysed carefully according to branch, sector, organisation and country. There is still an empirical gap in the theoretical hypotheses about the changes of work organisation in different sectors. Permanent observation should be introduced in the field of work organisation with regard to the use of technology, division of labour and employment relationships within different industrial and service sectors.
- 2) The restructuring of the global value chains has created more economic pressure on local markets, on organisations as well as on the individual work place. As life-long employment and job security are gradually fading, more and more employees have to accept flexible jobs. Generally the demand for flexibility on the organisational as well as on the individual level can be considered as one aspect of these processes worldwide.

Political strategies should take these processes into account offering strategies and programmes in order to create a counterpart to these demands for flexibility. Therefore, these strategies and programmes should enhance the “employability” of those workers who are vulnerable to the immediate consequences of globalisation.

- 3) Political programmes enhancing the “employability” of the workers should imply several strategies and instruments. Besides vocational training programmes the creation of new (un)employment policies and new instruments of social policies also seem important for improving the adaptation of workers to the fast-changing labour markets.
- 4) Vocational training policies should imply a wide range of training efforts which are based on the specific needs of the occupational groups as well as on the characteristics of the sectors. These training programmes should also be able to stimulate and to engage organisational restructuring processes and therefore organisational learning. With the vocational training system, IT applications and qualifications should be an integral part of these programmes as IT has increased in importance in a large number of sectors and functions.
- 5) The flexicurity concept should be understood as a multi-level concept which can be developed distinctly according to the differences of working conditions within European countries. Basically the idea of the concept is to harmonize the need of flexibility on the labour markets and work organisation with the need to protect worker’s employment and income security. With regard to the European employment and unemployment structure the Expert Group on Flexicurity advocates the encouragement of lifelong learning and life course incentives for all actors involved, the better organisation of knowledge chains across company and sector borders and new pacts between government, social partners and training institutions.
- 6) Labour policies should be implemented within social welfare policies. As empirical evidence shows, through technological and organisational changes on the labour markets the intensification of work has increased. Quality of work, however, is strongly connected with work-life balance. Therefore, basically the relationship between flexibility and security should avoid “compatibility issues” that means e.g. working time arrangements are less compatible with social time patterns or transfers of entrepreneurial risks towards the individual etc. The increase of social risks in the last years, however, should be emphasised in the overall discourse about change of work.

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Annex:

Questions raised as an input for the workshop discussion

With regard to the STOA workshop at 9th of October 2007, the following issues were proposed as topics of discussion. These have also been presented and discussed in part by the experts.

1. The interaction between new technologies and labour markets in public debates is still reflected by the notion of economic growth, job creation, or welfare strategies. How does this (traditional) model cover actual developments in European countries?
2. Technological innovation can be considered as an important driving factor for the re-organisation of working patterns as well as of labour markets. How can this relationship be described in terms of job creation and job losses? How can this relation be described in relation to new demands for qualifications and skills?
3. IT has had tremendous effects on the development of economic globalisation and its effects on labour markets. Internal and external flexibility demands have led to an increase of existing social problems. The concept of the empowerment of the employers principally is based on training and vocational training. How does the concept cover different (sectoral) demands for skills and qualifications? In some branches deskilling processes have taken place (e.g. food industry, service industry etc.) which have led to precarious work situations.
4. What is the experience with the flexicurity concept in some European countries (the Netherlands, Finland)? What are the results? Are they likely to be connected with the national labour market policies?
5. Vocational training and training are the 'flagship' of the European employment policy. Basically they are developed from the company's perspective of new demands. Which role does social dialogue or collective bargaining play within the programmes?

