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An empirical assessment of the informational society: Employment and occupational structures of G-7 countries, 1920-2000

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The dramatic transformation of the economy and social trends observed during the 1990s warrant a re-examination of the theory of the informational society. Since work is at the core of social structure – and one of the most direct expressions of structural change – analysis of employment and occupational trends offers insights into the actual impact of the new informational economy.

It was indeed only in the 1990s that networked computers diffused widely and came to dominate the information-processing activities at the core of the advanced industrialized economies.[1] By 2000, the new informational paradigm, associated with the emergence of the network enterprise, was well in place with solid foundations upon which to unfold. This period also coincided with a dramatic reversal of fortunes between the Japanese and American economies. The phenomenal performance of the United States' economy, with its innovative, job-creating and dynamic growth capabilities, stands in sharp contrast to the economic woes of Japan, which continues to suffer from a "lost decade" of half-hearted structural reform, mounting bad loans and rising unemployment as a result of globalization.

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[1] Because electronic hardware was considered to be of strategic importance to the advanced industrialized economies in the 1980s, numerous reports focused on this subject, particularly the semiconductor industry, rather than on software and networking (see, for example, Warshofsky, 1989; Okimoto, Sugano and Weinstein, 1984; Borrus, 1982; Semiconductor Industry Association, 1985; OECD, 1985; United Nations, 1986).

This article extends the argument laid out in Castells and Aoyama (1993, 1994) with fresh evidence on employment and occupational trends in Canada, France, Germany, Italy, Japan, the United Kingdom and the United States over the 1990s. Our previous analysis showed that all of these countries were at an advanced stage of transition to the informational society by the early 1990s. We argued that interaction between technology, the economy and institutions translated into patterns of employment and occupation that determined the cultural/institutional diversity of the informational society. The focus on the G-7 countries is dictated in part by their role as the world's largest economies, those which spearheaded the information revolution. In 1997, the G-7 countries were responsible for two-thirds of the world's production of information and communications technology (ICT); they produced over 80 per cent of the world's office equipment and radio-communications and radar equipment (including cell phones). But the focus on these countries is also dictated by the availability of detailed industrial and occupational data spanning a long period and allowing cross-national comparisons to be conducted.[2]

Based on the long-term observation of employment and occupational changes across the G-7 countries, this article aims primarily to present empirical evidence in support of the theory of the informational society (see Castells and Aoyama, 1994; Castells, 2000). Accordingly, theoretical discussions have been kept to a minimum, with only a brief reminder of the theoretical relevance of the empirical evidence presented.[3] This is given in the first section of this article, together with a recapitulation of our earlier findings. The second section reviews some of the developments that characterized the G-7 economies in the 1990s, while the third focuses on changes in their employment structures, also in the 1990s. The fourth section examines changes in their occupational structures between 1950 and 2000. The fifth section looks at work and the informational divide, and the sixth offers a comparative assessment of the incidence of information-processing jobs in the United States and Japan. A concluding section briefly sums up the main findings of the article.

[2] This article is based on the most up-to-date publicly available statistics at the time of research (August, 2001). Every effort has been made to preserve the comparability of data both longitudinally and cross-nationally, and any significant discrepancies are pointed out.

[3] For a detailed discussion of methodological and conceptual issues, see Castells and Aoyama, 1993 and 1994; see also Castells, 2000.

Employment and occupational changes 1920-1990: A recapitulation of findings

In a previous article (Castells and Aoyama, 1994), we critically reviewed the theories of post-industrialism that had initially emerged in the form of social forecasts (Touraine, 1969; Bell 1973). Instead, we proposed informationalism – a theory of development that offered a better description of the social process up to 1990 (see also Castells and Aoyama, 1993; Castells, 2000). The theory of post-industrialism was based on three distinct socio-economic transformations: (1) knowledge and information processing as the source of productivity growth; (2) irreversible shifts in employment from agriculture and manufacturing to services; and (3) the emergence of managerial, professional and technical occupations as the core occupational categories because of the economy's high knowledge and information content. In reality, each of these transformations involves particular conceptual, theoretical and empirical issues (for details, see Castells and Aoyama, 1993 and 1994). As a first step toward establishing an analytical separation between the structural logic of production and its social structure, we conducted an empirical analysis of employment and occupational structures in the seven largest market economies of the twentieth century – the so-called G-7 countries – over the period 1920-90. In the light of this analysis, we contested some widely held assumptions developed by post-industrialism. One of these was the claim that advanced economies would experience a disproportionate increase in low-wage service employment. Another was the assumption that the above three features of socio-economic transformation eventually coalesce into a single model of informational society. This single-model construct resembles the predominant theories of modern times: in each case, from Adam Smith to Marx, a single developmental trajectory was advocated and widely accepted in spite of the "exceptions" that persisted throughout the world. We, by contrast, sought to identify common threads in the persistent variations observed across societies. Indeed, the proposed theory of informationalism does not suggest a universal developmental trajectory for social structure, but rather a production system organized around the principles of maximizing knowledge-based productivity through the development and diffusion of information technologies. It thus represents a shift in the technological paradigm, whereby productivity potential increasingly depends upon information technologies regardless of whether particular activities fall into the goods-handling or information-processing sector.

For reasons of data compatibility and coincidental theoretical convenience, our previous analysis of employment structure separated the "post-agricultural" period (1920-70) from the "post-industrial" period

(1970-90).[4] We adopted Singlemann's (1978) groupings, which offered a more detailed breakdown of service activities, although we were still somewhat constrained by the need to rely on the category called "services" for long-term analysis because of the lack of alternative data.

The primary finding was a reduction in the share of manufacturing employment in all countries, though the decline took place at varying speeds. The most rapid de-industrialization over the period 1970-90 took place in the United Kingdom, the United States and Italy, while the rate of decline was much slower in Japan and Germany.[5] The ratio of service-sector to industrial employment showed moderate increases across the board in the period 1920-70, with the United States and Canada leading the transition. Over the period 1970-90, the growth of service-sector employment accelerated and became generalized, albeit at varying speeds.

The ratio of service-sector to industrial employment was found to be consistently higher than the ratio of goods-handling to information-handling employment. The United States had the highest ratio of information employment, followed closely by the United Kingdom, Canada and France. At the time of our analysis, the separate indicators for service and information employment suggested that the structure of employment in the United States clearly set this country apart from the others as a service economy, though not as an information economy. Also observed was a general trend toward a higher ratio of information-processing employment, except in Japan. Furthermore, while all seven countries had reached the stage of dominant service employment, none of them had an information employment ratio over 1 in 1990 (only the United States was nearing that threshold). We therefore concluded that there is a time-lag between the rise of information-processing activity and the rise of information employment. In other words, while information processing may have already become a critical component in the functioning of the economy, information em-

[4] The first attempt at evidencing "information activity" can be found in Porat's 1977 study for the United States Department of Commerce. Porat's notion of information refers to "data that have been organized and communicated", and information activity includes "all the resources consumed in producing, processing, and distributing information goods and services" (Porat, 1977, p. 2). However, we chose Singelmann's (1978) sectoral typologies because of their usefulness in cross-national comparisons (further justifications were provided in Castells and Aoyama, 1994). Because we cannot assure an absolute equivalence of our classification with that of Singelmann, we presented the data separately for 1920-70 and 1970-90. They must not be read as a statistical series but as two distinct statistical trends made roughly homogeneous in terms of the analytical categories used to compile the data. We encountered considerable methodological difficulties in establishing equivalent categories for the various countries and opted for a very conservative approach, consolidating the data at the lowest common denominator and limiting our comparisons to points in time for which data were available from the same source, in order to ensure compatibility.

[5] For the purpose of data comparability, Germany in this article refers only to the territory of the former Federal Republic of Germany.

ployment may lag behind and develop significantly slower than service employment.

Another conclusion of the analysis up to 1990 derived from evidence that the economies which performed well in the 1980s – notably those of Japan and Germany – retained the highest shares of manufacturing employment and the lowest ratios of information-handling to goods-handling employment for the period 1970-90. Thus those economies in which high technology played a most significant role in productivity and competitiveness, with the strongest emphasis on information technologies in the manufacturing process, also appeared to have the lowest levels of information employment in 1990. This led us to consider the possibility of differential use of technologies: is information processing more effective when it is embedded in material production or in goods handling, instead of operating disjointedly in a technical division of labour? The combined evidence pointed to a significant degree of internalization of producer-service jobs in manufacturing companies. In 1990, these same countries exhibited the lowest shares of producer-service employment, which was considered to embody the strategic services of the information economy. This question, however, will be re-examined in the light of the data for 2000.

Analysis of the period 1970-90 showed that *producer services* did not comprise substantial shares of employment in all countries, ranging from 7.3 to 14 per cent of national totals. *Social services*, by contrast, represented far greater shares of employment, between one-fifth and one-quarter of the totals, except in Japan. The share of social services in Japan during the period 1970-90 came close to the shares observed for other G-7 countries during the period 1950-70. *Distributive services*, largely considered low-skill and low-tech, accounted for significant shares of total employment (over 20 per cent) in all of the countries except Germany. As our previous research did not elaborate on the reasons why this may be the case, this question too will be re-examined in the light of new evidence. *Personal services*, often considered a remnant of the dualistic industrial society, remained strong and accounted for shares at least comparable to those of producer services in all countries except Germany. The aggregate of producer and social services – the quintessential post-industrial service categories – grew substantially for all countries in the period 1970-90, ranging from 29.5 per cent in France to 39.2 per cent in the United Kingdom at the end of the period.[6]

Based on the data up to 1990, we argued that the new economy and social structure had blurred the boundary between "goods" and "services" over time, effectively making these broad categories obsolete. The emerging social structure was characterized by a shift from goods to services, by the rise of managerial professional occupations, by

[6] Italy was excluded from this aggregate due to the unreliability of our data.

the demise of agricultural and manufacturing jobs, and by the growing information content of current work.

