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Article *in* Journal of Knowledge Management · June 2005

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The concept of knowledge work revisited

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Abstract

Purpose – *To identify and critically assess the most recurrent themes in the ongoing debate on knowledge work.*

Design/methodology/approach – *A representative selection of studies published since 1962 is reviewed. The review focuses on the theoretical strengths and limitations of the concept of knowledge work.*

Findings – *The review indicates that definitions of knowledge work abound. Although knowledge work has attracted scholarly minds for several decades and the number of publications in this area has rapidly increased in recent years, it has proved hard to come by a clear and concise definition of this term. However, certain themes, such as a high level of education and skills and the use of information technology as an integral part of the informational labour process, have become increasingly common to both the empirical and the theoretical literature.*

Originality/value – *The paper helps pave the way for more detailed research by providing an ideal-typical profile of informational labour.*

Keywords *Knowledge management, Information personnel, Information society*

Paper type *Conceptual paper*

Introduction

When one flips through the pages of popular business magazines or mainstream management books, it is easy to get the impression that the notion of knowledge work is new. However, Fritz Machlup, observing development in American society, established knowledge-based activities as a legitimate field of empirical research in economics as early as 1962 (Machulp, 1962). Peter Drucker (1969) and Daniel Bell (1973) then popularized the idea beyond academic circles. Simultaneously, yet independently of their American counterparts, Japanese researchers foresaw the coming of an information society (*johoka shakai*) and also developed a distinctive methodology for quantifying the consumption of information flows cascading across society's communication channels (Duff, 2000).

Although these early ''traditions'' of information society studies represented completely different schools of thought, their conclusions were quite similar. On the one hand, if we look at the latter half of the twentieth century, we can see a significant increase in the production and consumption of information goods and services. Communication systems constitute one of the fastest growing and most important components in the economies of most nations – for good reason, it is often said that the volume of information at our disposal is now doubling every couple of years. On the other hand, we can also witness the rise of knowledge work as a major trend in Western labour markets, a key factor that distinguishes globally competitive economies from their weaker rivals (Soete, 2001). What is in demand now is a high level of education and skills that add value to the goods and services produced.

The growing importance of knowledge as an economic resource reflects the fact that, as economies and production technologies develop, they become ever more complex and

specialized, leading to increasing coordination costs. In the language of information economics, the organizational or informational task of coordinating the diverse steps in the productive chain grows, as the number of transactions within and among productive units increases (Joncher, 1983). Logically, the increasingly complex economy must also generate more information flows (Robinson, 1986). In other words, the more complex and specialized the production system becomes, the more communicative effort is required to manage organizational processes. In keeping with this trend, the demand for informational labour that is capable of handling, synthesizing and creating new knowledge has grown, while space for traditional manual work, susceptible to be replaced by automation and mechanization, has been reduced.

This development, to quote a vivid passage by Brown and Lauder (2001), ''signals the terminal demise of industrial man, typified by the Fordist worker who has become a minor player in the overall pattern of economic life'' (p. 159). Pick up any major newspaper today and look at its appointments section, and you will get an idea of just how marginal the number of jobs in the manufacture of material goods (not to mention primary production) is in comparison to professional and service occupations that involve working with knowledge or people. Business success no longer relies merely on improving efficiency, but essentially on an unbroken flow of human capability to innovate and embody new ideas and knowledge throughout the economy. As a consequence, especially managerial, professional and technical occupations have expanded. Although part of this ''up-skilling'' might be illusory, explained for example by the growth of credentialism, i.e. the re-labelling of old occupational titles and the invention of seemingly novel ones, there is a substantial body of research evidence on how education and rapid learning in particular have become the key qualities of labour upon which future economic growth and welfare is built (Archibugi and Lundvall, 2001).