Outline

1. Introduction - Perspective of the interim report
2. Interaction between new technologies and job markets
3. General trends in qualification and skills
4. The importance of vocational training
5. Flexicurity as a political instrument
6. Discussion

1. Introduction – Perspective of the interim report

- Technological approach focus on the development of “knowledge and service economies” (A. Giddens)
- Strong bias on Information and Communication Technologies (“Informatisation of work”)
- Changes of working pattern (organisational and individual level)
- New demands on qualification and skills
- Comprehensive perspective (branches and sectors, European level)

2. Interaction between new technologies and job markets

- Introduction of new technologies was and still is an important factor for changes in the different sectors and branches (quantitative and qualitative changes)
- Based on technological and social changes there is a continuous shift toward skilled and high-skilled professions
- Qualitative changes can be considered on the organisational and individual level of job profiles (nearly all sectors and branches)
- The interaction between new technologies and job markets is highly interconnected with external factors that it will be impossible to estimate numbers of jobs ‘lost’ or ‘gained’

3. General trends in qualification and skills

A technically oriented perspective stresses very much the (new) demands for skills and qualification:

- Defining upskilling and deskilling tendencies do not fully reflect change of working life in different sectors and branches (big variety)
- Changes in the nature of tasks carried out (decline of traditional and rise of new occupations)
- Changes in organisation of work (structure, time, control, management)
- Change towards ‘knowledge structure’ of work (non-standardised, autonomous, cooperative, ongoing learning process)

4. The importance of vocational training

Efforts of vocational training or training activities are considered as the counterpart to new demands of qualification and skills (concept of individual empowerment)

→ On an European level as well as on different national levels education and training are considered institutional solutions for developing and adapting the work force

But:

- There is still an empirical gap about the **training needs in different sectors** and branches
- There is a general trend towards **social polarisation**
- **Employability** gains importance, vocational training should enhance employability
- Learning opportunities not only presuppose new task requirements, but also the ability *to deal* with task requirements
- Vocational training policies should be able to stimulate and to engage **organisational learning**, that means to facilitate the organisational reorganisation for the employees

5. Flexicurity as a political instrument

Commission of the European Communities (2007):

→ Originally the concept strengthens very much the integration of employees' in precarious working situations

- **Flexible and reliable contractual arrangements** through modern labour laws, collective agreements and work organisation
- **Comprehensive lifelong learning strategies** to ensure the continual adaptability and employability of workers
- **Effective active labour market policies** that help people cope with rapid change, reduce unemployment spells and ease transitions to new jobs
- **Modern social security systems** that provide adequate income support, encourage employment and facilitate labour market mobility

6. Discussion

- Interaction between technologies and labour markets – a critical perspective (Gérard Valenduc)
- New demands for qualification and skills and the importance of vocational training (Monique Ramioul)
- Demand for flexibility and social consequences (Joël Decaillon and Matthew Higham)
- Flexicurity as political strategy of social innovation (Ton Wilthagen)
- Future development of labour markets: the prominent role of public policy (Jörg Flecker)

Available abstracts of the workshop participants

Interactions between technologies and labour markets: a critical perspective

G rard Valenduc¹⁵, FTU Namur, Belgium

This contribution mainly addresses topic 2 in the discussion list of the ETAG report (p. 47): “Technological innovation can be considered as an important driving factor for the reorganisation of work patterns and labour markets. How can this relationship be described in terms of job creation and job losses? In relation to new demands of qualification and skills?” The first part of the presentation deals with questions related to the implicit “technological determinism” of the research question. Without attempting to deal extensively with this key question in the sociology of science and technology, two issues will be raised:

- The degree of (in) determinism in the interactions between technology and work highly depends on the level of observation of changes in work¹⁶: while structuring effects of technological innovation can shape trends at the level of industrial sectors, business functions or value chains, social relations are more determinant at the firm level and the occupational level, where they can shape technology-related options (social shaping of technology).
- There are differentiated effects of technology (particularly information and communication technology, ICT) on differentiated occupational groups, defined according to the intensity of their relationship to technology mastering and use. Five categories of occupational groups can be distinguished¹⁷: ICT-based occupations; ICT-enabled occupations; ICT-supported occupations; ICT-transformed occupations; ICT-absent occupations. Challenges related to employment prospects, skills requirements and training need are rather different for these five groups.

