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**Working Paper**  
Of knowledge and work

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Ben Dankbaar and Geert Vissers  
**Of Knowledge and Work**

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anck Institute  
for the Study of Societies

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## **Abstract**

The idea of the knowledge economy has brought with it a new paradigm of work that espouses the professionalization of all work. This new paradigm is now affecting the organization of work throughout the economy. However, not all work is knowledge work, whatever definition is used. The number of “professionals” may rise, but many workers still face rather traditional working conditions. Moreover, we argue, the expected growth in the share of knowledge work may be less than expected: along with the forces pushing for an increase in knowledge work, there are also forces counteracting these. We develop a simple typology of work that takes autonomy and frequency of external contacts as dimensions. Workplaces with high autonomy and frequent external contacts (with customers and other stakeholders) are considered “paradigmatic” for knowledge work. Using data from the European Working Conditions Survey (EWCS), we analyze the distribution of the European workforce across different types of work. Analysis of EWCS data (1995, 2000, 2005) shows that “paradigmatic” knowledge work is actually shrinking. We offer a first, tentative explanation of this remarkable trend.

## **Zusammenfassung**

Die Idee der „Wissensökonomie“ beinhaltet ein neues Paradigma der Professionalisierung von Arbeit, das Einzug in die Organisation der Arbeit der gesamten Wirtschaft gehalten hat. Doch nicht jede Arbeit ist Wissensarbeit, wie auch immer man diese definiert. Die Anzahl der „Wissensarbeiter“ mag steigen, doch sehen sich viele Arbeitnehmer weiterhin durchaus traditionellen Arbeitsbedingungen gegenüber. Darüber hinaus, so die Argumentation der Autoren, kann das erwartete Wachstum des Anteils der Wissensarbeit noch geringer ausfallen als erwartet: Neben Trends, die einen Anstieg der Wissensarbeit fördern, gibt es auch solche, die dagegenhalten. Das Papier entwickelt eine einfache Typologie wissensbasierter Arbeit, in deren Zentrum die Autonomie der Arbeitnehmer und die Häufigkeit externer Kontakte stehen. Arbeitsplätze mit hoher Autonomie und häufigen externen Kontakten (mit Kunden und anderen Akteuren) werden als „paradigmatisch“ für Wissensarbeit gewertet. Die Verteilung der Arbeitskraft in Europa auf verschiedene Beschäftigungstypen wird anhand von Datenmaterial des European Working Conditions Survey (EWCS) aus 1995, 2000 und 2005 analysiert. Die Ergebnisse zeigen, dass „paradigmatische“ Wissensarbeit eher rückläufig ist. Das Papier versucht eine erste Erklärung dieser überraschenden Entwicklung.

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## Introduction

Knowledge has always been important for the economy, but only recently we have started talking about the “knowledge economy.” What has happened that makes modern economies deserving of this particular epithet? Is there more knowledge around today than there was fifty or a hundred years ago? How would we measure this? And how would we weigh the relative importance of different pieces of knowledge? Are modern economies based on the application of a different kind of knowledge compared to fifty years ago? Are they perhaps more science-based? How would we measure that? Is knowledge now playing a different role, one that is somehow more fundamental than in the past? What is the opposite of knowledge in this context anyway? Tradition? Instincts? Raising these definitional questions opens up a wide range of empirical and ultimately historical and philosophical questions. In this paper, we will not deal with these questions and instead propose a very pragmatic approach. We propose to call an economy a knowledge economy if it has the following two characteristics: first, a high proportion of the total working population (say, a third) has pursued some form of higher education; second, the large majority of the working population (perhaps 75 percent) is not working in agriculture or manufacturing. The exact percentages are not so important, but just in these two respects modern advanced economies do differ from economies of even fifty years ago. The rising levels of education in the working population and the rising proportion of service jobs in the labor market are long-term trends. While their effects are surfacing only gradually, the introduction of the concept “knowledge economy” suggests that somewhere along the way a threshold was crossed, one which would justify a different characterization of what the economy is about. Earlier efforts to characterize changes in the economy looked at the same trends and introduced concepts like post-industrial economy, service economy, or information economy. We prefer the designation “knowledge economy” over these older ones because it avoids the mistaken suggestion that manufacturing (or, for that matter, agriculture) is no longer important for the economy, or that the economy can be characterized by the application of a single technology.

In this paper we are interested in the characteristics of work in the knowledge economy. The same long-term trends that are behind the emergence of the knowledge society have also given rise to a new paradigm, or reference model, of work. In the industrial economy, work in the manufacturing industry was the standard of comparison. More specifically, the reference model for work during most of the past century was assembly-line work in mass production. All other work would be characterized in terms of its

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distance from this standard, which scored high on what counted most: productivity. In today's knowledge economy, knowledge work seems to have become such a standard. Its defining characteristics are sought in the type of work that was considered "knowledge work" before that expression was ever used: in professional work. The traditional characteristics of professional work are becoming the standard against which all other work is measured. Even in the traditional manufacturing environment, indeed even on the assembly line, workers are invited to behave as professionals, i.e., to bring in their expertise, to come up with proposals for improvement, to take responsibility for quality, etc. It is in this sense that knowledge work can now be considered paradigmatic.

Reading the managerial literature about trends in job design, work organization and human resources, one gets the impression of a general trend towards professionalization of work and of work organizations (O'Toole/Lawler 2008; for an early example, see Peters 1988). More academic studies of work organization have also frequently emphasized the increasing importance of such notions as autonomy, self-regulation, team work, customer orientation, continuous improvement, human resource development, coaching, and democratic leadership, all of which were absent in the old "Fordist" paradigm (Appelbaum et al. 2000; Morgan 2006). Obviously, not all work is or will become knowledge work, whatever exact definition is used. Nevertheless, it seems to be a widespread assumption that most, if not all, work will move in the direction of the new paradigm. More than an assumption, it is also an implicit promise made to those who move through higher education. It is the official aim now of many EU and OECD countries to have 60 percent of every annual cohort leave the full-time education system with at least a bachelor's degree. When these students enter the labor market, they expect to be treated as knowledge workers, i.e. as professionals.

This paper offers some reflections on the assumption of the increasing importance of knowledge work in the knowledge economy. We will first argue that there may be forces counteracting the trends towards knowledge work. Thus, the share of knowledge workers in the total work force may not be increasing so quickly. In the second part of the paper we will present empirical evidence which appears to support our argument. We start with a further analysis of the trends that have given rise to the shift in perspective, or the new paradigm, usually referred to as the "knowledge economy." We then describe the new paradigm and offer a simple, pragmatic definition of "knowledge work." Using that definition, we present an analysis of data from the European Working Conditions Survey (EWCS), comparing 1995, 2000, and 2005. The analysis seems to confirm our expectation that paradigmatic knowledge work has not increased in importance in recent years and may even have been shrinking. We conclude with a discussion of the implications of our findings, some qualifying observations, and some pointers for further research.