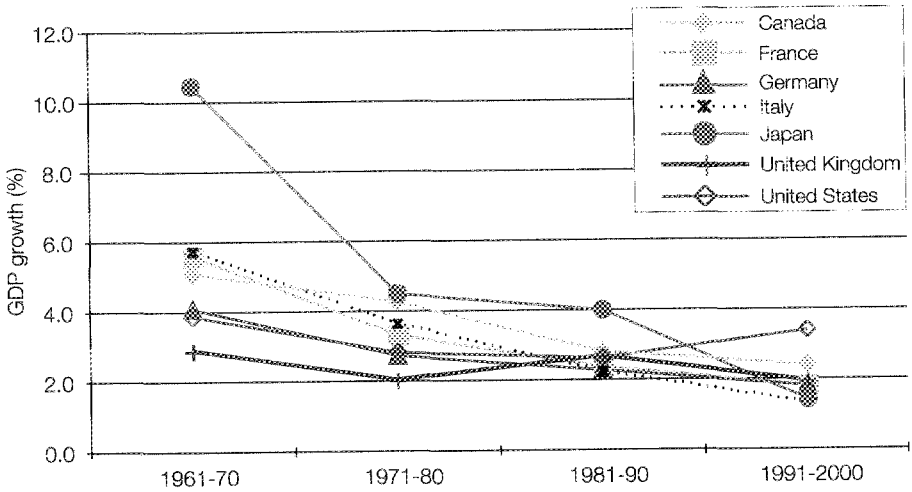
Finally, based on a synthesis of these trends, we identified the Anglo-Saxon model and the Japanese/German model. The Anglo-Saxon model – which included the United States, the United Kingdom and Canada – shifted from manufacturing to advanced services, while the Japanese/German model expanded advanced services but maintained a sizeable share of employment in the manufacturing sector by internalizing some advanced services within that sector. France fell in between, though closer to the Anglo-Saxon model. We generally observed no disappearance of any major service category, but rather an increasing diversity of activities across countries. The data for 2000, however, reveal a trend that was only incipient in 1990: information processing does indeed replace goods-processing as the dominant activity, and this was reflected in employment structure by 2000.

The economy in the 1990s: Evidencing the informational society

Before we move on to extend the analysis with year-2000 data, this section first provides a brief overview of the economic conditions of the G-7 countries in the 1990s, a decade which witnessed the emergence of several factors that contributed to accelerating the transformation of work. First, computer technology, along with networking technologies and, most importantly, the commercialization of the Internet and its applications, became increasingly affordable and manageable on a large scale. Second, in response to global competition, technological and organizational innovation was refocused on increasing flexibility and networking. As a consequence of the massive diffusion of information technologies and the subsequent proliferation of network enterprises, workers are now divided into the networkers, the networked and the "switched-off" workers or, alternatively, the deciders, the participants and the executants (Castells, 2000). The new division of labour is increasingly determined by the roles workers take vis-à-vis information technologies.

The first question that may arise among social scientists is whether the rapid technological changes that occurred during this period translated into economic growth. The GDP growth rates of the G-7 countries show concurrent trends of decline and convergence between 1961 and 2000 (see figure 1). The convergence is evident for all countries except Japan, which stands out as an anomaly. In the 1980s, the average annual GDP growth rates of the other six economies converged to within a narrow range of 2.2-2.8 per cent. In the 1990s, growth among the G-7 countries came to a near stand-still, with averages declining to a single percentile for most countries.

Figure 1. Average annual GDP growth by decade, 1961-2000



Note: Germany refers to western Germany only. The 1961-70 average for Germany is derived from the 1966-70 average, and the 1991-2000 average is derived from the 1991-94 average.

Sources: For 1961-1999: World Bank, *World Development Indicators*, summarized in the Global Development Network Growth Database (http://www.worldbank.org/research/growth/GDNdata.htm); for 2000: *OECD in Figures 2001* (http://www.oecd.org/publications/figures/index-fr.htm).

While most countries experienced slower growth in the 1990s than in the 1980s, the United States stood out as an anomaly. The exceptional performance of the United States economy in the 1990s is also reflected in its productivity gains (see table 1). From having the slowest productivity growth of all the G-7 countries in the 1980s, the United States moved to the top of the group. By contrast, Canada, France, Japan and the United Kingdom experienced a decline in productivity in the 1990s. In the early 1990s, it was Germany and Italy which recorded the highest outputs per worker, whereas in the late 1990s, it was the United States (data not shown).

Is this a reflection of strong growth of the information technology industry in the United States, which successfully translated technological change into overall economic growth in the 1990s, while other economies have only just begun to reap its benefits? Much of the growth of the 1990s – and particularly that of the American economy – has been attributed to the emergence of the "new economy", with the commercialization of the Internet as its backbone. This Internet-based economic growth includes the emergence and proliferation: (1) of firms engaged in infrastructural aspects of the information flows, including both hardware and software (e.g. servers, consoles, personal computers, fibre optic cables, communications providers, web-browsers, etc.), and (2) of

Table 1. Productivity: Average annualized growth in output per employed person, 1980-98

	1980-90	1990-95	1995-98
Canada	1.2	1.4	0.9
France	2.5	1.6	1.6
Germany	1.9	2.4*	1.9*
Italy	1.9	2.5	1.1
Japan	2.8	0.9	0.9
United Kingdom	2.5	1.9	1.3
United States	1.2	1.2	2.1

* Figure for all of Germany.
Source: OECD, 2000.

firms that produce the actual information content, including content providers (news, magazines, weather, local information, government, company/product information), database providers, digital graphics producers, e-commerce (both b-to-b and b-to-c) merchants, application service providers, and the like.

Let us examine some indicators of ICT production and markets, as shown in table 2. In absolute terms, the United States did indeed stand out as the largest producer of ICT goods in 1997. However, it was closely followed by Japan; and the share of ICT goods in its total production was not particularly high. The United States and Japan together accounted for over half the ICT goods produced worldwide. Among the world's top 50 ICT firms, 37 were American and nine were Japanese.

What is most notable is the United States' consumption of ICT. Not only was it over three times higher than that of the second ICT market (Japan), but its growth rate over ten years was at the top of the G-7 group – 3.2 points above the OECD average of 8 per cent. Aside from the impact of ICT on the production side of the economy, this also shows the extent to which information technologies are used and consumed in the United States, deepening their influence over the whole economy. Of the OECD countries for which data are available, the United States has the highest share of GDP growth attributed to ICT sector activities (OECD, 2000).

What does this mean for the structure of employment? While the relationship between technology and employment growth has long been considered uncertain, Carnoy (2000) showed that despite globalization, many of the industrialized economies have experienced net employment gains. Globally, manufacturing jobs are on the rise , and the concern that technologies might replace employment is now largely disregarded. A number of studies dismiss the theory that labour displacement is caused solely by technological advancement (Young and

Table 2. ICT production and markets, 1997

	Production of ICT goods		ICT market		% ICT in GDP
	US$ million	% share*	US$ million	% CAGR**	
Canada	9 285	28.0	20 276	9.5	5.9
France	31 149	22.7	33 425	4.9	3.8
Germany	34 488	13.9	43 662	6.2	–
Italy	16 085	20.9	16 432	0.7	3.5
Japan	217 992	26.0	97 233	4.6	7.3
United Kingdom	37 182	10.6	42 213	8.0	6.8
United States	266 798	22.1	316 634	11.2	7.8

* Share in total goods production. ** Compounded annual growth rate of the previous decade.
Source: OECD, 2000, Chapter 1, tables 2 and 14; Chapter 2, table 1; Appendix tables.

Lawson, 1984; Kaplinsky, 1987; Watanabe, 1986; Bessant, 1989). Economies that combine technological advancement and active entrepreneurship – such as those of the United States and the Netherlands – are considered dynamic (Carnoy, 2000). Between 1988 and 1998, the overall number of jobs grew at an average annual rate of 1.3 per cent in the United States, 0.8 per cent in Japan, and 0.3-0.4 per cent in France, Germany and the United Kingdom; only in Italy did it decline, at –0.3 per cent (OECD, 2001a). Evidence from the western European economies in the 1990s showed that the loss of computer manufacturing jobs was compensated by job creation in communications equipment and electronics components manufacturing and in computer-related services (see ILO, 2001, p. 120, table 4.4). In the United States – where small firms have been largely responsible for job creation during the past decade (Acs, 1999; Acs, Carlsson and Karlsson, 1999; Audretsch and Thurik, 2000) – over a million jobs were created by the new electronic commerce industry (ILO, 2001). Indeed, most G-7 countries experienced employment growth in the 1990s, and this growth was not skewed toward low-paying jobs as had been widely predicted. High-paying service employment grew more rapidly than low-paying service employment in most OECD countries (OECD, 2001a). In the European Union and the United States alike, the service sector accounts for substantial proportions of *both* low-paid and high-paid jobs (73-74 and 78-80 per cent, respectively). As for medium-paid jobs, the service sector accounted for 46 per cent of the total in the European Union and for 69 per cent of the total in the United States.

In most G-7 countries unemployment rates have been on the rise in the 1990s. Once again, the exception is the United States. While Carnoy (2000) found no clear relationship between technology diffusion and employment growth, the data he used actually showed a propensity towards lower unemployment for economies that invested more in

information technologies, at least up to the mid-1990s. The United States showed the highest level of ICT spending per worker – 1.7-2.5 times higher than that of the other G-7 countries – and coincidentally recorded the highest employment growth.[7] According to estimates of ICT-sector employment for 1999, the United States had the highest level of ICT employment of all the G-7 countries, both in absolute numbers and as a percentage of its total employment (see table 3). Roughly half the total ICT employment of the G-7 countries is located in the United States.

The combination of ICT use and globalization was widely assumed to result in the suppression of employment growth and a trend toward deskilling, pushing overall income downward. The actual trend in the United States and in other countries, however, has not been an overall decline of wages, but rather polarization of wages over the past two decades, thereby challenging the prediction of disproportionate growth in low-level service employment in the advanced industrialized economies (Harrison and Bluestone, 1989; Carnoy, 1994; Castells, 2000). The United States had the widest income inequality in the 1990s (see table 4). While Japan's top quintile had an average income 2.84 times higher than that of the bottom quintile in 1999,[8] the figure for the United States was 10.43 (Japan Bureau of Statistics, 2001; United States Census Bureau, 2002).[9]

The United States, in particular, has experienced widening income inequality since the late 1970s, though this trend is not common to all the G-7 countries (see figure 2). The share of income of the highest quintile has been growing consistently since 1967, while the shares of the other four quintiles have been shrinking consistently since the early 1980s. Despite this long-term trend, however, the ratio between the rich and the poor remained relatively stable in recent years. A closer look at the data for the period 1993-99 reveals that the sinking of the lower three quintiles either stopped or progressed much more slowly on an

[7] Carnoy's argument is valid for 21 OECD countries, among which there appears to have been little relationship between ICT spending and employment growth. A notable example is Austria, which experienced even higher employment growth than the United States in 1987-94, but with ICT spending 70 per cent lower than that of the United States. Clearly, non-technology factors also influence employment growth, though the influence of such factors does not necessarily rule out a relationship between technological innovation and employment growth.