The second part of the presentation reviews an earlier study carried out for STOA in 1999 on “Technology induced atypical work forms”¹⁸ – interestingly convergent with the current ETAG report. It is really stimulating to comment how research questions, arguments and recommendations evolved (or not evolved) during the last 10 years on several issues such as the role of technological innovation, the forms of labour market flexibility, the changes in skills profiles and requirements, etc.

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¹⁶ Valenduc G., *La technologie, un jeu de soci t *, Academia Bruylant, Louvain-la-Neuve, 2005.

¹⁷ Vendramin P., Valenduc G., *Les impacts de l’informatique sur les m tiers et les comp tences*, dans *Encyclop die des syst mes d’information*, Vuibert, Paris, 2006 (pp. 1611-1616).

¹⁸ Valenduc G., Vendramin P., Gillespie A., Richardson R., *Technology-induced atypical work forms*, STOA report 98/0801, Brussels / Luxembourg, April 1999.

New demands for qualification and skills and the importance of vocational training

Monique Ramioul, HIVA-KUL, Leuven, Belgium

This contribution will focus on two topics:

Changes in the demand for skills related to technological and organisational innovations and global value chain restructuring

Most available EU research on the impact technological change and organisational change concludes not on major job losses, but on a slowing down of job destruction and accelerating job renewal. This job renewal however is skill-biased in the sense that there is an acceleration of the outflow of the lower skilled and replacement by higher skilled. The effects of organisational change on job levels and skills structures are even more skill-biased than the effects of technological change as such.

Organisational changes today can be linked to restructuring of global value chains, implying spatial and contractual relocation of activities along the chain and as a result more complex (inter-organisational) relationships. Strategies related to the acquisition, use and development of skills and knowledge have to be adapted in these new organisational configurations. Positive effects for employees can occur when increased access to new knowledge and more learning opportunities in networked organisations can occur, but at the same time these organisational forms entail risks of deskilling due to the codification of knowledge, the standardisation and fragmentation of work and due to increased formalisation of work and performance monitoring systems.

Some evidence on vocational training in Europe

Training is key to augment and adapt existing skills to the changes of technology and to organisational innovations. Company training covers a substantial part of education after labour market entry. Next to formal training employees can renew and broaden their skills through informal learning during and while working on the job. Evidence on the incidence of training efforts by companies, training access for employees and training intensity shows huge differences within the EU. Country effects account for almost half of the explained variation in training participation and more so than differences associated with industry, occupation, education, age and firm size. Further, both informal and formal training initiatives have clear Matthew effects in the sense that the educated receive more of both than the unskilled. These are important messages for government policies.

Flexicurity as political strategy of social innovation

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For the European Union technological innovation without any doubt represents a crucial driving force behind economic growth and thus behind the safeguarding of welfare within European societies. However, it is clear that for technological innovation to develop and to be successfully implemented social innovation is a precondition. To give an example: in some countries, among which the Netherlands, research has shown that the production of (technological) knowledge as such is not the main problem in view of the emergence of a knowledge economy. Rather, the *absorption* and *application* of this knowledge at the company level remains suboptimal, due to the work organisation (companies are still too strongly organised in separate departments; organisational flexibility, adaptability and communication needs to be enhanced).