## Four trends in developed economies

The rise of a new paradigm of work reflects fundamental changes in the dynamics of capitalist economies. Just as the picture of the worker at the assembly line emerged in conjunction with the rise of systems of mass production, now a picture of the new professional is developing in conjunction with new patterns of economic activity. In this section, we will sketch out some underlying trends that directly pertain to the place of work in the economic system.

### The rising level of education

The average level of education of the working population in developed capitalist countries has risen constantly in the past two centuries and is still rising today. This trend can be explained only partially, if at all, by the higher qualifications that employees must possess. An effect in the opposite direction is more likely: that the large supply of highly qualified workers has made it possible to design work structures that place higher demands on workers. Such structures are not only installed for the purpose of utilizing employee capabilities, they also help to meet the work-related demands and expectations of people who have invested much in their education. Thus higher education levels create permanent pressure to develop new conceptions of work, such as the one mentioned above. Empirical research shows that required job qualifications are indeed increasing, albeit not enough to match the rise of the average level of education of the working population (Asselberghs et al. 1998). The result is that workers' capabilities are only partially used. However, it should be added that claims about workers' rising qualifications are largely based on statistics such as "average duration of education" or "spread of the population over different types (and different levels) of schools." The assumption, usually unexpressed, is that the same type of school or the same duration of education would provide the same qualification today as in the past. Only if this assumption is valid can we conclude that an increasing number of years in school, or a rising percentage of the population attaining a higher level of education, results in higher levels of qualification. But how valid is this assumption?

If we want to elucidate the relationship between schooling and skills there are few empirical studies to rely upon, since skills are usually measured by proxy: as applicants' education levels or the qualifications they hold (McIntosh/Vignoles 2001), or as educational attainment, employment experience, or the type of work undertaken (Kelly/Lewis 2003). The result of such indirect measurement is that evidence is lacking about the relationship between skills and any of the proxies mentioned, which may explain (at least in part) the simultaneous presence of two strands of research that are hard to reconcile. The first focuses on school quality and the quality of teachers, emphasizing the economic necessity of improving these (Hanushek 2003; Handel 2003; Hanushek/Woessmann 2008). The other concentrates on the economic costs of overeducation



(McGuinness 2006; Verhaest/Omey 2006), arguing that overeducation lowers job satisfaction, which in turn hampers productivity. Many education practitioners support the first line of reasoning, insisting that school quality is declining and that today more years in school are necessary to attain a given skill level than before, or the same number of years in a higher-level school. The claim is serious, since skill levels are now more dependent on school quality than they were in the past, when workers acquired much of their knowledge and skills in practice.

However, disputes about school quality, teacher quality, over- and undereducation, skills mismatch in the labor market, or the school-to-work transition are all about issues of alignment between education and work, and take a high and increasing average level of education for granted. It is beyond discussion, in developed countries, that an elaborate education system exists, that school attendance rates are high, and that the changing nature of work requires an increasingly well-educated working population.

### The growth of services

A second trend is the changing structure of employment (Singelmann/Browning 1980; Aoyama/Castells 2002). Presently, in developed countries only a small part of the working population is employed in the manufacturing industry – and of those employed there, only a minority are directly involved in actual production. In addition, the contribution of agriculture, or of the primary sector in general, to total employment has become very small (Feinstein 1999), even in countries with large agricultural exports, such as the Netherlands or the United States. The vast majority of the people are employed in services, whether public or private, and this share is still growing (Wölfl 2004).

To some extent, this trend reflects the outsourcing of service activities by manufacturing companies. Work that is now conducted by independent service-providing firms used to be done by industrial firms themselves. In other words, work once registered in official statistics as manufacturing is now registered as service (Schettkat/Yocarini 2006). The change is not merely administrative, however. In traditional manufacturing companies, the departments providing services were seen as appendages to the main activity, which was manufacturing. In an independent service firm, in contrast, the provision of services is the main activity, no longer hampered by a lack of priority. This leads to a subtle shift in the priorities guiding the organization of work: away from an overriding attention to efficiency, and toward a focus on close interaction with customers that is so characteristic of the service industry (Frenkel 2000; Peneder/Kanioovski/Dachs 2003; Edvardsson/Gustavsson 2003). The “culture of service” is then markedly separate from the “culture of manufacturing.” Service delivery requires different qualifications, a different attitude, and different codes of conduct from industrial production.

Having said this, we should note that manufacturing has started to emulate the culture of services. Quality systems are being installed that aim to bring customer demands into the structure and perhaps even into the awareness of manufacturing units. Concepts like “lean thinking” (Womack/Jones 2003) and “mini-companies” (De Leede/Looise 1999; Suzuki 2002) emphasize the need for all workers to concentrate on the needs of customers – be they inside or outside the company. Besides, many industrial firms have discovered that it is beneficial to define their products in terms of the service delivered to their customers. More often than not, this helps a firm to recognize services that are complementary to a tangible product and that can be sold, sometimes very profitably, in combination with this product.

Various explanations of the growing share of services in the employment structure have been proposed, including the outsourcing of service functions by industrial firms; a lower growth of productivity in services than in manufacturing; the internationalization of service activities as a result of loosened trade restrictions; the greater complexity of corporate activities, which necessitates more service inputs; the so-called Engels effect, meaning that the growing wealth of end consumers leads to increasing demands for services; and the creation of new service sector activities, such as online information services (Button/Pentecost 1993: 626). But “isolating the impact of each has proved elusive” (ibid). Various circumstances contribute to this problem: the simultaneous occurrence of the factors mentioned; the heterogeneity of services and variations between sectors, regions, and countries (Bernard/Jones 1996; Inklaar/Timmer/van Ark 2007); difficulties of actually measuring the growth of services and manufacturing (Schettkat/Yocarini 2006); and indirect effects of service productivity that must be taken into account (Maroto/Rubalcaba 2008).

For present purposes, a detailed explanation of the growth of the service sector is not necessary. The important thing is that the factors mentioned above not only involve issues of registration, but also imply a recognition of actual changes in the employment structure. In the words of Schettkat and Yocarini (2006), “the shift to services is real.” The point is that the consumption of services is less constrained by physical limitations than is the consumption of products from the primary or secondary sector. It is possible, then, to speak of a tertiarization (Peneder/Kanioviski/Dachs 2003) of the advanced economies, a process closely related to two further trends in contemporary capitalism: globalization and automation.

