

*External services, structural change
and industrial performance*

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Michael Peneder, Serguei Kaniovski and Bernhard Dachs
Austrian Institute of Economic Research WIFO

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For further information, contact
European Commission
Enterprise Directorate-General
Information and communication unit
Rue de la Loi/ Wetstraat 200
B-1049 Brussels

Fax: (32-2) 299 1926
To request copies, fax (32-2) 296 9930.
E-mail: entr-information-communic@cec.eu.int

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ENTERPRISE DG
WORKING PAPER

***EXTERNAL SERVICES, STRUCTURAL CHANGE
AND INDUSTRIAL PERFORMANCE***

BACKGROUND REPORT FOR
"THE EUROPEAN COMPETITIVENESS REPORT 2000"

Michael PENEDER, Serguei KANIOVSKI and Bernhard DACHS

Austrian Institute of Economic Research WIFO

September 2000

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External Services, Structural Change and Industrial Performance

1. Introduction

The *rise of the service economy* characterises the predominant pattern of structural change in the 20th century. A major determinant of this process has been the increasing demand of producers for *external service inputs* provided by specialised suppliers (as opposed to in-house activities). This chapter sets out to collect *basic data & facts*, in order to sift and arrange some of the empirical evidence currently available. The main focus is on the input-output relationship of services with other industries within a given economic territory. It thus complements the subsequent chapter, which concentrates on the international dimension of trade and foreign direct investments in services.

This chapter is organised as follows: First of all, we question the economic meaning of the traditional distinction between services and manufacturing industries. In a second step, we investigate more closely the process of tertiarisation, asking, for instance, whether the growth in services is spread evenly across different sectors, or is more concentrated in particular kind of activities. As it appears, many traditional services have not grown above average in terms of value added, and the general dynamics of structural change is particularly confined to a subgroup of knowledge and information-based services.

In a third step, we analyse the impact of inputs from external services on the competitive performance of European industries. The central concern is how the provision of services spreads through the economic system and the access to high-quality and competitively priced service inputs is therefore able to affect the local sources of competitive advantage. We specifically find that manufacturing industries with high shares of intermediary inputs from knowledge based services are typically characterised by higher levels of labour productivity and larger potentials for product differentiation. It is precisely this group of industries, where European manufacturing shows the most pronounced structural weaknesses relative to the USA (measured in terms of its shares in total value added and exports).

2. The Locational Dimension

Services can generally be defined as economic activities which create value and thus affect human conditions through the transformation of `material objects, goods, people, the natural

environment or symbolic representations, data, text, etc.¹ Hence, services lie at the heart of any economic process and no material goods could be manufactured without the combination of various services drawn from a company's disposable resources. The common distinction between services and material goods is nevertheless apparent in the general classification of economic branches. Activities that result in the market exchange of material goods were generally identified as manufacturing (*secondary sector*), or agriculture and mining (*primary sector*). Conversely, other activities with no clear relationship to material products were classified under the more or less residual category of services (*tertiary sector*). As a direct consequence, those activities which are now included in the tertiary sector are extremely heterogeneous. In order to arrange this vast and heterogeneous category more clearly, a proposal has already been made to single out the comparatively new and fast growing branches of knowledge-based and informational services as a fourth class of activities, called the '*quaternary sector*'.²

Despite frequent exceptions to general rules, the distinction between service industries and manufacturing nevertheless highlights an important difference between the organisation of the two markets: In manufacturing, the economic value, which has been created, can be appropriated through the exchange of material goods, most of which can be stored and spatially transferred. In contrast, services involve immaterial outcomes, characterised in terms of specific transformations of the tangible or intangible conditions of human life. These differences in the appropriability of the value produced have a decisive impact on the modes of interaction between buyers and sellers on the market. And this must also affect the prevalent sources of competitive advantage. Due to the *immaterial, non-storable* and *transient* nature of supply, business success requires direct interaction with consumers and consequently, a high degree of coincidence of consumption and production, both in time and space.

Mobility and organisation thus become key assets for successful customer relations and the quality and efficiency in the supply of services is highly affected by territorial barriers. Economic integration and the harmonisation of rules for market access is therefore an important means of overcoming such restrictions and establishing a supportive environment for service businesses. Even in the world of borderless digital communications, the new information & communication technologies (ICTs) have established themselves as gateways

¹ Metcalfe, S., Miles, I., (2000), Innovation Systems in the Service Economy. Measurement and Case Study Analysis, p. 2.

² deBandt, J. (1999), The Concept of Labour and Competence Requirements in a Service Economy, in: The Service Industries Journal, 19 (1), p. 2.

(and potential barriers) that regulate access to the virtual space of electronic transactions and informational services.

3. Evolution of the Service Economy

3.1 The Historical Record

Measured in terms of labour force reallocations, the scope of structural change that has occurred throughout the 20th century is impressive. According to reported estimates for the total of 25 developed economies,³ at the turn of the century about 47 % of total civil employment was in the agricultural sector, 28 % in manufacturing and only 24.6 % in services. Up to 1950, structural change was mainly characterised by the rapid decline of the agricultural sector, in which employment was cut in half to the level of 28 %. New jobs were created in both manufacturing and services, for which the shares amounted to approximately 34 % and 38 % respectively. This implies that during the first half of the past century, employment in services was already growing faster than in manufacturing, albeit by only a small margin. In the post war period, this tendency continued to gain strength and until the early 1970s, most of the ongoing decline in primary sector employment (13 % in 1971) was absorbed by growth in services (49 %). The structural shift in favour of manufacturing industries was levelling off, increasing modestly up to a share of 38 % of total civil employment. From the 1970s onwards, the process of *tertiarisation* in employment patterns was accelerating; the share of service industries in total civil employment eventually reached 67.4 % in the year 1998 (again these numbers refer to the total of 25 OECD countries). In most developed nations, the shares of manufacturing in total employment peaked between the years 1964 and 1975. The individual peaks differed between countries, ranging for instance from a comparatively low level of 34 % in Canada or 36 % in the USA (both peaked in 1966) to 49 % in Germany (1970). For the total sample of 25 OECD countries, the decline that followed resulted in an employment share for the secondary sector of 27.8 % in 1998. At the same time, the primary sector contracted further to a level of only 4.8 %.

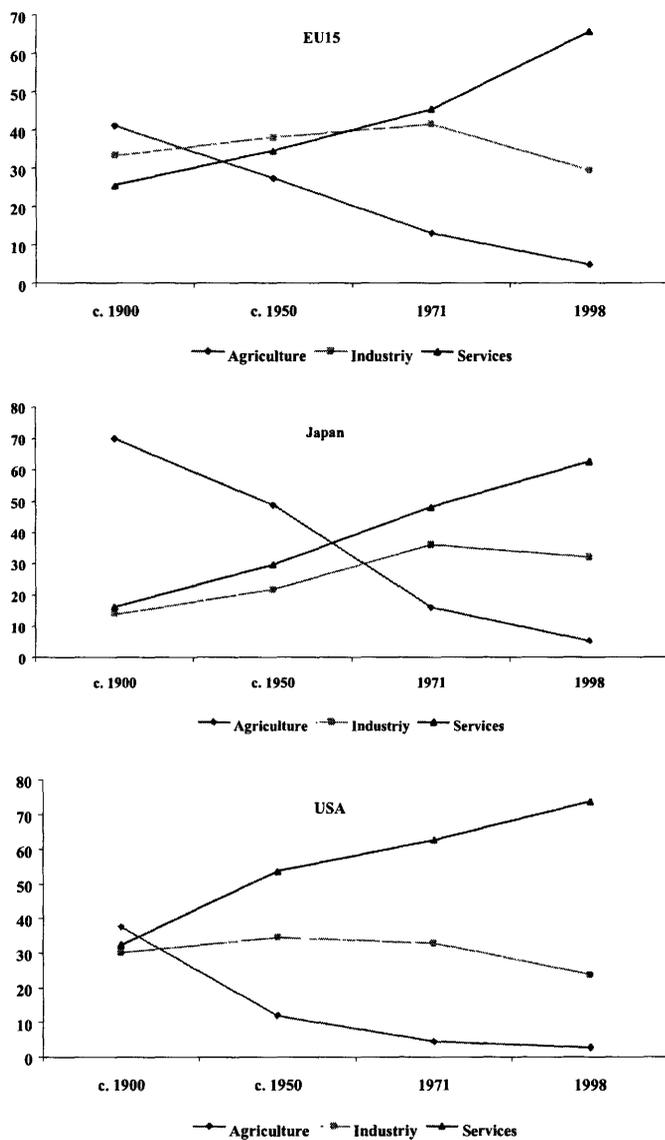
Comparing the long-term structural change in the countries which are now members of the EU, to that of Japan and the USA (Figure 1), we observe that in the USA, the process of tertiaryisation began much earlier than in the two other economic areas. In contrast to both, the service sector in the USA had already gained a substantial lead in terms of employment shares by the middle of the century. In Japan, the most pronounced differences appear in the

³ All the data in this section are taken from Feinstein, C. (1999), *Structural Change in the Developed Countries During the Twentieth Century*, in: *Oxford Review of Economic Policy*, 15 (4), pp. 35-55.

agricultural sector, which didn't lose its dominant position until the post war period. Although by the end of the century, industrial structure in the three economic areas has converged to more similar patterns of specialisation, in 1998 the USA was still characterised by the highest employment shares in the service sector (73.70 %), followed by the European Union (65.66 %) and Japan (62.68 %).