[8] The ratio was 4.33 in 1964, and 2.71 in 1981, indicating that Japan's income gap has narrowed significantly since the 1960s, although it widened slightly between the early 1980s and late 1990s (Japan Bureau of Statistics, 1968 and 1983).

[9] While household inequality data were not available in quintiles for France, the individual income ratios of 90/10 in 1998 were 3.17 for males and 2.59 for females (INSEE, 2001). The comparable figures for the United States in the same year were 5.31 for males and 4.33 for females, indicating greater inequality for both sexes in the United States (United States Census Bureau, 2002).

Table 3. Employment in the ICT sector, 1999

	Employment	Share of ICT in total employment
France	905 000	4.0
Germany	1 255 000	3.5
Italy	632 000	3.1
Japan	3 000 000	4.3
United Kingdom	1 338 000	5.0
United States	7 400 000	6.1

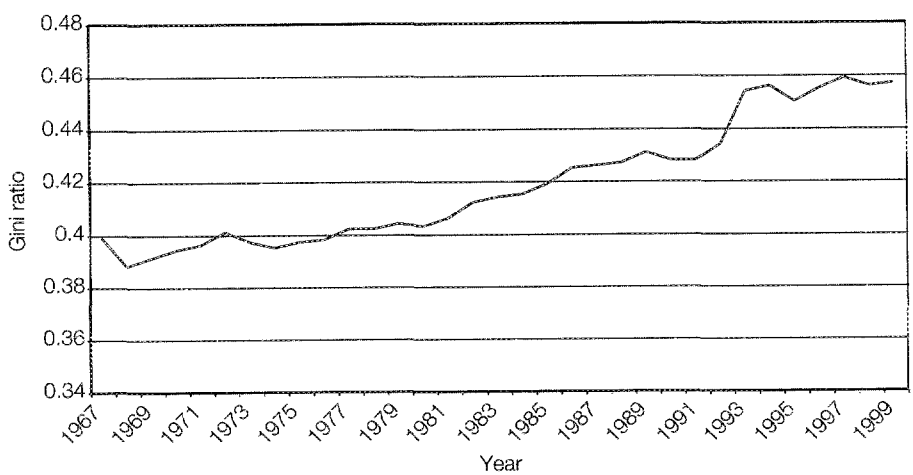
Note: The figure for 1997 is used for Japan, and the figure for 1998 is used for the United States.
Source: ILO, 2001, table 4.2.

Table 4. Inequality in income or consumption

	Survey year	Share of income or consumption (%)				Inequality measures			
		Poorest 10%	Poorest 20%	Richest 20%	Richest 10%	Gini index	Richest 10% to poorest 10%	Richest 20% to poorest 20%	
								1991-97*	1975-86*
Canada	1994	2.8	7.5	39.3	23.8	31.5	8.5	5.2	7.5
France	1995	2.8	7.2	40.2	25.1	32.7	9.1	5.6	7.7
Germany	1994	3.3	8.2	38.5	23.7	30.0	7.1	4.7	5.0
Italy	1995	3.5	8.7	36.3	21.8	27.3	6.2	4.2	7.1
Japan	1993	4.8	10.6	35.7	21.7	24.9	4.5	3.4	4.3
United Kingdom	1991	2.6	6.6	43.0	27.3	36.1	10.4	6.5	5.7
United States	1997	1.8	5.2	46.4	30.5	40.8	16.6	9.0	—

* The data refer to the most recent year available during the period specified.
Source: UNDP, 1990 and 2001.

Figure 2. Gini ratios for households in the United States, 1967-99



Source: United States Census Bureau, 2001.

annual basis. Also during this period, the income of the top two quintiles grew more slowly, suggesting no acceleration of the trend divergence. Only the top 5 per cent of households recorded faster income gains in 1993-99 than in 1967-92. Thus the gains of the 1990s were largely concentrated in the wealthiest minority. In sum, the 1990s were a period of relative stability in income inequality in the United States, except for the significant gains of the very top income group.

Household income disparity reflects not only the effects of technological advancement, but also the effects of a variety of other factors, such as the greater participation of the top quintile as workers, investors and equity holders; the growing number of double-income professional households, which pushes average household income upward; and strong demand for high-skilled professionals. Arguably, most of these trends were directly and indirectly linked to rapid changes in ICT, enabling people to work flexible schedules to balance work and family better, generating demand for high-paid work, and expanding opportunities for investment. Most importantly, the data challenge the assumption of downward pressures on household income due largely to the introduction of ICT. Instead, institutional characteristics, macroeconomic policies and the period of adjustment may account for the high level of unemployment observed in Western Europe (Castells, 2000).

Changes in employment structures, 1990-2000[10]

The socio-economic trends already observed among the G-7 countries continued in many ways in the 1990s: globalization, deregulation of markets for goods and services, and technological innovation all progressed with greater material access to a larger segment of the population. No longer is there any doubt that the 1990s were characterized by the regained technological leadership of the United States which, aside from its standard-setting, platform-generating and system-creating capabilities, benefited considerably from initial advantages in technological innovation and mass consumption. The dramatic reversal of economic fortunes between Japan and the United States during the 1990s had repercussions on the debate over the two competing models of economic growth: from that of state-led industrialization, the focus has increasingly shifted to that of the entrepreneurial economy supported by risk capital. In the process, a number of changes were observed in the logic of competition, means of communication, cor-

[10] As in our previous analysis, Italy is excluded from the general discussions presented in this section, as the data are sketchy and time-series comparability could not be established. For the United Kingdom, we use employee data on Great Britain, once again to maximize time-series comparability.

porate organizations and the institutional framework that support the new economy. Similarly, anxiety over trade wars – real and widespread in the early 1990s[11] – is now replaced by the fear of regional conflicts and terrorism affecting consumption, investor confidence, and logistics.

However, with the end of the longest period of economic expansion on record, in March 2001, the decade-long economic optimism of the United States also came to an end. It is now important to reassess long-term employment and occupational transformations in order to separate reality from hype, and distinguish short-term changes from long-term trends. In our previous analysis, the period 1920-70 was identified as the period of transition from agriculture to services, with most countries sustaining or increasing their shares of employment in manufacturing. Between 1970 and 1990, however, there was an overall decline in the share of manufacturing employment in G-7 countries, and this trend continued up to 2000. From 1990 to 2000, the sharpest declines were observed in the United Kingdom and the United States – from 22.5 to 15.2 and from 18 to 14.7 per cent of total employment, respectively. The decline was also significant in the former manufacturing strongholds, Germany and Japan. Germany still retains the highest share of employment in the transformative sector of all the G-7 countries, yet its ratio of manufacturing to total employment declined from 32.2 per cent in 1987 to 25.2 per cent in 2000. A similar trend, albeit more moderate, was observed for Japan. Japan's manufacturing employment, which increased slightly (by 0.2 points) in the 1980s to 23.6 per cent of total employment, fell by a full 4 points during the 1990s, to 19.6 per cent by 2000. While both economies have clearly undergone considerable restructuring, with accelerated offshoring of manufacturing jobs, they are still the most manufacturing-oriented of the G-7 economies, retaining over 30 per cent of their total employment in the transformative sector (manufacturing, utilities and construction) in 2000. The Anglo-Saxon model, with its low ratio of manufacturing to total employment, persists in the United States, Canada and the United Kingdom. France still falls in between the two groups.

While these trends in manufacturing are in essence a continuation of the process observed in the 1980s, the figures for 2000 show that the 1990s were a decade of dramatic growth in *producer service* employment (see table 5). By 2000, producer services had grown from a single-digit to a double-digit share of employment in all countries, with Japan having the lowest share (11 per cent) and the United Kingdom the highest (19 per cent) after overtaking the United States and Canada during the 1990s. Thus the rise of professionals and managers, yet to be fully reflected in the data in 1990, represented a tangible structural shift by

[11] Examples of books that appeared on the subject include Schlossstein (1984), Woronoff (1983), Schaffer (1989) and Capie (1992).

Table 5. Sectoral distribution of employment, 1920-2000

Canada, 1921-2000[a]	1921	1941	1971	1971	1981	1992	1996	2000
Extractive	36.9	31.7	9.1	8.3	7.1	5.7	5.6	—
Transformative	16.1	28.2	30.0	27.1	26.8	22.3	21.0	21.6
Distributive services	19.2	17.7	23.0	20.8	22.9	24.0	23.7	23.3
Producer services	3.7	2.7	7.3	6.6	9.7	11.3	12.1	14.6
Social services	7.5	9.4	21.1	22.0	24.0	22.6	24.2	25.1
Personal services	6.7	10.2	9.6	7.5	9.5	13.5	13.5	13.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

France, 1921-2000[b]	1921	1946	1968	1968	1980	1990	1998	2000
Extractive	43.6	40.2	17.0	15.6	8.7	5.5	4.3	4.1
Transformative	29.7	29.6	39.3	37.4	34.8	29.1	24.6	24.7
Distributive services	14.4	15.1	15.5	18.8	19.9	20.1	19.9	19.4
Producer services	1.6	1.9	5.5	5.0	7.8	12.4	14.4	14.8
Social services	5.3	6.8	14.5	15.1	17.1	25.1	27.4	27.1
Personal services	5.6	6.4	7.9	8.2	11.6	6.7	8.1	8.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Germany, 1925-2000[c]	1925	1950	1970	1970	1987	2000
Extractive	33.5	16.1	5.1	8.7	4.1	2.9
Transformative	38.9	47.3	49.0	47.1	40.3	33.1
Distributive services	11.9	15.7	16.4	17.9	17.7	17.5
Producer services	2.1	2.5	5.1	4.5	7.3	12.1
Social services	6.0	11.1	17.4	15.7	24.3	25.8
Personal services	7.7	6.9	7.4	6.1	6.3	8.6
Total	100.0	100.0	100.0	100.0	100.0	100.0