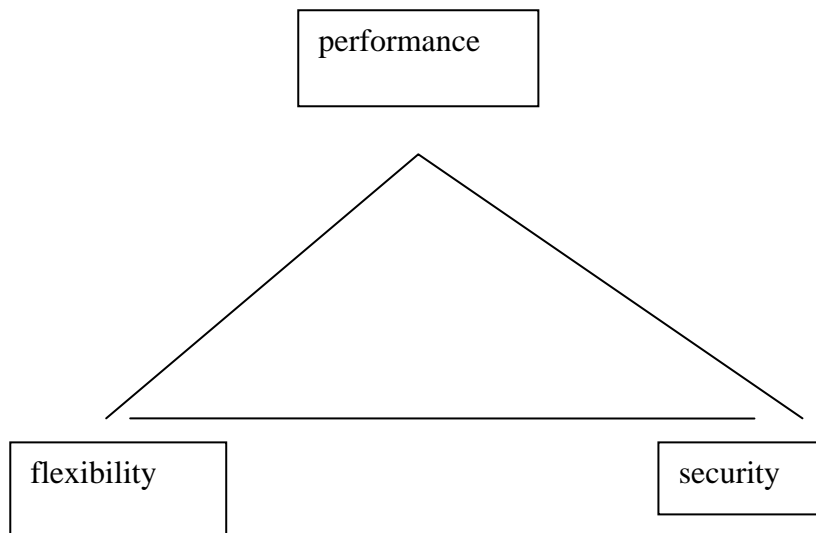
Social innovation has been defined by the Social and Economic Council of the Netherlands as “innovation of the work organisation and maximum use of competencies, aimed at improving company performance and development of talent”.

It is important to add that social innovation should be considered a multi-level concept, i.e. social innovation should be developed at the national, sector and local/company levels, as well as at the European level. Flexicurity, a policy strategy that aims at enhancing on the one hand the flexibility of labour markets, labour relations and the work organisation and employment and income security on the other, can be characterized as a form of social and economic innovation that fosters technological innovation and so-called high roads towards productivity, performance and more and better jobs.

Flexicurity needs do be developed at all four levels – European, national, sector and decentral – because only the interaction of these levels can lead to optimal strategies – every level forms a precondition of the operations at the other levels (cp. the concept of multi-level governance).

From the literature the argument can be derived that, at the company level, performance and productivity develop best within a work organisation setting that provides the right balance between flexibility and security. Without flexibility the adaptability of the work organisation but also the combination of work and private responsibilities (for the worker) can not be properly warranted; without security the commitment and involvement of the worker and the return on investment for the company will be less than adequate. This threefold relationship can be displayed as follows:

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From a flexicurity perspective it is essential to further enhance all four components of flexicurity as identified by the European Commission – flexible and reliable contracts, effective active labour market policies, responsive and reliable life-long learning systems and modern social security – plus supportive and productive social dialogue, to establish the right climate and setting for new technologies to gain maximum economic and social impact. Various forms of flexibility can be productively combined with forms of employment and income security. Evidently, training and vocational training in particular play a key role here. Strategies that can be further developed are e.g.:

- portability and transferability of skills
- better organization of knowledge chains across company and sector borders
- new pacts between government, social partners and training institutions
- development of sector level training funds that also provide for training across sector borders
- accreditation of prior learning
- life-long learning and career support/life course incentives and facilities for all actors involved

Future developments of labour markets: the prominent role of public policy *Jörg Flecker, FORBA, Vienna, Austria*

Technology

Research has repeatedly pointed out that technology and, in particular, information and communication technologies (ICT) are crucial for changes in work. It has become obvious that companies and organisations use ICT to implement very different work designs and forms of work organisation: Automation and customer self service, though being advanced in many sectors, will further spread in particular in the service sector; the application of ICT renders many jobs in manufacturing and service industries more complex; but ICT is also used to simplify jobs and to make them more repetitive. This wide variation also applies to employment contracts: While rising skill levels and increased need for knowledge strengthens employers' preferences for long-term standard employment relationships in some sectors, codification of knowledge and means for control and surveillance of work are used to employ easily replaceable flexible labour in others.

There is thus considerable latitude in the application of ICT, in work organisation and in work design. Yet, this is not a prominent policy area in most member states nor at EU level. The Scandinavian countries are an exception here. Denmark, for example, carried out, among other things, a large programme against repetitive work and now features the lowest level of repetitive work in the EU. ICT also enable and support the restructuring of value chains through outsourcing and formation of company networks. This often leads to changes in levels and conditions of employment. Hence, new technology, the development of which is often supported by public policy, can be seen as a major enabling force both at organisational and sector levels. This raises the question as to who is in a position to decide on and influence the use technology is made of. There is only little workers involvement in issues of technology and work organisation and there are hardly any workers rights to negotiate on these. The profound consequences such decisions have on workers lives raise the question as to whether such a lack of democracy will be acceptable in the future.