The overall picture is also consistent with a comparison of the shares in *value added*, where comparable data are available only from 1970 onwards (Table 1): The size of the tertiary sector is again largest in the USA (72.80 % in 1997), followed by the European Union (66.82 % in 1995) and Japan (61.85 %). Among the individual member states of the European Union the shares of the services sector typically fall into the range between 65 % and 70 %. With shares of the services sector far below the EU total, Ireland (where the data mirror the remarkable expansion of manufacturing production during the 1990s) and Portugal are the only pronounced exceptions to this rule. Within the European Union the value added shares of the services sector are highest in France and in Belgium.

Figure 1: Shares in total civil employment in %



Source: Feinstein, 1999.

Table 1: Shares in total value added

	Belgium			Denmark			Germany*)		
	Agriculture	Industry	Services	Agriculture	Industry	Services	Agriculture	Industry	Services
1970	3.60	43.09	53.32	6.34	33.64	60.02	3.29	50.62	46.09
1980	2.19	35.27	62.53	5.47	28.72	65.81	2.10	42.67	55.24
1990	1.91	31.50	66.59	4.27	26.84	68.88	1.53	39.15	59.32
1995	1.25	29.30	69.45	3.22	27.17	69.60	1.00	33.21	65.79
1997	1.18	28.81	70.01	-	-	-	-	-	-
	Greece			Spain			France		
	Agriculture	Industry	Services	Agriculture	Industry	Services	Agriculture	Industry	Services
1970	18.24	31.21	50.55	10.73	41.79	47.48	7.34	39.81	52.85
1980	17.32	30.42	52.27	6.94	37.98	55.08	4.46	35.51	60.03
1990	14.45	26.52	59.04	4.87	34.35	60.77	3.54	30.34	66.12
1995	9.69	22.04	68.26	3.14	31.67	65.20	2.48	27.75	69.78
1997	8.07	23.00	68.93	-	-	-	2.37	27.53	70.11
	Italy			Ireland			Netherlands		
	Agriculture	Industry	Services	Agriculture	Industry	Services	Agriculture	Industry	Services
1970	7.97	42.05	49.98	15.57	42.49	41.94	5.97	38.68	55.34
1980	5.84	39.64	54.52	11.72	38.77	49.51	3.66	34.03	62.31
1990	3.26	33.87	62.87	8.44	34.68	56.88	4.29	30.37	65.34
1995	2.91	31.92	65.17	5.32	43.68	51.00	3.25	28.24	68.51
1997	2.68	31.06	66.26	-	-	-	2.96	28.51	68.53
	Austria			Portugal			Finland		
	Agriculture	Industry	Services	Agriculture	Industry	Services	Agriculture	Industry	Services
1970	-	-	-	-	-	-	-	-	-
1980	4.58	37.68	57.74	10.03	37.79	52.19	9.74	37.76	52.50
1990	3.26	33.61	63.14	6.43	34.99	58.58	6.38	32.98	60.63
1995	1.59	31.72	66.69	4.06	33.48	62.45	4.58	32.37	63.05
1997	1.44	32.27	66.29	-	-	-	4.11	31.65	64.24
	Sweden			United Kingdom					
	Agriculture	Industry	Services	Agriculture	Industry	Services	Agriculture	Industry	Services
1970	-	-	-	2.24	45.68	52.08			
1980	3.48	31.69	64.83	1.71	42.06	56.22			
1990	2.74	31.37	65.89	1.51	34.84	63.65			
1995	2.03	29.63	68.34	1.53	31.73	66.73			
1997	-	-	-	-	-	-			
	EU			Japan			USA		
	Agriculture	Industry	Services	Agriculture	Industry	Services	Agriculture	Industry	Services
1970**)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1980	-1.59	-5.39	6.98	-2.37	-4.49	6.85	-0.48	-0.89	1.37
1990	-2.56	-10.00	12.56	-3.52	-5.70	9.22	-1.04	-6.44	7.48
1995	-3.39	-13.12	16.51	-4.09	-8.28	12.37	-1.44	-8.02	9.47
1997				-4.27	-9.18	13.45	-1.33	-8.68	10.01

Note: The label 'industry' comprises the manufacturing sector plus mining, construction, etc.;

*) 1995: New territory;

***) Excluding Austria, Portugal, Finland and Sweden.

Source: Eurostat, OECD, WIFO calculations.

3.2 The Sources of Structural Change

As the historical data have demonstrated, *tertiarisation* is a tremendously powerful process of structural change, characterised by the shift of economic activities away from such traditional

areas as agriculture and manufacturing towards the tertiary sector. In this section, we continue the analysis with an investigation of the underlying sources of this process. Focusing on input-output data for selected OECD countries, covering a time span ranging from the early 1970s to the 1990s, output growth will be decomposed into several of its constitutive components.

In general, there are three possible explanations of why, in developed economies, changes in industrial structures systematically favour services rather than manufactured goods: The first explanation focuses on effects from the demand side, the second on changes in technology, and the third on shifts in international patterns of comparative advantage.

3.2.1 Increasing Demand for Services

Beginning with the *demand side*, tertiarisation is often explained in terms of a general shift in tastes and preferences towards intangible components of consumer satisfaction, which become evident as income levels and standards of living rise. The income elasticity of demand is believed to be high for immaterial sources of well-being, often associated with increasing leisure, entertainment and luxury. Conversely, private expenditures on material goods are presumed to be more quickly affected by the saturation of markets, especially in the case of physiological limits to further consumption (e.g. agricultural products, foods & tobacco). The argument is that raw materials and basic manufactured products, which by and large are associated with their respective physical quantities, have fewer opportunities to raise demand in correspondence with increases in disposable income per capita.

3.2.2 Technological and Organisational Change

The second major force towards tertiarisation is a result of changes in *technology* and *organisation*. In contrast to the above argument based upon differential shifts in the level of intermediary demand for various industries (i.e. holding constant the technology coefficient in the matrix of intermediary inputs), the technology effect results from a change in the intermediary demand per unit of output. Positive impulses for tertiarisation would then correspond to the common observation of increasing differentiation and '*complexification*' of production. Efficient organisation, innovation, brand creation and customised services become the primary sources of competitive advantage, all of them exerting a certain tendency towards raising the level of required inputs from specialised services. Organisational change in terms of contracting-out of activities previously carried out in-house is another source from which external service industries are arising. Organisational and technological changes are strongly intertwined, both resulting in similar changes of coefficients in the matrix of intermediary inputs.

3.2.3 Shifts in the International Patterns of Comparative Advantage

It is sometimes argued that tertiarisation stems from a presumed loss of competitiveness due to the increasing competition of economically less developed, low-wage countries, which benefit from the global integration of markets for manufactured products. Conversely, in those economies where high wages and free trade drive out price sensitive segments of production, employment shifts towards the service industries. The underlying reason is presumed to be that relative to manufacturing goods most service industries are more closely tied to their locations and therefore less exposed to the competitive pressures of global trade. Although this traditional explanation emphasises only the negative impact of decreases in comparative advantage in manufactured goods, we must also consider the role of positive shifts in comparative advantage in favour of (for example ICT related) services which become increasingly tradable (see the complementary chapter on the internationalisation of services).

3.2.4 Decomposition of Output Growth

The empirical investigation consists of a simple decomposition of the overall growth in output of five broad sectoral aggregates into their constitutive components of (i) changes in the *technology coefficients*, which give the amount of each category of intermediary inputs required per unit of output; (ii) the growth of domestic *demand* comprising public and private consumption, as well as investment outlays (the latter reported separately and including variations in stock); and finally (iii) the impact of changes in net exports, reflecting shifts in demand which become effective through *foreign trade* relationships.

Box 1: Decomposition of output growth

Input-output tables attempt to provide a complete record of all transactions of goods and services in the economy, including separate matrices for intermediary demand (X) and the various components of final demand (Y). Together, the sum of these components is gross output (Q). Final demand (net of imports) consists of private and public consumption (C), investments (I ; here also including changes in stocks), and net exports (F). Hence, $Y=C+I+F$. For the purpose of this decomposition, the basic relationship ($X + Y = Q$) can be converted into: $(E-A)^{-1} * Y = Q$ with Q representing gross output, A the direct input coefficients of the matrix for intermediary demand and E the identity matrix. The term $(E-A)^{-1}$ is called the Leontief-inverse L . We thus get the relationship $Q=LY=L(C+I+F)$. Growth of gross output between two points in time (t and $t-z$ years) can now be decomposed into its technological component, i.e. growth due to changes of the Leontief-inverse matrix of technology coefficients (holding final demand Y_t constant); and changes resulting from shifts in any of the individual components of final demand, i.e. domestic consumption, investment and net exports (while holding the matrix of technology coefficients L_{t-z} constant):

$$\frac{Q_t - Q_{t-z}}{zQ_{t-z}} = \frac{(L_t - L_{t-z})Y_t}{zQ_{t-z}} + \frac{L_{t-z}(C_t - C_{t-z})}{zQ_{t-z}} + \frac{L_{t-z}(I_t - I_{t-z})}{zQ_{t-z}} + \frac{L_{t-z}(F_t - F_{t-z})}{zQ_{t-z}}$$

The numbers in the tables must be read as average annual growth expressed in terms of the average change in percentage points of gross output during the base year, which can be attributed to the individual components. The contribution of the individual components sums up to the arithmetic mean of output growth measured in percentage points.

Industries are aggregated into five broad sectors: *manufacturing* (ISIC 3), *distributive services* (wholesale and retail trade, transport; ISIC 61, 62, 71), *knowledge-based services* (communications, financial services, real estate and business services; ISIC 72, 81, 82, 83), *personal & social services* (restaurants & hotels, community services, etc.; ISIC 9 and 63), and *other* sectors (agriculture, mining, construction, utilities; ISIC 1, 2, 4, 5).

