

4 SERVICES IN PRODUCTION AND PRODUCTION OF SERVICES IN SWEDISH MANUFACTURING

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1. Introduction

The share of the service sector has been increasing in most developed economies during the last 20 years. A general view is that the service content within the manufacturing industry has also increased. By this is usually meant the manufacturing firms purchase and internal use of services as well as their sales of services. In the last 10-15 years, some of the firms' service activities, e.g. research and development (R&D), have been intensively studied. But our knowledge about the scale of resources that manufacturing firms spend on other activities than factory production, and how much of manufacturing production is made up of services, is still very incomplete.

Several arguments have been put forward to explain the supposed increase in manufacturing service production. One argument is that industrial products in general have become more complicated and advanced. This has been the result of R&D-efforts, which have also increased the need for extensive marketing to inform customers about characteristics and use of complex and technically advanced products. Another argument emphasizes the increasing participation of firms in joint ventures. To coordinate these large, often international projects, a great variety of management services are needed.

This paper has two purposes. The *first* is to describe the purchase, internal use and sales of services in manufacturing. The statistics are based on surveys to Swedish manufacturing firms undertaken by IUI. These have been supplemented by information from other national and international sources in order to obtain a more complete picture. The *second* purpose is to test some hypotheses about the role of services in manufacturing. Hence, we will study the choice between internal and external production of services, the relationships between service intensity and profitability, and between input and output intensity of services.

At the *macroeconomic* level attention is directed to the blurred statistical borderline between the manufacturing sector and parts of the service sector.

Depending on how firms are organized, activities like finance, insurance and especially business services like technical and administrative consultancy, legal and accountancy services and advertising, may be provided either internally by the manufacturing firms or bought externally. Thus, observations on the size of the manufacturing sector are becoming less meaningful. The declining development of industrial production and employment in most countries during the last 10-15 years would probably look less gloomy if the sector "business services" were added to the industry statistics. This relationship between manufacturing and service sectors is important, since the size of the manufacturing sector is often regarded as a separate policy target. It also raises questions about how we should measure manufacturing investments, productivity, etc.

From a *microeconomic* point of view the service content in manufacturing production carries significant information about the ways firms are organized. Do firms buy services mainly because they are more efficiently produced in the market, or is this a way of acquiring specialist knowledge and modern technology, or is it just a way to smooth out a temporarily high work-load?

The way the paper is organized indicates how we attempt to answer these questions. In section 2 the definitions of services are discussed. The internal use of services in manufacturing is presented in Section 3. Industry's purchase and sales of services are evaluated in Sections 4 and 5. The paper ends (in Section 6) with a summary and conclusions.

2. The Surveys – Definitions and Coverage

The concepts of industry's purchase, use and sales of services are not all well defined. On the input side services are bought not only from the service sector but also from other manufacturing firms. Sales of services are, however, difficult to separate from sales of goods. Goods production is generally the dominant feature of manufacturing firm activities and services are often an integral part of goods' sales. Services provided by industry are more seldom sold separately from goods. It is also difficult to separate the functions within the manufacturing firms which should be considered as services from those which are mainly related to factory production. Even the factory production process itself requires a significant input of software activities like production planning, materials and quality control etc.

In the survey on the internal use of services, seven functions were separated, following closely the definitions in the firms internal accounting system. Throughout this paper internal services are defined very broadly as labor costs for all activities except direct factory production. In the other surveys, the firms were asked about their purchase and sales of services according to their own definition of the service concept, which may vary somewhat

among firms. This should of course be kept in mind when analyzing the results. It should also be observed that the surveys are based on a sample of about 270 large Swedish manufacturing firms and that only the domestic part of the companies is included.¹ Separate estimations have, however, been carried out on the size and service content of foreign subsidiaries. In spite of certain problems with representativity and definitions, the survey results, combined with information from other sources, probably give a good picture of the service content in manufacturing production in a highly industrialized country like Sweden.