Skills

The ETAG interim report to STOA points out that the development of skills takes various directions: Not only upskilling and downskilling can be observed simultaneously but also considerable shifts in the composition of skills. New skill needs make it necessary to provide further training but in fact access to further training is extremely uneven. Not only do more highly educated workers get more training, there are also big differences between the member states: While on average more than 60% of all companies in the EU provide further training, in Southern European countries only 18 to 36% of all companies do so. In view of dynamic changes in skill needs the responsibility for training and the access to training will be major policy issues also in the years to come.

In spite of a shift towards more highly skilled jobs in many industries it would be premature to assume that the much heralded 'knowledge society' is already a reality: CEDEFOP forecast that despite a decrease of jobs requiring only low levels of education and skills, by 2010 their share of all jobs in the European Union will still be around 45%. There are important policy issues involved: What prospects do workers in those jobs have? Are there learning opportunities? Is there skill enhancing work design in place? Often, developments are contradictory: While work is repetitive and does not require vocational training qualifications, still high levels of 'soft-skills' such as social skills, skills for self-organisation etc may be required both in manufacturing and service industries. Is there training for such skills that are often seen as personality traits? Are these skills paid for in particular in women's work?

The debate on 'employability' often glosses over quite many actual conflicts and contradictions. The dynamics and complexity of developments on the labour market and the flexibility required from workers may lead to a loss of control over one's career. Workers cannot 'see' their future any more. This, in turn, may well reduce instead of enhance the motivation for further training. In general, education experts suggest broad general knowledge and skills and education systems that are independent from market pressures. This seems the only way to make sure that the needs of future markets are met.

Flexicurity

The European Expert Group on Flexicurity stresses that while the concept of 'flexicurity' concerns different policy areas it is a 'unified' concept in the sense that all parts need to be put into practice simultaneously. However, actual developments do not seem to follow the concept. One important question in this respect is whether social security systems are fit for labour market flexibility. Recent developments show that social security at least in the continental 'conservative' welfare states such as Germany and Austria has become more employment oriented with transfer payments depending more on the standard employment relationship and on continuous careers. This means that the actual developments are not following the demands for 'flexicurity' but are going in the opposite direction weakening the social protection for flexible labour and, in particular, for women.

European citizens are confronted with rising levels of insecurity. Yet, in the 'Eurospeak' of the political debates this does not figure very prominently. Here, more often than not conflicting goals are presented as if they can be reached simultaneously while the conflicts and contradictions are hardly discussed at all. To establish trust policy debates should more closely reflect the experiences workers and citizens make in their everyday life.

In the debate, the need for more labour market flexibility is taken for granted. But are the flexibility needs of companies and their relationship with employment issues well understood? Flexible labour is clearly not the only means to reach higher levels of company flexibility. And where flexibility of companies relies on flexible labour, flexibility is not impeded in principle by so-called rigidities of the labour market. Rather, overtime bonuses, severance pay, notice periods etc usually make flexibility strategies costly for employers. This, in turn, means that flexibility is to a large extent a question of distribution. With the developments of wages and profits being back on the policy agenda, also the 'flexicurity' debate might need to point more clearly at the distribution aspects involved.

Among the conflicting goals that are often presented as harmonious flexibility for companies and flexibility for workers figure prominently in the debate. In reality, many companies' flexibility strategies make it more and more difficult for workers to reach a work-life-balance. Shorter working hours would make it much easier to reconcile employers' and workers' needs. This is why working time experts suggested a new working time standard of 30 hours per week, for example, for both men and women with appropriate variations during the life cycle. Reducing working hours and introducing a life cycle perspective seems necessary also in view of the widespread intensification of work and the policy aim to keep elderly workers longer in employment.