Knowledge, Work and Subject in Informational Capitalism

Rudi Schmiede
Technische Universität Darmstadt, Institut für Soziologie
schmiede@ifs.tu-darmstadt.de
http://www.ifs.tu-darmstadt.de/85/

Abstract. With the development of informational capitalism and the network society, globalization and informatization play an increasingly crucial role for understanding technology and society. Informatization describes a qualitative leap in technology development which opens up new dimensions of productivity by information modelling on the one hand, but which demands new forms of knowledge of information workers on the other hand. Work is becoming more flexible, but also more precarious and more polarized socially. These tendencies create a contradictory situation for the subject: formalization and new scopes of autonomy exist side by side. This constellation allows for new approaches to the social shaping of technologies. But they presuppose a fundamental change in attitude by both, system developers and social scientists.

Keywords: Information Society; informational capitalism; informatization; network society; flexible work; digital divide; knowledge; shaping technology

1 Introduction

The fact that the informatization of work comprehensively and lastingly influences the latter has meanwhile become general knowledge, apart from the term itself.[i] The fact that this process is an essential feature of a society changing fundamentally is less common, sometimes even contested. The organizers of the conference which was the origin of this paper[ii], even when formulating their headline, started out from their definite conviction that this internal structural connection exists and is highly significant for an appropriate way of understanding today's society and its tendencies of development. It is expressed by the concept of 'informational capitalism', as coined by Manuel Castells, of informatized capitalism, and of the network society [Castells 2001] whose differentia specifica will thus be sketched in the first paragraph (2). Together with an extended qualitative way of understanding the process of informatization as creating a redoubled world of the 'second nature',

which will be the subject of the then following paragraph (3), a theoretical framework is thus offered, within which many of the loose ends presented in this debate may be tied together. The current social change is not only connected to a clear quantitative extension of informational work but even more perceptible are its qualitative changes which can be observed with work itself, with the ways in which it is organized, and on the social level as a tendency towards 'social digital divide' (4). However, informatization is not a linear tendency but contradictory in itself: it needs extended subjective ingredients and interpretations which in each case newly define themselves to generate knowledge from it and thus make it useful for a purposeful practice; the fact that the term 'information society' is gradually replaced by 'knowledge society' is an indication of the increasing awareness of this shift. Information and knowledge, knowledge and not-knowing form an internal unity (5). From this tension between information and knowledge, between formalization and subjectivity there finally result leeways for the subject and thus leeways for the shaping of technology and organization. Their perspectives will be discussed in the final paragraph (6).

2 Informational Capitalism and Network Society

The process of informatizing and the diagnosis of a fundamental social change were most explicitly and most extensively related to each other by Manuel Castells in his theory of 'informational capitalism' and the rise of the 'network society' which is connected to it. However, he is not at all the only author to see a close connection between the development and spread of IC-technologies and social changes, i. e. parallel developments in the fields of economy, technology, society, and politics; the formation of concepts like 'digital capitalism', 'knowledge capitalism', or 'high-tech capitalism' are indications of this connection.[iii] The central ideas of these analyses, the emphasis being on Castells´ theory, are as follows: with the world economic crisis of the mid-70ies of the 20th century, which only at first sight was an 'oil crisis', the long age of mass production highly based on the division of labour and standardization – which was marked by its Taylorist and Fordist technological-organizational basis as well as by the enduring Keynesian-based state intervention into the economy – reached the end of its development possibilities. What are the new aspects that justify speaking of a break of ages?

Two answers – not at all belonging to each other intentionally but practically and in respect of their consequences complementary – to this crises have developed: globalization and informatization of economy and society. Even if or just because *globalization* is a common catchphrase these days, it is worth the effort to name its most important dimensions. Since the end of the 70ies we have been able to observe a clearly intensified competition on the worldwide markets and as a result also on the national goods and financial markets. At the same time the latter have changed their structure: worldwide differentiated and specialized sub-markets have developed and pushed through; they are the arena for increased competition. Trans-national companies have become decisive actors in many of these markets. Although the national states are still the dominating political organizational form of societies

[Bielefeld, 2003], nevertheless the national state erodes particularly in the area of economic policies, national economies find themselves being increasingly bound in trans-national goods, financial and labour markets. Clear neo-liberal tendencies of de-regulation increase the influence of economy at all levels, in many cases they make social and political action a subject of their hegemony.[iv] Not surprisingly, these processes come along nationally and internationally with social differentiation and polarization, i. e. a renewed increase of social inequality.

Apart from this external dimension which is directed towards the national and international markets, there is a second, internal, and equally important effect of globalization which is directed at companies and organizations. Appropriate to the external hegemony of economy there is an internal and new direct influence of economy which is perceived in many ways. The first clearly visible and publicly perceived step of this change was the spread of models of 'lean production' and 'lean administration' following the Japanese example after the end of the 80ies in Germany (in the USA and Great Britain some years earlier). This means on the one hand de-centralizing moments of labour and company organization: the move of leeways of flexibility, but also the shifting of responsibility towards the single labourer, the team, or the department. Its equivalence is the thinning-out of the middle levels of hierarchy, by help of which more direct information and decision chains are created. Already a part of this system was also the direct and constant comparison to parallel processes, to increase transparency and stimulate competition for the best ways and the least amount of time and costs; continuous quality control has since become a common practice of a whole lot of companies.[v] These elements are completed by the purposeful re-organization of logistic chains being orientated towards the optimization of the processes of the dominating companies, in the words of a popular manager-slogan: 'concentrating on core competencies' provided starting points and examples of the general re-organization of economy. Along this guideline both a new international division of labour with strongly differentiated, specialized, and flexible markets and new forms of the division of labour in product markets and in branches in the form of company networks, network or virtual companies, i. e. 'horizontal' organizations (Castells), emerged.

However, these organizational aspects of de-centralization should not be taken for the whole: regarding the dimensions of capital concentration, financial control, or the economic and political power of the companies, centralization goes on incessantly. This is not only true for producing or services companies but even more for purely financial service corporations. In a certain sense, the finance-capitalist origins of globalization catch up again with the sphere of real production and services and structure them: the orientation towards the short-term goals of 'shareholder value' makes corporations, even the big and biggest ones, newly dependent upon global capital flows. Financial and finance policy centralization together with organizational de-centralization are typical for globalized companies; the company's limits are of virtual, financial nature, they are not any more the traditional factory walls or fences.

Network structures do not only play an increasing role in and among companies but they also occur throughout other parts of society. As the appropriate literature shows, they are found just as well in communal ways of co-existence, in the structures of communication and decision in the political field, and in the informal

ways of cooperation in all parts of society. They seem to be a general way of organizing social relationships, appropriate to highly changeable and complex structures. Networks are not – just as it was the case with the traditional bureaucratic-hierarchical kinds of companies of the past – per se the adequate way of organizing capitalist business. In our opinion, the fact that they more and more push through and so to speak become a paradigm of modern organizing is due to network structures allowing for the immediacy of economic influences on the one hand but also the uncertainty of individual action on the other hand, as necessary for a way of doing business increasingly orientated not any more towards execution but towards the result. According to the number and strength of their knots and to increasing or decreasing effects, networks open up several possibilities to reach a goal or another place. Under today's conditions of increased economic and social complexity and appropriate increases in insecurity they allow for the extent of individuality, also of individual responsibility, which make the most extensive inclusion of the individual into added-value chains possible. The network-shaped economy – as Castells impressingly shows by the case of the amalgamization of traditional social and family network-structures and most modern capitalism in South East Asia – also results in forms of a network society.

To avoid misunderstandings: currently the empirically found organizational shape of production and service organizations is a colourful mixture of old and new models. Forms of flexible project organization or even of virtual companies are contrasted by attempts at re-Taylorizing and enduring large flow technologies. Nevertheless, the sketched tendency of finer granulating and growing importance of market-economic structures is obvious. Also the still existing companies producing by large-scale technologies find themselves being under the pressure of developing towards technological and organizational de-centralization to be able to survive as financially highly centralized company-units. Today's information and communication technologies, which provide the technological basis for international capitalism, play a key-role for these diverging development tendencies of value and production economy.