The data have been collected from national statistical offices, as well as a set of harmonised input-output tables provided by the OECD. The OECD data cover the period from the early 1970s up to 1990 and are available in constant and current national currencies. The government sector (including public investments) is generally treated as a part of final consumption. Data from 1990 onwards stem from national statistical offices and are not harmonised. In most cases, they are only available in current prices.

Conclusions must be drawn with care, as the methods of data generation and construction of input-output tables vary between countries and can introduce considerable distortions with respect to the sources of tertiarisation. Most important, the original data from the national statistical offices were still organised under different classificatory regimes. Consequently, an interpretation should put less emphasis on specific numbers and concentrate more on the general picture that is revealed by the decomposition.

The following general observations summarise the data (Tables 2 and 3):

- ◆ *Since the 1970s, the process of tertiarisation has been driven primarily by the growth of knowledge-based services.* Apart from a few minor exceptions, knowledge-based services (comprising financial services, business related services⁴, and communications) have consistently been the fastest growing sector of all five aggregates, outperforming manufacturing growth in every single observation available. In many cases, the growth differential is substantial. But the same cannot be said of the other service categories, in which average annual growth of gross output differs much less from that of the manufacturing sector and sometimes has even been observed to fall behind.
- ◆ *Among the sources of structural development, the increase of domestic demand has had the most pronounced impact on growth in the five broad sectors.* Besides knowledge-based services, personal & social services benefited most from this rise in consumption. In France, the UK and the USA, the negative contributions of net exports to average annual output growth indicate that *comparative advantage* has shifted away from manufacturing towards service industries. This effect was most pronounced in the UK before the 1990s. This tendency, however, cannot be characterised as a general trend for developed economies; manufacturing growth in other nations, such as Germany, the Netherlands, Denmark, and Japan has consistently enjoyed positive impulses generated by foreign

⁴ In the OECD and many national data bases this also comprises real estate.

trade. In France and the USA an improving foreign trade position has positively contributed to output growth in the distribution related services (comprising transport as well as wholesale and retail trade). In the UK, at least from 1992 onwards, a similar shift in comparative advantage appears to have favoured the growth in knowledge-based services.

- ◆ The *technology effect* (as revealed by the change of coefficients in the matrix of intermediary inputs) has been most pronounced in knowledge-based services. When measured at constant prices, from the early 1970s up to the 1990s the technological component accounted for about half of output growth in France and Germany, or about one third in Denmark and the Netherlands. For the UK, the technological component was unusually high; whereas in Japan and the USA, the growth of knowledge-based services appears to have been driven more strongly by domestic demand.

Table 2: Decomposition of average annual output growth: percentage points, constant prices

	Gross output	Technology	Consumption	Investment	Net exports
Denmark 1972-1990 (prices 1980)					
Manufacturing industries	1.38	-0.61	0.83	0.44	0.73
Distributive services	1.87	-0.23	0.63	0.16	1.32
Knowledge-based services	2.64	0.87	1.50	0.05	0.22
Personal and social services	1.40	-0.06	1.27	0.02	0.16
Other Sectors	1.48	-0.18	1.43	-0.34	0.57
France 1972-1990 (prices 1980)					
Manufacturing industries	1.44	-0.28	1.69	0.51	-0.47
Distributive services	2.25	0.27	1.71	0.09	0.18
Knowledge-based services	3.49	1.75	1.78	-0.02	-0.02
Personal and social services	2.65	0.21	2.40	0.02	0.03
Other sectors	1.69	-0.45	2.13	-0.16	0.17
Germany 1978-1990 (prices 1985)					
Manufacturing industries	1.84	0.00	1.01	0.79	0.04
Distributive services	2.31	0.11	1.57	0.28	0.35
Knowledge-based services	3.82	1.79	1.80	0.21	0.02
Personal and social services	1.88	0.26	1.43	0.11	0.08
Other sectors	1.21	-0.65	1.38	0.50	-0.03
The Netherlands 1972-1986 (prices 1980)					
Manufacturing industries	2.47	0.16	1.15	0.49	0.67
Distributive services	2.24	-0.07	0.83	0.23	1.25
Knowledge-based services	3.90	1.18	2.11	0.29	0.31
Personal and social services	2.47	-0.05	2.37	0.04	0.12
Other sectors	2.39	0.48	1.49	0.25	0.17
United Kingdom 1968-1990 (prices 1980)					
Manufacturing industries	1.03	1.46	1.24	0.60	-2.28
Distributive services	2.18	0.86	1.86	0.27	-0.81
Knowledge-based services	3.50	3.11	0.81	-0.11	-0.30
Personal and social services	3.56	0.57	3.26	0.04	-0.31
Other sectors	1.80	0.90	0.73	0.52	-0.35
Japan 1970-1990 (prices 1985)					
Manufacturing industries	2.79	-0.37	1.86	1.22	0.08
Distributive services	2.99	0.13	2.17	0.73	-0.04
Knowledge-based services	3.29	0.80	2.06	0.47	-0.04
Personal and social services	2.72	-0.31	2.79	0.38	-0.13
Other sectors	2.30	-1.52	2.08	1.86	-0.12
USA 1972-1990 (prices 1982)					
Manufacturing industries	1.56	-0.38	1.58	0.64	-0.27
Distributive services	2.81	0.33	2.03	0.24	0.21
Knowledge-based services	2.74	0.51	2.00	0.17	0.06
Personal and social services	2.68	0.03	2.57	0.06	0.03
Other sectors	0.87	-0.59	1.54	0.38	-0.47

Sources: OECD, national statistical offices, WIFO calculations.

Table 3: Decomposition of average annual output growth: percentage points, current prices

	Gross output	Technology	Consumption	Investment	Net exports
Denmark 1972-1990					
Manufacturing industries	4.39	-0.37	3.38	1.34	0.05
Distributive services	4.48	0.08	2.41	0.44	1.55
Knowledge-based services	4.87	0.99	3.50	0.25	0.13
Personal and social services	4.55	0.23	4.10	0.11	0.11
Other sectors	4.42	-0.21	3.60	0.98	0.05
France 1972-1990					
Manufacturing industries	4.51	-1.14	4.45	1.45	-0.25
Distributive services	4.78	-0.11	4.26	0.41	0.22
Knowledge-based services	5.08	1.63	3.14	0.29	0.03
Personal and social services	4.93	0.26	4.55	0.09	0.04
Other sectors	4.87	-0.75	4.62	1.08	-0.08
Germany 1978-1990					
Manufacturing industries	3.54	-0.37	2.16	1.20	0.55
Distributive services	3.84	0.05	2.79	0.45	0.54
Knowledge-based services	5.19	1.87	2.88	0.35	0.10
Personal and social services	4.10	0.43	3.32	0.16	0.19
Other sectors	3.35	-0.86	2.85	1.30	0.06
Germany 1991-1995					
Manufacturing industries	0.40	-2.15	1.47	-0.04	1.11
Distributive services	3.32	0.35	2.88	-0.25	0.34
Knowledge-based services	9.50	-0.43	9.74	0.20	-0.02
Personal and social services	5.95	0.96	4.83	0.16	0.00
Other sectors	7.91	1.45	3.17	2.96	0.32
The Netherlands 1972-1986					
Manufacturing industries	4.32	-0.04	2.87	1.11	0.37
Distributive services	4.49	0.03	2.26	0.49	1.72
Knowledge-based services	5.42	1.06	3.48	0.50	0.37
Personal and social services	4.93	0.08	4.63	0.07	0.15
Other sectors	4.56	0.41	2.77	0.92	0.46
The Netherlands 1986-1990					
Manufacturing industries	4.77	-0.11	0.99	0.83	3.05
Distributive services	5.71	1.06	3.06	0.51	1.08
Knowledge-based services	7.61	2.14	3.74	0.64	1.09
Personal and social services	3.67	0.13	3.52	0.06	-0.03
Other sectors	1.49	-1.48	0.18	2.46	0.34
The Netherlands 1990-1993					
Manufacturing industries	0.54	-0.90	1.88	-1.55	1.11
Distributive services	6.58	-0.11	4.29	0.26	2.14
Knowledge-based services	8.15	0.79	6.20	0.45	0.71
Personal and social services	5.93	0.16	5.74	0.04	-0.02
Other sectors	1.50	-0.65	1.65	0.02	0.49

Table 3: Decomposition of average annual output growth (continued)