However, definitions of knowledge work abound. Although knowledge work has attracted scholarly minds for several decades and the number of publications in this area has rapidly increased in recent years, it has proved hard to come by a clear and concise definition of this term. It appears that the information age is still not mature enough fully to define the role of the core of its workforce (Elliott and Jacobson, 2002). Yet, as attempts to characterize informational labour have evolved, certain themes, such as a high level of education and skills and the use of information technology as an integral part of the informational labour process, have become increasingly common to both the empirical and theoretical literature (Amar, 2002; Cortada, 1998; Horibe, 1999; Newell *et al.*, 2002).

The purpose of this paper is to identify and deconstruct these themes. On the one hand, it provides an ideal-typical profile of informational labour with an emphasis on recent changes in the economy and work organizations; and, on the other hand, it provides evidence on the growing importance and size of this category of workers. Because there exists a substantial empirical body of research on the rise of knowledge work, the analysis is confined to those theoretical and conceptual implications that are less discussed and as such of the most interest to organization and management studies.

The rise of the knowledge worker

> All human activities, including the so-called manual ones, have a mental component, but in the case of intellectual work this component predominates. Furthermore, in order to perform intellectual work – as distinct from spontaneous or free mental activity – the mind must first be trained, by dint of protracted study, to deal with abstract ideas (Cuvillier, 1974, pp. 292-3).

It is hardly coincidental that the first scholarly authors on knowledge work – including Machlup, Drucker and Bell – chose to concentrate on the United States, and the Japanese *johoka shakai* researchers also used the USA as their benchmark case. According to Machlup and his successors, most notably Marc Porat (1977), the USA has led the way towards the informationalization of social structures (see also Rubin and Huber, 1986; Schement and Curtis, 1995). Compared to other OECD countries just a few decades ago only Canada was on a par with the USA in terms of the size of the information sector and its

> **"The growth of knowledge work reflects a sea change in the mode of capitalist production."**

employment effects. According to the Organization for Economic Co-operation and Development (1981), by the beginning of the 1970s around 40 percent of the working population in the USA and Canada were classified to the information sector, whereas in most other OECD countries the figures were still considerably lower.

These early comparative statistics, relying on official occupational classifications, were premised on the well-attested observation that occupations in primary production and manufacturing were giving way to a growing percentage of service and white-collar work. Following the example set by Machlup and Porat, the OECD contended that conventional statistics actually hide from view a profound structural change which relates to the role of the activities of generating, processing and distributing information as well as the goods and services that these activities absorb. Thereby Machlup, Porat and the OECD projected that the occupations involved primarily in informational activities represent an important and rapidly growing segment of the labour force. Today, we may conclude that this has indeed happened: knowledge workers have risen to prominence both in numbers and especially in terms of their significance for national economies (Blom *et al.*, 2002; Engelbrecht, 2000; Kuo and Low, 2001; Lavoie *et al.*, 2002; Martin, 1998).

The growth of knowledge work reflects a sea change in the mode of capitalist production. In this context, one of the most basic theoretical distinctions is usually made between traditional industrial production based on cheap labour and energy and heavy material investments as the primary sources of economic productivity; and, on the other hand, the use information or knowledge as a new source of wealth creation in post-industrial societies. In the former mode of production the economic system was closely tied to physically tangible assets, whereas in the latter knowledge has become the most important asset individual and collective actors can possess. Indeed, as for example the case of the Scandinavian information societies indicate, even small economies that are relatively disadvantaged in natural resources but skilled in the production and exploitation of knowledge can outperform larger rivals that have abundant natural resources but that are lacking in such skills (Benner, 2003; Castells and Himanen, 2002; Pyöriä, 2003a).

In information economics (e.g. Joncher, 1983; Nass, 1988) a similar distinction to that mentioned above is usually made between work activities with material (matter/energy) and immaterial (information/knowledge) outputs. From the point of view of work and organizational processes, this dualism serves an important analytical purpose. The point is that unlike the traditional industrial worker, the knowledge worker processes and manipulates information as an end in itself which means it is the informational content of the job that defines the task, the product, and ultimately the worker (Schement, 1990). Indeed, as Machlup (1980) has correctly observed, for most parts of the production of knowledge no possible measure of output can be conceived that would be logically separate from a measure of inputs. For most knowledge workers, then, the real substance of work is not the product, but the process.