3 The Informatization of Economy and Society

Informatization – the second answer to the world economic crisis of the Seventies and the end of the age of Taylorist and Fordist mass production as indicated by it – does not only and not primarily mean the ubiquitous spread of digital information and communication technologies but first of all their qualitative increase of significance. But despite the popularization of the concept of information induced by the mass spread of computers we must not deceive ourselves about the fact that neither information nor information technology are new for the predominant way of production; they have accompanied capitalism right from its beginnings. The first manifestation of the abstracting information, which doubles reality in the form of a model, is double-entry bookkeeping which, as it is well-known, was developed in Northern Italy in the 13th and 14th centuries, that is during the first, short peak of a commercial capitalism which also came up against the limiting factors of modern

production. The different systems of bookkeeping; card systems which have gained increased significance since the spread of the piece-work system after the end of the 19th century; the collecting of information in personnel accounting and calculation offices; the development of filing systems, record systems, index card-techniques, registries etc.; finally the technologies for copying, spread and evaluation of information like typewriters, stencil and repro processes, pneumatic dispatch systems, telegraph, telex, calculators, Hollerith machines which preceded the computer, make clear that the history of the capitalist way of production was at the same time a history of the increasing significance of information and communication and the development of the appropriate technologies.[vi]

Thus, what is new about the digital information and communication technologies? What gives us the right to speak of a new kind of informatization, which is the technological basis of informational capitalism? It is three fundamental, technological features of IC-technologies, resulting in several consequences. First, computer technology is different from all preceding technologies – which all were auxiliaries for solving particular tasks, i. e. were special machines – due to the fact that the computer is a 'universal machine' [Krämer, 1988; Krämer, 1989, 38-52; Heintz, 1993] which – as being programme-controlled – may be used for any task. As it is the objectification of a general, symbolic machine, it can also work on the universe of symbolic models and worlds. Although this machine needs an input from the real world and must give back its output to the real world to fulfil its purpose within the context of the system as a whole, within the redoubled world of working on and processing symbols it is free of these limits and open to any step of work.

This leads us to the second fundamental feature of IC-technologies: they are not anymore primarily a tool for supporting solutions located outside of their tasks but they are a part of a whole process, of a system. On the one hand, the 'autonomization of the machine system' [Holling and Kempin, 1989, 139 sq.] includes enormous dangers of subjecting the individual to a seemingly inevitable technological process and is perceived in the contexts of work and everyday life as deeply influential omni-presence of the IC-technologies. On the other hand, however – and this was and still is the condition for its pushing through and its central role in current capitalism – due to just this nature it offers a gigantic new potential of productivity: in the redoubled second world of information a growing number of material processes can be modelled, calculated, simulated by all its variants, calculated regarding their mechanic, chemical, biological, or electronic effects. Increasing shares of the changing and designing work of the real world are shifted towards the world of information and are carried out there in a virtual way. To have it more theoretically: innovations are generated and again used for innovations in a cumulative feedback context. The IC-technologies have become reflexive: facts and contexts are understood to be informational processes right from the beginning and are formulated and modelled appropriately; they are the starting point of processes of re-organization and technologization. What is new is the 'technology-based, media-mediated ability of changing knowledge'. The complete technologization of knowledge in its informational form is the step from conventional mechanization towards informatization [Spinner, 1998, 63, 75)]. The strategies of productivity competition, which still is the economic basis of capitalist production, have shifted from material production, which more and more is becoming a dependent variable,

towards this world of virtual product development [Anderl, 2006] and product planning where at the moment 'things are happening'.

The third specifically new feature of the IC-technologies is their effect on space and time. By way of informatization, information and communication networks become possible which are able to operate globally and in real time. This became visible for the first time at the end of the 70ies by the financial and capital markets working worldwide 'on the spot'; and if some years ago the then VW boss Piech, while referring to Charles V.´s famous sentence said that for his trust the sun went never down, this makes clear how important just-in-time production is also for this producing company. Globalized socio-technological systems – this way the tendency may be described in summary – have been created which generate, communicate, and process information, and they do it in 'real time'. It is not only that in principle they make worldwide access to any content possible, they are also the technological basis of the IC-technologies becoming reflexive, as mentioned for the second point. If in the 80ies and the early 90ies of the 20th century the spread of network technologies was still limited by proprietary formats, by the client-server principle, as well as by the command line-form of the Internet, the standardized graphic access (in the World Wide Web) brought the breakthrough of mass and universalized use of Internet technologies. Currently, by service-based system architectures a qualitatively new step is indicated where that might become true what was some years ago predicted by Tim Berners-Lee, the inventor of the web-standard: that the net itself will become the computer, today's (workplace-) computer only being the front-end [Schmiede et al., 2006, ch. 3.6; Silberberger, 2003].

These three new specific features of the digital IC-technologies – the creation of an in principle unlimited virtual world of information by help of the universal machine, the computer; the IC-technologies becoming reflexive within this space of the autonomization of the machine system; the spread of globalized real-time information and communication networks with increasing functionalities – are what makes the structural changes of economy and society, of markets and organizations, as sketched in the first paragraph, possible. This internal coherence can be made even clearer by reminding to the fact that the just mentioned steps of development were preceded by the age of mainframe technologies with their proprietary and closed networks; for large-scale one-purpose applications like e. g. early stock exchange-information systems they were sufficient for some time. Thus, the argument is that the steps of globalization and steps of the development of IC-technologies can be closely paralleled and that this way their mutual dependence can be made visible.[vii]

Castells in his analysis of 'informational capitalism' not only emphasized the role of network-shaped information technologies but also the spread of network-based forms of organization and cooperation, which again were a mighty impulse for the development, and spread of the appropriate technologies. Indeed, in the course of the last quarter of a century various kinds of networks, most of all in the field of business, have developed, which shall here be shortly summarized by an overview. Most clearly visible are *inter-organizational* networks. They are known as information-processing combines from the world of financial services, where usually they come along with the development of 'flexible bureaucracies'.[viii] For some time, these networks have been influential also in the form of production combines, as

they have been spreading among car industries in the context of 'lean production'; meanwhile, they operate on a global level and have differentiated to be continent-wide material production networks which to a great extent cooperate by way of information technology. Similar structures can be found for electronics production in various fields.[ix] Common guideline for these kinds of networks is the 're-organization of value chains', i. e. the rationalizing re-adjustment of the complete value chain by way of specialising and adjusting their material and digital links.[x] *Intra-organizational* networks closely follow the tendencies of re-organization as already mentioned under the headword of 'lean production': the spread of groupwork, teamwork, and projectwork; the levelling of organization by way of flattening hierarchies, something, however, which often comes along with eroding the middle ranks; organizational de-centralization which creates units to be as clearly identifiable, but also controllable, as possible; and the creation of graded forms of self-responsibility going towards the 'company within the company' and which find expression e. g. by profit centres, competitive relations between parts of the same company and other companies, are important forms of this network level. In the course of intensified economic control, the partition walls and structures have rather been influenced financially than organizationally.

