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SERVICES IN PRODUCTION AND PRODUCTION OF SERVICES IN SWEDISH MANUFACTURING

by

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ABSTRACT

In this paper panel survey data are used to analyze the service content in Swedish manufacturing production. The service activities in firms are shown to account for more than half of total labor costs in the expanding parts of manufacturing. Service activities, such as marketing and R&D, are growing at the expense of factory production. The correlation between internal and external service intensity is shown to be negative, which is of interest for the future development of the service sectors. The observed trend towards increasing service production in manufacturing raises general questions about the classification, measurement and interpretation of aggregate variables, such as industry investments and productivity.

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 of production within manufacturing industry has also increased. By this is usually meant the industrial firms purchase and internal use of services, as well as 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. The knowledge about how much resources industrial firms spend on other activities than hardware processing and how much of industrial production that is made up of services is however still very incomplete.

There are several arguments put forward to explain the supposed increase in industrial service activities. One argument is that industrial products in general have become more complicated and advanced. This tendency, which is the result of R&D-efforts oriented towards product quality improvements, has also increased the need for extensive marketing to inform customers about characteristics and use of the complex and technically advanced products. Another argument emphasizes the increasing participation of firms in large industrial projects, in which usually a large number of firms cooperate. To coordinate these large, often international projects, services are needed. Moreover, services in the form of education, management, maintenance etc. are often provided by manufacturing firms as part of the project.

This paper has two purposes. The first is to improve the knowledge about services production and use within manufacturing firms by quantifying industry purchase, internal use and sales of services. To a large extent the paper is based upon surveys to Swedish manufacturing firms undertaken by the Industrial Institute for Economic and Social Research (IUI). These have been complemented by information from other national and international sources in order to obtain a picture as complete possible. The

second purpose is to use the data to test some hypotheses about the role of services in industry. Hence, we will analyze the choice between internal and external production of services, the relationship between service intensity and profitability and also the relationship between input and output intensity of services.

The information about services in production and production of services in industry from the surveys show the relationship and the statistical borderline between industry and service sector in more detail than traditional national accounts and input-output statistics. Knowledge about services in industry is relevant both from a macroeconomic and a microeconomic point of view.

On the macroeconomic level there is an increasing awareness about the blurred line between the industrial sector and parts of the service sector in the national statistics. 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 industrial firms or bought in markets from agents external to the firm. Thus, observations on the size of the industrial sector are becoming less meaningful. The declining development of industrial production and employment in most countries during the last 10-15 years looks decidedly less gloomy if the sector "business services" is added to the industry statistics. This relationship between industry and service sectors is important, since the size of the industry sector is often regarded as a separate policy target. It also raises questions about how we should measure industry investments, productivity, etc.

From a microeconomic point of view the service content in industry illustrates how firms are organized. Firms generally have the option to produce services internally or acquire them externally in markets. An interesting question is the motives for firms to buy services externally. Is it mainly because external services are provided more efficiently, or is it a way of acquiring specialist knowledge and modern technology, or is it just a way to smooth

out a temporary peak in business activity?

The paper is organized in the following way. In Section 2 definitions of services are treated. The internal use of services in industry 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 "purchase", "use" and "sales" of services are not well defined concepts. On the input side services ar bought not only from the service sector but also from other industrial 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 normally an integrated part of goods sales. Services provided by industry are more seldom sold isolated from goods. It is also difficult to separate the functions within manufacturing firms which should be considered as services from those which are mainly related to factory production. Even the production process itself requires a substantial amount 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 accounting system. Throughout the 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. Thus, these responses show the perception by firms of purchases and sales of services, which may well vary

between 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 firms and that only the domestic part of the companies is included.[1] In spite of these restrictions the survey results together with information from other sources give a good picture of the service content in industry production in a highly industrialized country like Sweden.

