MOSST
Background Paper

10

Changes in the Size and Structure
of Manufacturing Employment
in Industrial Countries

1979

Ministry of State
Science and Technology
Canada

Ministère d'État
Sciences et Technologie
Canada

10

Changes in the Size and Structure
of Manufacturing Employment
in Industrial Countries

1979

TABLE OF CONTENTS

CHANGES IN THE SIZE AND STRUCTURE OF MANUFACTURING EMPLOYMENT IN INDUSTRIAL ECONOMIES

INTRODUCTION

The decade of the seventies has been a troublesome one for the international economy. Various factors such as the breakdown of the fixed exchange rate system, the steep increases in the price of oil, unemployment, inflation and balance of payments problems have disrupted the growth performance of industrial economies.

In light of these developments, considerable concern has been expressed in Canada about the role and competitiveness of Canadian manufacturing. Much of this discussion is focused on trends in manufacturing employment, with a decline in the ratio of manufacturing employment to total employment being a subject of particular concern.

This paper examines the changes in the size and structure of employment in the manufacturing sectors of Canada and five other major industrial economies of the OECD. The paper begins by highlighting the major structural changes in employment in these economies during the post-World War II period. This is followed by an examination of how trends in output and productivity have affected the role of the manu-

facturing sector as a source of job creation. The manner in which the structure of manufacturing employment has changed in the industrial economies is also discussed and, in this context, the critical role of technology-intensive industries is considered.

STRUCTURAL SHIFTS IN EMPLOYMENT

The developed economies of the world have undergone profound changes in terms of their broad economic structure since the Second World War. This is especially evident in the types and nature of activities in which people are engaged. We have moved from a predominantly goods-producing economy to a service-producing one. (See Table 1)

These changes in the distribution of industrial employment are largely a reflection of the substantial productivity advances achieved in industrial countries during the post-war period. These productivity gains have led to increases in real income which in turn have fundamentally altered the patterns of consumption and demand in these economies. As standards of living have increased, a relatively smaller proportion of consumer incomes has been directed towards agricultural commodities and there has been a concomitant increase in demand for both public and private services ranging from educational and health to recreational

TABLE 1

Industrial Distribution of Civilian Employment
Percent

	Goods[1]		Services[2]	
	1950	1975	1950	1975
Canada	58.4	36.0	41.6	64.0
United States	47.6	33.0	52.4	67.0
Germany	67.6	53.3	32.4	46.7
Japan	65.8	48.5	34.2	51.5
United Kingdom	53.3	43.6	46.7	56.4
France	67.2	50.0	32.8	50.0

[1]The Goods Sector includes agriculture, forestry, mining, manufacturing, utilities and construction.

[2]The Service Sector includes wholesale and retail trade; transport, storage and communication; finance, insurance, real estate and business services; community, social and personal services; public administration.

Source: Based on data from OECD Labor Force Statistics

and professional business services. These shifts in demand have been the driving force behind the substantial increase in service employment. At the same time, while the pattern of demand for manufactured goods has altered substantially, changes in manufacturing employment have been much less pronounced in comparison to the changes in the agricultural and service sectors.

The decline in the relative importance of employment in the total goods sector is therefore primarily a reflection of developments in the agricultural sector. Employment in agriculture has declined sharply during the last twenty-five years, both absolutely and relatively. As a result of these changes, the agricultural sector now accounts for only a few percentage points of the labour force in these economies, with the bulk of goods-producing employment being concentrated in manufacturing.

The absolute level of manufacturing employment to total employment is subject to wide variation among countries. (See Table 2) This reflects the combined effect of the many factors contributing to their historical development, including differences in resource endowments, geography and climate, the importance of international trade to national income, the size of manufacturing establishments, the degree of product diversification, the cost of capital, and so on.

TABLE 2

Ratio of Manufacturing to Total Employment

	1950	1960	1970	1975
Canada	27.4	24.1	22.3	20.2
U.S.A.	28.7	25.5	24.6	21.6
Germany	na	37.6	40.5	38.3
Japan	16.6	21.3	27.0	25.8
U.K.	39.0	37.5	36.6	32.6
France	na	27.2	26.7	25.7

na: not available

Source: Based on data from "International Economic Indicators", U.S. Department of Commerce, Washington, D.C. December 1977.

and

"Yearbook of Labor Statistics", International Labor Organization (Geneva).