## Automation and ICT

Tertiarization of the economy is not possible without the ongoing increase of labor productivity in manufacturing. Over the years mechanization, automation, and related organizational changes have constantly reduced the amount of labor per unit of product. At present, only a fraction of the retail price of consumption goods relates to actual

production costs, and the wages of production workers represent an even smaller fraction. A significant share of retail prices goes to product development, design, distribution, and marketing costs. The volumes of production (and consumption) of industrial goods have risen over the years, but not enough to keep up with productivity growth. The result is less manufacturing employment in general, and less employment in direct production in particular. The work that is still necessary in highly automated manufacturing processes usually requires higher skills and a deeper understanding of the processes than was needed before automation. The use of information technology has also allowed for a higher variety of products and greater flexibility of processes, making small-batch production economically more feasible. Work on such processes requires workers with greater “intellective skills” who are able to operate the new machinery (Vallas/Beck 1996: 341).

Productivity increases have been smaller in the service industry than in manufacturing, but here too the effects of automation and information and communications technologies (ICT) are noticeable. However, considerable differences exist between types of services (for a classification, see Browning/Singelmann 1976; Castells/Aoyama 1994). In personal services such as hairdressing, for instance, automation is difficult to accomplish, both technically and because it may not be appreciated by customers. But in other service sectors automation has become quite important, especially where a distinction between *front office* and *back office* work has been made. The front office is where activities take place that require customer contact, while supporting and administrative processes are carried out in the back office, away from customers (Zomerdijk/De Vries 2007: 110). The productivity of back-office work has particularly increased, largely because of the use of information technology. In finance, for instance, the present volumes and speeds of payments would not have been possible with the technologies that were in use a few decades ago. Indeed, the impact of ICT on service work has been so great that we may refer to the economic and technological transformation that followed as the first “post-industrial” revolution (distinguishing it from the First Industrial Revolution of the late eighteenth century and the Second Industrial Revolution of the late nineteenth and early twentieth centuries, both of which mainly affected the nature of manufacturing work [Dankbaar 2000]).

### Globalization and the relocation of work

Services are produced in close interaction with customers. This is why it is often difficult to bring the production of services abroad, a limitation that does not apply to the manufacturing of tangible goods. In recent years, the manufacturing of many industrial products, or of parts and components, has been relocated to countries with relatively low wages. Only sectors with very high levels of automation (especially process industries) have been relatively immune to relocation, because the wage costs in these largely automated sectors have become almost negligible. Such “offshoring” initially in-

volved mainly production processes requiring relatively low skills, but nowadays this restriction no longer applies. The working population in many low-wage countries has a level of education that is high enough to allow for the use of advanced production techniques. For instance, the same robots can be found in the body shops of car plants in Eastern Europe or China as in West European or North American car plants. These robots are used in the offshore facilities to ensure the required levels of quality for export markets. Where quality is comparable, relocation decisions will be based on wage and productivity differences and on transportation costs. Thus, part of the tertiarization of Western economies is a result of relocation of production. Routine work that requires few worker qualifications is either almost completely automated or brought to countries with lower wages (Vosse 1999). As a consequence, the idea of industry as mass production and mass assembly with a large share of manual work – arguably the dominant model for the organization of work in the twentieth century – has almost ceased to exist in Western countries. In some industries, such as the clothing industry, nearly all production has been relocated to low-wage countries. In other industries, such as car manufacturing, large parts of the production of parts and components have been relocated to low-wage countries, but not final assembly. Location decisions in an important industry such as the automobile industry are based on sociopolitical as well as economic grounds.

### **A new paradigm**

The long-term result of the trends discussed above is the knowledge economy, where a large and increasing percentage of school leavers has completed higher education and in which the “culture of service” has become dominant. Work has changed as a consequence, and the thinking about what constitutes “normal” work has changed as well. For many decades, normal work was work on the assembly line: machine-paced, repetitive, and isolated. Sometimes workers were even forbidden to speak with one another during work. Throughout much of the twentieth century, the assembly-line model symbolized progress and inspired thinking about work organization in many branches of the economy, and not just in manufacturing (e.g., in administrative organization as well). Today the assembly-line model is no longer the prevailing one, not even in the sectors it used to dominate, and a paradigm of “knowledge work” has arisen that is in many respects the opposite of the assembly-line work paradigm. Key concepts describing knowledge work are autonomy and customer orientation. Both of them derive from the world of professions and services and are now considered normal and indeed normative characteristics of work. Even in the manufacturing environment and on the assembly line, job design is now phrased in terms of autonomy (self-regulation) and customer orientation.

The new paradigm has been particularly inspired by knowledge-intensive services (Scott 1998; Burton-Jones 1999), and by consulting firms in particular. Consulting firms are “in many ways emblematic of knowledge organizations” (Bergström/Hasselblad/Kärreman 2009: 180), and “consultancy is typically classified as knowledge work” (Donnolly 2006: 79). Indeed, at times it seems as if advocates of the new paradigm rely on their own management consulting practices when outlining the trends and sketching the needs of today’s business firms (for an early and influential example, see Peters 1988). Consultants act in close interaction with their customers. They apply their knowledge to the problems of a particular customer, and even though the methods they use may be more or less standardized, the uniqueness of each customer will necessitate local adaptations and creative thinking. In this respect, consultants usually have a large measure of autonomy in the way they perform their tasks. Accordingly, autonomy and external contacts, particularly with customers, can be viewed as features of paradigmatic knowledge work. If indeed the economy is developing into a knowledge economy, the proportion of jobs displaying these features can be expected to increase.

In this paper we argue that this claim must be taken broadly. The knowledge work paradigm implies that the share of jobs involving autonomy and external contacts will increase as an economy becomes more knowledge-intensive. This applies to knowledge work as the term is commonly understood, referring to workers who have a high level of education and, very importantly, who own the means of production in a knowledge-based organization (Drucker 1993, quoted by Blackler 1995: 1027) – and it also applies to other work (“non-knowledge work”). Not only is the proportion of knowledge workers larger in a knowledge economy than in the economy that preceded it (often industrial), but the knowledge requirements to be met by other, non-knowledge workers are larger as well. Increasingly, workers in other economic sectors (including manufacturing) are supposed to behave as consultants, at least part of the time. In addition to performing their regular tasks, in the execution of which they may already enjoy considerable autonomy, they are expected to contribute to the improvement of organizational routines, consulting other stakeholders inside and outside their workplace and using the insights thus obtained to propose improvements in existing products and processes.

Thus, not all work characterized by high levels of autonomy and external contacts qualifies as knowledge work as it is commonly understood, but autonomy and external contacts are nonetheless features of work that meets the knowledge work paradigm. A study of the development of work in an economy that is moving towards greater knowledge intensity cannot be restricted to “knowledge workers” and leave other worker categories undiscussed. Besides, it must be noted that the concepts of “knowledge workers” and “knowledge-intensive firms” are not well-defined (Alvesson 2001; Donnolly 2006). Presently, “knowledge work” tends to be associated with non-routine tasks that have to be performed. Warhurst and Thompson (2006: 787) define it as work that “draws on a body of theoretical (specialized and abstract) knowledge that is utilized, under conditions of comparative autonomy, to innovate products and processes.” And Gargiulo, Ertug and Galunic (2009) speak of knowledge workers as those who “create value by ac-

quiring, processing, and providing information to create solutions and address complex problems.” This definition is simple, in that it selects only one of the dimensions that might be used to define knowledge workers, yet it does not allow for a clear distinction between those who are and those who are not knowledge workers. For that, terms like “information” and “complex problems” are not clear enough themselves.