3. Internal Production of Services

3.1 Services in Domestic Operations

In the survey on the internal use of services the firms were asked to divide the total labor costs for 1976 and 1982 according to seven functions, namely R&D; engineering design and documentation; work scheduling; factory production; marketing and distribution; administration; and other. The results (see Table 1) show that in 1982 as much as 36 percent of total labor costs could be assigned to other activities than factory production. The largest service functions were marketing and administration with about 10 percent each. R&D, engineering design and documentation, and work scheduling each made up about 5 percent of labor cost.

Defining services broadly as all labor costs applied except for factory production, we notice that the raw materials processing and intermediate goods industries had, as expected, the smallest share of labor cost in services, about 25 percent. The highest concentration of services is found in the investment goods industry, 45 percent, while the service share in the consumption goods and building materials industries is close to the average.

The investment goods industry spends almost 20 percent of labor costs on R&D, engineering design and documentation, while the corresponding figure for the raw materials processing industry is only 4 percent. The high marketing shares in the building materials industry can probably be explained by the inclusion of distribution in this item.

A further disaggregation of the results from sectors to subsectors show that the dispersion in the service share of labor costs is much larger at the

¹ The number of firms in the sample varies somewhat around 270 for the different surveys. The sample includes all domestic manufacturing firms with more than 1000 employees and about 100 firms in the group 500-1000 employees. The responding unit is divisions of production units for some firms and the total company for others. This means that for some firms, particularly large ones, the head office is not included in the response.

lower levels. For the wood, pulp and paper industry the service share is only 10-15 percent of labor cost, while for the chemical-technical industry and the electrical industry the corresponding share is more than 50 percent.

The change in the distribution of labor costs by functions during the period 1976-82 is presented in Figure 1. Factory production is the function which has changed most. For total industry the factory production share decreased by 3 percentage points. The decrease is largest in the investment goods industry, but also notable in the other industries. Marketing shows an increasing share in all sectors. The share of labor costs spent on R&D increased in 4 out of 5 sectors, and together with about 1 percentage point. Thus, the survey results clearly show the decreasing relative importance of factory production, and the increasing importance of marketing and R&D.

The trend from factory production to services is also shown by data on the number of salaried employees. In the period 1964-83 the share of salaried employees in Swedish manufacturing industry increased steadily from 25 to 31 percent. In the subperiod 1976-82, covered by the survey data, the share increased from 28 to 31 percent. All sectors separated in the survey show an increasing share of salaried employees (SOS, Manufacturing).