	Gross output	Technology	Consumption	Investment	Net exports
The Netherlands 1993-1995					
Manufacturing industries	5.12	-0.50	1.20	1.50	2.92
Distributive services	4.63	0.31	3.11	0.32	0.90
Knowledge-based services	8.06	1.59	5.03	0.77	0.67
Personal and social services	3.65	0.01	2.48	0.34	0.82
Other sectors	3.33	-0.95	1.34	1.74	1.19
The Netherlands 1995-1998					
Manufacturing industries	4.16	-0.24	1.57	0.42	2.41
Distributive services	6.98	1.76	4.84	0.47	-0.08
Knowledge-based services	11.83	3.69	5.06	2.07	1.00
Personal and social services	3.87	-0.10	3.92	0.17	-0.13
Other sectors	3.86	-0.45	1.97	2.19	0.15
United Kingdom 1968-1990					
Manufacturing industries	4.02	-0.15	3.58	1.36	-0.77
Distributive services	4.22	0.38	3.53	0.47	-0.16
Knowledge-based services	4.37	2.75	1.36	0.25	0.02
Personal and social services	4.43	0.48	3.99	0.08	-0.13
Other sectors	4.18	0.44	2.57	1.29	-0.12
United Kingdom 1992-1997					
Manufacturing industries	7.33	0.32	5.11	1.94	-0.04
Distributive services	9.19	2.48	5.86	0.62	0.22
Knowledge-based services	9.61	2.36	5.38	0.86	1.02
Personal and social services	8.47	3.07	5.24	0.16	0.00
Other sectors	4.38	-1.02	2.65	2.46	0.28
Japan 1970-1990					
Manufacturing industries	3.84	-0.91	2.80	1.72	0.23
Distributive services	4.20	0.24	2.89	0.96	0.10
Knowledge-based services	4.45	1.21	2.77	0.49	-0.02
Personal and social services	4.29	0.17	3.87	0.37	-0.12
Other sectors	3.98	-1.15	2.64	2.68	-0.19
USA 1972-1990					
Manufacturing industries	4.07	-0.39	3.77	1.02	-0.33
Distributive services	4.45	0.21	3.54	0.42	0.27
Knowledge-based services	4.61	0.59	3.64	0.28	0.09
Personal and social services	4.69	0.13	4.44	0.08	0.04
Other sectors	4.17	-0.07	3.52	1.11	-0.40
USA 1992-1996					
Manufacturing industries	6.08	0.88	3.41	3.08	-1.29
Distributive services	7.68	0.80	4.98	1.62	0.29
Knowledge-based services	8.72	1.09	5.15	2.31	0.16
Personal and social services	6.62	0.22	6.12	0.28	0.01
Other sectors	5.69	-0.56	3.39	3.60	-0.74

Sources: OECD, national statistical offices, WIFO calculations.

3.3 What Follows Tertiarisation?

Measured in terms of gross output, the general shift of economic activities away from the primary and secondary sectors, in favour of the tertiary sector, has not occurred uniformly across industries. As we observed in the prior section, there is the particular group of

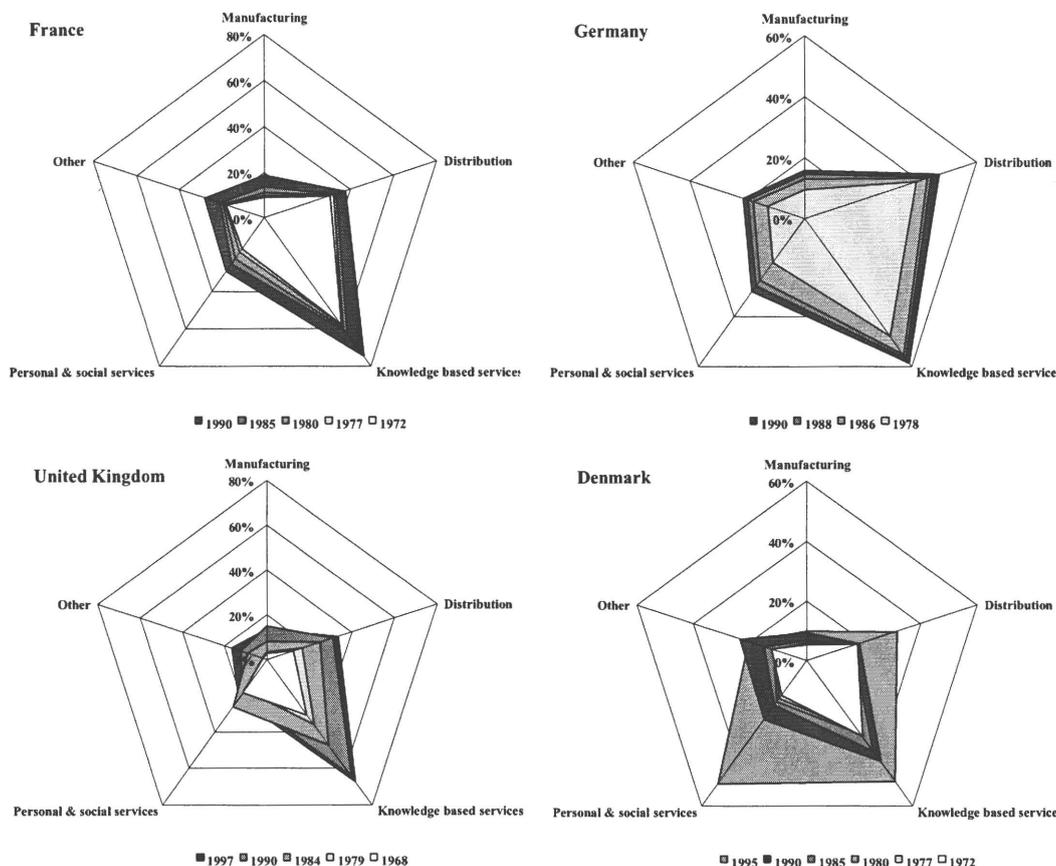
knowledge-based services, which has benefited most from technological change and general increases in demand. If tertiarisation was the dominant pattern of structural development which began in the early 1900s and dominated most of the 20th century, we are now in the midst of what we might call a process of *quaternarisation*, distinctly defined by the steady rise of information and knowledge-based services.

The general rationale behind this process is better known under such popular headings as, for instance, the 'information society', or the 'knowledge-based economy'. The essential difference to traditional growth in services is the specific role, knowledge-based services can play as sources of innovation, product differentiation and productivity growth for the rest of the economy.⁵ The general fear regarding the so-called 'cost disease'⁶ in services appears primarily to be the story of 'old' tertiarisation. It states that because of the limited potential to increase labour productivity through technological progress and the cumulation of complementary inputs to production, industries such as most of the traditional personal, social and public services, cannot compensate for the rise in aggregate wage levels, forced upon them by the more progressive industries with high productivity growth. This results in a natural and unavoidable rise in the cost of production, as well as a general tendency for increasing shares in employment and nominal output. As a consequence of gradual shifts in employment from sectors with high- towards those with low productivity growth, this view projects diminishing growth in productivity and income as the general long run perspective for the economically most developed economies characterised by high shares of service industries.

⁵ See Tomlinson, M. (1997), The Contribution of Services to Manufacturing Industry, CRIC Discussion Paper No. 5.

⁶ See Baumol, W. (1967), Macroeconomics of Unbalanced Growth: The Anatomy of Urban Crisis, in: American Economic Review, vol. 57, pp. 415-426.

Figure 2: Shares of knowledge-based services in total intermediary inputs (current prices)



Sources: OECD, national statistical offices; WIFO calculations.

But the observed increase in knowledge-based, primarily business-related services together with the vigorous and long-lasting economic upturn, which has occurred in the USA during the 1990s, suggests a different story. The knowledge-based services do not contribute directly to economic development only through their own growth in employment and income, they additionally have the potential to improve performance in the economic system via 'knowledge transfer and progressive specialisation', because they are capable of stimulating various kinds of competitive advantage and productivity growth:⁷ (i) *technological innovation* (e.g. engineering services, computing, testing, R&D labs); (ii) *organisation*, as well as *corporate finance* and *strategy* (management consulting, audits, manpower services); and, (iii) *marketing* (market research, advertising, public relations, design services, fairs & exhibitions). In addition, external, knowledge-based services offer flexible access to specialised expertise

⁷ Rubalcaba-Bermejo, L. (1999), Business Services in European Industry. Growth, Employment, and Competitiveness, European Commission, Brussels, p. 136ff.

at more operational levels of business (e.g. linguistic or legal services). Hence, in contrast to the gloomy forecasts on productivity and income envisaged by many with respect to the traditional process of tertiarisation, the label “*quaternarisation*” names a distinct process, in which the cumulative nature of information and knowledge as complementary factors of production raise the general prospects for entrepreneurial discovery and productivity growth.⁸

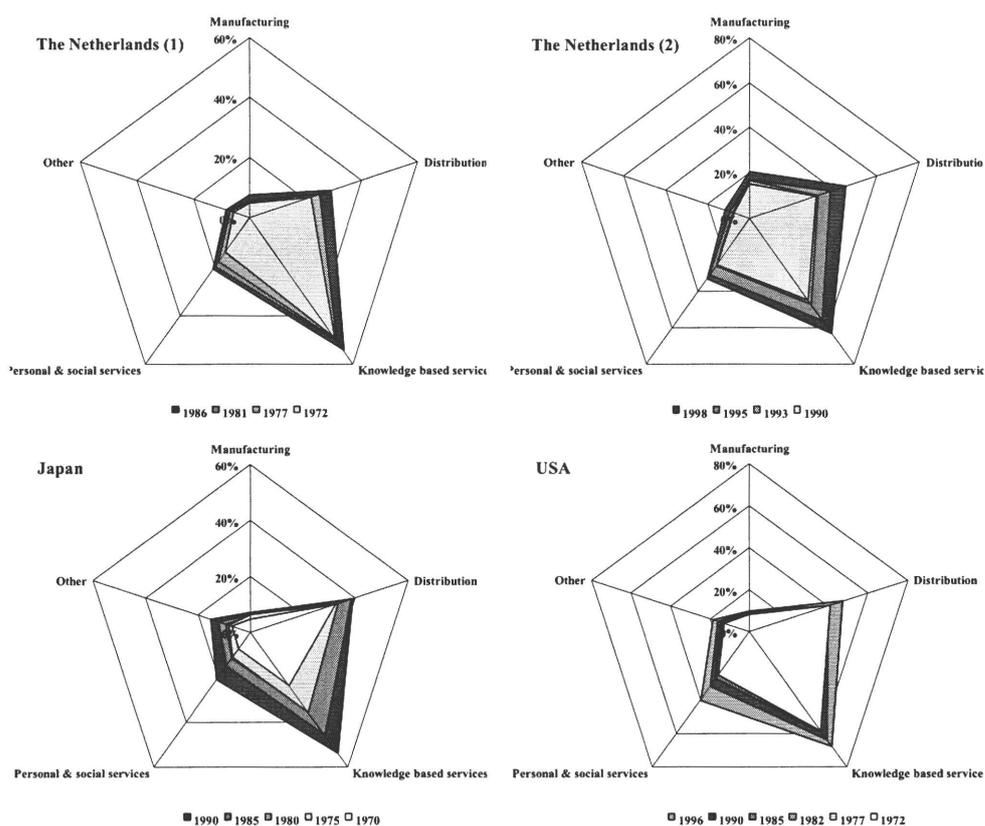
The numbers extracted from input-output tables leave no doubt that the rise of the knowledge-based economy is underway (Figures 2 and 3). For instance, in France the share of knowledge-based services in the intermediary inputs of the *total economy* has risen from 17 % in 1970 up to a level of 34 % in 1990, which is the highest among the countries compared. Corresponding figures for the Netherlands are 9 % (1972) and 33 % (1997); United Kingdom: 5 % (1968) and 30 % (1997); USA: 19 % (1972) and 31 % (1996); Denmark: 11 % (1972) and 29 % (1995); Germany: 16 % (1978) and 26 % (1990); and finally Japan: 8 % (1970) and 17 % (1990).