As already mentioned, both types – inter- and intra-organizational networks – do not only serve for adjusting to more flexible and globalized market demands. At the same time they are an important way of dealing with the increased insecurities and uncertainties which are connected to these, of at least transforming them into calculable risks. Both in the material and in the immaterial sense they serve for mobilizing resources as well as for securing their availability and their access. That what at first was propagated as 'business process re-engineering' at the beginning of the 90ies has after the middle of the 90ies most of all concentrated on mobilizing the stocks of experience and knowledge within organizations and networks. Under the flag of 'knowledge management' a whole lot of approaches have been created to support the exchange of knowledge of all kinds by way of intensifying network relations.[xi] This, too, aims at orientating these professional activities towards the value chain; following the older concept of 'human capital' it is now about mobilising and exploiting the 'intellectual' capital of the company [Edvinsson and Malone, 1997]. However, the practical experience with this approach is rather sobering. It is not only that the technological basis of electronically supporting these processes is not at all fully matured; additionally, in the course of many experiments it soon turned out that networks are highly complex social structures and that dealing with knowledge is strongly interwoven with them. Knowledge processes are closely connected to motivation, interest, and power structures. Every employee is conscious – even if he does not know the slogan which is ascribed to Francis Bacon – of the fact that knowledge is power; whether one is ready to give up on this instrument of power, is – apart from hierarchically exerted pressure – dependent on contradictious processes like trust, acceptance, and gratifications, i. e. on the shape of the networks and their embeddedness in that what – often euphemistically – is called corporate culture.

These experiences and insights draw the attention to a third form of networks which come from practical work and which take the inter-personal dimension more strongly into account, and which I thus like to call *micro-structural* networks. Their

discussion – most of all in US literature and research – also comes from the context of knowledge processes, i. e. from learning and acquiring knowledge in and by way of practice; accordingly, they are mostly called 'communities of practice' but sometimes also communities of collaboration or communication.[xii] Here it is mostly about observing and analysing the transfer of experience and knowledge and – the more recently the more often – also the appropriate use of IC-technologies for real cooperation and communication. The background of this increased and still increasing attention is definitely to be seen in the fact that with the spread of network-shaped cooperation structures, cooperation and communication – also beyond the immediate work context – has become economically, organizationally, and also technologically more important. Furthermore, for the practice of cooperation the use of digital technologies plays a crucial infra-structural role. The communities of practice are defined by a common domain, by being member of a social community, and by being tied together by a common practical context of work.[xiii] Until now, however, only a limited number of investigations of work processes has been presented; many investigations refer to local communities. But they can be supplemented by studies from a workfield which has up to now been rather information technologically influenced and has been supported by only a few psychologists, i. e. the research on 'Computer Supported Cooperative Work' (CSCW), as well as by a few other investigations.[xiv] Altogether, these connections of practical cooperation, kinds of networks, use of IC-technologies, knowledge transfer, and work are a little researched field, i. e. there is a distinctive research deficit. If one wants to develop an empirically rich concept of informatized work, one will have to accept the laborious investigation of this sub-levels of work and cooperation.

4 Flexibilization of Work and Forms of Digital Divide

What becomes most clearly visible with the structural change of work is not the concrete operational *working conditions* which have already been mentioned in the context of the dimension of work organization but much more the changes of the *conditions of employment* which become manifested by the ways of deployment of work and in the labour markets but which have also a subjective biographical dimension. This structural change is commonly described by the rather vague expression of 'flexibilization' of work, and already for about 20 years there has been wide agreement among German industrial sociology and labour market research on the fact that an erosion of the 'normal' or 'regular employment condition' (i. e. regulated, fulltime, qualification-adequate, and long-term work which traditionally was most of all typical for men's labour) is to be observed. Both tendencies are expressed by different dimensions of labour: *working times* have become clearly more variable during the last decades. This does not only address the successive extension of part-time work to meanwhile almost one fifth of all gainfully employed as coming along with increasing employment of women; working time is varied according to order situation, season, or time of day, and in the biographical dimension continuity decreases while particularly at the beginning and the end of working life work is increasingly unstable. The average *duration of employment* at

one company decreases. Although the employment situation in Germany is still miles away from the hire-and-fire practices in the Anglo-Saxon world, nevertheless in the environment of mass unemployment *dismissals*, *redundancies*, and *transfers to a different position* have become much easier and thus happen much more often. Meanwhile, *fixed-term* employment is not the exception but the rule for the first years of gainful employment. The continuous extension of *temporary work* and *subcontracted employment* also serves for shifting the risk beyond the walls of the company. Finally, the frequent change of the *professional status* of gainfully employed people counts among this, who partly voluntarily but to a great extent also are forced to change between dependent employment, self-employment, and the manifold forms of partial or falsely designated self-employment between these two poles.[xv]

The decreasing biographical continuity of gainful employment is not without consequences for the working people's *way of life*, for the *way they see themselves*, and for their *self-confidence*. Inevitably, long-term biographical plans are replaced by short-term or at the most mid-term perspectives. The employee is at the mercy of market powers he/she is not able to control, he/she becomes a haunted person – an effect which Richard Sennett by way of a number of case studies describes most impressively as a 'drift' but which he also makes clear to be a 'corrosion of character', as the original title of his book calls it, due to their potentially personality-affecting consequences [Sennett, 2000]. The social pathology of flexibilized and informatized work is still an unwritten chapter of labour research, something which is surely connected to the fact that its manifestations are made a taboo subject: the estimations according to which about one third of all employees in Germany are the victims of manifest mobbing, mostly by superiors, or those saying that work-related depressions have meanwhile reached the size of some million cases, are far from being popular. Nevertheless they are part of the overall picture of the structural change of work in the age of informatization.[xvi]

Flexibilization of work has also lastingly changed the *structures of the labour market*. Not only the continuity of employment has drastically decreased, at the same time also the internal labour markets, which were typical for many industries and for great parts of the 20th century and which offered a high degree of employment security and often even well-ordered career conditions for the permanent staff, have eroded to a large extent. Instead, fluctuating forms of employment – named by the appropriate term of 'contingent work force' in the US – are gaining increased significance. As the already quoted David Knoke has it, employment conditions which were to a large extent law-established and organized by collective contracts have been replaced by a 'new employment contract' which are characterized by the increased significance of external labour markets or external employees for usually only mid-term recruiting, but most of all by 'high-performance workplace practices' inside the company. Among the latter there count an intensified economy of time by way of just-in-time structures, inclusion into groupwork, teamwork, and project work, performance-orientated short-term skills training, changing the workplace between inside and outside, the omni-present information technologies, total quality management, and performance-dependent ways of payment.

These changes of employment and of labour markets come along – at least for the time being – with a clear *shift of power* from waged work towards capital. The

flexibilization of employment conditions, which as a matter of fact comes along with increased exchangeability of workers (increase of contingent work force), weakens the individual's position towards the company; furthermore, he/she becomes more susceptible to reprisals of open or hidden nature. The limits of reasonableness at the workplace are extended. Thus, for many years we have been observing a continuous decrease of the readiness to be organised in trade unions.[xvii] For the time being, the trade unions have not succeeded with offering a perspective of representation and organization which is considered attractive by the employees of modern industrial branches and particularly of the IT branches. Instead, particularly in the IT-sector almost 'trade union-free zones' come into existence. To further trace back these changes it is reasonable to go back once again to the already partly discussed changes of working conditions.

Particularly in the informatized, high-technology fields of societal work the questions of gain, of security, of adjusting and further developing one's own *qualification* has more and more become the focus of the workers´ interests. It has clearly gained a dominating position towards the traditional goals of higher wages and shorter worktime. Why? Because the possibility and the perspectives of employment (the much quoted 'employability'), on which all the other factors are dependent, are closely connected to qualification and its appropriateness to the permanently newly arising tasks. With the rapid change of technologies in the course of increasing informatization the half-life of the decline of the respectively valid knowledge and experience has dramatically decreased. However, for the time being no social pattern of '*life-long learning*' as it is demanded by many has developed.