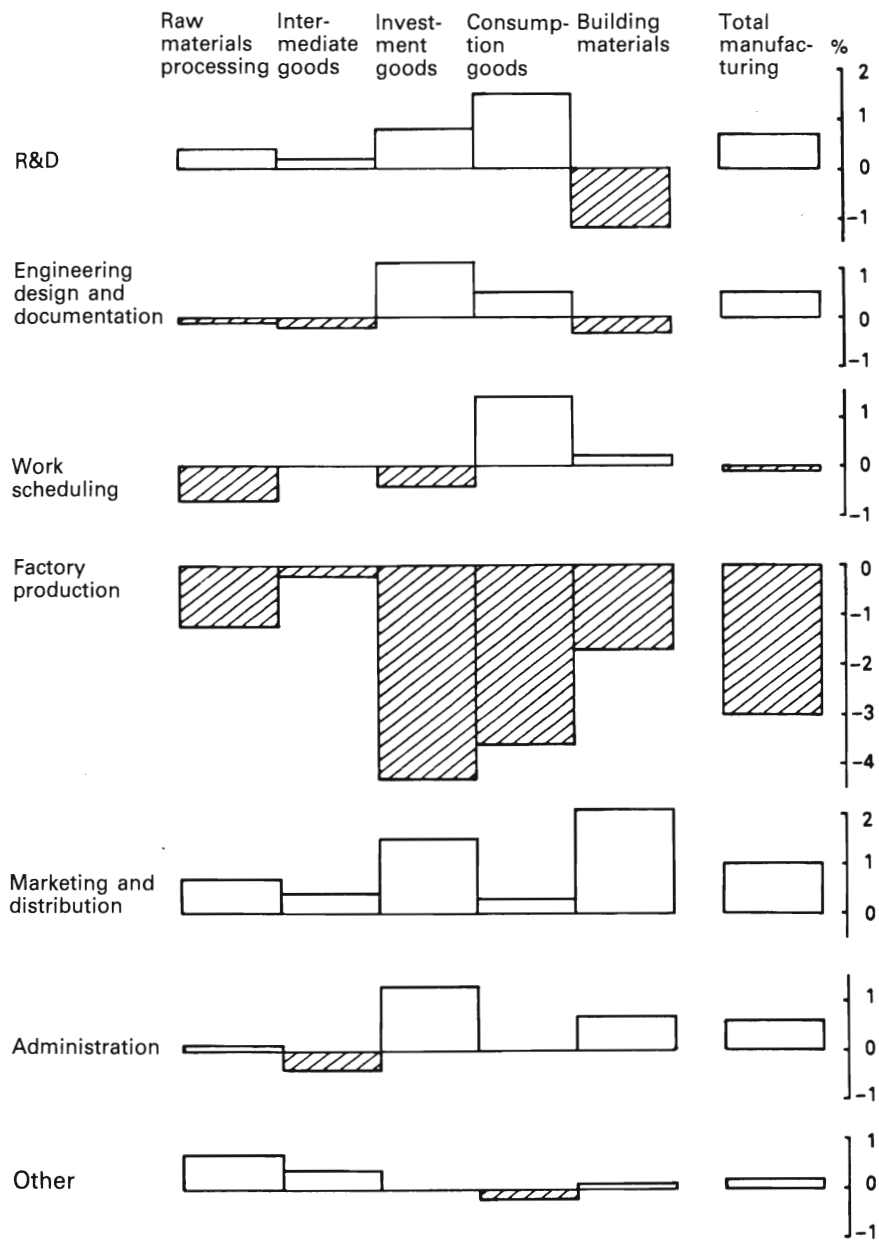
Table 1 *Labor costs in large Swedish manufacturing firms distributed by functions, 1982*
Percent

	Raw materials processing	Intermediate goods	Investment goods	Consumption goods	Building materials	Total manufacturing
R&D	2.4	4.0	9.0	5.9	3.8	6.0
Engineering design and documentation	1.4	2.0	10.2	3.1	2.5	5.3
Work scheduling	2.7	2.8	5.4	3.0	6.6	4.0
Factory production	77.5	73.8	54.7	65.6	64.2	64.4
Marketing and distribution	8.4	9.0	8.2	11.3	13.5	9.9
Administration	6.4	7.6	11.4	8.5	8.4	9.1
Other	1.3	0.8	1.1	2.6	1.0	1.4
Total	100.0	100.0	100.0	100.0	100.0	100.0

Note: The results, which are based on data from 135 firms, are weighted averages with labor costs in 1982 as weights.

Source: IUIs survey on industrial services 1983.

Figure 1 *The change in the distribution of labor costs on functions in large Swedish manufacturing firms 1976-82*
Percent



Note: The results, which are based on data from 115 firms responding 1976 and 1982, are weighted average with labor costs in 1982 as weights.

Source: IUIs survey on industrial services 1983.

3.2 Services in Foreign Subsidiaries

To get a better idea of total (domestic and international) firm activity, the survey presented in Section 3.1 has been supplemented with data on foreign operations. Table 2 shows employment in the 40 largest Swedish multinational manufacturing firms. Since 1974 the share of employment abroad has increased from 42 to 49 percent in 1982 and the number of persons employed in service subsidiaries abroad relative to total employment has increased from 10 to 13 percent.