We must of course take seriously the restricted comparability of input-output data both between countries and over the course of time, as the methods used in constructing the tables might differ. We should also suspect that the rising shares of knowledge-based services are partly due to improved statistics, although this in itself has been motivated by the growing awareness of their importance. As a final caveat, it must also be mentioned that the absolute level of inputs from external knowledge-based services does not constitute a necessary indicator of economic modernisation.

But even if we consciously refrain from placing too much weight on the specific numbers and abstain from comparisons of absolute levels between individual countries, the general picture is clear and surprisingly consistent, showing a steady *increase in the shares of knowledge-based services*, measured in percent of total intermediary inputs. Another robust observation tells us that most of the intermediary demand for knowledge-based services originates in knowledge-based services themselves. Conversely, the demand for knowledge-based services is lowest in manufacturing and in the aggregate of ‘other’ industries (comprising agriculture, mining, construction and several utilities).

⁸ Still, we cannot preclude the possibility that in some progressive services high growth rates will only be of transitory nature. See Baumol, W., Blackman, S.A., Wolff, E.N. (1985), *Unbalanced Growth Revisited: Asymptotic Stagnancy and New Evidence*, in: *American Economic Review*, 75 (4), pp. 806-817.

Figure 3: Shares of knowledge-based services in total intermediary inputs (current prices)



Sources: OECD, national statistical offices; WIFO calculations.

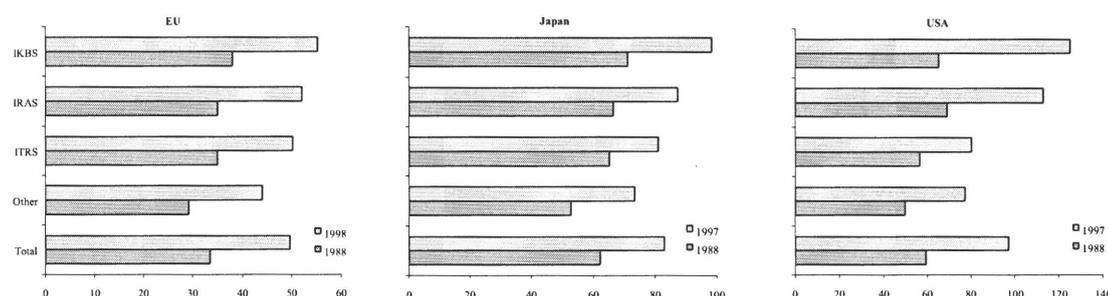
4. External Service Inputs and Competitive Performance

In the following section, we investigate whether any regularities can be observed in the relationship between differences in the intermediary demand for external services and the competitive performance of manufacturing industries. We therefore classified manufacturing industries according to their relative dependence on different kinds of external service inputs (Box 2), dividing manufacturing as a complete set into four mutually exclusive categories of industries with high shares of:

- ◆ *IKBS* – .. inputs from knowledge based services, such as various business-related services, communications or financial intermediation (examples are publishing, electronic components, medical equipment, air- and spacecraft; see Annex);
- ◆ *IR&A* – .. inputs from retail and advertising services (e.g. the manufacturing of food & beverages, pharmaceuticals, computers, sports goods);
- ◆ *ITR* – .. inputs from transport services (most basic goods industries, such as sawmilling, construction material or basic metals, but also motor vehicle bodies);

- ◆ and the residual category of *OTHER* industries, where the combination of external service inputs does not deviate in any pronounced way from the average of total manufacturing (various, from meat products to footwear, metal products, and motor vehicles).

Figure 4: Labour productivity in 1000 ECU



IKBS ...industries with a high level of inputs from knowledge based services
 IRAS ...industries with a high level of inputs from retail & advertising services
 ITRS ...industries with a high level of inputs from transport services

Source: SBS, WIFO calculations.

Box 2: The new taxonomy

The new industry classification is intended to complement the set of available empirical tools, established in order to investigate industrial performance with respect to the intangible sources of competitive advantage.¹ The program started with a focus on the intangible factors of production such as R&D and advertising, as opposed to tangible factors such physical capital and labour ('taxonomy 1'), first presented in the 1998 Competitiveness Report. The dimension of human resources ('taxonomy 2') was additionally introduced in the 1999 Competitiveness Report. In this report, we concentrate on the differentiation of industries according to the varying degrees of demand for external service inputs, as they can be extracted from input-output tables ('taxonomy 3').

Statistical cluster analysis classifies individual observations, depending on their relative similarity with respect to an array of chosen variables. Its purpose is to divide a specific data profile into separate and mutually exclusive segments by creating maximum homogeneity within and maximum distance between groups. For the current analysis, one hundred NACE 3-digit manufacturing industries were taken as observations, while the vectors representing intermediary demand for external service inputs were used as discriminating variables. Due to the importance of a sufficiently high level of disaggregation in the initial data, US input-output tables were used (available for 1992) in a matrix disaggregated to 498 industries times products. The high level of disaggregation does not just allow for a refined differentiation of service inputs, it also enables a sufficiently accurate transformation of the respective service intensities into NACE 3-digit industries. Besides this technical necessities, the USA is an attractive source of reference (i) first because of its status as one of the economically most advanced nations, whose general patterns in the division of labour constitutes a good benchmark; and (ii) secondly, also being a large economy with according lower risks of distortions in the data due to highly particular local patterns of specialisation.

The classification was produced over a sequence of four analytic steps: First, the demand for external services had to be *aggregated* into a reasonable number of variables. In the end, inputs from the various service industries were aggregated into 6 variables: (i) 'transportation' (all of them related to the spatial transformation of goods and people; e.g. railroads, motor freight-, air transport, etc. but also including pipelines and postal services); (ii) 'trade' (wholesale- and retail); (iii) 'financial services' (including insurance and real estate); (iv) 'advertising'; (v) 'datcom' (comprising data processing, communications,

and electronic broadcasting); and finally (vi) 'techserv' (legal-, engineering- and accounting services plus testing and research labs. Personal services (hotels, restaurants, theatres, laundry, cleaning, barber shops, etc.), social services (e.g. health and education) as well as very special sectors such as public administration, the defence sector or social security were not included.

Among the remaining variables, correlation was still high, so in a second step, a *principal component analysis* was applied, leading to a 3-factor solution of uncorrelated variables, which were linear composites of the original vectors. The factor loadings of *variable 1* were highest for inputs from 'financial services', 'datcom' and 'techserv'. In contrast, *variable 2* captured the dimensions of the initial variables 'trade' and 'advertising', which appeared to be highly correlated. *Variable 3* was determined by 'transportation' and to a lesser degree by the initial variable labelled 'techserv'. In a third step, a non-hierarchical algorithm produced a first partition of the data profile into ten broad clusters, which in a fourth step was further aggregated by means of hierarchical clustering, relying on the cosine of the vectors as a measure of distance and the average linkage between groups as a method of agglomeration.

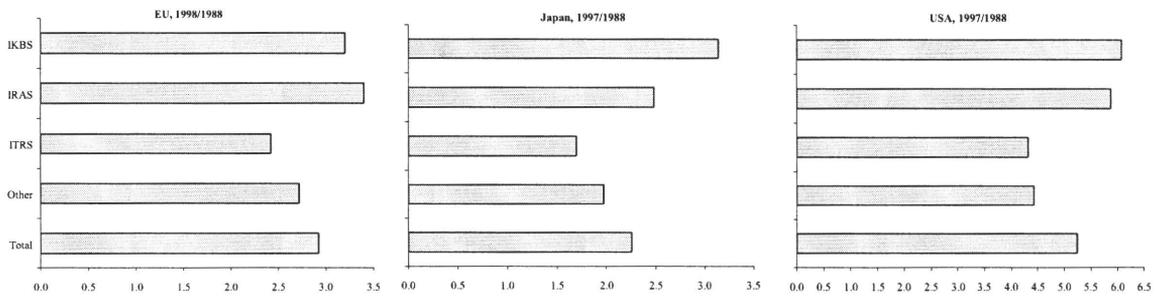
Analogous to the use of other classifications, we must remain aware of the fact that much heterogeneity within each individual category can still be found. Additionally, we cannot assume entire consistency between different economic areas with respect to the typical combinations of external service inputs, especially since the latter can be much affected by national differences in the regulation of service markets. It is one of the advantages of the taxonomic approach that the latter is not a necessary assumption for international comparisons. It only requires consistency as far as membership within the broad boundaries of the final classification is concerned. This obviously is a much weaker assumption and generally allows for more robust results.