In addition, it must be noted that work according to the knowledge work paradigm is not only defined by level of knowledge and kind of task, but also by values and attitudes. Characteristic attributes of knowledge work are responsibility, commitment, initiative, creativity, independent judgment, communicative skills, and discretion, all of which reflect traditional professional values. Consultants and representatives of other “new professions” attempt to mimic established professions by emphasizing the values that formerly distinguished these – a few groups occupying privileged, high-status positions in sectors like health and law – from other fields of occupation. Although the established professions were defined in terms of the mastery of a specific domain of knowledge, their special status was no less related to their ability to define and maintain ethical standards of work.

The comparison of knowledge work with established professions is frequently made (Reed 1996; Scarbrough 1999; Alvesson 2001; May/Korczynski/Frenkel 2002; Evetts 2003; Donnelly 2006; Hwang/Powell 2009). Typically, the established professions are seen as either constituting one of the categories of knowledge workers or as a related category that distinguishes itself from other knowledge-intensive work categories because of its officially recognized practices. In both cases, it is possible to compare the established professions with other categories of knowledge-intensive work – a comparison that leads to some noticeable observations: knowledge-based occupations are expanding employment categories, while professions, as a category, are experiencing “a reduction in autonomy” or “a weakening of their abilities to act as self-regulating occupational groups” (Evetts 2003: 396). Hwang and Powell (2009: 268) speak of a professionalism paradox: “The apparent decline in the influence of traditional professions such as law, medicine, and divinity has been accompanied by a general amplification of professionalism or the “professionalization of everyone.”

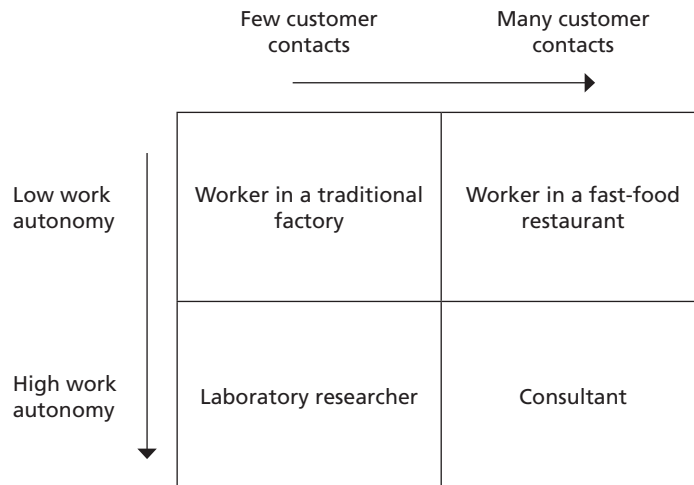
### **Counteracting tendencies**

Autonomy at work is an intricate concept, and its implications have long been a subject of debate among students of work organization (Smith 1997). In this paper we will not discuss the possible benefits or drawbacks of an increase in autonomy and external contacts. Instead we observe that, despite the new paradigm’s focus on professional work, in practice autonomy and external contacts continue to be limited or nonexistent in many workplaces (May/Korczynski/Frenkel 2002). First, traditional jobs with low



autonomy and few external contacts are still widely present, not just – and perhaps even less frequently – in manufacturing, but also in services. Second, autonomy and frequent external contacts are independent characteristics in the sense that one does not presuppose the other, as Figure 1 illustrates.

Figure 1 Work autonomy and customer contacts



Arrows show tendencies in the nature of work as a society moves from an industrial to a knowledge economy.

Contacts with customers are very frequent in fast-food companies or in call centers, but work processes in such organizations are highly standardized, with low autonomy as a consequence. On the other hand, there are jobs that combine high work autonomy with sparse customer contacts, for instance in industrial laboratories.

Discussions of the new services-inspired paradigm tend to pay little attention to the fact that jobs without high work autonomy or without frequent external contacts are still widespread. This lack of attention is unfortunate. Advocates of the new paradigm may claim that we are in a transitional stage, and that in due course all jobs will be redefined in ways that meet the professional service model, but even if this claim is valid (which cannot be verified), slight attention to “old” forms of work means little support for attempts to facilitate the transition from old to new work organizations. But it is also possible that the claim is simply invalid, and that the process toward a new, services-derived organization of work will be less comprehensive, less linear, less irreversible than advocates of the new paradigm tend to think, and less quickly progressing.

One reason to treat the “transition” claim cautiously is that the history of work organization gives little ground to believe in unambiguous and uninterrupted processes in a single direction (Parks 1995). But there is a second reason, deriving from Braverman’s

work (Braverman 1974) and the debate it provoked. Braverman argued that under conditions of capitalist production, the pressures of competition would force employers to engage in constant rationalization and to take control of work processes for that purpose, which would include the transfer of production knowledge from workers to managers. The rationalization of work would be made possible, or at least facilitated, by organizational concepts such as Taylorism and Fordism and by new technology. By increasing control, management would be able to improve productivity. The result would be “deskilling,” as workers’ skills and their abilities to exercise independent judgment became obsolete and were replaced by standardized routines, defined by engineers, that could be executed by less skilled workers.

Braverman’s theory has inspired a wide-ranging debate about the nature of work and future directions of work organization (Dankbaar 2004; Adler 2007), but in recent years his argument has been losing momentum. Thompson (2007) ascribes this loss of momentum to a change of perspective in social science, away from realism and materialism, and insists that it has “little to do with the validity of its [Braverman’s theory’s] empirical propositions, whether about skill formation or anything else.” This claim seems too strong, as research into deskilling has been inconclusive thus far. Some authors report evidence of deskilling, others of upskilling (or upgrading, in Adler’s vocabulary), and still others report evidence of both occurring at the same time (Burriss 1998: 142; Lewis 2007: 402–403).

Skilled work is not the same as knowledge work, and the two must not be conflated, but reference to the deskilling debate is relevant here. Empirically speaking, the point is that no clear case can be made for either deskilling or upskilling. Those supporting the upskilling hypothesis should be most concerned about this. In an age of automation, when much routine work is taken over by machines, less-skilled workers are more likely to be laid off – in which case they will no longer appear in labor force statistics, which consequently should show clear trends of upskilling. The relation to the knowledge economy thesis is that even the “transition claim” does not allow for such uncertainty about developments in the nature of work. Theoretically, the deskilling debate reminds us of the fact that work, whether assembly-line work or paradigmatic knowledge work, is still – and in the case of established professions even increasingly – embedded in corporations that are subject to market requirements such as productivity, profitability, and efficiency. These market requirements drive executives and managers towards efforts to control workers and to implement performance schemes. Such efforts will reduce work autonomy for knowledge workers and other workers alike.