Despite these differences, however, increases in manufacturing employment relative to increases in total employment have been small in the post-war period for all countries. This has resulted in declining shares of manufacturing employment to total employment in both Canada and the other industrial economies. Of the six industrial economies examined here, only in Germany and Japan did the ratio of manufacturing employment to total employment increase between 1950 and 1970. To a large extent these trends were a reflection of the reconstruction of the manufacturing facilities of these economies following the aftermath of the Second World War. However, since 1970, they have also experienced a declining ratio of manufacturing employment to total employment. (See Table 2)

Of course, in most industrial countries, the manufacturing sector has recorded absolute growth in employment. However, relative to the rest of the non-agricultural economy, the manufacturing sector has not been a major source of direct employment gains in these economies. The growth of employment in the non-manufacturing sector of the major industrial countries of Europe and North America has since 1950 been consistently and substantially higher than the rate of growth of manufacturing employment. (See Table 3) In the case of Japan, which started its drive toward indus-

TABLE 3

Employment Trends in Manufacturing and Non-Manufacturing Industries of Selected OECD Countries

(Average Annual Percentage Rates of Growth)

	1950-1970		1971-1975	
	Mfg	NMfg[1]	Mfg	NMfg[1]
Canada	1.5	4.0	1.6	4.5
United States	1.1	2.7	-0.1	2.7
Germany	0.6[2]	1.0[2]	-3.1	0.6
Japan	4.4	4.3	-0.3	2.5
United Kingdom	-0.2	1.4	-2.0	1.7
France	na	na	0.3	1.6

[1] NMfg: Non-manufacturing industries include utilities, construction and the service industries.

[2] 1959-1970

na: not available

Source: International Labor Organization, "Yearbook of Labor Statistics", various issues (Geneva)

trialization from a much lower base than western nations, growth in manufacturing employment was equal to the growth in non-manufacturing employment before 1970. However, by the 1971-76 period, the non-manufacturing sector continued to exhibit strong rates of employment growth in all countries including Japan despite the fact that manufacturing employment has declined absolutely in most cases.

A distinguishing characteristic of manufacturing employment in industrial economies has generally been its greater sensitivity to the vagaries of the business cycle as compared to employment in service industries. During recessions and periods of slack, manufacturing industries typically shed employment and, as demand picks up, there is generally a corresponding increase in employment. However, when viewed from a longer-term perspective, it is clear that the manufacturing sector at least in terms of employment is not and has not been a growing sector relative to the other sectors of the economy.

OUTPUT AND PRODUCTIVITY

Employment trends are also intimately linked with trends in output and productivity. Thus, when examining manufacturing employment, account has to be taken of its interrelationship with both output and productivity. In

general terms, the rate of output growth in an industry is equal to the rate of growth in employment plus the rate of growth of productivity. If productivity increases in the sector, but the demand for its output remains the same, total employment in the sector must decline. On the other hand, if the demand for the output of the sector increases more rapidly than productivity, employment in the sector increases. In the event that increases in volume of output match the growth in productivity, employment remains unchanged.

The case of the agricultural sector in industrial economies serves to illustrate the above relationship. Given the limited scope for further growth of agricultural markets, the sustained increases in productivity over the last twenty-five years realized as a result of advances in mechanization, intensive use of fertilizers, the consolidation of farms, and similar factors have resulted in employment continuously declining in this sector in both absolute and relative terms.

In the case of the manufacturing sector, the impact of productivity changes on employment will vary from industry to industry. In more mature industries such as textiles, where further opportunities for growth in sales are inherently limited and productivity advances are directed at reducing costs or simply maintaining firms' existing market shares, there almost certainly will be absolute declines in employment. In other

manufacturing industries, for example, chemical products, where advances in productivity are associated with the development of either new or better-quality products, the potential for further growth in sales may be sufficient to generate absolute increases in employment. Thus, whilst productivity advances may result in eliminating certain types of jobs, new jobs will be created in other areas of manufacturing in response to expanding markets for manufactured products. Table 4 highlights the relationship between employment, productivity and output for the chemical and textile industries in selected OECD countries.

On balance, the continued growth of manufacturing productivity can be expected to result in increases in the volume of output. At the same time, the share of manufacturing employment to total employment will depend on the overall level of demand for manufactured products. The net result of these trends is that the growth of manufacturing employment in the advanced industrialized countries during the post-war period has generally been below rates of increase in the labour force. In future, with the anticipated decline in labour-force growth rates, it is likely that there will be little or no growth in manufacturing employment. Indeed, it would not be surprising if industrialized countries continued to experience jobless growth in manufacturing with employment opportunities being increasingly concentrated in the service sector.