Despite the everywhere observed informatization of work, experience-based knowledge coming along with work and the use of technologies still plays a crucial role. Informatization and need for subjectivity are not alternatives but complementary processes. This is true both for the restricted field of professional knowledge and for the wider field of work, organization, and social experience. This combination of increased, continually changing specialized knowledge on the one hand and process- and dimension-related experience on the other hand are subsumed under the concept of*competencies*. The already mentioned crucial significance of qualification together with acquiring and securing broad competencies becomes clear by Chris Benner´s results when investigating information work in Silicon Valley: particularly in the field of 'high-tech qualifications', networks ('occupational communities') play an important role for the exchange of knowledge. They have resulted in the creation of guild-like or profession-orientated employees' organizations (called 'guilds' or 'new occupation-based associations' by Benner). In some cases also trade unions have opened up towards these specific interests of 'information workers' and have thus achieved organizational success in this otherwise completely union-free field ('next generation unionism').[xviii]

Altogether, when looking at the changes of work in informatized capitalism we come to the conclusion that the forms of *social inequality* connected to it have clearly increased, a development which is often called 'digital divide' or more precisely 'social digital divide'. At least for the USA, *tendencies of splitting* in the employment structure have been named which are closely connected to informatization: at the upper end of the qualification hierarchy there appeared the 'symbol analysts' (Reich) or 'knowledge workers' (Burton-Jones) or the information

workers of the so called new economy.[xix] At the lower end, an obvious class of to a great extent degraded mass workers, most of all in the services sector (retail trade; personnel for cleaning, housework, and security), has developed which so to speak must provide for the material working conditions of the information workers. Even if by the crisis of the 'new economy' in 2001-2004 a significant part of the information employees were taken back from temporarily dominating special conditions regarding their chances of career and income to the normality of capitalist labour markets, both groups are drifting apart; both are growing; on the other hand, there seem to be tendencies of erosion for the middle-class between them. Manuel Castells, however, points out to the fact that these tendencies of social polarization and splitting have not primarily originated in their qualifications drifting away from each other but most of all are observed for employment conditions. We thus observe an overlap of several tendencies of development: on the hand, the general, average level of education and qualification is rising. At the same time, however, the fringes of the qualification spectre seem to drift apart, which results in a suction for medium qualifications. But these polarization tendencies are thirdly much more distinctive for employment conditions and job chances. Finally, they are fourthly eclipsed by a clear spread of income levels.

5 Knowledge and Information

The already mentioned contradictory character of the informatization processes is closely connected to the tension between knowledge and information which is thus worth discussing in more detail, as there can be found decisive conditions for the constraints, but also for the leeways the working subjects are confronted with. *Information* is only a raw material for work, knowledge and organizational processes: abstracted, shaped, and thus formalized content. Information must not only, like the data of technical communications models, be technically understood by transmitter and receiver but the contents transported by them must also be syntactically understandable. Nevertheless, the information stays to be free from the context: a newspaper report may be completely understandable concerning its words and their meaning for me as a reader, but due to lacking context its meaning may be completely incomprehensible at the same time. To have it more generally: information is always positively determined and must always be so, as only clearly defined objects and relations – also if they are only be clearly defined statistically – can be technically modelled. This, however, makes it at the same time restricted in principle, for positive determination can only be reached by disregarding variety, i. e. by abstraction. Thus, information always includes only designed and formalized excerpts of reality, i. e. those cleared of disturbing conditions and complexities.[xx]

Knowledge, on the other hand, in principle stays tied to the knowing subject, for it is always context-related, dependent on interpretation and understanding. It is – as Michael Polanyi has it – always 'personal knowledge'. There are no stocks of knowledge which are not communicated by the thinking subject's head; without being worked on by it they stay dead material. Dealing with those stocks of information and knowledge as being outside the individual, i. e. changing

information into knowledge and connecting knowledge to practice, stays to be an intellectual performance which cannot be taken away from the individual subject. As all previous experience shows, it can only to a very limited extent be replaced by intelligent technological systems, i. e. artificial intelligence. Like in the case of other technologies this conversion of information into knowledge may be supported by means of production (and here there is for the present and in the foreseeable future a significant shaping potential for the sciences as well as for business and society) but it can never or only partly be substituted. Thus, knowledge is 'information critique' (Gamm) in a certain sense. Furthermore, it is dialectically related to not-knowing: due to the increasing complexity of society and its sub-systems (in the system-theoretical diction) or rather due to the insecurity of all social and individual living conditions, growing together with globalization and the thorough-going capitalization of economy and society (from the critical-theoretical point of view), not-knowing is increasing despite all efforts of increasing knowledge. Knowledge – to pointedly follow Willke – increasingly becomes knowing about ways of how to deal with not-knowing; knowledge and not-knowing, as his diagnosis of today's 'knowledge crisis' says, are complementary manifestations of the same social development.

Thus, one cannot simply, as done for naïve concepts of knowledge management, transform implicit knowledge to a great extent into explicit knowledge but must provide space for processes which do make it possible for tacit knowledge to come into effect. How is that to be understood? Knowledge is defined only by negation: I am able to know what I do not know. In contrast, a positive definition of that what is known is only apparently possible, as it becomes again and again clear for everyone confronted with the comparably simple task of marking at school or university. For, first, knowledge includes experience of all kind –memories of the body, emotional experience, experience of relationships, estimating people, experience of practically dealing with objects and organizations etc. Secondly, knowledge, as the linguistic cognation shows[xxi], is tied to certainty, i. e. to subjective interpretations and convictions. Thus, in this context it becomes, thirdly, visible that knowledge – as it is always about the question for truth – cannot be separated from reason; reason, as we know after Kant and Hegel, presupposes a social individual, i. e. the constantly socially interacting subject. This makes, fourthly, clear that knowledge is closely connected to processes of the appreciation of knowledge contents themselves, but also of the person (as the English term 'acknowledgement' signifies), i. e. to genuinely social processes. Finally, knowledge is in an even more comprehensive way socially and politically embedded: the slogan 'Knowledge is Power', ascribed to Francis Bacon, is again and again confirmed by everyday knowledge processes. Thus, knowledge is – summarized – not a positively stateable matter of fact but a constant process, infinite effort, fight against not-knowing, fundamentally subjective but always also objectively communicated probation in a fundamentally undetermined world.

Beyond this, new contents and kinds of knowledge have developed which have been made possible at all only by the informatization of knowledge: in the *quantitative dimension,* by informatization facts, relations, and structures become depictable and calculable which before could not be dealt with at all due to the amounts of information. The terabytes of information which are produced daily by

the great international geologic and geographic projects; the modelling and calculation of the characteristics of materials and free forms by help of systems of infinite equations in the field of mechanics; the modelling and visualizing of energetic processes in the fields of thermodynamics or construction physics; recognizing patterns and the numerical comparison of genetic sequences in the field of bio-genetics; modelling and increasingly small-scale calculation of weather development by help of a variety of parameters in the field of meteorology; but also the extensive statistical calculation of cluster structures in the sociological analysis of social structures which has become a new basis for the formation of concepts and terms – all these are examples which make clear the enormous potential of informatized procedures. They lead to the procedures and techniques of *simulation*, used from technological development and design as far as to risk calculation, from the analysis of chemical compounds in respect of their characteristics as far as to traffic planning, from water management in settlements as far as to critical decisions of companies. It must be asked how far these kinds of quantitative insight and decisions based on this, i. e. the manifestations of 'informatized knowledge' – for which Daniel Bell coined the term of 'intellectual technology' more than 30 years ago – have today become the dominating kind of thinking and knowledge among the sciences.[xxii]

Inevitably, *standardization processes and the creation of norms* go along with informatization at the same time, which mostly also include the pushing through of the English or American language as a standard. On the one hand, standards make the general access to resources possible, but on the other hand regarding content matter they mean a restriction of variety. Maybe the first aspect becomes most visible with the massive processes of de-facto standardization of technological objects in the field of construction, which makes the technological integration of development networks possible at all; the effects of the second aspect become visible by the standardization of contents of naturally complex facts like in the case of diseases by the ICD 10 (International Classification of Diseases), which meanwhile has lead to a worldwide accepted and practically (e. g. in the form of acceptance by health insurances) highly momentous canon of accepted diseases or syndromes (with the effect that non-conventional symptoms are excluded by definition or at least can only indirectly be described and defined). The effect of informatization as re-structuring the world by standardization cannot at all be over-estimated.