If the foreign subsidiaries are added to the domestic part, the share of marketing in labor costs in 1982 can be estimated at 20 percent.¹ This implies an increase by 10 percentage points compared to only the domestic part (cf. Table 1). The relative size of the other functions is of course reduced in proportion. The factory production share falls from 64 to 56 percent. The increasing share of employment in service subsidiaries abroad in the period 1974-82 also means that the survey results on the domestic part underestimate the change from factory production to services in general and marketing in particular.

Table 2 *Employment in the 40 largest Swedish multinational manufacturing firms, 1974, 1978 and 1982*
Average number of employees

	1974	1978	1982
Abroad	276 700	285 500	320 000
of which:			
producing subsidiaries	209 100	212 300	238 000 ^b
sales subsidiaries ^a	67 600	73 200	82 000 ^b
Sweden	377 000	347 100	327 500
Total	653 700	632 600	647 500

^a Including sales subsidiaries with no or small production and service subsidiaries.

^b The share of employment in foreign producing and sales subsidiaries in 1982 is assumed to be the same as in 1978.

Sources: Bergholm and Jagrén (1985) and Eliasson (1985).

¹ Three assumptions are necessary for the estimation. Firstly, the distribution of labor costs on functions in foreign producing subsidiaries is assumed to be identical to the domestic parts, according to survey data, and total labor cost in foreign sales subsidiaries is regarded as marketing. Secondly, the distribution of labor costs on functions, from the survey, is applied to the number of employees instead of labor costs. Thirdly, the share of employment in foreign producing and sales subsidiaries in 1982 is assumed to be the same as in 1978.

3.3 Profitability and Service Intensity

An interesting question is how the marketing and research intensive firms distinguish themselves from other firms. Are they the most profitable ones? Our hypothesis is that there should be a positive relationship between the share of services and profitability since high service content in factory production generally means more sophisticated products.

The first test consisted of a simple correlation analysis between the gross profit margin and the share of internal services in 1982. It was carried out for a sample of 103 production units in the manufacturing industry. The expected positive correlation was weak, only 0.26. A somewhat stronger correlation (0.35) was found between the gross profit margin and the share of labor costs spent on marketing.

The 10 largest industry groups in Sweden were then selected, and their rate of return on total capital was compared with the service content in their constituent parts. The correlation between the change in profitability and internal service intensity in these 10 companies from the mid 70s to the early 80s was inconclusive. There was a positive relationship between the change in rate of return and service intensity for only 4 out of 10 companies. Thus, although it may be profitable to increase the service share in manufacturing firms this hypothesis is only weakly supported by our data. This is, however, not too surprising since the rate of return is determined in a complex way by many other factors than service intensity.

4. Purchase of Services

There is a flow of services to industry both from the service sector, including transports, and from transactions within industry. From national account and input-output statistics the first part of this flow may be estimated. In the period 1970-82 the provision of services from the service sector in relation to production in manufacturing increased from 5.5 to 6.7 percent (Ek 1985). A sample of large Swedish manufacturing firms were asked to estimate the total purchase of services (including transport) in 1981. For total manufacturing the purchase of services made up 6.2 percent of total sales (see Table 3), which is in accordance with the figures from input-output statistics.

The amount spent by industry on external services has also been studied by OECD (1983). For the seven countries studied, the services purchased made up 13.5 percent of the turnover in 1979.¹ The total spending on external services varied considerably between the countries, from France with

¹ The countries are Belgium, Denmark, France, Germany, Italy, the Netherlands and the United Kingdom.

20.0 percent to Belgium with 8.3 percent. A division of services into industrial and other (from the service sector) showed that the former made up 4.0 percent, and the latter 9.5 percent. Four of the countries also report data on the development 1975-80.¹ In this period the total purchase of services increased its share of the turnover from 11.0 percent to 12.0 percent. The purchase of services in Swedish industry, 6.2 percent of the turnover in 1981, seems to be on the low side compared to the other countries.