¹ Reference: Peneder, M., *Entrepreneurial Competition and Industrial Location*, forthcoming, Edward Elgar, Cheltenham, UK.

Beginning with relative differences in the *productivity of labour*, industries with a high demand for inputs from external knowledge-based services appear on top of the rankings in the European Union as well as Japan and the USA (Figure 4). Taking all three areas together, labour productivity in 1997 amounted to an average of 91,635 ECU per capita, far ahead and growing faster (+5.9 % p.a. since 1988) than any other category. Industries with high inputs from retail and advertising ranked second (78,704 ECU/capita; +4.8 % p.a.), followed by transport intensive industries (67,222 ECU/capita; and growth of 3.7 % p.a.). The overall patterns for the European Union are largely consistent with the other two major economic areas, but in Japan and the USA the differences between industry types are even more pronounced.

In the EU, Japan and the USA taken as a whole, the *value added* of industries with high shares of inputs from knowledge based services grew at 4.8 % p.a., which is 1 % above the average for total manufacturing and the highest among all four industry groups. In both Japan and the USA no other type of industries experienced faster growth. In the European Union, average annual growth of 3.2 % was outperformed only by retail and advertising intensive industries with an average of 3.4 % (Figure 5).

Figure 5: Value added, average annual growth in %

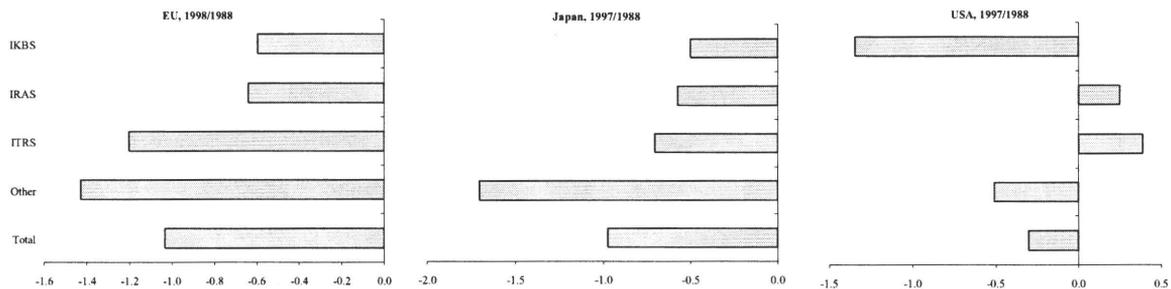


IKBS ...industries with a high level of inputs from knowledge based services
 IRAS ...industries with a high level of inputs from retail & advertising services
 ITRS ...industries with a high level of inputs from transport services

Source: SBS, WIFO calculations.

In the European Union as well as in Japan, industries with high shares of knowledge-based services achieved their good productivity performance mostly by means of above average growth in value added, whereas the decline in *employment* was the lowest of all four categories. The European patterns of overall change in employment are largely consistent with those of Japan. Generally speaking, industries characterised by high levels of service inputs such as retail and advertising, or transport, appear to be less exposed to pressure for further job losses, than for instance the group of other industries, with no pronounced intermediary demand for any kind of external services. But this picture differs remarkably in the case of the USA, where productivity growth of industries with high shares of knowledge-based services appears to result from two simultaneous movements: high growth in value added and extraordinary large-scale reductions of employment, which at the same time are not observed in the other industry groups (Figure 6).

Figure 6: Employment, average annual change in %



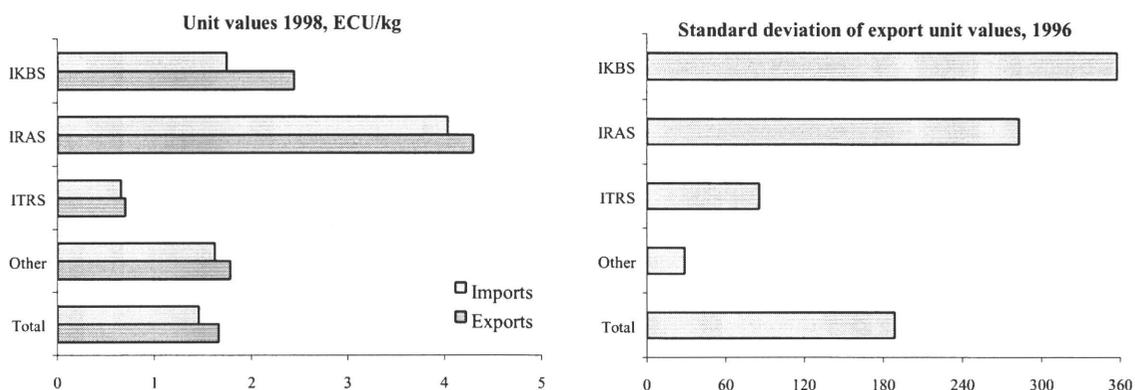
IKBS ...industries with a high level of inputs from knowledge based services
 IRAS ...industries with a high level of inputs from retail & advertising services
 ITRS ...industries with a high level of inputs from transport services

Source: SBS, WIFO calculations.

Regarding *unit values* in the European Union's foreign trade relations, these are by far highest in the group of industries which are characterised by large external inputs from retail and

advertising (Figure 7). An obvious reason is the generally low physical weight of final consumer goods. Finally turning to the degree of quality differentiation as opposed to mere price competition, the standard deviation of unit values is highest in industries with high shares of inputs from knowledge-based services. Industries with a high level of inputs from retail and advertising still come in second. Corresponding to the findings on the European quality premium, unit values of exports are consistently higher than those of imported goods. Additionally, we can observe that the quality differential of exports relative to imports is most pronounced in the group of industries with high shares of knowledge-based services.

Figure 7: Indicators for product quality and differentiability: EU



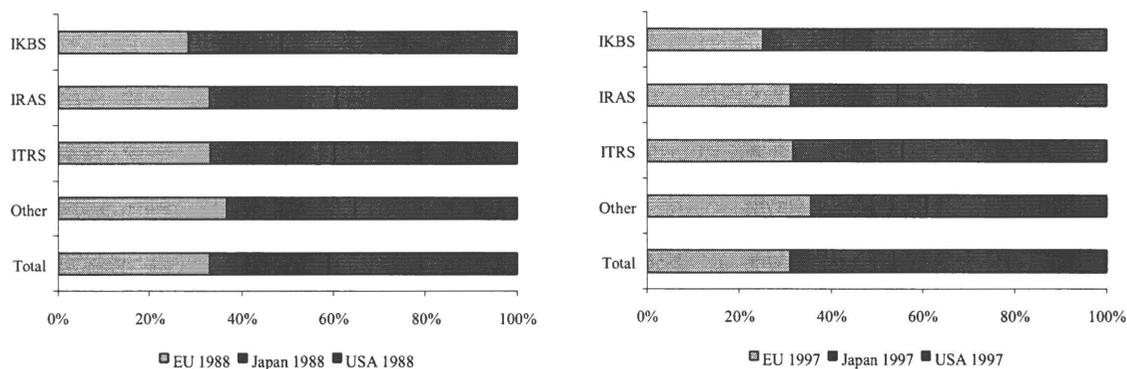
IKBS ...industries with a high level of inputs from knowledge based services
 IRAS ...industries with a high level of inputs from retail & advertising services
 ITRS ...industries with a high level of inputs from transport services

Source: COMEXT, WIFO calculations.

Applying this classification of industries to a comparison of the overall patterns of specialisation within the triad, the general picture for the European Union reveals a pronounced structural deficit which has further grown between 1988 and 1997. For manufacturing industries with a particularly high level of inputs from knowledge based services, the share in total value added of the triad has fallen from 28.5 % in 1988 to 25.2 % in 1997 (Figure 8). It is the lowest of all the four categories, which in 1997 amounted to 31.1 % for industries with a high level of inputs from retail and advertising, 31.7 % for transport intensive industries and 35.6 % in the group of 'other' manufacturing. In contrast, the USA enjoys precisely reverse patterns of specialisation, with the highest share in the value added of the triad in the group of industries with large inputs from knowledge-based services (57.2 % in 1997 up from 51.2 in 1988), followed by industries with high intermediary demand for retail and advertising (45.3 % in 1997), transport intensive production (44.3 %), and the lowest specialisation in 'other' manufacturing (39.2 %). Similar to the European Union, Japan is characterised by a comparatively low number of shares in industries classified as having

high intermediary demand for knowledge-based services (17.6 %), but its value added shares are more evenly distributed (between 23.6 % and 25.2 %) in the three other categories.

Figure 8: Specialisation; shares of value added in the combined total for EU+Japan+USA



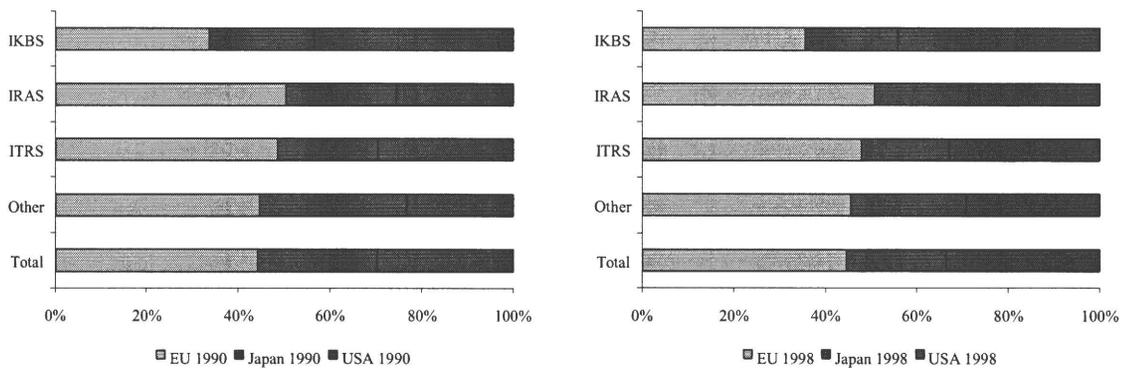
IKBS ...industries with a high level of inputs from knowledge based services
 IRAS ...industries with a high level of inputs from retail & advertising services
 ITRS ...industries with a high level of inputs from transport services

Source: SBS, WIFO calculations.