Italy, 1921-1999[d]	1921	1951	1961	1961	1971	1981	1990	1999
Extractive	57.1	42.9	29.8	29.8	17.2	11.7	9.5	5.1
Transformative	24.3	31.8	40.0	39.9	44.3	40.5	29.7	29.9
Distributive services	8.6	10.6	13.0	15.3	18.7	16.2	23.8	20.4
Producer services	1.2	1.9	2.0	1.1	1.5	4.6	1.8	12.3
Social services	4.1	7.9	9.3	6.9	6.5	19.1	15.5	19.0
Personal services	4.6	4.7	5.9	—	—	7.9	4.1	8.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Japan, 1920-2000	1920	1940	1970	1970	1980	1990	2000
Extractive	56.4	46.3	19.6	19.8	11.2	7.2	5.4
Transformative	19.6	24.9	34.2	34.1	33.7	33.7	30.1
Distributive services	12.4	15.2	22.5	22.4	25.1	24.3	24.2
Producer services	0.8	1.2	5.1	4.8	7.5	9.6	11.0
Social services	4.9	6.0	10.1	10.3	12.9	14.3	16.9
Personal services	5.7	6.3	8.5	8.5	9.6	10.2	11.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

United Kingdom, 1921-2001[e]	1921	1951	1971	1971	1980	1990	1995	2001
Extractive	14.2	8.9	4.3	3.4	4.8	3.2	1.5	1.9
Transformative	42.2	45.4	43.8	45.9	35.7	27.3	23.1	20.6
Distributive services	19.3	19.2	17.9	18.7	20.2	20.4	19.9	21.1
Producer services	2.6	3.2	5.6	5.2	7.5	12.1	17.3	19.0
Social services	8.9	12.1	19.4	18.3	23.9	27.2	27.8	25.8
Personal services	12.9	11.3	9.0	8.1	7.9	9.8	11.0	11.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

United States, 1920-2000	1920	1940	1970	1970	1980	1990	2000
Extractive	28.9	21.3	4.5	4.6	4.5	4.0	2.9
Transformative	32.9	29.8	33.1	33.0	29.6	27.2	22.6
Distributive services	18.7	20.4	22.3	22.4	21.0	20.9	21.0
Producer services	2.8	4.6	8.5	8.2	10.5	12.7	15.7
Social services	8.7	10.0	21.9	22.0	23.7	23.6	26.1
Personal services	8.2	14.0	10.0	10.0	10.5	11.7	11.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Notes: The data for circa-1970 are presented twice to show the discrepancy between Singelmann's (1978) calculations and ours for tables 5 and 6. For a detailed explanation, see Castells and Aoyama (1994). The numbers may not add up due to rounding and the omission of unclassifiable employment.

[a] 1992 and 2000 figures may not be comparable to figures from other years because of different sources. The 2000 data is presented here for reader's information only. The results of the Canadian Census 2001 were not available at the time of writing. [b] 1998 figures are preliminary. 2000 figures may not be comparable to earlier years because of different sources. [c] 1970, 1987, and 2000 figures are for the former West Germany. [d] 1990 and 1999 figures may not be comparable to earlier years because of different sources. [e] The data for 1921-1971 are for England and Wales only.

Sources: Castells and Aoyama, 1993 and 1994. **Canada:** 1920-71: Singelmann (1978); 1971-81, 1996: Statistics Canada, Population Census; 1992: *The Labour Force*; 2000: *Annual Estimates of Employment, Earnings and Hours*. **France:** 1921-68: Singelmann (1978); 1968-98: INSEE, *Annuaire statistique de la France*; 2000: INSEE, *Enquête sur l'emploi de mars 2000*. **Germany:** 1925-70: Singelmann (1978); 1970-87: Statistisches Bundesamt, *Volkszählung*; 2000: Statistisches Bundesamt, *Mikrozensus*. **Italy:** 1921-61: Singelmann (1978); 1961-81: Istituto centrale di statistica, *Censimento generale della popolazione*; 1990: Istituto nazionale di statistica, *Annuario Statistico Italiano 1991*; 1999: Istituto nazionale di statistica, *National Accounts*. **Japan:** 1920-70: Singelmann (1978); 1970-2000: Population Census, Bureau of Statistics, *Japan Statistical Yearbook*. **United Kingdom:** 1921-71: Singelmann (1978); 1971-95: Department of Employment, *Annual Abstract of Statistics, Employment Gazette* (various years); 2001: *Labour Market Trends*, July 2001. **United States:** 1920-70: Singelmann (1978); 1970: *Population Census*; 1980-2000: Bureau of Labor Statistics, *Current Population Survey*.

2000. For most countries, the largest increase within producer services since 1970 is observed in miscellaneous business services (not disaggregated in table 5). The United Kingdom recorded the largest gain in this category, from 1.1 per cent in 1970 to 10.2 per cent in 2000. Other countries also recorded growth in this category of services, from 1.8 to 7 per cent in the United States, from 1.4 to 5.6 per cent in Japan, and from 0.9 to 4.5 per cent in Germany.

The share of *social services* increased steadily in all countries to constitute a quarter of total employment, with the notable exception of Japan. By 2000, the social service category was the largest sub-sector in our analysis, with a higher share of employment than the transformative sector in Canada, the United States, the United Kingdom and France. At 16.9 per cent in 2000, Japan's level of social service employment is comparable to that of other G-7 countries in 1970. In this respect it still trails far behind the other countries, showing that the gap observed in our previous analysis with 1990 data has not been closed. Despite a slight acceleration of the rate of growth of its social services sector in comparison to the previous two decades, Japan's employment structure is still characterized by the relatively high share of the transformative sector, at over 30 per cent, with the share of social services amounting to just over half that percentage.

With the accelerated growth of producer services and the steady growth of social services in the 1990s, the aggregate share of producer- and social-service employment reached 44.8 per cent in the United Kingdom and 42.4 per cent in the United States. With the exception of Japan, all G-7 countries had at least a third of their total employment in producer and/or social services by 2000. Though the time-lag identified in our previous analysis can still be observed, the 1990s were characterized by a far more explicit manifestation of the informational society in employment structures across most G-7 countries. In addition, while the expressions of this trend still vary across social and institutional structures, they represent a distinct process of the growing importance of information-handling employment in the G-7 economies.

As we stated previously, the shift from industrialism to informationalism is not the historical equivalent of the transition from agricultural to industrial economies, and therefore cannot be equated with the emergence of the service economy (see Castells and Aoyama, 1994). The following analysis confirms this characterization, as shown in table 6. In all seven countries, the ratios of service-sector to industrial employment continued to increase. The 1990s were not only the decade in which all countries reached a ratio of at least 2.0, they were also a decade of significant acceleration toward service-dominated employment. In the United Kingdom, the ratio increased from 2.4 in 1990 to 3.7 in 2000; the industrial heavyweights too saw significant shifts in their employment, with the ratio rising from 1.4 to 2.0 in Germany, and from 1.8 to 2.2 in Japan.

Table 6. Non-agricultural employment by industry and services, 1920-2000 (in percentages and ratios)

Canada, 1921-2000[a]	1921	1941	1971	1971	1981	1992	1996	2000
Industry	42.7	42.3	33.0	29.7	29.0	23.5	22.1	21.7
Services	57.3	57.7	67.0	70.3	71.0	76.5	77.9	78.3
Goods handling	72.3	69.6	58.6	52.6	58.1	54.3	47.2	45.4
Information handling	27.6	30.4	41.4	47.4	41.9	45.7	52.8	54.6
Services: Industry (ratio)	1.3	1.4	2.0	2.4	2.4	3.3	3.5	3.6
Information: Goods (ratio)	0.4	0.4	0.7	0.9	0.7	0.8	1.1	1.2

France, 1921-2000[b]	1921	1946	1968	1968	1980	1990	1998	2000
Industry	53.1	49.7	47.3	45.0	37.4	29.9	24.8	24.9
Services	46.9	50.3	52.7	55.0	62.6	70.1	75.2	75.1
Goods handling	79.8	77.8	67.7	64.0	60.8	53.3	48.2	47.4
Information handling	20.2	22.4	32.3	36.0	39.2	45.6	50.4	51.2
Services: Industry (ratio)	0.9	1.0	1.1	1.2	1.7	2.3	3.0	3.0
Information: Goods (ratio)	0.3	0.3	0.5	0.6	0.6	0.9	1.0	1.1

Germany, 1925-2000[c]	1925	1950	1970	1970	1987	2000
Industry	59.1	57.3	51.2	51.4	41.5	33.6
Services	40.9	42.7	48.8	48.6	58.5	66.4
Goods handling	78.8	78.1	71.4	71.6	60.8	52.5
Information handling	21.2	21.9	29.1	28.4	39.2	47.5
Services: Industry (ratio)	0.7	0.7	1.0	0.9	1.4	2.0
Information: Goods (ratio)	0.3	0.3	0.4	0.4	0.6	0.9

Italy, 1921-1999[d]	1921	1951	1961	1961	1971	1981	1990	1999
Industry	56.5	55.3	56.6	56.4	52.5	45.0	31.9	31.0
Services	43.5	44.7	43.4	43.6	47.5	55.0	68.1	69.0
Goods handling	76.6	76.1	75.6	78.8	76.1	63.6	62.2	57.7
Information handling	23.4	23.9	24.4	21.2	23.9	36.4	37.8	42.3
Services: Industry (ratio)	0.8	0.8	0.8	0.8	0.9	1.2	2.1	2.2
Information: Goods (ratio)	0.3	0.3	0.3	0.3	0.3	0.6	0.6	0.7

Japan, 1920-2000	1920	1940	1970	1970	1980	1990	2000
Industry	46.3	47.8	42.1	42.1	37.4	35.8	31.3
Services	53.7	52.2	57.9	57.9	62.6	64.2	68.7
Goods handling	76.8	77.3	73.2	73.0	69.6	65.9	61.6
Information handling	23.2	22.5	27.0	26.9	30.4	33.4	37.2
Services: Industry (ratio)	1.2	1.1	1.4	1.4	1.7	1.8	2.2
Information: Goods (ratio)	0.3	0.3	0.4	0.4	0.4	0.5	0.6