An interesting question is which categories of services firms choose to acquire in the market and what kinds they consider necessary to produce within the firm. This trade-off between internal and external production of services is of course primarily based on cost efficiency considerations, in the same way as for the production of goods. Another important aspect is probably business secrecy.

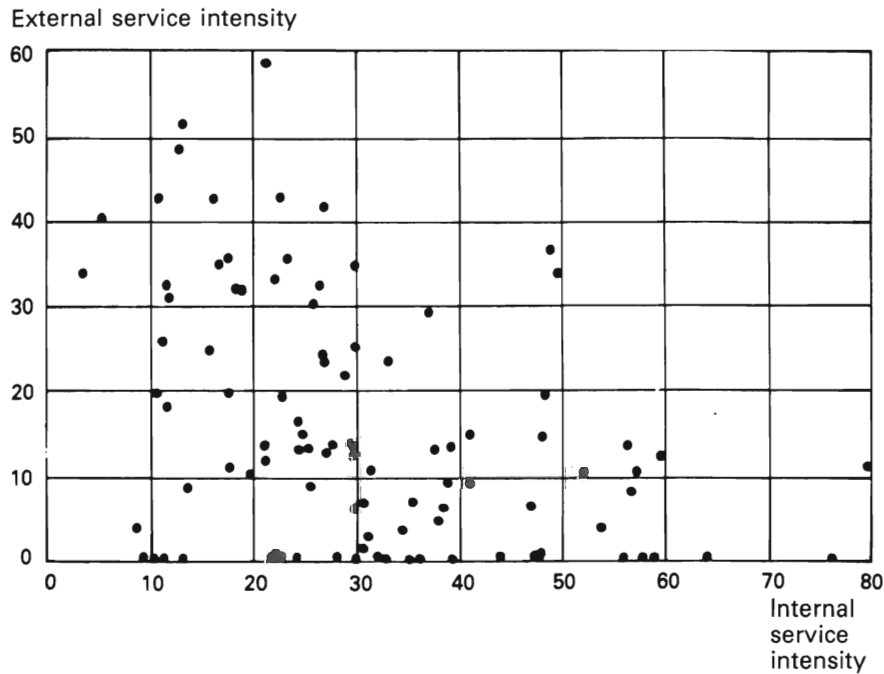
In manufacturing firms with a large share of internal services the service competence can be expected to be high and one can therefore assume that the propensity to purchase external services would be low. To test this hypothesis the correlation between the share of internal and external services in firms was analyzed (see Figure 2). It is clear from the figure that there is a negative relationship between the intensity of internal and external services. The negative correlation was strongest in the investment goods and consumption goods industries, -0.54 respectively -0.56. A plausible interpretation of this relationship is that internal and external services in manufacturing firms are primarily substitutes rather than complements. This view was also supported in interviews with a group of 13 service sales intensive firms (c.f. Section 5). According to these firms, services bought were very often of the same kind as those sold. At peaks one chooses to engage external service subcontractors. Further disaggregation of total services into different categories would clarify this issue in more detail.

5. Sales of Services

Industry's sales of services are, as mentioned, difficult to separate since the sales of goods is often the dominant activity. This means e.g. that the pricing of services seldom is explicit. According to survey data, the sales of services by Swedish manufacturing firms are of limited importance. For only 13 firms out of 210 did the sales of services in 1978 or 1983 make up more than 5 percent of the turnover. Sales of services is of greatest importance in the investment goods industry and of least importance in the raw materials processing and consumption goods industries. At lower levels the electrical in-

¹ The countries are Denmark, Germany, Italy and the United Kingdom.

Figure 2 *Internal and external service intensity in large manufacturing firms 1981*
Percent



Note: The data in the figure represents data from 103 manufacturing firms.
 External service intensity = $PS/(TS+PS)$
 Internal service intensity = $IS/(TS+PS)$
 where: PS = purchase of services; IS = internal labor cost for non-production employees; TS = total internal labor cost.