TABLE 4

Trends in Employment, Productivity and Output
in Selected Industries

(Average Annual Percentage Rates of Change, 1964-75)

TEXTILES, CLOTHING AND LEATHER INDUSTRIES (ISIC32)

	Employment	Productivity	Output
Canada	-0.2	3.5	3.4
United States	-0.4	1.3	0.9
Germany	-3.5	4.4	0.9
Japan	-1.2	4.6	3.4
United Kingdom	-2.7	2.7	0.6
France	-1.8	3.2 (1)	1.4 (1)

[1] Excluding Clothing.

CHEMICALS, PETROLEUM AND RUBBER INDUSTRIES (ISIC35)

	Employment	Productivity	Output
Canada	2.1	3.2	5.3
United States	1.8	4.2	6.1
Germany	1.3	5.7	6.9
Japan	1.2	9.7	10.9
United Kingdom	0.3	4.8	5.2
France	2.9	3.8	6.7

Source: Based on data from OECD labour force and industrial production statistics.

Although the manufacturing sector per se will not be important as a source of direct employment gains, the continued increase in overall manufacturing productivity will nevertheless still play a critical role in the development of advanced industrial economies. As noted earlier, it is the rate of growth in productivity which leads to increases in real incomes and, hence, increases in standards of living. Improvements in the productivity of the manufacturing sector are especially important because of the role they play in determining the competitiveness of a nation in international markets.

In a world of increasing international competition, the achievement of further productivity gains in manufacturing by the advanced economies will be strongly influenced by developments in the rapidly industrializing third world countries. The emergence of these countries will have important implications for the distribution of manufacturing activities in the world economy.

Developing countries such as Taiwan, Hong Kong, Singapore, South Korea and Brazil will increasingly be the most economic producers of labour-intensive manufactured goods which are based on well-known and established technologies. As the drive toward industrialization continues in the countries of the third world, the comparative advantage in producing these types of goods will continue to shift to these areas. These countries have a double advantage over

industrial countries in the production of labour-intensive, standard-technology goods. On the one hand, they can draw on vast supplies of labour from the agricultural sector which still dominates their economies and, on the other hand, they have access to and can draw on the immense stock of technology already existing in the world. This process is already occurring in the case of the above-mentioned developing countries and is reflected in the "spectacular" rates of economic growth which they have experienced without undertaking any R&D or innovative work.

The low wage costs in the developing countries, even when adjusted for relative differences in productivity levels, will increasingly erode the competitive position of traditional industries in the already industrialized countries. In view of these external pressures, the trend in the advanced economies will be toward the more capital-intensive modes of production in their traditional industries. Productivity will continue to increase through technological advances in the form of new equipment and machinery and increased automation. However, with the growing number of new producers in the world, the potential for further output growth in these industries will be severely limited. In short, the combination of more capital-intensive production methods and the limited scope for output-gains implies that employment

opportunities in traditional industries will decline in the advanced economies.

THE ROLE OF TECHNOLOGY

The prospects for continued growth in the industrial economies will increasingly rest with technology-intensive industries, that is, those industries which are the products of sophisticated technologies resulting from innovation, R&D, etc. The distinguishing characteristic of technology-intensive industries is that, as incomes rise, the market for their outputs tend to grow more rapidly than for goods as a whole. Thus, unlike mature industries, the effects of technological change in these leading areas are not primarily cost-reducing or labour-saving. Instead, they are directed toward the creation of new markets and/or the expansion of old ones, both through the domestic expansion of sales and the generation of exports. This growth of output, in turn, acts not only to increase productivity, but also leads to absolute employment gains.

The point which stands out in the above discussion is that competitiveness and the achievement of continued productivity growth in the manufacturing sector of advanced economies does not necessarily require increases in manufacturing's share of total employment or even absolute in-

creases in manufacturing employment. What is more significant is the shift of employment within manufacturing toward the technology-intensive industries.