In more practical terms, the increasing knowledge-intensity of work and organizational processes may assume two primary forms. First, the rising educational level of the workforce is a well-documented trend reflecting a growing demand for symbolic and interactive skills at the expense of manual skills. Second, scientific and technical knowledge has become an integral part of the development of new products and services, and this trend looks set to intensify. Anticipating the growing importance of these currents, Bell (1973) went so far as to interpret the increasing symbolic and interactive content of work as the fundamental fact about work in a post-industrial society. Bell, however, was not content simply to observe the

present. He also postulated that theoretical or abstract knowledge is the axial principle of an emerging social, political and cultural logic marking the end of industrialism.

According to Bell an industrial society was based on the coordination of machines and men for the production of goods, whereas a post-industrial society is organized around knowledge for the purpose of social control. In Bell's (1973) words: ''What has become decisive for the organization of decisions and the direction of change is the centrality of *theoretical* knowledge – the primacy of theory over empiricism and the codification of knowledge into abstract systems of symbols that, as in any axiomatic system, can be used to illuminate the many different and varied areas of experience'' (p. 20). It is this aspect of Bell's account that has proved to have the most lasting value, although the novelty of his idea can be questioned. That is, in general terms, the idea of knowledge as a form of capital has been around since at least the days of Adam Smith.

As Manuel Castells, drawing on Bell among others, has convincingly argued in his highly acclaimed *The Information Age*, it is precisely this independent and yet intrinsic role of knowledge that is one of the most distinctive features of all successful economies and organizations. Castells does not stress the role of information or knowledge in general, but the application of Weberian rationalization to the production of knowledge itself. According to Castells it is the virtuous cycle of knowledge accumulation that is the key to prosperity:

> In the new, informational mode of development the source of productivity lies in the technology of knowledge creation, information processing, and symbol communication. To be sure, knowledge and information are critical elements in all modes of development, since the process of production is always based on some level of knowledge and in the processing of information. However, what is specific to the informational mode of development is the action of knowledge upon knowledge itself as the main source of productivity. (Castells, 1996, p. 17).

Of course, as Castells implies, all forms of society and all cultures are ultimately based on the distinctively human capacity to process symbols. No matter how routine an activity is, it always requires some measure of intelligence and an ability to process and manipulate information. In this sense Western culture cannot be regarded as unique, but the importance that is attached by our society to knowledge as an economic resource certainly sets us apart. F.W. Taylor's principles of scientific management provide a well-known example. In order to organize work as productively as possible information is needed prior to the execution of work tasks. Or, as information economists would say, why, what and how have to be resolved before physical labour makes economic sense (Eliasson *et al.*, 1990).

It is equally important to emphasize that the skill of abstract thinking acquired in formal education has never been more pronounced than it is in contemporary organizations; it is a route that must be taken before informal learning can take place. It is for this reason that Castells discusses informational work and its processes, arguing that we are now on the threshold of a new era with regard to both occupational and other key structures in society. In analytical terms the difference is the same as between the concepts of industry and industrial: even if all forms of social activity are based on processes that mediate information, not all societies are informational no more than they are all industrial. Similarly, virtually all organizations today are dependent on modern information technology, yet only few organizations are thoroughly technology-driven.

On the basis of the foregoing it can be argued that the diffusion of IT and the informationalization of work and organizational processes do not develop in tandem by some logical necessity. The argument put forward below is that in contrast to what is sometimes suggested, the use of information technology is not in itself a sufficient criterion for classifying work as informational. It is also necessary to take into account qualitative changes in work and organizations.