Source: IUIs survey on industrial services 1983, the Federation of Swedish Industries and IUIs Planning Survey 1982.

dustry has a considerably larger share of services than other subsectors. For one third of the responding firms in the electrical industry, the share of service sales was larger than 5 percent.

For the 13 service intensive firms, the sales of services relative to turnover was unchanged in the observed period (1978-83). The type of services sold by these firms were also studied separately. According to interviews with the firms, the most common category was engineering know-how, like development and construction work. Other services reported by the firms were com-

Table 3 *Purchase and sales of services in large Swedish manufacturing firms 1981*
Percent of turnover

	Purchase of services	Sales of services
Raw materials		
processing	5.9	0.7
Intermediate goods	9.1	2.1
Investment goods	6.2	1.5
Consumption goods	2.9	0.6
Building materials	8.5	4.4
Total	6.2	1.4

Source: The Federation of Swedish Industries and IUIs planning Survey 1982.

missions, transports, rents, education in connection with sales, and service, assembly and installation work. The services were generally sold together with the products and seldom marketed separately. Services sold were often, as mentioned in Section 3.3, of the same type as those purchased.

The rather small share of direct service sales in manufacturing was also confirmed in an earlier survey (see Table 3). In 1981 the sales of services made up only 1.4 percent of the turnover in total manufacturing. The relative magnitude of services in total sales for the various sectors has remained rather constant between the two surveys, with a small share for the raw materials processing and consumption goods industries.

The industrial service sales by industry has also been studied by OECD (1983). For the five countries which have reported data services made up 2.5 percent of the turnover in 1979.¹ This is a somewhat larger figure than Sweden's 1.4 percent in 1981. Thus, compared to other OECD countries the service intensity in Swedish industry is low both on the external input side and on the output side.

As shown in the previous sections, service intensity both on the input side (external and internal) and on the output side varies significantly between sectors. Is there then any relationship between the use of internal and external services on the one hand and sales of services on the other? One would expect that firms with a high intensity of services on the input side would also

¹ The countries are Belgium, Denmark, Germany, Italy and the Netherlands.

be service sales intensive. To check this relationship a measure of the service input intensity was plotted against sales of services in percent of turnover for various subsectors. There was, however, no simple correlation between the input and output intensity of services. Instead we observed that for the investment goods, consumption goods and building materials industries the service input intensity was rather constant while the service output intensity was quite different.

6. Summary and Conclusions

In Swedish manufacturing, service production was shown to make up as much as 35 percent of total labor costs in domestic operations. In rapidly expanding sectors, like the chemical-technical industry and the electrical industry, more than 50 percent of total labor costs is devoted to the production of internal services. The shift from factory production to services in manufacturing is even more marked if foreign subsidiaries are taken into account. In that case the service share in total manufacturing was estimated at about 45 percent. The hypothesis about a positive relationship between service intensity and profitability was, however, only weakly supported by the data.

The purchase of services in manufacturing was shown to be in the order of 6 percent of the turnover. For firm data the correlation between the intensity of internal and external services was found to be negative, indicating that services purchased are mainly substitutes for services within the firm. On the output side, service sales were relatively unimportant and amounted to less than 2 percent of the turnover in total manufacturing. The hypothesis about a positive correlation between input and output service intensity was rejected at the subsector level.

Compared to other OECD-countries the service content in Swedish manufacturing was shown to be below the average, both on the external input and output side. This, of course, raises some questions about the comparability of international data on services in industry.

In the future, the increasing service intensity in manufacturing, observed from the data, will most probably continue. Hopefully, this important trend will soon be recognized by national statistics authorities and actions taken to improve the striking lack of data in the area. Otherwise the gap between the manufacturing statistics and the sector it describes will continue to widen. In the meanwhile data, like these presented in this paper, gives us some guidance about the structural changes within industry and manufacturing firms.

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