6 Subject and Leeways for Shaping Work, Organization and Technology

Here, today's information and communication technologies, which to a great extent aim at mobilizing, making accessible, and keeping knowledge stocks, become visible as part and arena of a new kind of the dialectic of individual and society. The *increased role of knowledge* in society in general and for production and administrative processes in particular – this should be made clear – comes along with the *more important role of the subject* for these processes. At the same time, however, this increased importance of subjectivity in the social reproduction process is accompanied by an intensification of the *fundamental contradictoriness* in which

the subject finds itself in modern society: the extended demands on subjectivity are contrasted by the massive tendencies of formalization and objectification of the contexts in the spheres of technology, organization, and economy. The individual must continuously deal with the relationship of freedom and force in his/her concrete life situation. Again and again one's own reflection is limited by social norms which shape our interpretations and thoughts. Subjective creativity is confronted with the previous social and technical imprint of the offer and the structuring of information which contradict and limit the desire for knowledge. The freedom of market – in the double sense of freedom in the market and of being free from the market – is constantly thwarted by the universal dependence on the market. Now, by this dichotomy the conditions of the origin of the individual at the beginning of the bourgeois age is named. Are we thus at the beginning of a renewed rise of the chances for the realization of individuality?

The *new immediacy of the economy*, as addressed in the description of economic and organizational changes by which each individual is confronted particularly in the context of informatized work seems to indicate a comparable socio-structural constellation of the freedom of market and market-dependence; however, the detailed description of this changed status as a 'labour power-entrepreneur' [Voß and Pongratz, 1998, 131-158] makes clear also the limitation of this analogy. Today's freedom of market is essentially restricted to giving shape to one's own position as an employee. Subjectivity is demanded and at the same time restricted. However, it can hardly be doubted that these changes of the subject's status in the informatized society – the erosion of community, the tendencies of disintegration of society, and the tendencies of dissolving solidarity – reach far into personality. Subjectivity itself changes. Just like Don Quichotte at the threshold of modern society fought in vain against the bats of the new windmills, it seems, as Richard Sennet describes it very illustratively, that who trades his own labour power most successfully in a business-like manner rather pushes forward than impedes the disintegration of community and the concrete forms of socialization.

On the other hand, with today's changes of organization and work subjectivity is just demanded. Its mobilization and practice is so to speak a condition of productivity, i. e. economic and social necessity. For dealing with digital information and with informatized knowledge, which is communicated in a highly technological way, needs a broad specialist and social background of experience and embedding into social, practice-orientated networks which meanwhile have become name-giving for modern society. According to the here suggested interpretation, the informatization of work and the parallel increasing significance of knowledge work play a key role: knowledge processes are essentially not one-dimensional but contradictory; they contain a potential of contradiction and conflict, the more as in reality they often come along with different interests. They will not be able to invalidate the tendency towards abstract socialization. But they offer a starting point for preventing individuals from becoming pure function bearers of the technologically and organizationally mediated economy and that what is possible within it.

The support and at the same time the exploitation of the employee's subjectivity by modern management concepts, however, indicate a danger by which formation, maintenance, and further development of individuality are threatened due to the

close determination of the purposes of subjective efforts. The pushing through of the not peripheral but subordinated, adapted, integrated individual, for which in the face of the superior forces and rationalities of the system there is only mimetic adaptation, cannot be ruled out. However, we must assume that such a development, as it is accompanied by severe experiences of suffering due to the loss of one's own identity, could not at all happen without contradictions. Particularly under the aspect of further functionality and of extending the information and communication technology the *fight for the subject* has already started today. For their operation the current information and communication technologies demand the more the active subject the more they serve for dealing with knowledge. Thus, far-reaching questions of our society's future will be decided by the direction which the development of information, knowledge, and society will take and by the question of how to handle the information and communication technologies on which they are based.

Under these conditions, what can be meant by *leeways for shaping* in the fields of technology, organization, and work? To a great extent, the organization of today's information and communication technologies is still technology-focused. Computer specialists, system developers, and programmers in their great majority understand themselves as technology-designing engineers or handicraft enthusiasts whose guideline – according to the classical understanding of the engineer – is the elegant realization and optimization of given technological goals or functionalities. Awareness of the fact that technological design is at the same time a formation of social matters – pointedly formulated: that the development of information systems is applied sociology – is either non-existent at all, or this connection is considered a problem and task outside the field of development. This orientation is the subject of immanent, technologically and economically arguing criticism as well as a critique formulated from the outside, referring to organization and work.

The immanent critique states that by restricting its horizon in this way systems' development sets up artificial but nevertheless hardly surmountable hurdles for its own work. The assumptions as usual for development projects, that clients knew exactly what they wanted and that they and the users were the same group, are both not in accordance to reality and are based on neglecting the fundamental social facts of organizations. Accordingly, often there result information systems which show unnecessary complexity and on the other hand lack important functionalities, which furthermore do not meet expectations and are designed in a not very user-friendly way. The strongest confirmation of this criticism is in the still extremely poor success record of software projects themselves: the estimations – according to which about half of the projects fail without any result, on the other hand about one tenth reaches their goals with the available resources of time and money, and the rest is finished with significant additional expenditure and/or reduced functionality – have hardly changed during the past 20 years.[xxiii] In other fields – just think of e. g. a similar project record in flight technology or in the generation of energy – such results would simply be considered disastrous and would soon be deprived of their legitimacy or even their existence. The alternative of an *anthropocentric development of technology* can only be imagined on the basis of an extended, interdisciplinary approach in regard of content matters and the persons involved.

The external critique holds that the thus created information systems follow logics alien to the organizations and to work and thus do not appropriately support

them. The again and again observed needs of adjusting organizational processes and work subjects and routine to the demands of information technology is the empirical background of this criticism. This is sure to become clear by the almost proverbially permanent complaints by the great majority of users and affected persons about the jungle-like enigmatic nature of SAP/R3 and the thus not accessible or actually not existent functionalities. The structuring imprint of the organizational realities by IT-technology becomes tangible here. These thoughts imply as a strong support for the arguments in favour of *open and modular system architectures*. In their nucleus they state that only by decentralized system structures also decentralized organization and work forms can be appropriately depicted and supported [Schmiede, 2005]. The alternative to the above mentioned danger of mimetic adaptation of individuals to formalized social processes and pressure is the mimetic adaptation or 'cuddling up' of a small-scale IT-technology, which nevertheless stays to be able to interact by a reasonable modularization, standardized interfaces, and prudent semantic relationships, to the actual working processes and organizational units. Here there is a wide and significant field for further technological development. In my opinion, the increasing role of knowledge processes will exert increasing pressure towards this direction, as knowledge work is usually tied to individual activities and small units.

However, the necessity of facing the demands of interdisciplinary and anthropocentric technology design is also true for the opposite direction. Today, criticism of existent IC-techniques or -technologies is mostly criticism of the effects of technology. Even if in many cases correct in its statements, in principle it is defensive and mostly ineffective because it comes too late. In this sense, struggles against certain information technologies are in most cases nothing but Don Quichotte-like behaviour, for they are confronted by faits accomplis. Potentially effective struggles, fights, and decisions on directions happen in the fields before: by designing the basic structure and the architecture of the information systems. The above used, pointed formulation that the development of information systems was applied sociology is also true for the inversion of arguments: a significant application of sociology is in the development of information systems. Here, social reality is shaped and structured. This is a suggestion which is unusual for humanities and social science scholars and surely is considered strange by most of them. But if one makes clear to oneself that this distinguished reserve is a mirror-image equivalence of the sketched engineer's rationality, i. e. the humanities and sociology variant of shifting a problem away by help of division of labour, one's own obligation to deliver becomes clearer. O*penly facing and getting involved involvement into technology design* will definitely be connected with problems of understanding, frustration, communication difficulties, extended learning processes, and efforts, and it will not produce short-term success; on the long run, however, it promises to approach goals which otherwise would not even come into view.