Table 6. Non-agricultural employment by industry and services, 1920-2000 (in percentages and ratios) *(cont.)*

United Kingdom, 1921-2001[e]	1921	1951	1971	1971	1980	1990	1995	2001
Industry	53.0	51.8	46.7	48.5	39.5	29.6	23.7	21.1
Services	47.0	48.2	53.3	51.5	60.5	70.4	76.3	78.9
Goods handling	76.3	76.4	66.6	66.6	64.4	49.6	43.9	42.6
Information handling	23.7	23.6	33.3	33.1	35.7	50.4	56.1	57.0
Services: Industry (ratio)	0.9	0.9	1.1	1.1	1.5	2.4	3.2	3.7
Information: Goods (ratio)	0.3	0.3	0.5	0.5	0.6	1.0	1.3	1.3

United States, 1920-2000	1920	1940	1970	1970	1980	1990	2000
Industry	48.0	37.9	33.6	34.0	30.5	25.8	22.3
Services	52.0	62.1	66.4	66.0	69.5	74.2	77.7
Goods handling	73.3	67.4	61.1	61.2	57.3	52.6	49.4
Information handling	26.7	32.5	38.9	39.0	42.7	47.4	50.6
Services: Industry (ratio)	1.1	1.6	2.0	1.9	2.3	2.9	3.5
Information: Goods (ratio)	0.4	0.5	0.6	0.6	0.7	0.9	1.0

Notes: Industry = mining, construction, manufacturing; Services = remaining categories; Goods handling = mining, construction, manufacturing, transportation, wholesale/retail trade; Information handling = communications, finance/insurance/real estate (FIRE) services, government; Services: Industry = ratio of service-sector to industrial employment; Information: Goods = ratio of information handling to goods handling employment. The numbers may not add up due to rounding and the omission of unclassifiable employment. [a] 1992 and 2000 figures may not be comparable to figures from other years because of different sources. [b] 1998 figures are preliminary. 2000 figures may not be comparable to earlier years because of different sources. [c] 1970, 1987, and 2000 figures are for the former West Germany. [d] 1990 and 1999 figures may not be comparable to earlier years because of different sources. [e] The data for 1921-1971 are for England and Wales only.

Sources: See table 5.

Furthermore, the decade of the 1990s marked, for the first time, a reversal in importance between goods-handling and information-handling employment. The 2000 data show that Canada, France, the United Kingdom and the United States had a greater share of information-handling employment than of goods-handling employment, and Germany is close to joining these countries. The exceptions are Japan and Italy; Japan's persistently large share of goods-handling employment is remarkable in view of the fact that Italy, with its much smaller ICT employment, production and market in absolute terms, now surpasses Japan as to the ratio of information-handling to goods-handling jobs. This partly reflects the distinct characteristics of Japan's ICT industry, as well as the diversity of the ICT industry across countries.

Thus, in the course of the 1990s the employment structures of the G-7 countries shifted from being dominantly goods-handling to being dominantly information-handling in their characteristics, making that decade the first in which the informational society became a reality with effects clearly and explicitly manifested in the employment structures

of most G-7 countries. Thus, the decade marks the first period for which our theories were no longer forecasts and predictions, but firmly part of reality. The profound effect of information processing on social structures is now widely felt and recognized across the G-7 countries. It is, however, less clear whether the previously identified pattern of industry-service ratios as between the Anglo-Saxon and the German/ Japanese models still held in 2000. In fact, the shift of the German economy towards an increasingly informational nature, despite the continued strength of its manufacturing employment, leaves Japan as the only – and increasing – anomaly in terms of the sectoral distribution of employment. In the following section, further substantiation of this trend will be provided through an analysis of occupational profiles.

Changes in occupational structures, 1950-2000

In his analysis of occupational change in the United States, Porat (1977) defined "information workers" as those who satisfy the firm's informational requirements; their occupations include research scientist, engineer, draftsman, designer, manager, secretary, clerk, accountant, lawyer, advertising manager, communications officer, and personnel director. People in these occupational categories are classified as information workers on account of their role in creating knowledge, communicating ideas or processing information in one way or another which transforms symbols, and because their income originates *primarily* in the manipulation of symbols and information. Porat acknowledged that all workers handle information one way or another. In order to generate a working definition of "information workers", he categorized 422 occupations into information and non-information groups according to the degree of information activity involved. While information workers do not deal exclusively with information, their primary engagement is in information, "either at a high intellectual content (i.e., production of new knowledge) or at a more routine level (i.e., feeding computer cards into a card reader)" (Porat, 1977, p. 3).

Cross-national comparability of occupational structures, however, poses a serious difficulty for two reasons, one socio-temporal and the other techno-institutional. First, the historical evolution of a society's occupational categories is closely associated with class, some more directly than others, and social backgrounds shape contemporary occupational characteristics which are specific to each society. As a result, cultural perception – shaped over history in regard to various professions – deeply influences a country's classification of occupational categories which, at times, contribute to significant international variation within an occupation in terms of definitions and actual tasks. Second, even within the same society, the actual tasks and skills required for a given profession change over time, sometimes dramatically, through technological

change and organizational restructuring. But despite these unresolved methodological issues, "occupation" remains an important analytical category because it reflects the changing nature of work, often more accurately than do sectoral employment characteristics.

In our previous analysis, we noted the diversity of occupational profiles across G-7 countries, despite similarities in their economic standing in the world (Castells and Aoyama, 1994). General trends among the G-7 countries up to 1990 showed a clear tendency towards an increase in the proportion of managers, professionals and technicians – the group that epitomizes the informational society – and in the overall proportion of "white-collar" occupations (including sales and clerical workers). At the time, however, this transformation still looked tentative when viewed across societies. Japan and Germany had less than half their labour force in white-collar occupations. While managers, professionals and technicians comprised about 30 per cent of the workforce in the United States, Canada and the United Kingdom, the share of these occupational categories in Japan was only 14.9 per cent, reflecting Japan's hierarchical labour market structure, in which even future executives enter the internal labour market of the corporate world initially as clerical and sales workers. By contrast, the category of craft workers and operators, down to about 20 per cent in North America, accounted for 31.8 per cent of the labour force in Japan and for over 27 per cent in both France and Germany. Diversity in occupational structures was also reflected in the shares of semi-skilled service workers, which were significant in the United States, Canada and Germany, but much lower in Japan and France. Finally, despite much speculation, the data up to 1990 showed no evidence of the predicted occupational polarization, i.e. simultaneous growth at the top and bottom ends of countries' occupational structures. This challenged the popular notion that the information society features a disproportionately large share of low-level service jobs. Indeed, occupational polarization alone does not explain socio-economic polarization in advanced societies. Other factors, such as sectoral, territorial and firm-specific factors and demographic characteristics play a significant role in influencing social polarization.

The data for 2000 show that all countries except Japan experienced significant growth in the managerial category during the 1990s (see table 7).[12] France displayed particularly strong growth in this category: following sluggish growth in the 1980s (from 7.1 to 7.5 per cent between 1982 and 1989), its share jumped to 11.1 per cent of total employment by 2000. In the United Kingdom, by contrast, the bulk of growth in the managerial category occurred in the 1980s (from 5.3 per cent in 1981 to

[12] Data for Italy is again excluded owing to the lack of time-series comparability.

Table 7. Occupational structure of selected countries, 1950-2000 (%)

Canada, 1950-99[a]	1950	1970	1980	1992	1999
Managerial	8.4	10.0	7.7	13.0	11.7
Professional	7.0	13.6	15.6	17.6	20.2
Technicians	1.5	^	^	^	^
Sales	6.9	7.1	10.8	9.9	8.7
Clerical	10.6	14.8	17.5	16.0	14.5
Crafts and operators	28.2	29.6	26.0	21.1	18.6
Semi-skilled service workers	8.8	12.3	13.1	13.7	15.6
Semi-skilled transport workers	6.9	5.3	4.1	3.5	3.9
Farm workers and managers	21.7	7.4	5.3	5.1	4.2
Total	100.0	100.0	100.0	100.0	100.0

France, 1982-2000	1982	1989	2000
Managerial	7.1	7.5	11.1
Professional	4.8	6.0	8.0
Technicians	12.3	12.4	13.1
Sales	3.3	3.8	4.1
Clerical	22.8	24.2	24.6
Crafts and operators	30.9	28.1	23.7
Semi-skilled service workers	6.2	7.2	8.5
Semi-skilled transport workers	4.6	4.2	4.3
Farm workers and managers	8.0	6.6	2.5
Total	100.0	100.0	100.0

Germany, 1976-99[b]	1976	1980	1989	1999
Managerial	3.8	3.2	4.1	4.9
Professional	11.0	11.1	13.9	14.6
Technicians	7.0	7.2	8.7	7.0
Sales	7.6	7.6	7.8	8.4
Clerical	13.1	14.2	13.7	15.4
Crafts and operators	31.8	32.0	27.9	25.5
Semi-skilled service workers	12.5	12.5	12.3	13.7
Semi-skilled transport workers	6.3	6.1	5.5	5.9
Farm workers and managers	5.8	4.8	3.1	2.9
Total	100.0	100.0	100.0	100.0

Japan, 1960-99[c]	1960	1970	1980	1990	1999
Managerial	2.1	2.6	4.0	3.8	3.3
Professional	5.0	5.8	7.9	11.1	13.2
Technicians	^	^	^	^	^
Sales	13.4	13.0	14.4	15.1	14.3

Table 7. Occupational structure of selected countries, 1950-2000 (%) *(cont.)*

Japan, 1960-99[c]	1960	1970	1980	1990	1999
Clerical	11.2	14.8	16.7	18.6	19.8
Crafts and operators	29.5	34.2	33.1	31.8	30.2
Semi-skilled service workers	6.7	7.6	9.1	8.6	10.4
Semi-skilled transport workers	2.3	4.6	4.5	3.7	3.5
Farm workers and managers	29.8	17.3	10.3	7.2	5.2
Total	100.0	100.0	100.0	100.0	100.0