Knowledge work today

Although the concept of knowledge work was first popularized some 30 years ago, the discussion began to gather momentum again in the 1990s. For example, in *The Work of Nations* Robert Reich, a professor of political science and a former Secretary of Labour during

Bill Clinton's first term in the White House, sketched a portrait of an elite of workers he calls symbolic analysts, explaining that this category refers to design tasks and expert jobs that require creativity and innovativeness *par excellence*. In Reich's (1991) analysis, the workforce in the USA as well as in other advanced economies is divided into three distinct groups:

1. *Routine production services* entail repetitive tasks guided by standard procedures and codified rules. Although routine producers must be able to read and to perform simple computations, their cardinal virtues are reliability, loyalty and the capacity to take direction. This category comprises traditional blue-collar jobs, but also routine supervisory jobs as well as routine information processing. By 1990, routine production work comprised about one-quarter of the US workforce, and the number was declining.
2. *In-person services* also entail simple and repetitive tasks. The big difference between in-person and routine production services is that the former must be provided person-to-person and thus are not sold worldwide. Another difference is that many in-person servers need to have a pleasant and discreet demeanour. Traditionally most in-person servers have been women, typical jobs including retail sales workers, cashiers, hairdressers, secretaries, etc. By 1990, in-person services accounted for about 30 percent of the US workforce, and their numbers were growing rapidly.
3. *Symbolic-analytical services* entail all the problem-solving, problem-identifying and strategic brokering activities that are non-standardized. These services can be traded worldwide and thus are susceptible to global competition. Symbolic analysts often work in teams. Since neither problems nor solutions can be defined in advance, frequent and informal conversations help ensure that insights and discoveries are put to their best uses and subjected to quick, critical evaluation. Symbolic analysis currently accounts for no more than 20 percent of American jobs.

In Reich's view, these three groups cover more than three out of four American jobs. Among the remainder are farmers, miners and other extractors of natural resources, comprising less than 5 percent of the US labour force. The rest are mainly government employees or government-financed workers, almost all of whom are sheltered from global competition.

An interesting point here is that in Reich's usage, knowledge work refers strictly to expert labour whose resources are pooled from increasingly international external labour markets and whose competitive edge lies in solving, identifying and brokering new problems. The category of symbolic analysts includes such professionals as lawyers, investment bankers, management consultants, research scientists, and so forth. From this point of view, the routine communication of information, as understood for example by Machlup and Porat, is not yet considered a type of work distinctive of the new information economy. However, what Reich shares in common with the majority of other scholars, is the view that the proportion of workers engaged in symbolic analysis has increased substantially since the mid-twentieth century, although his estimate of their current prevalence is rather moderate.

Another well-known critic of the information society is Jeremy Rifkin, who in his scientifically controversial yet certainly thought-provoking book, *The End of Work*, states explicitly that it is unlikely any of the most important occupational groups of the future will be very large:

> The few good jobs that are becoming available in the new high-tech global economy are in the knowledge sector. It is naïve to believe that large numbers of unskilled and skilled blue collar and white collar workers will be retrained to be physicists, computer scientists, high-level technicians, molecular biologists, business consultants, lawyers, accountants, and the like (Rifkin, 1995, p. 36).

"Individual creativity and innovativeness comprise the scarcest and arguably the most valuable resource in an information society."

The most important implication of the above views is that individual creativity and innovativeness comprise the scarcest and arguably the most valuable resource in an information society. According to Reich and others who emphasize the symbolic aspects of knowledge work above all else, the key to the new work processes lies not in the homogenous social collective but in the cooperative and flexible individual as well as in the ability of that individual to act as an interface between new technology and human interaction.

The key here is flexibility, interdisciplinary cooperation and rapid learning. Knowledge workers are defined primarily by the nature of their work, which is relatively unstructured and organizationally contingent, and which reflects the changing demands of organizations more than occupationally defined norms and practices (Scarbrough, 1999). As Reich implies, clinging to an existing body of knowledge does not suffice; an ideal-typical knowledge worker is expected to use knowledge creatively. Thus, the category of knowledge workers may include but is not restricted to traditional professionals who have mastered a particular domain of knowledge (cf. Fincham, 1996). Computer programmers, for example, as practitioners of a relatively young and rapidly evolving discipline, do not share a common code of ethics, attachment to credentials or involvement in professional organizations such as medical doctors, teachers or lawyers do.