3 Internal Production of Services

3.1 Services in Domestic Operations

In a survey to a sample of 271 large companies these were asked to distribute total labor costs for 1982 and 1976 on seven functions: R&D; engineering design and documentation; work scheduling; factory production; marketing and distribution; administration; and other. The results (see Table 1) show that as much as 36 percent of labor cost 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 making up about 5 percent of labor costs. According to reports from Statistics Sweden the share of labor costs spent on R&D in large manufacturing firms (more than 500 employees) was 6.2 percent in 1975 and 10.3 percent in 1983. This is somewhat higher than observed in the survey. Probably part of R&D spending in our survey is classified as "engineering design and documentation".

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[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 1,000 employees and about 100 firms in the group 500-1,000 employees. The responding unit is divisions or 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.

Defining services broadly as all labor cost expended except for factory production we notice that the raw materials processing and intermediate goods producing industries have the smallest share of labor costs in services, about 25 percent. The highest concentrations to 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 for total manufacturing.

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 buildings materials industry could probably be explained by the inclusion of distribution in this function.

A further disaggregation of the results from branches to subbranches show that the dispersion in the service share of labor costs is much larger at the 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 and the electrical industry the corresponding share is more than 50 percent.

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

The trend from factory production to services is also supported by data on salaried employees. In the period 1964-84 the share of

salaried employees in Swedish manufacturing industry increased steadily from 25 percent to 31 percent, which is shown in Table 2. In the subperiod 1976-82, covered by the survey data, the share increased from 28 percent to 31 percent. All industries studied in the survey show an increasing share of salaried employees.

3.2 Services in Foreign Subsidiaries

The survey presented in Section 3.1 covers only the domestic part of the companies. To get an idea of total firm activity these figures have been complemented by data from foreign establishments. In Table 3 employment in the 40 largest Swedish multinational firms is shown. These companies are heavily represented among the firms of the survey sample. The total share of employment abroad has increased in the period 1974-82 and the number of persons employed in non-manufacturing subsidiaries abroad relative to total employment has increased from 10 to 13 percent.

If data from the foreign subsidiaries are added to the domestic part the share of marketing in labor costs can be estimated to 20 percent in 1982.[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 decreased to the same extent. The factory production share e.g. is reduced from 64 to 56 percent. The increasing share of employment in non-manufacturing subsidiaries abroad in the period 1974-82 also means that the survey results on the domestic part underestimates the change from factory production to services in general and marketing in particular.

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[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

After having observed this pronounced change in industrial structure towards a growing reliance on services in manufacturing production we now study the relative profit performance of these firms. Are the marketing and research intensive firms also the most profitable ones, while traditional manufacturers lag behind? Our hypothesis is that there should be a positive relationship between profitability and the share of services.

The first test consisted of a simple correlation analysis between the share of internal services and the gross profit margin in 1982. It was carried out for a sample of 103 production units in the manufacturing industry. The expected positive correlation was rather 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.

In the next step the 10 largest industry groups in Sweden were selected and their rate of return was compared with the service content in their constituent parts. Figure 2 shows the change in profitability and service intensity in these 10 companies from the mid-70s to the early 80s. It is clear from the figure that the correlation between profitability and internal service intensity is inconclusive. There is a positive relationship between the change in the 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 the service intensity.

4 Purchase of Services

There is a flow of services to industry both from the service sector and from transactions within industry. From national accounts and input-output statistics the first part of this flow may be estimated. In the period 1976-82 the provision of services from the service sector in relation to production in manufacturing increased from 5.6 percent to 6.5 percent (Ek, 1985). In a survey to a sample of large Swedish firms these were asked to estimate the total purchase of services (including transports) in 1981. For total manufacturing the purchase of services made up 6.2 percent of total sales (see Table 4), which is in accordance with the figures from input-output statistics.

The amount spent on the purchase of services, which to a large extent is labor costs, can also be compared to total labor costs in the firms. For total manufacturing external services made up about 20 percent of total (internal and external) labor cost, which is shown in Table 4. The corresponding figure for internal services was about 30 percent. In the raw materials processing, intermediate goods and building materials industries the purchase of services was about the same size as internal services.