United Kingdom, 1961-2000	1961	1971	1981	1991	2000
Managerial	2.7	3.7	5.3	14.3	16.3
Professional	8.7	8.6	11.8	9.4	11.0
Technicians	^	2.4	2.0	8.9	10.4
Sales	9.7	8.9	8.8	7.8	8.3
Clerical	13.3	14.1	14.8	16.0	14.8
Crafts and operators	43.1	34.2	27.9	25.4	20.5
Semi-skilled service workers	11.9	12.7	14.0	9.2	11.0
Semi-skilled transport workers	8.5	10.0	9.1	^	^
Farm workers and managers	4.0	2.9	2.4	9.0	7.7
Total	100.0	100.0	100.0	100.0	100.0

United States, 1960-2000	1960	1970	1980	1990	2000
Managerial	11.1	10.5	11.2	12.6	14.6
Professional	11.8	14.2	16.1	13.4	15.6
Technicians	^	^	^	3.3	3.2
Sales	7.3	6.2	6.3	12.0	12.1
Clerical	14.8	17.4	18.6	15.8	13.8
Crafts and operators	30.2	32.2	28.1	22.5	20.4
Semi-skilled service workers	13.0	12.4	13.3	13.4	13.5
Semi-skilled transport workers	4.9	3.2	3.6	4.1	4.1
Farm workers and managers	7.0	4.0	2.8	2.9	2.5
Total	100.0	100.0	100.0	100.0	100.0

Notes: ^ signifies that the figure is included in the category immediately above. The numbers may not add up due to rounding and the omission of unclassifiable occupations. [a] Figures for 1999 may not be comparable to earlier years because of a classification change. [b] Data for 1976-89 are for West Germany; 1999 figures refer to all of Germany. [c] Sweepers and garbage collectors are included in the "semi-skilled service" category between 1970 and 1980. For later years, they are included in "crafts and operators".

Sources: Castells and Aoyama, 1993; **Canada:** 1950-1992: Statistics Canada, *The Labour Force*, various issues; 1999: Statistics Canada, *Canada Yearbook 2001*. **France:** INSEE, *Enquête sur l'emploi*, various issues. **Germany:** Statistisches Bundesamt, *Statistisches Jahrbuch*, various issues. **Japan:** Bureau of Statistics, *Statistical Yearbook of Japan*, various issues. **United Kingdom:** 1961-81: *Population Census*; 1991-2000: *Labour Force Survey*. **United States:** Bureau of Labor Statistics, *Employment and Earnings*, various issues.

14.3 per cent in 1991), with more moderate growth thereafter, to 16.3 per cent in 2000. The United States, where the managerial category already accounted for 11.1 per cent of the workforce in 1960, has since experienced measured but steady growth, to 14.6 per cent. Taken together, the managerial, professional and technicians categories constituted roughly a third of total employment in France, the United Kingdom and the United States, about a quarter in Germany, and one-sixth in Japan in 2000.

Japan continues to be an anomaly among the G-7 countries, with its managerial category peaking at a mere 4 per cent in 1975 and in 1980, and then declining to 3.8 per cent in 1995 and 3.3 per cent in 2000. This pattern contradicts the prediction that a rapidly ageing society coupled with a seniority-based promotion system results in inflation of the managerial category. However, it reflects the consequences of dramatic corporate restructuring which is still ongoing, including leaner organizations, early retirement, and adoption of a merit-based promotion system.

The category of semi-skilled service workers grew more rapidly in the 1990s, except in the United States. In Canada, Germany, Japan and the United Kingdom, the employment share of this category of workers shrank in the 1980s, but surged in the 1990s, even reaching over 10 per cent in Japan for the first time. France experienced steady growth in this category, while in the United States it grew by a mere 0.1 per cent both in the 1980s and in the 1990s. For the craftworkers and operators category, the prime occupations of the industrial era, the 1990s brought significant decreases across-the-board. The only economy to have retained over 30 per cent of employment in this category by 2000 was Japan's. The clerical and sales categories showed a diverging pattern. The share of sales occupations declined in Canada and Japan in the 1990s, while stabilizing or growing moderately in the other five countries. In the United States, after doubling during the 1980s, it remained virtually unchanged during the 1990s, with an increase of only 0.1 per cent. The share of clerical occupations peaked in 1980 in the United States and Canada, and in 1991-92 in the United Kingdom, while in the other countries it continued to grow. Overall, "white-collar" occupations (i.e. managerial, professional, technical, sales and clerical) accounted for over half of total employment in all seven countries by 2000, indicating that the decade of the 1990s marked a shift from shop-floor and semi-skilled service employment to office employment.

Flexible work in the 1990s

In contrast to manufacturing jobs, service jobs are considered unstable, unreliable and more likely to entail non-standard employment, i.e. part-time or temporary. It was thus assumed that the emergence of the service economy would bring about a higher degree of

employment instability: OECD data show that the incidence of part-time work is higher in the service sector than in the goods-producing sector (see table 8). Non-standard employment has indeed been on the rise in many advanced industrialized economies (Carnoy, 2000; Castells, 2000).

For most of the 1990s, part-time employment generally increased in the G-7 countries except in the United States where it actually declined by 0.8 points between 1989 and 1999 (see table 9). By 1999, part-time employment comprised between one-tenth and a quarter of total employment, with Italy having the lowest proportion and Japan the highest.

In Japan, some 40 per cent of women and 13 per cent of men are employed part time. The high proportion of part-timers in the Japanese labour force provides critical flexibility to an otherwise rigid labour market. Indeed, Japan's traditional system of lifetime employment, though increasingly obsolete, is by no means dead. In fact, there has not been a major reorganization of the labour market in Japan. For example, most of the numerous lay-offs announced by Japan's major electronics firms in the summer of 2001 are being handled as early retirements and cuts in overseas establishments, or spread over an extended period (up to three years). Instead of reforming their overall hiring practices, firms have responded to the current recession with a piecemeal approach, by foregoing new hires and relying on temporary workers to fill clerical jobs, while protecting their core workforce under the traditional system of life-time employment.

However, given the significant influence of gender on forms of work, the higher incidence of part-time employment in the service sector could reflect the greater share of female workers in that sector, and may have little to do with the nature of the work itself. In the case of Japan, for example, men made up 88 per cent of the workforce in the goods-producing sector, but only 53 per cent of that in services (2000 census).[13]

In contrast to part-time work, the incidence of temporary employment is spread across both sectors (see table 10). Since the available data are not broken down by sex, however, it is unclear whether this pattern is connected to female employment.

Self-employment either stayed constant or declined in the 1990s for all G-7 countries except Canada (see table 11). This indicates that although self-employment – i.e. externalizing labour individually – may be used widely across economies to increase labour market flexibility, it

[13] Hidden behind Japan's prized life-time employment system lies a series of labour market strategies that have sustained flexibility, such as *shukko* (typically a involuntary transfer of workers to affiliated firms), but the factor that gave corporations the greatest flexibility was female employment which, until recently, often did not require the same treatment as male employment.

Table 8. Relative importance of part-time employment by sector, 1999
(Ratio of incidence of part-time employment in each sector to average incidence for all sectors)

	Average incidence for all sectors (%)	Goods-producing sector						Service sector				
		Total	Agriculture, hunting, and forestry	Mining and quarrying	Manu-facturing	Electricity, gas and water supply	Construc-tion	Total	Producer services	Distributive services	Personal services	Social services
Canada	18.7	0.51	0.97	0.18	0.47	0.11	0.47	1.21	0.99	1.11	1.81	1.15
France	14.7	0.33	0.91	0.13	0.27	0.19	0.24	1.29	0.79	0.69	2.18	1.67
Germany	17.4	0.50	0.79	0.15	0.53	0.28	0.34	1.30	1.20	1.22	1.65	1.30
Italy	11.9	0.44	0.88	0.21	0.38	0.26	0.34	1.34	0.95	0.64	1.59	2.11
Japan	23.5	0.88	1.76	—	0.79	0.80	0.63	1.07	1.06	0.98	1.35	1.06
United Kingdom	22.9	0.34	0.74	0.11	0.33	0.26	0.29	1.25	0.78	1.21	1.94	1.34
United States	11.9	0.37	1.27	0.10	0.26	0.15	0.37	1.22	0.80	1.17	2.18	1.13

Notes: Part-time employment refers to usual weekly hours of work of less than 30. For Japan, part-time employment refers to actual weekly hours of less than 35. For Canada and Japan, 1998 figures are used. Sanitation services and activities of membership organizations are included in personal services instead of social services.

Source: OECD, 2001a.

Table 9. Part-time employment, 1989-99

	Part-time employment as percentage of total employment						Percentage female in total part-time employment	
	Both sexes		Men		Women			
	1989	1999	1989	1999	1989	1999	1989	1999
Canada	16.6	18.5	8.3	10.3	26.7	28.0	70.6	69.7
France	12.2	14.7	4.9	5.8	21.4	24.7	77.4	79.0
Germany	11.6	17.1	2.0	4.8	26.6	33.1	89.6	84.1
Italy	8.8	11.8	3.9	5.3	18.4	23.2	71.1	71.5
Japan	17.6	24.1	8.0	13.4	31.8	39.7	73.1	67.0
United Kingdom	20.2	23.0	4.9	8.5	40.4	40.6	86.2	79.6
United States	14.1	13.3	8.3	8.1	20.5	19.0	68.7	68.4

Source: OECD, 2001b.

Table 10. Relative importance of temporary employment by sector, 1999 (Ratio of incidence of temporary employment in each sector to average incidence for all sectors)

	Canada	France	Germany	Italy	Japan	United Kingdom	United States
Average incidence for all sectors (%)	11.8	14.0	12.7	9.9	11.4	6.8	4.5
Goods-producing sector							
Total	0.91	0.96	0.92	0.99	0.72	0.72	0.81
Agriculture, hunting, and forestry	3.03	1.52	1.97	3.71	1.97	1.46	2.46
Mining and quarrying	0.72	0.13	0.63	0.30	—	0.76	0.60
Manufacturing	0.53	0.89	0.76	0.63	0.64	0.60	0.50
Electricity, gas and water supply	0.65	0.52	0.83	0.50	0.24	1.07	0.72
Construction	1.94	1.16	1.19	1.40	0.86	1.00	1.41
Service sector							
Total	1.04	1.02	1.05	1.01	1.15	1.10	1.06
Producer services	0.96	0.83	0.85	0.86	0.94	0.98	1.18
Distributive services	0.73	0.80	0.86	0.87	1.11	0.60	0.53
Personal services	1.32	1.21	1.36	1.88	1.81	1.57	1.16
Social services	1.20	1.18	1.20	0.93	0.84	1.42	1.38

Notes: The data refer to wage and salary workers only. 1998 figures are used for Canada. For Japan, sanitation services and activities of membership organizations are included in personal services instead of social services. The data for the United States refer to "contingent" workers, i.e. all workers who expect their work will end in the near future for economic (as opposed to personal) reasons.