In this respect, knowledge work resembles traditional craftsmanship, where workers were responsible for doing a total job in small groups, and where knowledge was tacitly passed on from masters to apprentices. Like craftwork, knowledge work in teams is largely individual, *ad hoc*, and invisible, says Richard McDermott (1995), one of the most renowned consultants specializing in knowledge work. The engagement in the work process or practice is the key here. As Lave and Wenger (1991), who have coined the term ''communities of practice'', argue, learning takes place within a framework of participation, rather than in individual minds. In this process an individual not only learns about a practice, but he or she becomes a practitioner conforming to a common set of implicit and explicit rules, regulations and a shared way of thinking (Brown and Duguid, 1991).

Yet, the difference compared to the past is twofold: in knowledge-intensive organizations the ''new craftsmen'' are dependent on theoretical knowledge and formal education rather than on empirical and anecdotal experience only; and, because of the increasingly abstract nature of knowledge, it is often necessary to work closely with other specialists. A combination of both theoretical and interpersonal knowledge is needed. As Eileen Trauth, the author of *The Culture of an Information Economy*, writes, ''the former is required for one's specific job; the latter makes workers well rounded and enables them to respond to the contingencies of the workplace'' (Trauth, 2000, p. 10).

It goes without saying that practical and tacit forms of knowing are of crucial importance, but the point addressed here is that in contemporary work organizations formal training generally precedes hands-on experience. Because the life cycle of advanced knowledge and new technologies is getting shorter and shorter, the most important skill a knowledge worker can possess is the ability to continuously build upon his or her previous state of expertise. In this process formal training provides a theoretical foundation without which on-the-job learning would not be possible. In other words, theoretical knowledge, for example the mastery of mathematical symbols and equations, functions as a common language among specialists, enabling them to interact and exchange ideas and, as Trauth (2000) says, ''make the mental leaps into the new methods and approaches that accompany the technology that is ever on the horizon'' (p. 10).

Thus, in addition to the unstructured nature of work tasks, another common baseline assumption emerging from the recent literature is that extensive formal expertise is required of informational labour. For example, according to Paul Thompson *et al.* (2000), the implicit model of the traditional knowledge worker is someone who has access to, learns and is qualified to practice a body of knowledge that is formal, complex and abstract. In a similar vein, to take just one more example from the burgeoning research literature, Stephen Frenkel *et al.* (1995) say that knowledge workers rely predominantly on theoretical knowledge, and their work requires a high level of creativity for which they mainly use intellective skills.

In other words, the most important criteria for knowledge work, as they emerge from recent studies, are centred on the symbolic content of task structures that, according to the authors cited above, allow for creative application, manipulation or extension of knowledge in organizationally contingent settings (see also Blackler, 1995; Despres and Hiltrop, 1995; Kelloway and Barling, 2000; Pyöriä, 2003b).

Some critical remarks

The use of IT

Of course, these and any other sets of criteria are problematic and highly controversial. Consider the role of information technology, which has implicitly been attached to the concept of knowledge work since at least the 1970s. To give a few examples, the job of a writer, a freelance journalist or a university lecturer does not necessarily require the use of information technology, but in practice the typewriter has been replaced by the PC and the telephone has been all but replaced by e-mail as a means of communication among people whose job involves producing and manipulating symbols. Although problematic, this presumption is justified because the number of cases that fit in with the general idea of knowledge work but that involve no use of information technology is so small that it is impossible to draw any relevant generalizations, even with extensive statistical materials. Therefore, it is reasonable to include IT use in the definition of knowledge work.