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 a lot between the countries, from France with 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 to 9.5 percent. Four of the countries also report data on the development 1975-80.[2] In this period the total purchase of

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

[2] The countries are Denmark, Germany, Italy and the United Kingdom.

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 kinds of services firms choose to purchase externally and which types that are considered necessary to keep 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 secrets in relation with strategic firm policies.

In firms with a large share of internal services the service competence can be expected to be high and one could therefore assume that the propensity to purchase external services would be low. To test this hypothesis the correlation between the share of internal service production and external service purchases was compared (see Figure 3). It is clear from the figure that there is a negative relationship between the intensity of internal and external services. The negative correlation is strongest in the investment goods and consumption goods industries, as shown in Table 5. A plausible interpretation of this relationship is that internal and external services in manufacturing firms primarily are substitutes rather than complements. This view was also supported in interviews with a group of 13 service sales intensive firms (cf. Section 5). According to these firms the services bought were often of the same type as those sold. At peaks one chooses to engage external firms. 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 difficult to separate. Sales of goods is often the dominating activity, which means that the price of services seldom is explicit. According to survey data sales of

services by Swedish industrial firms are also of limited importance. Only 13 firms out of 210 reported sales of services in 1983 or 1978 in excess of 5 percent of the turnover (see Table 6). Sales of services are most important in the investment goods industry and of least importance in the raw materials processing and consumption goods industries. At the industry level the electrical industry has a considerably larger share of services than other industries. For one third of the responding firms in the electrical industry the share of service sales was larger than 5 percent of the turnover.

Out of the 13 service intensive firms in the survey, 4 reported an increasing service share in the period 1978-82, 7 an unchanged share and 2 a decreasing share. The number of firms for which sales of services made up more than 10 percent of turnover was 5 in 1978 and 6 in 1983. For these service intensive firms the sales of services relative to turnover has been rather unchanged in the observation period.

To examine the type of services sold, the service intensive firms in the survey were studied separately. According to interviews engineering know-how, such as development and construction work was the most common category. Other services reported by the firms were commissions, 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. The services sold were often, as mentioned in Section 3.3, of the same type as those purchased.

The limited importance of service sales in industry was also confirmed in an earlier survey (see Table 7). In 1981 sales of services made up only 1.4 percent of the turnover in total manufacturing. The relative importance of services in total sales for the various industries is rather stable in the two surveys, with a small share for the raw materials processing and consumption goods industries.

The industrial services provided 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, both on the input side (external and internal) and on the output side service intensity varies widely between branches of Swedish industry. 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 firms with a high intensity of services on the input side to 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 (see Figure 4). It is clear from the figure, however, that there is no simple correlation between the input and output intensity of services. Instead we observe that for the investment goods, consumption goods and building materials industries the service input intensity is rather constant, while service output intensity varies a lot.

6 Summary and conclusions

This paper presents survey data on the service content of Swedish manufacturing. Some hypotheses about the role of services in industry are tested.

Service production was shown to make up as much as 35 percent of total labor costs in domestic operations of Swedish manufacturing. In rapidly expanding branches, like the chemical-technical and the electrical industry, more than 50 percent of total labor costs is spent on internal services.

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

The shift from 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 to about 45 percent in 1982 up from xx percent in 1976. 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, or equivalently 19 percent of internal labor costs plus external services. 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 subindustry level.

Compared to other OECD-countries the service content in Swedish manufacturing was shown to be below the average, both on the 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 industrial firms.

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 cost in 1982 as weights.

Source: IUI's survey on industrial services 1983.

Table 2 Salaried employees in Swedish manufacturing 1964, 1975 and 1984

	1964		1975		1984	
	Salaried employees 1000s	Salaried employees in percent of total employment	Salaried employees 1000s	Salaried employees in percent of total employment	Salaried employees 1000s	Salaried employees in percent of total employment
Raw materials processing	21	19.2	23	22.0	16	22.3
Intermediate goods	38	23.7	43	25.7	43	28.4
Investment goods	80	30.6	95	32.6	89	37.1
Consumption goods	69	23.7	72	27.3	69	29.8
Building materials	18	18.5	23	23.5	17	24.4
Total	225	24.6	256	27.7	235	30.6

Source: SOS, Manufacturing, Part 1, yearly.