To have it more generally: where social contradictions become apparent, there usually also leeways for action and shaping reality are created. The radical changes of society coming along with the informatization of work are again and again followed by spaces of 'undeterminedness'. Despite structural affinities there is no automatism, no inevitable relationship of causes between the different social fields; here there are leeways for shaping the future. The condition for influencing,

however, is an attitude (and a culture) of facing realities – both in the theoretical-scientific and in the practically organizing sense. To use the really existing uncertainties as a potential, to draw a potential for one's own certainties in the sense of self-determination is only possible under today's conditions by including organizations and information technologies. It is inevitable to be confronted with powerful competitors or opponents but surprising coalitions are also possible. The social struggles for the access to worldwide digital information incl. medial contents, for those standards as characterizing the future, opening up or closing off chances, for the privatization of software by way of granting patents, for the alternative of open source development, as well as for the future of technological network structures are only some of the fields where currently more or less heavy power struggles are happening. Who wants to shape future technological and social reality will not be able to avoid interfering with them.

References

Anderl, Reiner, 2006: Virtuelle Produktentwicklung in der Automobilindustrie, in: Baukrowitz, Andrea, et al., eds., 2006: *Informatisierung der Arbeit: Perspektiven zur Gestaltung eines gesellschaftlichen Umbruchprozesses*, Berlin: edition sigma (forthcoming)

Baukrowitz, Andrea, 1996: Neue Produktionsmethoden mit alten EDV-Konzepten? Zu den Eigenschaften moderner Informations- und Kommunikationssysteme jenseits des Automatisierungsparadigmas, in: Schmiede, Rudi, ed., 1996: *Virtuelle Arbeitswelten*, Berlin (edition sigma), pp. 49-77

Baukrowitz, Andrea, et al., eds., 2006: *Informatisierung der Arbeit: Perspektiven zur Gestaltung eines gesellschaftlichen Umbruchprozesses*, Berlin: edition sigma (forthcoming)

Benner, Chris, 2002: Work in the New Economy. Flexible Labor Markets in Silicon Valley, Malden/Mass.,

Benner, Chris, 2003: 'Computers in the Wild': Guilds and Next-Generation Unionism in the Information Revolution", in: Aad Blok/Greg Downey, eds.: Uncovering Labour in Information Revolutions, 1750-2000. *International Review of Social History* IRSH 48 (2003), Supplement, pp. 181-204

Bielefeld, Ulrich, 2003: *Nation und Gesellschaft*, Hamburg

Boes, Andreas; Baukrowitz, Andrea, 2002: *Arbeitsbeziehungen in der IT-Industrie - Erosion oder Innovation der Mitbestimmung?*, Berlin

Boltanski, Luc/Chiapello, Ève, 2003: *Der neue Geist des Kapitalismus*, Konstanz

Bradner, E./Gloria Mark, 2002: Why Distance Matters. Effects on Cooperation, Persuasion and Deception, in: *Proceedings of the ACM Conference on CSCW (CSCW '02),* New Orleans, November 16-20, New York, pp. 226-235

Bratton, John, 1992: *Japanization at Work*, London

Burton-Jones, Alan, 1999: *Knowledge Capitalism. Business, Work, and Learning in the New Economy*, Oxford

Castells, Manuel, 2001a: *The Internet Galaxy. Reflections on the Internet, Business and Society, New York*

Castells, Manuel, 2001b: *Der Aufstieg der Netzwerkgesellschaft. Das Informationszeitalter*, Teil 1, Opladen (Engl. Orig. 1996)

Collard, Ron, 1993: *Total Quality. Success Through People*, 2nd ed. London

Degele, Nina, 2000: *Informiertes Wissen. Eine Wissenssoziologie der computerisierten Gesellschaft*, Frankfurt a.M./New York

Dose, Carsten, 2003: 'Flexible Bürokratie. Rationalisierungsprozesse im Privatkundenbereich von Finanzdienstleistern', Diss. TU Darmstadt

Dostal, Werner, 2006: IT-Beschäftigung als Frühindikator neuer Arbeitsformen?, in Baukrowitz, Andrea, et al., eds., 2006: *Informatisierung der Arbeit: Perspektiven zur Gestaltung eines gesellschaftlichen Umbruchprozesses*, Berlin: edition sigma (forthcoming)

Edvinsson, Leif/Malone, Michael S., 1997: *Intellectual Capital. Realizing Your Company's True Value by Finding its Hidden Brainpower*, New York

Ehrenberg, Alain, 2004: *Das erschöpfte Selbst. Depression und Gesellschaft in der Gegenwart, Frankfurt*

Fairchild, Alea M., 2004: *Technological Aspects of Virtual Organizations*. Boston/Dordrecht/London

Faust, Michael/Voskamp, Ulrich/Wittke, Volker, 2004: European Industrial Restructuring in a Global Economy: Fragmentation and Relocation of Value Chains. Paper presented at the International Workshop: European Industrial Restructuring in a Global Economy: Fragmentation and Relocation of Value Chains., Göttingen, March.

Gamm, Gerhard, 2000: Wissen und Information, in: Gamm, ed.: *Nicht nichts. Studien zu einer Semantik des Unbestimmten*, Frankfurt am Main, pp. 192 – 204

Goll, Michaela, 2002: *Arbeiten Im Netz. Kommunikationsstrukturen, Arbeitsabläufe, Wissensmanagement*. Wiesbaden

Haase, Anabel Quan, and Cothrel, Joseph, 2003: Uses of Information Sources in an Internet-Era Firm: Online and Offline, in: Huysman, et al.: *Communities and Technologies*, pp. 143-163

Haug, Wolfgang Fritz, 2003: *High-Tech-Kapitalismus. Analysen zur Produktionsweise, Arbeit, Sexualität, Krieg und Hegemonie*, Hamburg

Heintz, Bettina, 1993: *Die Herrschaft der Regel. Zur Grundlagengeschichte des Computers, Frankfurt/New York*

Holling, Eggert/Kempin, Peter, 1989: *Identität, Geist und Maschine. Auf dem Weg zur technologischen Zivilisation*, Reinbek bei Hamburg, pp. 139 sqq.

Hooff, Bart van der/Elving, Wim/Meeuwsen, Jan Michiel/Dumoulin, Claudette, 2003: *Knowledge Sharing in Knowledge Communities*, in: Huysman, et al.: Communities and Technologies, pp. 119-143

Huysman, Marleen/Wenger, Etienne/Wulf, Volker, eds., 2003: *Communities and Technologies*, Amsterdam/ Dordrecht/Boston/London,

Jackson, Tim, 1993: *Turning Japanese. The Fight for Industrial Control of the New Europe*, London

Knoke, David, 2001: *Changing Organizations. Business Networks in the New Political Economy*, Boulder/Co.