However, it must be pointed out that if knowledge work is approached as an integrated process, then we might be able to identify a number of stages that are not directly bound up with the use of technology. If it is thought that creativity is emphasized in knowledge work at the expense of routines, then the most decisive and knowledge-intensive part of the job description may refer to cognitive processes that are independent of time, place and the tools used. An innovative idea may emerge during leisure time just as well as on the job. Furthermore, a major technical innovation based on a simple abstract idea or theoretical model may well be finalized using paper and pencil just as well as sophisticated software. After all, it is not as though the pre-computer world had no technological aids in the processing of information: only an arrogance or ignorance under the spell of the modern ''cult'' of information technology could contest this fact (Duff, 2000).

On the other hand, in some jobs a PC, computer terminal or a programmable machining tool may be comparable to the conveyor belt, serving as tools with which the operator can repeat routines or control the production process without any creative input whatsoever. Although the jury is still out to decide whether or not the work of telephone operators, for instance, is knowledge-intensive (Mueller *et al.*, 1995; Taylor *et al.*, 2002), there is no doubt that information technology has helped in the automation of many office routines, thereby creating more space for non-routine activities and enriching many traditional white-collar jobs. In other words, IT use alone does not serve as a sufficient criterion for knowledge work, even though in practice they are often connected.

Formal education

It is clear, then, that we need more specific determinants for a useful definition of knowledge work. In addition to the use of information technology, a second criterion suggested here is a high-level of formal education, which is characteristic of all advanced information societies. Much in the same way as IT use, this is a somewhat problematic criterion in that an academic degree is neither an absolute condition for, nor an obstacle to, employment in a job that requires creative problem solving or designing key aspects of the job. For example, the reality that many individuals without extensive formal education are employed in IT professions reflects the importance of an often-neglected route to skill development by informal learning on the job (Hilton, 2001). In practice, however, it is more and more difficult to get a job without formal qualifications.

> **"The concept of knowledge work is best understood as an ideal type, because in reality knowledge workers do not constitute an empirically homogeneous category."**

The nature of work

Finally, the autonomous and non-routine nature of work should be considered, although this criterion is no less problematic than either IT use or education. For example, it has been argued that it is a gross simplification to equate knowledge work with non-routine tasks, because even scientists perform mundane and highly repetitive routine activities such as tabulations, data collection, lab experiments, and so on (Purser and Montuori, 1995). However, the view advocated here is that non-routine problem-solving is the core of knowledge work that together with the education criterion allows us to distinguish knowledge workers not only from traditional workers but also from routine IT users on the basis of the design component involved in the job. These two additional criteria avoid the problem of excessive technological determinism and also underline the cognitive side of knowledge work without presenting it in too elitist a light.

Choi and Varney (1995) have arrived at a similar conclusion in saying that the category of knowledge workers should include all people who are well educated, perform non-routine work, and are required to think and make decisions. Similarly, Sulek and Marucheck (1994) have argued that the term knowledge worker should be used to refer to those workers who possess high levels of education, experience and organizational status, and thus are allowed to exercise considerable autonomy and discretion in performing their work. Closely following Reich's reasoning, Sulek and Marucheck continue that knowledge workers include, but are not limited to, professionals such as academics, doctors, lawyers, engineers, and scientists whose work tends to be intangible in nature: ''Hence, knowledge work involves cognitive skills (e.g. typical tasks include planning, problem solving, decision-making) and many frequently require innovation or creativity on the part of the worker'' (Sulek and Marucheck, 1994, p. 5).

Who, then, is a knowledge worker and who is not? In contrast to the approach pioneered by Machlup and Porat, who both relied on occupational classifications, more recent studies do not attempt to place knowledge workers in any particular industry or occupational category. As Winslow and Bramer (1994) conclude, a knowledge worker simply is someone who interprets and applies information to create and provide value-adding solutions, and to make informed recommendations. Indeed, in recent studies such diverse jobs as classical scholarship (Ruhleder, 1995), international policing (Sheptycki, 1998) and investment banking (Royal and Althauser, 2003) have been analysed under the heading of knowledge work. However, the themes that appear most frequently in the literature are the use of IT, education and the non-routine nature of work.