And indeed, modern knowledge work organizations show signals of management taking control (Bergström/Hasselblad/Kärreman 2009). In hospitals and in universities, in consulting firms and in financial companies: in all of these places, work is subjected to systems of performance measurement, quality control and an ensuing standardization of work procedures and methods, all of which were virtually absent only twenty-five years ago. There is considerable debate about the effectiveness of these managerial in-



struments in raising the efficiency and quality of performance, but the sheer size of many organizations seems to make these measures necessary. The risk of shirking by less motivated workers makes a reduction in autonomy almost inevitable, but so does the desire of workers to be treated equitably and according to their individual performance. In this context, it is also necessary to point to knowledge management as a managerial strategy that affects the autonomy of knowledge workers. Knowledge management is not immediately concerned with controlling workers, but it is concerned with controlling their knowledge, in the sense that an important aim of knowledge management is to make a company less dependent on individual persons possessing particular pieces of knowledge. There are clear parallels with Braverman's analysis of workers' manufacturing knowledge being analyzed and translated by industrial engineers into standard operating procedures. Increasingly, knowledge workers are confronted with "evidence-based" expert systems, supporting and more often than not instructing them in their work. If they want to use their own judgment and depart from the advice given by the system, they do so at their own risk.

With regard to that other defining characteristic of knowledge work, external contacts, especially with customers, it is also possible to point to some counteracting tendencies that may limit the rise of true knowledge work. Starting with the large service organizations in the financial sector, we see that machines have been inserted between the representatives of the organizations and the customers. Many customers only relate to their banks through ATMs and the Internet. And if they pick up the phone with some particular question, they are guided through a whole system of options before ending at a real person (if they are lucky), who is likely to read a pre-formulated answer to their question from a computer screen. That real person may not be at the location that the customer thinks they are calling into, and could be all the way on the other side of the globe. Information and communications technology allow for largely standardized and rationalized customer service systems, which reduce actual communication between members of the organization and customers to a minimum.

More generally, mechanization and automation in services frequently take the form of self-service (Gershuny 1978). In some cases, the service can be taken over by the customer almost completely. Examples date from even before the IT revolution. The self-service supermarket did not involve any mechanization or automation when it was introduced. With no more than a reorganization of the shop, contacts with the customer were reduced to a routine at the cash register. Personal advice from grocers was replaced by glossy circulars with recipes and tips. Today new technologies allow customers to self-scan their items, eliminating even the personal contact at the exit. Expert systems, thus far mainly in use to support knowledge workers at work, are increasingly used to support self-service by customers as well, even in such unexpected areas as medical diagnosis.

To summarize, we have observed various trends pushing for an increase in knowledge work, which is giving rise to a new paradigm of work that is largely inspired by profes-

sional services, but we have also observed some counteracting tendencies that are likely to limit the rise of workplaces in which high autonomy and frequent external contacts are combined. Most knowledge work takes place in companies that operate in a highly competitive environment in which management tries to raise levels of efficiency by setting performance standards, quality standards, and sometimes even behavioral standards. The predominant approach in the literature on work and work organization is to emphasize the first development, while disregarding the second. In the next section, we will test the claim, inherent in the new work paradigm, that knowledge work is steadily increasing in advanced economies, and we will look for evidence in support of our own assumption that, as a corollary to the spread of the new paradigm, the activities of knowledge workers are increasingly subjected to automation and managerial control, with a consequent loss in autonomy and customer contacts.

## Empirical analysis

For our empirical analysis, we drew upon the 1995, 2000, and 2005 European Working Conditions Surveys (EWCS). The EWCS are conducted by the European Foundation for the Improvement of Living and Working Conditions, a European Union body installed by the European Council in 1975 and charged with the task of contributing to the planning and design of living and working conditions in Europe.<sup>1</sup> Thus far, four surveys have been conducted, of which the surveys used in this study are the most recent (the first survey was in 1991).<sup>2</sup>

The three surveys are not identical. First, questions in the 2005 survey are more numerous and sometimes more detailed than in the previous surveys. Second, the number of countries involved has increased in a way that reflects the enlargement of the European Union. The 1995 and 2000 surveys were administered in fifteen Member States, the 2005 survey in thirty-one states – including not only the new Member States but also the (then-) projected Member States of Romania and Bulgaria, as well as Norway, Switzerland, Croatia, and Turkey. For reasons of comparison, the present study confines itself to the fifteen states present in the 1995 and 2000 surveys. A third difference is that the 1995 and 2000 surveys were proportional, including more respondents from large countries (Germany, France, United Kingdom) than from smaller countries (Netherlands, Belgium, Denmark). In the 2005 survey, each country contributed more or less the same number of respondents, approximately 1000 per country.

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1 <[www.eurofound.europa.eu/about/index.htm](http://www.eurofound.europa.eu/about/index.htm)>

2 Survey data can be obtained from the Economic and Social Data Service (ESDS), hosted by the University of Essex <[www.esds.ac.uk](http://www.esds.ac.uk)>.

In the present study, the only respondents included are those who claimed to be “self-employed without employees,” “self-employed with employees,” or “employed” (values 1–3 on item *q3a* in all three surveys). This left us with the following respondent numbers for the three surveys: 15,240 (1995), 20,825 (2000), and 14,307 (2005).

### Developments in the proportion of knowledge work

As described earlier, frequent external contacts and autonomy at work are considered paradigmatic elements of work in the knowledge economy. We refer to work showing these characteristics as “knowledge work.” We used the question “Does your main paid job involve dealing directly with people who are not employees at your workplace?” to indicate “frequency of external contacts.” This question (item *q11j* in all three surveys) was measured on a seven-point scale ranging from “all of the time” to “never.” In the 2005 survey, the values 1 and 2 (“all of the time” and “almost all of the time”) accounted for about 50 percent of the answers. We took these “1” and “2” values to indicate “many external contacts,” not only for the 2005 survey but also for the earlier surveys. Work autonomy, our second dimension of knowledge work, was calculated from three questions: “Are you able to choose or change your order of tasks?”; “Are you able to choose or change your methods of work?”; and “Are you able to choose or change your speed or rate of work?” (item *q24a–c* in all three surveys). The choices for these items were binary; respondents could answer “yes” or “no.” Assuming that autonomy at work would require each of these questions to be answered in the affirmative, we created a composite item “autonomy” that is “high” if a respondent answered “yes” to all three questions, and “low” in other cases. Table 1 presents the results of cross-tabulating these two dimensions for each of the three surveys.