Köhler, Holm-Detlev, 1999: Auf dem Weg zum Netzwerkunternehmen? Anmerkungen zu einem problematischen Konzept am Beispiel der deutschen Automobilkonzerne, in: *Industrielle Beziehungen*, vol. 6 (1999), number 1, pp. 36-51

Klug, Tina, 2006: Flexibilisierung von Arbeit und Beschäftigung: Faktoren sozialer Ungleichheit? Chris Benners Analysen aus Silicon Valley, in Baukrowitz, Andrea, et al., eds., 2006: *Informatisierung der Arbeit: Perspektiven zur Gestaltung eines gesellschaftlichen Umbruchprozesses*, Berlin: edition sigma (forthcoming)

Krämer, Sybille, 1988: *Symbolische Maschinen. Die Idee der Formalisierung in geschichtlichem Abriß*. Darmstadt

Krämer, Sybille, 1989: Geistes-Technologie. Über syntaktische Maschinen und typographische Schriften, In: Werner Rammert/ Gotthard Bechmann, eds. : *Technik und Gesellschaft, Jahrbuch 5*, Frankfurt am Main/New York, pp. 38-52

Lave, Jean/Wenger, Etienne, 1991: *Situated Learning. Legitimate Peripheral Participation, Cambridge/UK*

Lüthje, Boy/Schumm, Wilhelm/Sproll, Martina, 2002: *Contract Manufacturing. Transnationale Produktion und Industriearbeit in der IT-Branche*, Frankfurt am Main/New York

Mark, Gloria, 2002: Conventions and Commitments in Distributed Groups, in: *Computer Supported Cooperative Work. The Journal of Collaborative Computing*, vol. 11, no. 3-4, pp. 349-387

Mark, Gloria/Abrams, Steve/Nassif, Nayla, 2003: Group-to-Group Distance Collaboration. Examining the 'Space Between', in: *Proceedings of the 8th European Conference of Computer-supported Cooperative Work (ECSCW '03)*, 14-18. September 2003, Helsinki, pp. 99-118

Mills, C. Wright, 1955: *Menschen im Büro. Ein Beitrag zur Soziologie der Angestellten*, Köln-Deutz (amerik. Orig. White Collar 1951)

Mishel, Lawrence/Bernstein, Jared/Boushey, Heather, 2003: *The State of Working America 2002/2003*, Ithaca/NY

Nonaka, Ikujiro/Takeuchi, Hirotaka, 1997: *Die Organisation des Wissens*, Frankfurt a.M., New York

Nora, Simon/Minc, Alain, 1979: *Die Informatisierung der Gesellschaft*, edited by Kalbhen, Uwe (Veröffentlichungen der Gesellschaft für Mathematik und Datenverarbeitung), Frankfurt am Main/New York (Franz. Orginal 1978)

Osterlund, Carsten/Carlile, Paul, 2003: How Practice Matters: A Relational View of Knowledge Sharing, in: Huysman, et al.: *Communities and Technologies*, pp. 1-23

Pirker, Theo, 1962: *Büro und Maschine*, Basel

Pirker, Theo, 1963: *Bürotechnik*, Stuttgart

Polanyi, Michael, 1958: *Personal Knowledge. Towards a post-critical philosophy*, London

Probst, G. et al., 1999: *Wissen managen. Wie Unternehmen ihre wertvolle Ressource optimal* nutzen, Wiesbaden

Reich, Robert B, 1994: *Die neue Weltwirtschaft. Das Ende der nationalen Ökonomie*, Frankfurt am Main (Engl. Orig. 1992)

Ruuska, Inkeri/Vartiainen, Matti, 2003: Communities and Other Social Structures for Knowledge Sharing - a Case Study in an Internet Consultancy Company, in: Huysman, et al.: *Communities and Technologies*, pp. 163-85

Schiller, Dan, 2000: *Digital Capitalism. Networking the Global Market System*, Cambridge, Mass./London

Schmiede, Rudi, 1979: Das Ende des westdeutschen Wirtschaftswunders 1966-1977, in: Die Linke im Rechtsstaat, Bd. 2: *Bedingungen sozialistischer Politik 1965 bis heute*, Berlin/West, pp. 34-78

Schmiede, Rudi, 1989: Reelle Subsumtion als gesellschaftstheoretische Kategorie, in: Wilhelm Schumm, ed.: *Zur Entwicklungsdynamik des modernen Kapitalismus. Beiträge zur Gesellschaftstheorie, Industriesoziologie und Gewerkschaftsforschung*. Symposium für Gerhard Brandt, Frankfurt/Main, New York (Campus), pp. 21-38

Schmiede, Rudi, 1996: Informatisierung, Formalisierung und kapitalistische Produktionsweise - Entstehung der Informationstechnik und Wandel der gesellschaftlichen Arbeit, in: Rudi Schmiede, ed.: *Virtuelle Arbeitswelten. Arbeit, Produktion und Subjekt in der 'Informationsgesellschaft',* Berlin (edition sigma), pp. 15-47

Ibid., pp. 107-128

Schmiede, Rudi, 2000: Virtuelle Arbeitswelten, flexible Arbeit und Arbeitsmärkte, in: Silvia Krömmelbein/Alfons Schmid, eds.: *Globalisierung, Vernetzung und Erwerbsarbeit. Theoretische Zugänge und empirische Entwicklungen*, Wiesbaden, pp. 9-21

Schmiede, Rudi, 2003: Informationstechnik im gegenwärtigen Kapitalismus, in: Gernot Böhme/Alexandra Manzei, eds.: *Kritische Theorie der Technik und der Natur*, München, pp. 173-183

Schmiede, Rudi, 2005: Scientific Work and the Usage of Digital Scientific Information – Some Notes on Structures, Discrepancies, Tendencies, and Strategies, in: Matthias Hemmje/Claudia Niederee/Thomas Risse, eds.: *From Integrated Publication and*

Information Systems to Virtual Information and Knowledge Environments. Essays Dedicated to Erich J. Neuhold on the Occasion of His 65th Birthday, Berlin/Heidelberg/New York: Springer Lecture Notes in Computer Science 3379, pp. 107-116

Schmiede, Rudi et al., 2006: Virtuelle Organisation und verteilte Anwendungen – Web Services-basierte Netzwerke als neue Stufe der IT-Technologie, in Baukrowitz, Andrea, et al., eds., 2006: *Informatisierung der Arbeit: Perspektiven zur Gestaltung eines gesellschaftlichen Umbruchprozesses*, Berlin: edition sigma (forthcoming)

Sennett, Richard, 2000: *Der flexible Mensch. Die Kultur des neuen Kapitalismus*, München (Engl. Orig. The Corrosion of Character, 1998)

Silberberger, Holger, 2003: *Collaborative Business und Web Services*, Berlin

Spinner, Helmut, 1998: *Die Architektur der Informationsgesellschaft. Entwurf eines wissensorientierten Gesamtkonzepts*, Bodenheim

Sydow, Jörg/Guido Möllering, 2003: *Kompetenzentwicklung in Netzwerken*, Wiesbaden

The Information Society (http://www.indiana.edu/~tisj/)

Voß, Günter G. /Hans J. Pongratz, 1998: Der Arbeitskraftunternehmer. Eine neue Grundform der Ware Arbeitskraft?, in: *Kölner Zeitschrift für Soziologie und Sozialpsychologie*, vol. 50, number 1, pp. 131 – 158

Warnke, Philine, 2002: Computersimulation und Intervention. Eine Methode der Technikentwicklung als Vermittlungsinstrument soziotechnischer Umordnungen, Diss. FB Gesellschafts- und Geschichtswissenschaften an der TU Darmstadt (http://elib.tu-darmstadt.de/diss/000277/)

Welsch, Johann, 2006: Flexibilisierung und digital divide – Ein verhängnisvoller Kreislauf in: Baukrowitz, Andrea, et al., eds., 2006: *Informatisierung der Arbeit: Perspektiven zur Gestaltung eines gesellschaftlichen Umbruchprozesses*, Berlin: edition sigma (forthcoming)

Weltz, Friedrich/Ortmann, Rolf G., 1992: *Das Softwareprojekt. Projektmanagement in der Praxis*, Frankfurt am Main/New York

Wenger, Etienne, 1998: *Communities of Practice. Learning, Meaning, and Identity*, Cambridge/UK

Wenger, Etienne, 2000: Communities of Practice. The Key to Knowledge Strategy, in: E.L. Lesser/M.A. Fontaine/J.A. Slusher, eds.: *Knowledge and Communities. Resources for the Knowledge-based Economy*, Woburn/MA, pp. 3-20