Knowledge work as an ideal-type

On the basis of the foregoing it is hard to escape the conclusion that project-specific definitions of knowledge work are inevitable. Yet, the view advocated here is that they also provide some important advantages over occupational classifications. For example, occupational classifications tend to be misleading in that they are poorly suited to comparisons over time. The longer the period under scrutiny, the more problematic comparisons become. As Donald Lamberton, one of the first economists to criticize the occupational approach, puts it:

> . . . the question to be posed is whether the information sector of country X in 1975 is one and the same sector as it was in, say, 1925. Even a cursory glance at the list of information occupations included in the information sector reveals that many of those occupations have made their appearance in the list in the last few decades (Lamberton, 1982, p. 41).

The occupational approach has its merits, but it is equally important to concentrate on the changing nature of work regardless of the title or industry. Today, the occupational structure in all advanced information societies is very different from what it was just a decade ago. For instance, simple word-processing tasks and telephone exchange work have been transformed considerably. Accordingly, sociologists generally agree that the formal occupational categories are outdated and cannot keep up with the change (Barley and Kunda, 2001).

A well-known problem with occupational statistics is that somewhat arbitrary decisions cannot be avoided when deciding who is a knowledge worker and who is not. An additional problem is that the distinction between mental and physical labour has become increasingly blurred, in some cases non-existent, due to the automation of routine work first in factories and more recently in offices. For example, based on their detailed analysis of occupational titles, Schement and Lievrouw (1984) argued two decades ago that knowledge work occurs across all sectors of the workforce.

Admittedly, the notion of knowledge work is highly controversial and often remains ill-defined. Despite these shortcomings, it serves to draw attention to the multifaceted effects that technological development has for individuals and organizations as well as for academic attempts to comprehend the change. While it might indeed be impossible to come up with an unambiguous and uncontested definition of knowledge work, it is certainly possible to advance our understanding of the information society and its constituents – the discourse on knowledge work is a step in the right direction. It provides an important alternative to the study of work going beyond the traditional distinction between agriculture, manufacturing and services, rather than merely being an exercise in re-labelling old occupations.

To sum up, the concept of knowledge work is best understood as an ideal-type, because in reality knowledge workers do not constitute an empirically homogeneous category. According to Max Weber's classic definition, ideal-typical concepts are neither empirically detailed descriptions nor theoretically exhaustive elaborations of reality. Instead, their utility lies in the encapsulation of meaning by capturing essential attributes of certain classes of social phenomena sharing common features or family resemblance. Just as one can speak of ideal types that inform our thinking of organizations, one can speak of ideal-types of work: by reducing the diversity of work to a few modal images, ideal-typical occupations such as the category of knowledge workers help us comprehend the complexity of the division of labour and assign status to individuals (Barley and Kunda, 2001).

Table I summarizes the main characteristics of traditional work based on routines and standardization and knowledge work based on non-routine problem solving and the contingency of work processes. It has to be emphasized that the distinctions presented here should not be understood either as exact opposites of one another or as pure empirical types. To recapitulate, they are ideal-types that do not exist as such and that constitute a continuum between different levels of skills, education and job related demands.

Table I The ideal-types of traditional work and knowledge work

	Traditional work	*Knowledge work*
Education	Requires some formal education and on-the-job learning	Requires extensive formal education and continuous on-the-job learning
Skills	Strictly defined skills	Transferable skills
The nature of work	High level of standardization, involves working with physical matter either directly or indirectly through electronic interfaces (e.g. control of production processes)	Low level of standardization, involves working with abstract knowledge and symbols (e.g. design and planning of production processes)
Organization	Ranges from bureaucracy to teams, fixed roles and positions, knowledge as a secondary production factor	Ranges from professional bureaucracies to self-managing teams, job and task circulation, knowledge as a primary production factor
The medium of work	Physical materials and/or people	Symbols and/or people

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