Source: OECD, 2001a.

Table 11. Self-employment, 1989-99

	Self-employment as percentage of total employment	
	1989	1999
Canada	8.8	10.9
France	13.4	10.6
Germany	10.9	9.9
Italy	24.1	24.3
Japan	14.6	11.7
United Kingdom	13.2	11.7
United States	8.4	7.5

Source: OECD, 2001b.

has not translated into an overall increase. In fact, the decline in self-employment may be largely induced by the shrinking extractive sector, which offset the effects of flexible labour arrangements in most countries.

Information-processing jobs in the United States and Japan

Evidence from most OECD countries shows the "digital divide" to be a global phenomenon, as is the widening "international digital divide" between the developed and the developing worlds (OECD, 2000; OECD, 2001b). But while access to information infrastructure and networks has been recognized to vary greatly across income groups and societies, little is known about the direct impacts of information technologies on work arrangements and how such arrangements differ across advanced economies.[14]

The analysis conducted by Porat (1977) over two decades ago included cross-tabulation of information sectors and information occupations. Porat's conceptualization of information sectors and occupations differs from ours in two fundamental ways. First, since he was dealing with data on the United States only, he was not concerned with establishing cross-nationally comparable categories. Second, the activities of a number of sectors and occupations have undergone qualitative transformations since he conducted his study, which was based on 1967 data. For example, Porat included doctors' and dentists' offices and "other" medical and health services (veterinarians, medical laboratories and sanitoria) as information occupations, while the same services provided at hospitals were excluded because most hospital-based occupations at the time engaged "in the provision of 'craft' or personal service, with the informational activities being ancillary in nature" (Porat, 1977, p. 36). Our analysis, by contrast, considers all medical sectors to be at least as "informational" as other specialized services, many of which rely heavily on information technologies, with information processing an integral aspect of their activities. While Porat considered the security industry as non-informational, we included security occupations as primarily informational. These occupations today are by no means primarily goods-handling, and while a significant proportion of

[14] One controversial example is teleworking, which has the potential to free workers from their workplace and bring more flexibility into their working lives. In the United States alone, the number of teleworkers grew from 8.5 million in 1995 to 19.6 million in 1999, which amounts to 9 per cent of the country's total employment; and 41 per cent believe their jobs are teleworkable (see International Telework Association & Council: *Telework Facts*, http://www.telecommute.org/resources/facts.shtm). Yet, teleworking is not a full-time activity, at least in the United States: its occurrence averaged 5.5 days/month, and it has not alleviated traffic congestion, which actually worsened in most cities between 1982 and 1999. Although telework is estimated to be on the rise, with 137 million teleworkers worldwide, the overall impact of increased teleworking on work arrangements remains unclear.

security workers may be low-skilled or unskilled, they rely increasingly on advanced communications technologies to perform their tasks. A sizeable share of security occupations fall in the government sector, showing that the incumbents are primarily members of police forces and rescue workers.

Recent data with a matrix of employment sector and occupational categories are readily available for two of the G-7 countries: the United States and Japan (see table 12). Comparing the data on these two countries is particularly worthwhile because they often stand at opposite ends of the spectrum of G-7 countries, in terms of their sectoral distribution of employment, occupational characteristics and income distribution. Because the data on Japan are less detailed than those on the United States, we adopted the breakdowns used for the Japanese data as our analytical categories and adapted the United States data accordingly, so as to achieve compatibility. While every effort has been made to ensure maximum comparability, the nature of the data often makes it impossible to eliminate all discrepancies.[15] Also, because of different data sources and categories, the results may not be directly comparable to the data presented earlier in table 7. Nonetheless, the comparisons shed light on the role of information processing in today's advanced economies. In fact, as will be shown, the relative positions of occupations in the United States and Japan confirm the patterns presented earlier.

The two countries show significant commonalities and differences in terms of occupational characteristics within employment sectors. Predictably, for both countries, the share of "blue-collar" occupations is higher in industrial sectors, and that of "white-collar" occupations higher in service sectors. Aside from industrial sectors such as manufacturing, utilities and construction, the sectors with a large proportion of "blue-collar work" are transportation/communications and real estate. In both countries, low-level service jobs are concentrated in wholesale, retail and eating/drinking places. The most remarkable common feature, however, is perhaps the significant proportion of professional/technical occupations in the "services" sector. For both countries, service industries involve a set of highly specialized activities requiring considerable educational attainment and specialized skills. This is particularly notable because the "services" category here excludes the finance/insurance/real estate (FIRE) sector, government, transportation/communications, the wholesale/retail trade and eating/drinking

[15] The biggest problem in this respect might be that the source for Japan is population data, while the source for the United States is enterprise data, which does not include the self-employed. As shown in table 11, however, the proportion of self-employed in the United States is less than 10 per cent and declining over time.

Table 12. Employment sector and occupational category matrix, Japan and the United States (%)

	Total	Professional/ technical	Managerial	Clerical	Sales	Service	Security	Agriculture/ forestry/ fisheries	Transportation/ communications	Crafts/ labourer
JAPAN, 2000										
Agriculture, forestry, fisheries	100.0	0.2	0.4	1.4	0.4	0.1	0.0	95.4	0.2	2.0
Mining	100.0	2.4	6.8	17.2	4.0	—	0.2	0.4	18.5	50.3
Construction	100.0	11.2	4.5	13.8	5.4	0.1	0.1	0.4	1.4	62.9
Manufacturing	100.0	6.7	3.4	15.2	6.1	0.2	0.1	0.0	0.9	67.4
Utilities	100.0	15.1	3.5	43.7	4.6	0.3	0.4	—	0.6	31.9
Transportation, communications	100.0	1.4	3.3	26.0	6.5	1.2	0.4	0.0	45.1	16.0
Wholesale, retail, eating and drinking places	100.0	1.6	2.8	18.2	44.2	17.1	0.1	0.1	0.6	15.4
Finance and insurance	100.0	2.3	4.8	52.3	39.5	0.5	0.1	—	0.3	0.3
Real estate	100.0	1.5	10.3	27.0	39.8	15.6	0.7	0.1	0.2	4.7
Services	100.0	38.9	2.4	20.8	3.8	16.6	1.9	0.3	1.3	14.0
Government	100.0	7.2	3.9	55.4	—	0.3	30.0	0.1	1.2	1.9
Total	100.0	13.7	3.0	19.8	14.9	8.7	1.6	5.2	3.7	28.2
UNITED STATES, 1999										
Agriculture, forestry, fisheries*	100.0	9.2	4.0	8.5	1.4	46.2	0.1	22.9	4.4	3.4
Mining	100.0	12.4	6.6	9.6	0.7	0.4	0.2	—	17.7	52.3
Construction	100.0	3.9	7.3	8.3	1.8	0.8	0.1	—	3.8	74.2
Manufacturing	100.0	12.0	6.5	10.6	3.0	0.9	0.2	0.4	8.9	57.5
Utilities	100.0	16.4	7.5	21.6	1.8	1.1	0.5	0.1	11.4	39.7
Transportation, communications	100.0	9.7	6.3	22.3	6.2	3.6	0.2	0.0	40.0	11.7
Wholesale, retail, eating and drinking places	100.0	4.3	5.3	14.5	31.6	26.3	0.4	0.3	9.3	8.1
Finance and insurance	100.0	25.3	11.5	51.2	10.9	0.4	0.2	0.0	0.1	0.4
Real estate	100.0	7.5	15.0	21.5	11.1	24.4	3.6	0.1	1.2	15.7
Services	100.0	39.8	6.1	17.2	3.3	20.6	2.3	0.0	3.9	6.8
Government	100.0	28.4	5.7	27.7	0.6	6.7	17.2	0.3	3.6	9.8
Total	100.0	21.6	6.3	17.7	10.2	15.3	2.3	0.4	7.5	18.6

Note: * The high percentage of service occupations stems from the inclusion of SOC code 37-000 (Building and grounds cleaning and maintenance occupations) in services.

Sources: Japan: Compiled by the authors from the data provided by the 2000 Census. United States: Compiled by Guido Schwarz from the data provided by the Bureau of Labor Statistics, 1999 National Industry-Specific Occupational Employment and Wage Estimates.

places. The notion that the service sector is dominated by low-skilled occupations is therefore once again proven wrong for both Japan and the United States.

Another similarity between the two countries is the continued dominance of "blue-collar" jobs in the industrial sectors, despite the combined effect of industrial upgrading in the advanced industrialized countries and the globalization of manufacturing. Over two-thirds of Japan's manufacturing jobs and close to 60 per cent of American manufacturing jobs are in the crafts worker/labourer category. In both countries, roughly a third of the manufacturing jobs are "white-collar", although the proportion of highly skilled white-collar workers varies. Among "white-collar" workers, a third are considered highly skilled in Japan (professional/technical and managerial categories), while the proportion is over half in the United States. Furthermore, a sector's structural characteristics are reflected in its occupational categories: in both countries, the sector with the highest proportion of managerial positions is real estate. This reflects the fragmented nature of the real estate business, dominated by small businesses catering to local markets.

There are also notable differences between the two countries. The share of highly skilled workers in the finance and insurance sector differs dramatically. In the United States, those in the professional and managerial categories respectively account for 25.3 and 11.5 per cent, while the corresponding shares for Japan are 2.3 and 4.8 per cent. By contrast, Japan's FIRE sector has a high proportion of sales workers, with two workers out of five, compared with one out of ten in the FIRE sector of the United States. In the mining and construction sectors, the United States has larger proportions of labourers than Japan, revealing a relatively unskilled labour force in those sectors. In the United States, the largest occupational group of the government sector is that of professionals, at 28.4 per cent, which is closely followed by the clerical category at 27.7 per cent. In Japan, over half the workers in the government sector are in the clerical category, while professionals account for only 7.2 per cent of the sector's total employment.