Wenger, Etienne/Richard McDermott/William M. Snyder, eds., 2002: *Cultivating Communites of Practice*, Boston/MA

Wickens, Peter, 1988: *The Road to Nissan. Flexibility, Quality, Teamwork*, London

Willke, Helmut, 2001: *Systemisches Wissensmanagement,* Stuttgart

Willke, Helmut, 2002: Die Krisis des Wissens, in: Willke, Helmut, ed.: *Dystopia. Studien zur Krisis des Wissens in der modernen Gesellschaft*, Frankfurt am Main, pp. 10 - 47

Windeler, Arnold, 2002: *Unternehmungsnetzwerke*. Wiesbaden

Windeler, Arnold, 2004: Organisation der TV-Produktion in Projektnetzwerken. Zur Bedeutung von Produkt- und Industriespezifika, in: Jörg Sydow/Arnold Windeler, eds.: *Organisation der Content-Produktion*, Wiesbaden, pp. 55-76

---

[i] The term ‘informatization’ is not very common in the German language, it is more common in the American language; its linguistic advantage is that it names the process nature of the penetration of all social dimensions by new contents, forms, and techniques of information. It became popular at first by the French government report, published in 1978, on *L´Informatisation de la Société* by Simon Nora and Alain Minc (in German under the title of [Nora and Minc, 1979]), but in those days it meant primarily the spread of information and communication technologies and their fusion to ‘Telematics’; further below I will discuss its further theoretical dimensions.

[ii] This paper presented the theoretical frame for a conference on 'The Informatization of Work – Society in Fundamental Change', held at Darmstadt, Germany, in January 2005.

[iii] Castells presented the broadest analysis of the new mode of production and the new form of society, but he is not at all the only sociologist to see a close connection of economic, technological, social, and political changes; see [Reich, 1994]; [Sennett, 2000]; [Burton-Jones, 1999]; [Schiller, 2000]; [Haug, 2003]; [Boltanski and Chiapello, 2003]. See also Castells´s empirical network analysis: [Castells, 2001a].

[iv] At several occasions I have called this tendency the 'new immediacy of economy': both markets and organizations are changed in such a way that economic and political interests of rule and control come into effect for the individual or the group or the organization in the most possible direct way; this institutional change of markets and organizations, however, cannot be called the same as the rule of 'true' (model) economy. See [Schmiede, 2000 (pp. 9-21)], and [Schmiede, 2003 (pp. 173-183)].

[v] On lean production in Europe see e. g. [Wickens, 1988]; [Bratton, 1992]; [Jackson, 1993]; [Collard, 1993]

[vi] In [Schmiede, 1996 (pp. 15-47)], I explained this in more detail; see also the references there. In the field of industrial sociology this development has not been paid much attention to. Exceptions in Germany are: [Pirker, 1962]; and [Pirker, 1963]; in the United States: [Mills, 1955, there part. chapt. 9 (pp. 262-293)]

[vii] [Baukrowitz, 1996 (pp. 49-77)], showed this in detail for the technological development until the mid-90ies.

[viii] This term comes from the investigation by [Dose, 2003]

[ix] See [Lüthje, Schumm and Sproll, 2002]; [Faust, Voskamp and Wittke, 2004]; see on car industries [Köhler, 1999 (pp. 36-51)]

[x] See on this [Knoke, 2001], and as an overview [Fairchild, 2004]; for Germany: [Windeler, 2002];[Windeler, 2004 (pp. 55-76)]

[xi] See on the concept [Probst et al., 1999]; [Willke, 2001]; on the theoretical basics see [Polanyi, 1958]; on the popularized version: [Nonaka and Takeuchi, 1997]

[xii] This concept was at first developed and propagated by Etienne Wenger. See [Lave and Wenger, 1991]; [Wenger, 1998]; [Wenger, 2000 (pp. 3-20)]; [Wenger, McDermott and Snyder, 2002]; an overview at the state of research is offered by the conference volume [Huysman, Wenger and Wulf, 2003], and by the issue 2/2005 of the journal *The Information Society*

[xiii] See in more detail [Wenger et al., 2002], Chapter 2: 'Communities of Practice and Their Structural Elements'

[xiv] [Haase and Cothrel, 2003 (pp. 143-163)]; [Hooff, et al., 2003 (pp. 119-143)]; [Osterlund and Carlile, 2003 (pp. 1-23)]; [Ruuska and Vartiainen, 2003 (pp. 163-185)]; see for Germany: [Goll, 2002]; [Sydow and Möllering, 2003]; see on the CSCW-context e. g.: [Bradner and Mark, 2002 (pp. 226-235)]; [Mark, 2002]; [Mark, Abrams and Nassif, 2003 (pp. 99-118)]

[xv] Here, I introduce these tendencies only as a summary; for a more detailed overview see [Dostal et al., 2006 (chapter 3.4)]. An older, summarizing overview is found in [Schmiede, 1996 (pp. 107-128)]; a good overview at the development in the USA is found in [Knoke, 2001 (pp. 164-203)]

[xvi] A recently completed study by the Institut für Arbeit und Technik (Institute for Work and Technology) in Gelsenkirchen, Germany, estimates the share of chronically exhausted members of staff of IT-projects to be one third; quoted from: *Computer-Zeitung*, No. 18, May 2, 2004. According to estimations by the Bundesanstalt für Arbeitsschutz und Arbeitsmedizin (Federal Institute for Health and Safety Protection at the Workplace and Industrial Medicine), EU-wide 28% of all employees complain about stress-related problems; according to estimations, stress at the workplace causes up to 60% of all sick days, i. e. yearly costs of several hundred billions – this is also a way of externalizing costs! Regarding retirement due to reduced ability to work, psychological illnesses caused

by the 'basic noise of fear' of failure and unemployment have meanwhile become the most important single complex of causes; in 2002 their share was 28% (tendency rising); quoted from the German newspaper *Darmstädter Echo*, September 30, 2004. Finally, see more generally [Ehrenberg, 2004]

[xvii] Even if in the face of an increasingly difficult situation crossing a certain threshold we can observe increased readiness for inner-company representation of interests (see [Boes and Baukrowitz, 2002]), for the time being this has not led to a positive trade union commitment of employees.

[xviii] See [Benner, 2002], as well as [Benner, 2003 (pp. 181-204)]; see on these studies the essay by [Klug, 2006].

[xix] See on digital divide [Welsch, 2006]; on information workers see [Dostal, 2006]. On the empirical analysis of the development in the US: [Mishel, Bernstein and Boushey, 2003]; on the following also [Castells, 2001b, Chapter 4]

[xx] See on this in more detail: [Schmiede, 2000] as well as further: [Gamm, 2000 (pp. 192-204)] and [Willke, 2002 (pp. 10-47)] as well as [Polanyi, 1958]

[xxi] In German language, knowledge ('Wissen') is closely related to certainty ('Gewissheit').

[xxii] See [Warnke, 2002]. By the way, this question can also be extended to traditional *fields of qualitative analysis*: by way of computer-based possibilities of retrieval and analysis the work with texts – traditionally in the focus of humanities from theology to philosophy and linguistic sciences as well as history and condensed in the hermeneutic procedures – is provided with a new basis (the development of computer philology shows this clearly). If in the past a theologist or a literary specialist could be reasonably occupied with the comparison and analysis of texts, this traditional scientific activity tends to becoming obsolete in favour of new – though hardly developed – complex procedures of comparing contents. The comparatively low degree of informatization in the humanities and the social sciences indicates openness towards experience and variety as well as analytical weakness and a backlog of procedures at the same time. [Degele, 2000] made this philosophically and sociologically highly significant fact of the change of knowledge by way of being informatized a matter of discussion, but did not solve it theoretically.

[xxiii] [Weltz and Ortmann, 1992] investigated these connections as early as 15 years ago in a very concise study; despite all further development of computing science the problems as described by the investigation are still existent.