Although the expression "technology-intensive" is imprecise, it is generally used to describe those industries which employ a higher proportion of scientists and engineers and which perform relatively more research and development. It is now generally recognized that the research and development conducted by these industries determines to a large extent an economy's indigenous capacity for technological innovation. Furthermore, it is not only those industries actually performing R&D which benefit from such work. Other industries in both the goods and services sector which purchase goods embodying advanced technology also benefit. For example, to the extent that innovative products from the technology-intensive industries allow other industries to reduce their production costs and/or expand their sales, technological advances in these industries can contribute to gains in output, productivity and employment throughout the economy. Thus, the technology-intensive industries play a crucial role in the growth and productivity performance of the manufacturing sector overall and the economy in general.

For purposes of international comparisons the following industries have generally been considered to be

technology-intensive: chemicals, petroleum, electrical products, machinery, transportation equipment, rubber and plastic products, and fabricated metal products.

The non-technology-intensive sector of manufacturing then comprises the following industries: food, beverages and tobacco, textiles, clothing, leather goods, wood products, pulp and paper products, printing and publishing, non-metallic minerals, primary metals and miscellaneous manufacturing.

Ideally, if more detailed data were available, it would be worthwhile to distinguish even further among individual industries and, indeed, specific product lines within the technology-intensive group in order to identify more precisely the high-growth areas. For example, in the case of the chemical industry, certain product lines such as soaps and detergents and industrial organic chemicals are not very technology-intensive in the sense that they are not associated with substantial outlays for research and development. Nevertheless, the examination of the broad trends in employment for these two groups of industries reveals how the structure of manufacturing employment in the advanced economies has changed and highlights the importance of technology-intensive activities.

Table 5 shows the average annual rates of growth in manufacturing employment for technology-intensive industries and non-technology-intensive industries for the period 1965-75 in the six major OECD countries. In every economy, the rate of growth of employment in technology-intensive industries was substantially higher than the rate of growth in total manufacturing. In the case of Britain, manufacturing employment declined in both sets of industries, but the rate of decrease was significantly less in technology-intensive industries than in the non-technology-intensive ones. Manufacturing employment also declined in the case of West Germany, but employment continued to increase in technology-intensive industries.

Partly as a result of labour-force and demographic trends, both Canada and Japan continued to register positive employment growth in non-technology-intensive industries. However, in the case of Japan, the growth in the non-technology-intensive industries was virtually negligible compared to the very strong growth in the technology-intensive ones. What is interesting to note, however, is that the other economies with the exception of Britain have been moving into the technology-intensive industries at a much more rapid rate than Canada.

Unfortunately, because of data limitations, it has not been possible to compute comparable rates of growth in

TABLE 5

Average Annual Rates of Growth in Manufacturing Employment
By Level of Technology
1965 — 1975

Percent

	Canada	U.S.A.	Germany	Japan	U.K.	France
Technology-Intensive Industries	2.0	0.5	1.1	3.3	-0.9	2.0
Non-Technology-Intensive Industries	1.3	-0.2	-3.3	0.4	-1.9	-0.4
Total Manufacturing	1.6	0.2	-0.9	1.9	-1.4	1.1

Source: Based on Data from OECD Labor Force Statistics

output and productivity for technology-intensive and non-technology-intensive industries in these economies. Nevertheless, studies conducted in Canada and the U.S. have consistently demonstrated that technology-intensive industries register superior growth in output, productivity and employment and lower rates of price increases as compared to non-technology-intensive industries.[1] It seems not unreasonable to assume that the industrial economies of Europe and Japan would also show similar results.

CONCLUSIONS

The above analysis shows that a lack of employment growth in the manufacturing sector of an industrialized economy is by no means synonomous with stagnation or a loss of competitiveness. Growth and development is characterized by innumberable changes in industrial structures both within and across different industry groupings. In the case of the manufacturing sector of industrial economies, this process

[1] MOSST, Background Paper No. 4, "Performance of Canadian Manufacturing Industries by Levels of Research Intensity", July 1978.

M. Boretsky, "U.S. Technology: Trends and Policy Issues", Monograph 17, George Washington University, Washington, D.C., October 1973.

of change has been associated with a strong shift in employment towards technology-intensive modes of production.

The rapidly industrializing third world countries will continue to expand their activities in manufacturing particularly in those "mature" product areas where mass markets already exist and production techniques are well-established. Competitiveness in these markets is no longer based on unique technological know-how but, instead, on low-cost production.

The continued competitiveness of industrial economies will increasingly depend on their ability to recognize and adapt to these changing economic conditions. In this context, employment opportunities within the manufacturing sectors of industrial economies will increasingly be concentrated in the technology-intensive industries.