These differences in occupational characteristics have direct effects on income distribution in the two countries. Among those who work for banks (depository institutions) in the United States, for instance, the annual median income in 1999 was US$25,440, while those in the managerial category earned US$59,630, those in computer and mathematical occupations (professional/technical) earned US$50,590, lawyers (professional/technical) earned US$94,500, those in sales occupations earned US$34,520, and those in clerical occupations earned US$21,300. For insurance carriers, the industry-wide annual median income was US$35,020, while managers earned US$75,230, computer occupations earned US$53,020, lawyers earned US$80,800, sales workers earned

US$38,820, and clerical workers earned US$27,250.[16] Given that over half of the jobs in the finance and insurance sectors are clerical in both Japan and the United States, low-wage workers thus dominate the most advanced segment of producer services. In the United States, the generally higher ratio of high-wage workers, combined with the presence of significant gaps in earnings across occupations, exacerbates income inequality.

Clearly, occupational categories are also deeply affected by labour relations in each country. For instance, the distinction between occupations considered to be professional/technical and those considered to fall into the clerical/sales categories seems far more obscure in Japan than in the United States. Once again, this difference is likely to stem largely from the persistence of Japan's postwar system of life-time employment, seniority and corporate training for firm-specific knowledge, reflecting an overall structure that has prevailed for the past 50 years.

Finally, the employment/occupational matrix data allowed us to estimate the share of information-processing jobs in total employment more accurately. The innovative feature of this classification is the consideration of both sectoral and occupational characteristics in determining whether jobs are primarily information-processing, as opposed to goods-processing. While occupational characteristics are considered the primary determinants of the tasks involved, sectoral associations also help to define tasks for some occupations. In defining information-processing jobs for the purpose of this article, we first excluded four occupational categories considered to be more closely associated with goods-handling, than with information-processing, i.e. crafts/labourers, agriculture/forestry/fisheries, services, and transportation/communications. In both Japan and the United States, the services category primarily includes such occupations as food preparation and service, and personal care. Also excluded, on the same grounds, are certain subcategories of sales occupations. However, there are jobs that deal with both goods and information, and it was difficult to determine whether such jobs were predominantly information-processing or goods-processing. In such cases, we arbitrarily considered half of those jobs to be informational. Table 13 shows the classification of goods/information-processing categories.

We considered all professional/technical occupations as primarily information-processing, and managerial occupations as information-processing in selected sectors. Thus, managers in agriculture, manufacturing, construction, mining, wholesale, retail and eating/drinking places are categorized as secondarily information-processing and are therefore counted as 50 per cent information-processing. Clerical and sales occupations, generally considered primarily informational, are

[16] For the source, see table 12.

distinguished by sector between those that are primarily goods-processing and those that are primarily information-processing in order to get a more accurate assessment of the proportion of information-processing jobs. Clerical workers in agriculture, mining, construction, manufacturing and the wholesale/retail trade are considered primarily goods-processing, while those in utilities, transportation/communications, finance/insurance, real estate, services and government are considered primarily information-handling. The same division was applied to sales workers, except those in transportation/communications (for reasons explained below). All service, agriculture, transportation/communications and crafts/labourer occupations are considered primarily goods-processing, while security occupations in all sectors are considered primarily information-processing.

The transportation/communications sector posed a special challenge because the Japanese data were available only at the aggregate level for this employment sector and could not therefore be disaggregated into two sectors of activity. In the case of Japan, however, the majority of clerical occupations clearly fall in the communications sector, and the majority of craft workers/labourers occupations in the transportation sector; and transportation/ communications occupations (equivalent to the category of "semi-skilled transportation workers" in table 7) are divided into roughly one-third communication-sector jobs and two-thirds transportation-sector jobs. In the absence of more detailed data, we decided to consider the transportation/communications occupations for all sectors as primarily goods-processing and to compensate by counting clerical occupations in the transportation/communications sector as primarily information-processing, and sales occupations in the transportation/communications sector as secondarily information-processing.

This classification scheme reflects our most conservative approach in determining predominantly information-processing jobs, hence the exclusion of some occupations that are typically regarded as information-processing. We acknowledge that these divisions are debatable, but the resulting framework is a first step in analysing the role of information-processing jobs with the data available.

Our analysis reveals that there are at least 55 million information-processing jobs in the United States and 20 million such jobs in Japan (see table 14), accounting for 43.3 and 31.9 per cent of total employment, respectively. In the United States, 27 million of the information-processing jobs (55 per cent of the total) are in the professional/technical categories, as against 8.6 million (43.6 per cent) in Japan. Ten per cent (6.4 million) of the information-processing jobs in the United States and 6.8 per cent (1.4 million) of those in Japan are managerial. By contrast, the share of clerical jobs in information-processing is higher in Japan than in the United States, at 35.4 per cent (7 million

Table 13. Goods-processing and information-processing jobs matrix

	Professional/ technical	Managerial	Clerical	Sales	Service	Security	Agriculture/ forestry/ fisheries	Transportation/ communications	Crafts/ labourer
Agriculture, forestry, fisheries	Information	Goods/Info	Goods	Goods	Goods	Information	Goods	Goods	Goods
Mining	Information	Goods/Info	Goods	Goods	Goods	Information	Goods	Goods	Goods
Construction	Information	Goods/Info	Goods	Goods	Goods	Information	Goods	Goods	Goods
Manufacturing	Information	Goods/Info	Goods	Goods	Goods	Information	Goods	Goods	Goods
Utilities	Information	Information	Information	Information	Goods	Information	Goods	Goods	Goods
Transportation, communications	Information	Information	Information	Goods/Info	Goods	Information	Goods	Goods	Goods
Wholesale, retail, eating and drinking places	Information	Goods/Info	Goods	Goods	Goods	Information	Goods	Goods	Goods
Finance and insurance	Information	Information	Information	Information	Goods	Information	Goods	Goods	Goods
Real estate	Information	Information	Information	Information	Goods	Information	Goods	Goods	Goods
Services	Information	Information	Information	Information	Goods	Information	Goods	Goods	Goods
Government	Information	Information	Information	Information	Goods	Information	Goods	Goods	Goods

Table 14. Information-processing jobs in the United States and Japan, 1999-2000

	United States	Japan
Total information-processing jobs	55 million (43.3% of total jobs)	20 million (31.9% of total jobs)
Professional/technical	27 million (50% of information-processing jobs)	8.6 million (43.6% of information-processing jobs)
Managerial	6.4 million (10% of information-processing jobs)	1.4 million (6.8% of information-processing jobs)
Clerical	15.6 million (28.3% of information-processing jobs)	7 million (35.4% of information-processing jobs)
Sales	2.6 million (4.7% of information-processing jobs)	1.8 million (9% of information-processing jobs)

Source: See table 12.

jobs) and 28.3 per cent (15.6 million jobs), respectively. The same goes for sales occupations in information-processing, at 9 per cent (1.8 million jobs) in Japan, against 4.7 per cent (2.6 million jobs) in the United States. In both countries, security occupations account for 5-6 per cent of total information-processing employment, though the absolute number of such jobs is three times higher in the United States than in Japan (3 million in the United States and 1 million in Japan).

Overall, in both countries, a significant share of today's employment centres on the activity of assessing, analysing and processing information for the purpose of delivering primarily information, rather than primarily goods. Half the jobs in the United States and over 40 per cent of the jobs in Japan can be described as primarily information-processing. The two countries differ, however, as to the occupational distribution of information-processing jobs, with the United States showing a greater share of high-skilled jobs in information-processing, which presumably contributes to the higher wage levels associated with information-processing jobs vis-à-vis goods-processing jobs. In relative terms, Japan's information-processing jobs fall into lower occupational categories, reflecting subtle differences in the relative status, value and treatment of information-processing in the Japanese economy (e.g. word processing has been viewed as a secretary's task), as well as in prevailing labour market practices. It can therefore be speculated that the ways in which societies assign the new task of information-processing across sectors and occupations are highly dependent upon relative sectoral strengths and the existing occupational structure.

The weakness of this analysis, however, stems from the lack of information on the actual use of information-processing equipment by various sectors and occupations. For example, since Japan has by far the highest number of industrial robots in use per worker, an increasing number of workers in the crafts/labourer category in Japan's manufacturing sector are likely to operate – and at times conduct the basic programming of – numerically controlled robots on the shopfloor. The question then is whether an automobile plant labourer operating industrial robots qualifies as having a primarily information-processing job, or whether this job is still primarily goods-processing? The assumption made for the analysis in this article is that such a job would still qualify as primarily goods-processing, though it is also acknowledged that a better analytical framework is required to deal with the increasing number of jobs that include operation of information technology equipment.

Concluding remarks

The empirical analysis in this article supports the view that there needs to be a shift of analytical focus from services to information processing as the dominant activity in today's advanced economies.

While our previous analysis up to the early 1990s showed initial evidence of the emergence of the informational economy among the G-7 countries, the data up to 2000 show that the informational economy became a fully-fledged reality during the 1990s, deeply altering employment structures and affecting sectoral and occupational distributions. The myth of service-sector employment characterized by low skills, low wages and low stability derives either from one small segment of the service sector (i.e. wholesale and retail trade), or from the influence of occupational segregation by sex (i.e. more women in services). Despite significant variations across the G-7 countries, all of them shifted to predominantly information-processing economies during the 1990s.

The new economy – an inflation-free hyper-growth model driven by productivity gains from the use of new ICT – has recently shown that it is not immune to downturns. Regardless of whether the current downturn is cyclical or structural (or, as some argue, both), concern is also expressed over the global nature of the recession. The crisis of dot.com-driven growth has drawn attention back to the more traditional sectors of the economy. While evidence for the faltering of the "new economy" will no doubt be assessed along with the first decade of the twenty-first century, the current availability of data limits the assessment to the decade that coincided with a peak of the new economy in the United States. Understanding the upturns, however, is in itself a worthwhile venture as we need, first and foremost, to understand the processes of recovery, of shifts and of transformation to the new mode of development that took place in the 1990s. And the data examined in this article confirm that the transformation has taken place, no longer tentatively but consistently, with widespread influences on the economic fortunes of the advanced economies.

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