Table 3 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).

Table 4 Purchase of services in large Swedish manufacturing firms 1981

	Purchase of services in percent of turnover	Purchase of services in percent of labor costs and external services	Internal services in percent of labor costs and external services
Raw materials processing	5.9	15.0	20.4
Intermediate goods	9.1	24.5	21.9
Investment goods	6.2	18.5	38.0
Consumption goods	2.9	15.1	33.9
Building materials	8.5	26.8	25.7
Total	6.2	18.9	29.1

Note: The share of labor for service functions in 1982, according to survey data, has been applied to firms' labor cost in 1981.

Source: The Federation of Swedish Industries and IUI's Planning Survey 1982.

Table 5 Correlation between internal and external service intensity in industries of Swedish manufacturing 1981

	Correlation coefficient	t-value	Degrees of freedom
Raw materials processing	-0.16	0.62	15
Intermediate goods	-0.47	2.46	21
Investment goods	-0.54	3.65	32
Consumption goods	-0.56	2.97	19
Building materials	-0.53	1.53	6
Total	-0.40	4.41	101

Sources: See Figure 3.

Table 6 Sales of services in large Swedish manufacturing firms 1978 and 1983

	Share of firms (%) for which sales of services made up			
	more than 5 % of turnover		more than 10 % of turnover	
	1978	1983	1978	1983
Raw materials processing	0	0	0	0
Intermediate goods	5	4	2	2
Investment goods	11	14	7	9
Consumption goods	0	0	0	0
Building materials	8	4	0	0
Total	5	5	2	3

Source: The Federation of Swedish Industries and IUI's planning Survey 1984.