Table 1 Combinations of autonomy and external contacts

	High autonomy/ many external contacts	High autonomy/ few external contacts	Low autonomy/ many external contacts	Low autonomy/ few external contacts
1995	30.2%	25.7%	20.9%	23.1%
2000	24.7%	28.4%	19.2%	27.7%
2005	25.6%	28.2%	20.8%	25.4%

Source: EWCS (1995, 2000, 2005).

The figures in Table 1 are remarkable. Between 1995 and 2005, the proportion of “knowledge work” became smaller. The decrease is sharpest in the high autonomy/many external contacts category between 1995 and 2000, followed by a modest increase between 2000 and 2005. This finding refutes the assumption underlying the new paradigm of work: that the proportion of knowledge workers is increasing.

It is possible that the pattern in Table 1 is a result of too stringent a criterion for “many external contacts,” because for respondents the difference may have been small between

“almost all of the time” and “around 3/4 of the time,” the next value of item *q11j*.<sup>3</sup> In Table 2, we inspect this possibility by presenting percentages in the high autonomy/many external contacts column after relaxing the criterion for “many external contacts.” It is obvious that relaxing the criterion for “many external contacts” enlarges the number of respondents who meet the criterion, so percentages in the left column of Table 1 would have been higher had we used a less stringent criterion. The percentages in the left column of Table 1 therefore have comparative value, and should not be taken as absolute values of the proportion of knowledge workers.

Table 2 Percentages in the high autonomy/many external contacts column under different criteria for many external contacts

	Stringent (almost all of the time or more)	Intermediate (around 3/4 of the time or more)	Relaxed (around half of the time or more)
1995	30.2%	32.7%	37.0%
2000	24.7%	27.2%	31.2%
2005	25.6%	28.4%	32.5%

Source: EWCS (1995, 2000, 2005).

Comparing the percentages in the three surveys, we find that relaxing the criterion for “many external contacts” does not change the observation of a sharp decrease in the share of “knowledge work” (the high autonomy/many external contacts category) between 1995 and 2000, and a modest increase between 2000 and 2005. In subsequent analyses, we will use the stringent criterion.

The analysis thus far has tested the claim that knowledge work is increasing, which is a cornerstone of the new paradigm of work. In the previous section, we presented some counteracting tendencies that were likely to limit the number of workplaces characterized by high levels of autonomy and external contacts. We still expected a slow rise in the share of “knowledge work,” but we were wrong. The proportion of knowledge work, as measured by autonomy and external contacts, is actually decreasing.

### Changes in the nature of knowledge work

The advent of the knowledge economy has not reduced the pressures of competition and the related need for efficiency and profitability. On the contrary, it seems to have added strong external demands concerning the quality (in various aspects) of goods and services delivered. An obvious instrument to make sure that such external demands

3 Values for variables *q11j* (“Does your main paid job involve dealing directly with people who are not employees at your workplace?”): 1 “All of the time”; 2 “Almost all of the time”; 3 “Around 3/4 of the time”; 4 “Around half of the time”; 5 “Around 1/4 of the time”; 6 “Almost never”; 7 “Never”; 8 “Don’t know/no opinion”; 9 “Refusal.”

are met is the use of output standards, an instrument that calls for higher levels of management control. We presume that knowledge work is increasingly being brought under such control, especially when knowledge work is growing (or is believed to be growing) to be a significant proportion of the total amount of work in an organization. In this section we test the proposition that the more that knowledge work becomes part of a firm's normal production processes, the more knowledge workers will be subjected to a high degree of management control.

Some of the items covering aspects of work in the EWCS surveys can be used to create a tentative measure of the degree of management control. This measure is based on two items: *q21c* ("Is your pace of work dependent on numerical production targets or performance targets?") and *q21e* ("Is your pace of work dependent on the direct control of your boss?"). Both items are binary; respondents could choose between "yes" and "no." We took a "no" answer on both items as indicating a low degree of management control. Although the measure pertains to "pace of work," and not output of work, it is still a more direct indicator of "management control" than autonomy – because a "yes" on the autonomy questions (e.g. "Are you able to choose or change your order of tasks?") does not necessarily mean that control is absent. These two variables, control and autonomy, might be closely related, reflecting the classic tension in organizations that more control means less autonomy (Feldman 1989; Scarbrough 1999; May/Korczynski/Frenkel 2002; Robertson/Swan 2003). However, this may not be how respondents understood the questions underlying management control. Table 3 shows a modestly strong but statistically significant relationship between "autonomy" and "management control" ( $\chi^2$  statistic in Table 3, all years  $p < .000$ ). The relationship is in the expected direction: in all three surveys, most respondents under conditions of low management control report high autonomy and most respondents under conditions of high management control report low autonomy. But clearly, the relationship is not perfect. Two groups do not fit in with the classic tension between autonomy and control. Those in the group that reports low autonomy under conditions of low management control may have experienced forms of control that do not, or not directly, stem from management. Examples are organizational culture (Robertson/Swan 2003) and peer pressure (Landsbergis/Cahill/Schnall 1999; Morrell/Wilkinson 2002). There is also a group, and not a tiny one, of respondents who report high autonomy under conditions of high management control. People in this group are saying: my pace of work is dependent on numerical production targets or performance targets, and the pace of my work is dependent on the direct control of my boss, and yet I am able to choose or change the order of my tasks, my work methods, and the speed or rate of my work. They are saying: yes, there is management control, but not enough to curb me.

We used the "management control" measure to examine the degree of management control exerted over knowledge workers (and other workers) in sectors (or sector categories) with varying degrees of knowledge intensity.

Table 3 Percentages of degree of management control and autonomy, and chi square statistic (Pearson)

	Low degree of management control		High degree of management control	
	High autonomy	Low autonomy	High autonomy	Low autonomy
1995 ( $\chi^2$ 486.5)	30.6	16.1	25.2	28.1
2000 ( $\chi^2$ 531.6)	31.5	20.3	21.6	26.7
2005 ( $\chi^2$ 151.6)	26.5	17.8	27.5	28.2

Source: EWCS (1995, 2000, 2005); percentages per survey.

The EWCS surveys do not provide firm-level information on knowledge intensity, but they do provide information about the sector of the company in which a respondent is working. In the surveys, measurement of economic sectors is based on NACE, the industrial classification of economic activities within the European Union. The 1995 survey includes the main sections of NACE Rev. 1<sup>4</sup> (Eurostat 1996), while categories in the 2000 and 2005 surveys are more detailed.