The structural weaknesses in European manufacturing similarly come to surface in reference to its shares in the triad's total exports. In 1998 the export shares of the EU15 were again lowest in industries with a particularly high level of inputs from knowledge-based services (Figure 9). Their share of 35.6 % is rather modest, when compared to the 50.8 % for industries with large inputs from retail and advertising, the 47.8 % in transport intensive production, and the 45.5 % for the group of other manufacturing.

Analogously, the US pattern of export specialisation consistently mirrors the European situation, with industries with high shares of inputs from knowledge-based services rank highest (44.1 %), and the export shares of all other types of industry are rather evenly distributed (between 28 % and 33 %). Japanese shares in the total exports of the triad generally do not differ much between these categories (ca. 20 %), except for the above average performance of the group of other manufacturing (ca. 25 %).

Figure 9: Specialisation; share of exports from the total for EU+Japan+USA



IKBS ...industries with high level of inputs from knowledge based services
 IRAS ...industries with high level of inputs from retail & advertising services
 ITRS ...industries with high level of inputs from transport services

Source: COMEXT, WIFO calculations.

The results of this section can be briefly summarised as follows: the USA is strongest in industries characterised by high shares of inputs from external knowledge-based services. This is precisely the group of industries which tends to exhibit the highest levels of labour productivity and product differentiation. In contrast, the European Union is more specialised in the group of 'other' industries, characterised not only by the lack of a pronounced reliance on external service inputs, but also – as we have seen in the figures above – by the lowest potential for product differentiation, the most severe decline in employment, below average growth of value added, and the lowest level of labour productivity.

5. Policy Implications

In order to overcome the *structural deficits* with respect to industries that typically rely heavily on external inputs from knowledge-based services, the European Union must face concerns about the regulatory environment affecting the supply of these services. Although much further research would be needed in order to claim a clear causal relationship, we might nevertheless suspect that the US strength in those industries is related to its earlier and more advanced development of the according markets for services.

As service industries in general are highly affected by specific *regulations*, and 'in many countries services are subject to more government interventions than most other activities',⁹ the topic naturally is linked to some of the most important concerns of economic policy

⁹ Sapir, A., Buigues, P., Jacquemin, A. (1993), European Competition Policy in Manufacturing and Services: A Two-Speed Approach?, in: Oxford Review of Economic Policy, 9(2), pp. 113-132.

reform. The liberalisation of telecommunications services within the European Union is only one such example, wherein harmonisation and further integration are already ranking high on the European policy agenda. Another example encompasses the manifold formal and informal barriers to equal market access for various professions such as legal, accounting, engineering or architectural services. Due to the more local nature of competition and the heterogeneous regulatory approaches of individual member states, the task of lifting existing restrictions and enabling effective competition amounts to a complex agenda.

In many service industries, such regulatory barriers to market access are justified with recourse to consumer protection and quality assurance. In the introductory section, we emphasised the characteristic prerequisite of simultaneous use and supply, which in many service industries exerts a strong influence on the specific organisation of the market. Another direct consequence concerns problems of *asymmetric information*, wherein buyers have difficulties acquiring information comparable to the sellers' exclusive knowledge about the particular quality of the services offered: 'Since services only exist while they are being consumed, their quality cannot easily be assessed prior to consumption'.¹⁰ Due to its context specific and highly customised nature, in many cases the quality of services is even difficult to compare after consumption. Consequently informational problems tend to be more severe in the exchange of services than on the more tangible and therefore more transparent goods markets. This in turn raises the problem of how to establish consumer confidence in the quality of the services. In their extreme form, such informational problems can effectively hinder the emergence of certain markets for high-quality services.

Various specific *institutional arrangements* have arisen, which are intended to mitigate the economic effects of the uncertain provision of quality: Guarantees and legal liabilities in cases of serious malpractice define certain minimum standards, below which the risk must be borne by sellers. Additional instruments such as quality controls or occupational licensing and certification (as e.g. for medical professions, lawyers, etc.) are regularly implemented. Such policy interventions are usually justified in terms of static efficiency arguments, derived from various sources of market failure, which frequently evoke the problem of asymmetric information. Viewed, however, from a dynamic perspective, many state interventions appear to obstruct private entrepreneurial initiative.

As a general rule, in competitive markets characterised by frequent interaction between buyers and sellers, we should not underestimate the scope of private solutions and *creative entrepreneurial response* even to problems posed by asymmetric information. In most

¹⁰ Sapir, 1993, p. 25. See also Pfaffermayr, M. (1998), Business Services in Austria, in: Austrian Economic Quarterly, 3 (3), pp. 137-146.

industries, private investment in the credible communication of the quality of the services is a basic requirement for competitive success. If quality turns out to be inferior, consumers have the power to effectively retaliate by stopping their purchases and changing suppliers. As established clients are already familiar with the quality of the services they purchase, their willingness to continue with their supplier provides valuable information to all other market participants. Consequently, sellers of high-quality services have particularly strong incentives to continuously cultivate their special relations to existing customers, because strong ties to established clients signal credibility to others as well.

More generally, companies regularly invest in the creation of brands and try to establish positive reputations, in order to communicate certain profiles of aspired quality. Another consequence regards the organisation of multinational enterprises, whereby international chains of multi-unit service firms combine local outlets organised under common brand names with largely standardised products on offer. In addition to the possible benefits of cost reductions and the increased efficiency of organisation and the monitoring of the performance of individual outlets, their efforts to homogenise services are also motivated by the desire for greater predictability, thereby enhancing consumer confidence with respect to expected quality standards.

Placing more confidence in the private capacity of creative entrepreneurial response to the various problems of asymmetric information, the largely fragmented field of national regulations and restrictions to market access should be *critically reviewed*. Wherever specific public intervention is indeed necessary to maintain the quality of services, safety and consumer protection, the mutual recognition and the European-wide harmonisation of regulatory standards should become the prime target of policy reform. Due to their nature as intermediary inputs, the efficient supply of specialised external services fulfils important functions enabling and affecting the competitive performance of many other industries. Re-designing an effectively streamlined and co-ordinated regulatory environment would lift entrepreneurship and increase competition within the sector, generating positive impulses for competitive performance and growth which could spread through large parts of the European economy.

Annex x.x: WIFO taxonomy: industries clustered by intensity of external service inputs

Industries characterised by high level of inputs from...

...transport services (ITRS)	...knowledge based services (IKBS)
1530 Fruits and vegetables	2210 Publishing
2010 Sawmilling, planing and impregnation of wood	2230 Reproduction of recorded media
2020 Panels and boards of wood	2410 Basic chemicals
2030 Builders' carpentry and joinery	2470 Man-made fibres
2040 Wooden containers	2670 Cutting, shaping, finishing of stone
2110 Pulp, paper and paperboard	2840 Forging, pressing, stamping and roll forming of metal
2120 Articles of paper and paperboard	2850 Treatment and coating of metals
2220 Printing	2860 Cutlery, tools and general hardware
2420 Pesticides, other agro-chemical products	2960 Weapons and ammunition
2430 Paints, coatings, printing ink	3210 Electronic valves and tubes, other electronic comp.
2460 Other chemical products	3220 TV, and radio transmitters, apparatus for line telephony
2510 Rubber products	3310 Medical equipment
2520 Plastic products	3320 Instruments for measuring, checking, testing, navigating
2610 Glass and glass products	3330 Industrial process control equipment
2620 Ceramic goods	3340 Optical instruments and photographic equipment
2630 Ceramic tiles and flags	3510 Ships and boats
2640 Bricks, tiles and construction products	3530 Aircraft and spacecraft
2650 Cement, lime and plaster	3550 Other transport equipment n. e. c.
2660 Articles of concret, plaster and cement	...other industries
2680 Other non-metallic mineral products	1510 Meat products
2710 Basic iron and steel, ferro-alloys (ECSC)	1520 Fish and fish products
2720 Tubes	1540 Vegetable and animal oils and fats
2730 Other first processing of iron and steel	1550 Dairy products; ice cream
2740 Basic precious and non-ferrous metals	1570 Prepared animal feed
2750 Casting of metals	1710 Textile fibres
3420 Bodies for motor vehicles, trailers	1720 Textile weaving
...retail and advertising (IR&S)	1730 Finishing of textiles
1560 Grain mill products and starches	1740 Made-up textile articles
1580 Other food products	1750 Other textiles
1590 Beverages	1760 Knitted and crocheted fabrics
1600 Tobacco products	1770 Knitted and crocheted articles
2050 Other products of wood; articles of cork etc.	1810 Leather clothes
2440 Pharmaceuticals	1820 Other wearing apparel and accessories
2450 Detergents, cleaning and polishing, perfumes	1830 Dressing and dyeing of fur; articles of fur
2920 Other general purpose machinery	1910 Tanning and dressing of leather
2930 Agricultural and forestry machinery	1920 Luggage, handbags, saddlery and harness
2940 Machine-tools	1930 Footwear
2950 Other special purpose machinery	2320 Refined petroleum products
3000 Office machinery and computers	2810 Structural metal products
3120 Electricity distribution and control apparatus	2820 Tanks, reservoirs, central heating radiators and boilers
3140 Accumulators, primary cells and primary batteries	2830 Steam generators
3150 Lighting equipment and electric lamps	2870 Other fabricated metal products
3160 Electrical equipment n. e. c.	2910 Machinery for production, use of mech. power
3350 Watches and clocks	2970 Domestic appliances n. e. c.
3540 Motorcycles and bicycles	3110 Electric motors, generators and transformers
3610 Furniture	3130 Isolated wire and cable
3620 Jewellery and related articles	3230 TV, radio and recording apparatus
3630 Musical instruments	3410 Motor vehicles
3640 Sports goods	3430 Parts and accessories for motor vehicles
3650 Games and toys	3520 Railway locomotives and rolling stock
3660 Miscellaneous manufacturing n. e. c.	