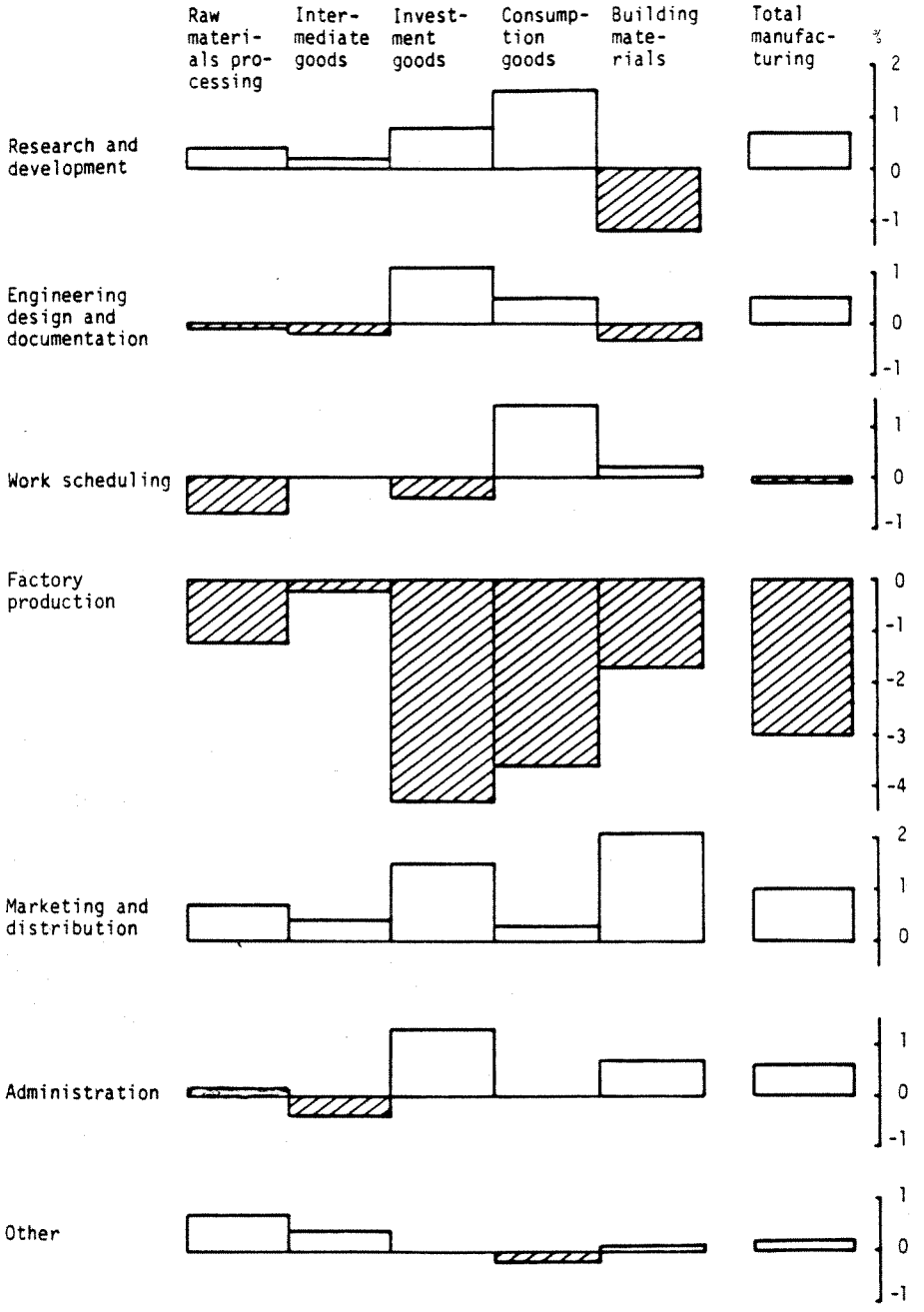
Table 7 Sales of services in large Swedish manufacturing firms 1981

	Sales of services in percent of total sales	Share of firms (%) with nonzero sales of services
Raw materials processing	0.7	27
Intermediate goods	2.1	42
Investment goods	1.5	63
Consumption goods	0.6	26
Building materials	4.4	57
Total	1.4	43

Source: The Federation of Swedish Industries and IUI's Planning Survey 1982.