To make the surveys comparable, we converted values in the 2000 and 2005 surveys to the NACE main sections as present in the 1995 survey. These are the sections in Table 4. This table presents the percentage of participants possessing “higher education” as an estimate of a sector’s knowledge intensity. For 2005, a percentage of people with higher education per sector is given that denotes ISCED levels 4–6 (post-secondary non-tertiary education or tertiary education). ISCED is UNESCO’s International Standard Classification of Education.<sup>5</sup> No ISCED item was included in the earlier surveys, but the 1995 survey contains the item, “How old were you when you stopped full-time education?” We take the value “20+ years” (the highest value for this item) to indicate higher education. The 2000 survey does not contain items pertaining to education level. Because of the different indicators for 1995 and 2005, education rank numbers are added.

The education rank of sectors is comparable between 1995 and 2005, but not identical. On the basis of data available in EWCS surveys, it is not possible to check if these differences must be ascribed to different questions used to collect education level data, or to actual changes in the percentage of highly educated workers in the sectors. Generally speaking, however, the same sectors are scoring high in both years, and the same sectors are scoring low. We use this outcome as an empirical criterion for defining sector categories of knowledge intensity: “High”, “Intermediate”, and “Low” (indicated by the letters in brackets in Table 4). The sector of public administration is not included. While we do recognize that public administration in many countries has been reformed in

4 In the 1995 survey, some main NACE sections were taken together. Fishing (B) was added to Agriculture, Hunting and Forestry (A). Mining and Quarrying (C) was added to Manufacturing (D). Education (M), Health and Social Work (N), Other Community, Social and Personal service activities (O), Private Households with Employed Persons (P), and Extra-territorial Organizations and Bodies (Q) were combined in the category “Other Services.”  
<[www.eurofound.europa.eu/ewco/surveys/previous-surveys/surveys91-96.htm](http://www.eurofound.europa.eu/ewco/surveys/previous-surveys/surveys91-96.htm)>

5 <[www-uis.unesco.org/TEMPLATE/pdf/isced/ISCED\\_A.pdf](http://www-uis.unesco.org/TEMPLATE/pdf/isced/ISCED_A.pdf)>



Table 4 Economic sectors (NACE main sections) by education

	1995	Rank 1995	2005	Rank 2005
Financial Intermediation [H]	34.6	4	56.0	1
Other Services [H]	42.2	3	56.0	1
Real Estate and Business Activities [H]	42.3	2	54.8	3
Public Administration [-]	44.1	1	45.6	4
Electricity, Gas and Water Supply [I]	29.0	5	34.9	5
Transportation and Communication [I]	24.6	7	28.7	6
Mining and Quarrying, Manufacturing [I]	25.1	6	26.5	7
Wholesale and Retail Trade, Repairs [L]	19.0	9	24.3	8
Construction [L]	22.2	8	20.8	9
Hotels and Restaurants [L]	15.4	10	18.1	10
Agriculture, Hunting, Forestry, Fishing [L]	14.1	11	14.6	11

The letter in brackets indicates a sector's "knowledge intensity category," explained in the text.

Source: EWCS (1995; higher education indicated by percentage of respondents who finished education at age 20+) and EWCS (2005; higher education indicated by percentage of respondents with ISCED-score 4 or higher).

recent decades under the banner of "new public management," and principles derived from private sectors – accountability, customer orientation, decentralization – were adopted (Hood 1995; Page 2005) to improve performance, no public administration is facing the kind of competition that private firms have to deal with. We can therefore expect different work regimes, and for this reason left public administration out of the sector categories of knowledge intensity.

In Table 5, sector knowledge intensity and knowledge work (measured as high autonomy and many external contacts, see Table 1) are combined with data on management control. The cells in the table display the percentage of respondents who indicated high levels of management control in the three survey years. Thus the table shows the relation between the knowledge intensity of a sector and the degree of management control for the two categories of work: knowledge work and "other" work. It also allows for comparisons between the years of the surveys. The "new paradigm" assumption would be that management control will be lower in knowledge work than in other work, and lower in sectors with high knowledge intensity than in sectors with low knowledge intensity, and that the percentage of respondents indicating high management control would diminish over time.

The low percentages of high management control in 2000 are noticeable, especially for knowledge work in the high and intermediate knowledge intensity sector categories. In every cell, the 2000 percentages are lower than those for 1995 and 2005. It is tempting to think of a business cycle effect here. The 2000 survey period of field work was between March 1 and April 30, 2000,<sup>6</sup> coinciding with the Wall Street dot-com crash. Presumably, the respondents' views on work would have been affected by the previous period of strong economic expansion and tight labor markets, since such conditions are generally seen as strengthening the position of workers against efforts to exert hierarchical control.

6 <[www.eurofound.europa.eu/pubdocs/2001/21/en/1/ef0121en.pdf](http://www.eurofound.europa.eu/pubdocs/2001/21/en/1/ef0121en.pdf)>

Ignoring the 2000 survey, we find that management control in high knowledge intensity sectors has increased between 1995 and 2005, for knowledge workers as well as for other workers. In the intermediate knowledge intensity sectors, management control was fairly stable; it also increased in the low knowledge intensity sectors, but there only for knowledge workers. Part of an explanation can be found in the high level of management control in the intermediate knowledge intensity sectors in 1995, where the high level presumably relates to the fact that respondents from the “intermediate” category were working in medium-sized and large companies relatively often. It is quite likely that larger companies were ahead of smaller companies in “rationalizing” work.

Table 5 Percentage of respondents scoring high on the management control variable

		Knowledge work (high autonomy, many external contacts)	Other work (low autonomy and/or few external contacts)
Knowledge intensity of sector	High	1995: 35.7 2000: 30.6 2005: 44.3	1995: 48.3 2000: 40.4 2005: 52.7
	Intermediate	1995: 47.5 2000: 30.6 2005: 44.7	1995: 70.6 2000: 64.7 2005: 69.2
	Low	1995: 39.1 2000: 36.6 2005: 47.7	1995: 58.8 2000: 51.0 2005: 58.1

Based on *q21c*, “numerical production targets or performance targets,” and on *q21e*, “the pace of work depends on direct control of your boss.”  
Source: EWCS (1995, 2000, 2005).

Comparing the columns in Table 5, we find that fewer knowledge workers mention a high degree of management control than do other workers, but the difference becomes smaller between 1995 and 2005, mainly because knowledge workers catch up: the percentage of knowledge workers mentioning a high level of control increased more rapidly than among other workers.