Source: WIFO calculations.

More information on Enterprise DG

Additional useful information on the work of Commissioner Erkki Liikanen and the Enterprise Directorate-General is available through printed publications and on the web.

Commissioner Erkki Liikanen, responsible for Enterprise and the Information Society:

http://europa.eu.int/comm/commissioners/liikanen/index_en.htm

Enterprise DG on the web:

http://europa.eu.int/comm/dgs/enterprise/index_en.htm

CORDIS (Community Research and Development Information Service):

<http://cordis.lu>

Enterprise DG work programme:

http://europa.eu.int/comm/dgs/enterprise/work_programme_2001.htm

Enterprise DG' s printed publications:

<http://europa.eu.int/comm/enterprise/library/index.htm>

Enterprise Europe is a free-of-charge newsletter published quarterly in the 11 Community languages by the Enterprise Directorate-General. It covers the whole range of Enterprise DG' s work, announcing new initiatives as well as providing practical information.

<http://europa.eu.int/comm/enterprise/library/enterprise-europe/index.htm>

CORDIS focus is published twice a month in English, French, German, Italian and Spanish. It provides a review of the main developments in all aspects of European Union research and innovation activities, covering general policy developments, programme implementation, calls for tenders and results, events, legislative activities, and much more.

<http://www.cordis.lu/focus/en/src/focus.htm>

Innovation & Technology Transfer is published six times a year in English, French, German, Italian and Spanish by the European Commission's Innovation Programme, which aims to promote innovation at Community level and encourages SME participation under the Fifth Research Framework Programme. The emphasis is on timely news relevant to these objectives and in-depth ' case studies' of successful projects.

<http://www.cordis.lu/itt/itt-en/home.html>

Euroabstracts is published six times a year in English by the 'Innovation and SMEs' programme, part of the European Commission's Fifth Research Framework Programme. The Innovation and SMEs programme promotes innovation and encourages the participation of small and medium-sized enterprises in the Framework Programme.

<http://www.cordis.lu/euroabstracts/en/home.html>

European Trend Chart on Innovation newsletter. The Trend Chart project develops practical tools for innovation policy makers in Europe. It pursues the collection, regular updating and analysis of information on innovation policies at national and Community level. The newsletter is published quarterly in English, French and German. Further reports and studies are available on the web site <http://trendchart.cordis.lu/Reports/>

Reports, studies etc.

The Enterprise Directorate-General regularly publishes reports and studies on its various areas of activity. Here is a selection of recent publications.

Global competitiveness in pharmaceuticals – A European perspective. Enterprise Papers No 1, 2001. Luxembourg (Eur-Op), 2001. 108 pp. (EN).
Cat. No NB-37-01-162-EN-C

The textile and clothing industry in the EU – A survey. Enterprise Papers No 2, 2001. Luxembourg (Eur-Op), 2001. 68 pp. (EN). Cat. No NB-38-01-770-EN-C

External services, structural change and industrial performance. Enterprise Papers No 3, 2001. Luxembourg (Eur-Op), 2001. 36 pp. (EN). Cat. No NB-38-01-956-EN-C

Europe's position in quality competition. Enterprise Papers No 4, 2001. Luxembourg (Eur-Op), 2001. 66 pp. (EN). Cat. No NB-38-01-964-EN-C

Funding of new technology-based firms by commercial banks in Europe . Luxembourg (Eur-Op), 2000. 81 pp. (EN). Cat. No NB-NA-17025-EN-C.

Assessment of the Community regional innovation and technology transfer strategies. Luxembourg (Eur-Op), 2001. 109 pp. (EN). Cat. No NB-NA-17028-EN-C.

Corporate venturing in Europe. Luxembourg (Eur-Op), 2001. 66 pp. (EN). Cat. No NB-NA-17029-EN-C.

Informal investors and high-tech entrepreneurship . Luxembourg (Eur-Op), 2001. 91 pp. (EN) Cat. No NB-NA-17030-EN-C.

Training needs of investment analysts . Luxembourg (Eur-Op), 2001. 48 pp. (EN). Cat. No NB-NA-17031-EN-C.

Enforcing small firms' patent rights. Luxembourg (Eur-Op), 2001. 89 pp. (EN). Cat. No NB-NA-17032-EN-C.

Building an innovative economy in Europe. Luxembourg (Eur-Op), 2001. 67 pp. (EN).
€ 11.50. Cat. No NB-NA-17-043-EN-C

Innovation policy in a knowledge-based economy. Luxembourg (Eur-Op), 2000. 99 pp. (EN). Cat. No NB-NA-17-023-EN-C

European innovative enterprises: lessons from successful applications of research results to dynamic markets. Luxembourg (Eur-Op), 2000. 102 pp. (EN).
Cat. No NB-BA-17-024-EN-C

Getting more innovation from public research. Luxembourg (Eur-Op), 2000. 99 pp. (EN).
Cat. No NB-NA-17-026-EN-C

Creating an entrepreneurial Europe. The activities of the European Union for small and medium-sized enterprises (SMEs) – 2000 edition. Luxembourg (Eur-Op), 2001. 150 pp. (available in all Community languages). Cat. No NB-27-00-992-**-C

The intangible economy: impact and policy issues. Luxembourg (Eur-Op), 2001. 59 pp. (EN). € 20. Cat. No NB-31-00-772-EN-C

The European observatory for SMEs - Sixth Report. Luxembourg (Eur-Op), 2000. 432 pp. (DE, EN, FR) € 53. Cat. No CT-22-99-200-**-C

The European observatory for SMEs - Sixth Report. Summary. Luxembourg (Eur-Op), 2000. 22 pp. (available in all Community languages). Cat. No CT-22-99-208-**-C

European competitiveness report 2000. Luxembourg (Eur-Op), 2000. 119 pp. (EN). € 9.
Cat. No NB-31-00-918-EN-C

Report on the implementation of the action plan to promote entrepreneurship and competitiveness. Brussels (European Commission), 2000, 2 vol. (Vol. I available in all Community languages, Vol. II in DE, EN, FR).

Industrial aspects of the information society: business networks and the knowledge-driven economy: an empirical study carried out in Europe and Canada. Luxembourg (Eur-Op), 2000. 81 pp. (EN). € 43. Cat. No CO-25-99-253-EN-C

Methodologies for benchmarking framework conditions. Luxembourg (Eur-Op), 2000. 17 pp. (EN). Cat. No NB-31-00-780-EN-C

The role of information and communications technologies in growth and competitiveness. Luxembourg (Eur-Op), 2000. 17 pp. (EN). Cat. No CO-26-99-449-EN-C

Guides

ATEX guidelines. Guidelines on the application of Directive 94/9/EC of 23 March 1994 on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres. Luxembourg (Eur-Op), 2001. 118 pp. (EN). Cat. No CO-22-99-014-**-C

Guide to the implementation of directives based on the new approach and the global approach. Luxembourg (Eur-Op), 2000. 112 pp. (DE, FR, EN).
Cat. No CO-22-99-014-**-C

Useful facts in relation to the personal protective equipment directive 89/686/EEC, 1999 edition. Luxembourg (Eur-Op), 2000. 145 pp. (EN).
Cat. No CO-21-99-020-EN-C

Electrical and mechanical engineering directory, 2000 edition. Luxembourg (Eur-Op), 2000. 133 pp. (EN). Cat. No CO-24-99-275-EN-C

Cosmetlex: The rules governing cosmetic products in the European Union. Luxembourg (Eur-Op), 2000, 3 vol. (EN). vol. 1: Cosmetics legislation, 74 pp., € 14.50; vol. 2: Methods of analysis, 187 pp. € 31; vol. 3: Guidelines, 84 pp., € 16.
vol. 1 Cat. No NB-26-99-958-EN-C vol. 2 NB-26-99-966-EN-C vol. 3 NB-26-99-974-EN-C

Eudrallex: The rules governing medicinal products in the European Union. Luxembourg (Eur-Op), 1998-, (DE, EN, ES, FR, IT), priced.

Medicinal products for human use, vols 1, 2a, 2b, 3
Medicinal products for human and veterinary use, vol 4
Veterinary medicinal practice, vols 5, 6a, 6b, 7a, 7b (8 and 9 not yet published).
On-line version: pharmacos.eudra.org/F2/eudrallex/index.htm

Contact:

European Commission, Enterprise Directorate-General, Information and Communication Unit, Documentation Centre, Rue de la Loi / Wetstraat 200 (SC15-00/51), B-1049 Brussels, Belgium
Fax (32-2) 296 99 30 http://europa.eu.int/comm/enterprise/mailbox/request_form_en.htm

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