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

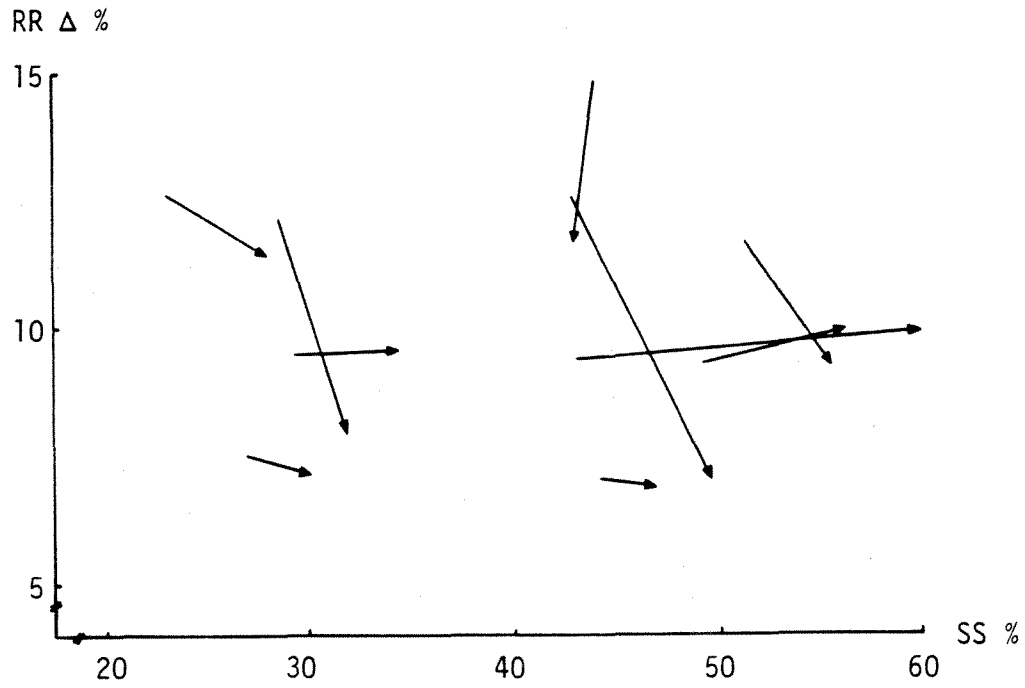
Percent



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

Source: IUI's survey on industrial services 1983.

Figure 2 **Rate of return and internal service intensity in the 10 largest Swedish manufacturing firms 1976 and 1982**
Percent



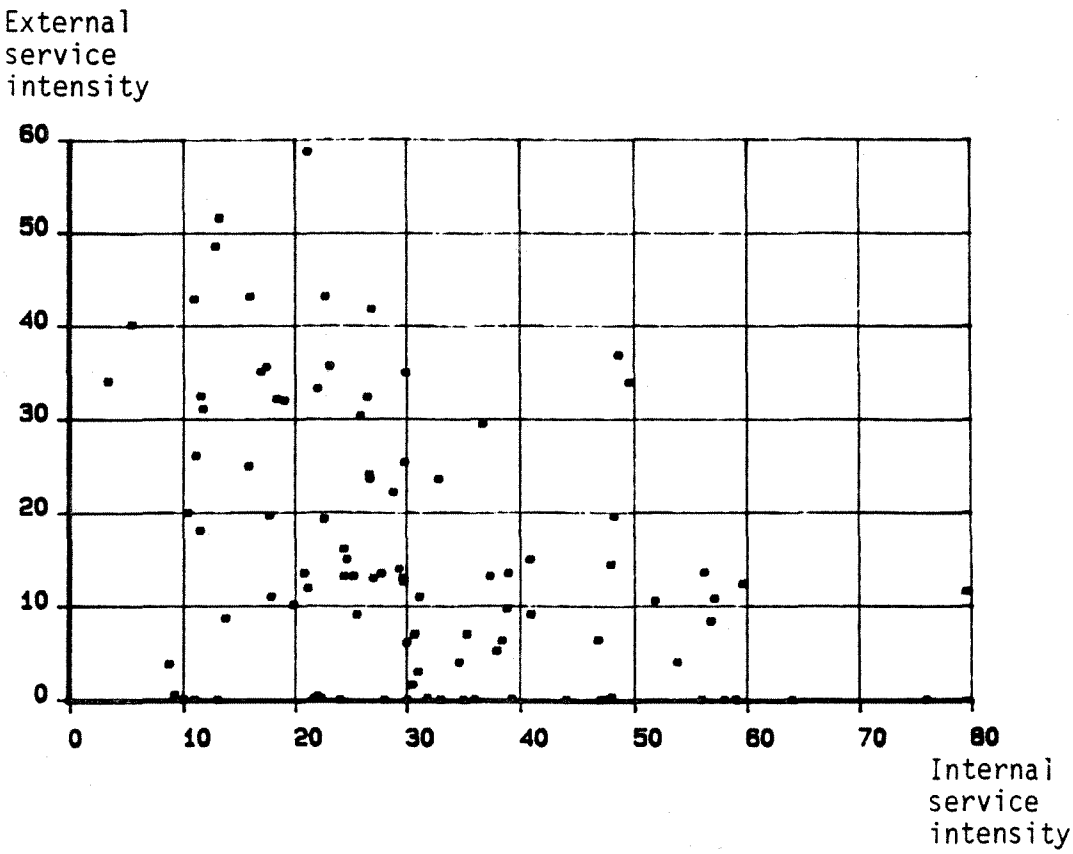
RR Rate of return on total capital valued at historic cost. Two observations are given in the figure: the average for the period 1970-76 and the average 1977-83.