## Discussion and conclusion

“Knowledge work” is an elusive concept. It can be used to refer to everything from the kind of work people do, the kind of company they work for, or even the kind of industry in which they are employed, to a person’s occupation, their educational background, or the professional group to which they belong. In this paper we chose an approach that avoids such a priori classifications of knowledge work. Characteristic of labor processes in the “knowledge society,” we argued, is that work is increasingly organized according



to standards from the consulting field – which is notable because “consultants not only exemplify the category of the highly-skilled knowledge worker; they also play a key role in the knowledge economy and are considered to be representative of the organizational arrangements that are emerging with the rise of a knowledge-based economy” (Donnelly 2004: 79). A high degree of work autonomy and many external contacts are typical of consulting (and of other occupations often associated with knowledge work). Using these two features to operationalize knowledge work, we were able to analyze developments in the proportion of knowledge work and the nature of knowledge work without having to resort to some known category of knowledge workers, whether this were based on education, occupation, industry, or any other of the definitions that are commonly used. The reason for not relying on any of these known categories is not that available definitions of knowledge work, and of knowledge workers, are unacceptable (though many are ambiguous, as argued). The point is rather that these definitions – all involving knowledge-related phenomena deemed crucial by those who submitted the definition – cannot be used for studying the development towards a knowledge economy: conclusions would be tautological. There is no need to prove that the number of workplaces occupied by persons with higher education has increased; that is a fact. Instead, we are interested in the characteristics of work in these workplaces and argue that increasing levels of education are not necessarily tied to the increasing professionalization of work. We add that the operationalization of knowledge work we propose may serve the study of changes in the nature of work within any of the known categories, in a way that does not require one to address the awkward question of whether profession X or industry Y is now using more knowledge than some decades ago. These are advantages.

There are disadvantages as well. A drawback of our approach is that the category of knowledge work will include respondents who do have autonomy and external contacts, but whose work still does not seem to qualify them as “genuine” knowledge workers – because their education level does not allow for it. We acknowledge that most, if not all, discussions of knowledge work take a higher education level for granted. In this sense, our approach may seem to run counter to established views of knowledge work. We still think there are good arguments for the view that workers who have autonomy and external contacts are representative of a knowledge economy, even if they are less educated. Clearly, there is a heterogeneous collection of trades, crafts, and even healthcare occupations that combine high autonomy and frequent external contacts with little or no formal education: barbers, knife-grinders, chimney sweepers, ice-cream vendors, taxi drivers. Interestingly, in the past, most people involved in such occupations were self-employed. Today, many of them are employed by others, and consequently their autonomy will often be limited. If such less-educated workers today indicate they have high autonomy and many external contacts, they are just as representative of trends in a knowledge economy as workers with more education – but their numbers will be small.

Another drawback is that some people who are usually considered knowledge workers (and who would consider themselves to be so) fall outside our definition, as they have limited or no contact with persons outside the company they work for. While this is a drawback, we don't consider it serious enough to drop "frequent external contacts" as a criterion. In a time when competitive performance is generally seen to depend on external networking, supply chain management, collaboration, alliances, customer orientation, and open innovation, all of which are often considered defining characteristics of the knowledge economy, it can be argued that "real" knowledge work will always involve frequent contacts with persons outside the company, be they suppliers or customers, competitors or university professors.

It should be noted that our data is based on a survey asking respondents about their views. Especially in cases of autonomy and management control, these views may not only differ from the estimations of neutral outside observers, they may also change independently of the real situation. It is for instance possible that in a situation in which real autonomy has actually increased, the percentage of respondents indicating high autonomy will be decreasing, because the greater autonomy has only stimulated workers' desire for even more autonomy. Bateson (1972) called this phenomenon "complementary escalation": capitulation increases demands (see also Omer 2001). In future research, respondents' perceptions of their autonomy will have to be compared with views concerning phenomena less likely to be subject to complementary escalation.

Despite these (possible) drawbacks, our analysis clearly demonstrates that a major claim of the new work paradigm – that it is a matter of time before all jobs meet the professional service model – is questionable. And if there is reason for doubt, adherence to the new paradigm can be harmful. At the firm level, this adherence may prevent efforts to create forms of work organization in which "old" and "new" work (and "old" and "new" workers) are brought together in ways that avoid a two-tiered work organization. Such a two-tier organization may worsen the working conditions of less-educated workers; it may lead to "erosion of internal labor markets" (Burriss 1998), and to a "redefinition of what constitutes legitimate work knowledge," to the "standardization of decisions made by non-expert workers," and ultimately engender workplace tensions and loss of organizational flexibility (Vallas/Beck 1996). At the state level, this adherence may strengthen the unfortunate belief that traditional work is ceasing to be important and that it is not necessary to make serious investments in it.

There are scientific implications as well. We found that the share of knowledge work, as indicated by autonomy and external contacts, is not growing; it is stable at best. Rather than taking this as an argument to reduce research on knowledge work (and knowledge workers), we suggest that the reasons for this stagnation be studied carefully. Subjects that may be examined in detail are (1) the processes contributing to the coming of a knowledge economy, along with counteracting tendencies, (2) knowledge heterogeneity within and between "groups" under conditions of an emerging knowledge economy, and (3) the role of "exogenous" processes and events.

1. In an earlier section, we described four trends that contributed to (the coming of) the knowledge economy and to the knowledge work paradigm: the rising level of education, the growth of services, automation and ICT, and the relocation of work. Each of these trends involves a large and complex collection of contributing processes that needs further exploration. It is possible, moreover, that further trends will need to be added. Scarbrough (1999), for instance, notes that the institutional setting for knowledge work is shifting away from professions or disciplines towards organizationally-defined contexts of use. This, he argues, is the result of four related developments: the relative decline of the professional model, the increasing importance of knowledge work in a range of occupational groups, the codification and commodification of knowledge through new ICTs, and the emergence of new sectors of knowledge production within the economy. What is needed, then, is a thorough analysis of trends and processes contributing to the knowledge economy, including an assessment of the importance of each of these, and an analysis of the factors that are hampering or slowing down the development of a knowledge economy.
2. As we have shown (Tables 4 and 5), sectors differ in terms of knowledge intensity. It is likely that such differences will be found at other levels of aggregation as well: work functions, firms, regions, countries. Not only is it important to examine the degree of knowledge heterogeneity at each level and analyze the reasons, but it is also important to study the implications, e.g. to investigate whether, and how, high and low knowledge-intensity firms are able to collaborate, or how working relations between well-educated and less-educated workers evolve (Burrell 1998).
3. Finally, the role of exogenous processes and events may have to be considered. Of the three surveys used in this study, two were administered at a peculiar point in time. Data in the 2000 survey was collected in the days of the dot-com crash. The 2005 survey was administered at the moment when European economies were just recovering from the recession that followed the dot-com crash. The next EWCS survey is due to follow in 2010, and responses will be influenced by the present economic circumstances. These days, it seems, there are not many “ordinary years” in which to conduct a survey on European working conditions, and this applies to knowledge economy-related trends and processes as well. Economic crisis is not the only factor that can change the course of “normal” trends and processes in the economy in an unpredictable way (political crisis is another good candidate), but it is probably the most important one. Rethinking its impact on short- and longer-term economic development, and its impact on available data concerning economic development, would be well-advised.

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