SS: The share of services is measured as labor costs for employees not occupied with production work in relation to the firms' total labor cost. Two observations are given: 1976 and 1982.

In the figure, the arrow-head point at the observations for the 80s.

Source: IUI's survey on industrial services 1983.

Figure 3 **Internal and external service intensity in large Swedish manufacturing firms 1981**
Percent

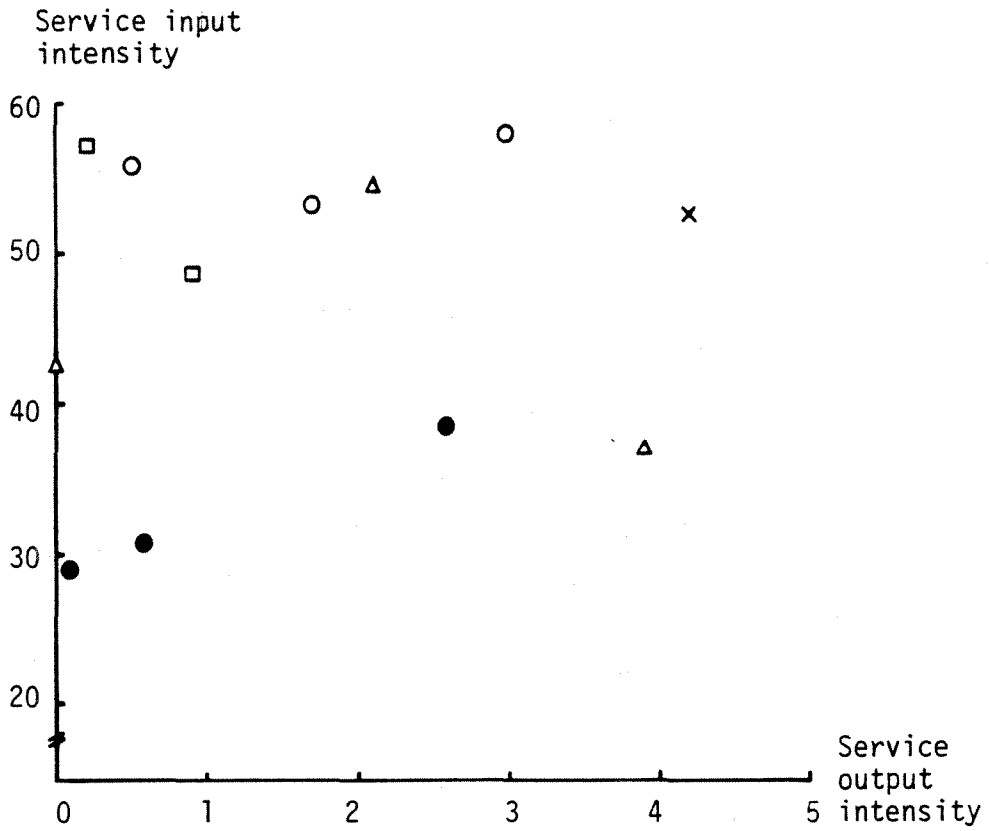


Note: The data in the figure represents data from 103 manufacturing firms.
External service intensity = PS/(TS+PS)
Internal service intensity = IS/(TS+PS)
where: PS = purchase of services; IS = internal labor cost for non-production employees; TS = total internal labor cost.

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

Figure 4 **Service input intensity and service output intensity in industries of Swedish manufacturing 1981**

Percent



Note:

- ● Raw materials processing
- △ Intermediate goods
- ○ Investment goods
- □ Consumption gods
- × Building materials

Service output intensity = sales of services in percent of total sales.
Service input intensity = (PS + IS)/(TS + PS),
where: PS = purchase of services; IS = internal labor cost for non-production employees; TS = total internal labor cost.

Source: See Figure 3.

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