Hand and edge tools industry experiences slow rise in productivity

During 1958–80, annual productivity growth averaged just 1.3 percent, less than half the rate for manufacturing as a whole; industry employment grew by more than 50 percent

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Despite the growing do-it-yourself market and the introduction of new technology, productivity growth has been sluggish in the manufacture of wrenches, hammers, axes, files, and other hand and edge tools. During the 23-year period ended in 1980, output per employee hour increased at less than half the annual rate of all manufacturing.

This modest productivity rise in the hand and edge tools industry stems from the very gradual nature of technological improvements. These improvements have been characterized by increases in equipment speed and the continued introduction of automated controls.

As measured by output per employee hour, productivity in the industry grew at an average annual rate of only 1.3 percent during 1958–80, compared with 2.8 percent for all manufacturing.[1] Output increased at a rate of 3.3 percent and employee hours, by 2.0 percent. (See table 1.)

During the period, the industry experienced moderate productivity growth in the early years and a significant slowdown in the later years—a pattern exhibited in general by the manufacturing sector. From 1958 to 1965, output per employee hour increased at an average annual rate of 2.6 percent. Productivity increased in every year except 1960. During 1965–80, productivity growth slowed significantly from the earlier period, advancing at an average rate of only 0.7 percent a year. The average annual output increase slowed to 2.6 percent while employee hours went up by 1.9 percent a year.

This marked falloff in productivity growth in turn reflects developments during two subperiods, 1965–73 and 1973–80, with different growth rates. From 1965 to 1973, productivity grew at an average annual rate of 1.3 percent, and during 1973–80, by 0.5 percent per year. The productivity trend was not steady, however, with both the largest increase and decrease occurring during the earlier subperiod. The largest drop, 6.4 percent, was in 1970, a recessionary year, during which output fell 7.1 percent and employee hours declined 0.7 percent. Both continued to decrease in 1971, but in 1972 the industry experienced a large turnaround; output rose by 17.1 percent, greatly outstripping the rise in employee hours of 9.2 percent. The resulting productivity gain of 7.2 percent was the largest during the study period.

The slow growth during the 1973–80 period reflected in part the 1974–75 recession. In 1974, output per employee hour dropped by 4.8 percent and in 1975, by 3.1 percent. Industry productivity rebounded strongly from the recession, however, rising by 3.9 percent in 1976 and by 2.5 percent in 1977. Productivity gains slowed in 1978 and 1979 as output growth moderated. The increase in 1978 was only 0.6 percent, followed by a rise of 3.7 percent in 1979. In 1980, with the economy experiencing a strong downturn, productivity fell by 5.1 percent.

Employment and plant size

The level of employment in the industry has grown 56 percent since 1958, from 30,300 to 47,200, equivalent

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to an average annual increase of 2.2 percent. Employee hours advanced at an annual rate of 2.0 percent during the period, reflecting a slight decline in average hours per person. The number of production workers increased 53 percent; the share of the total work force accounted for by production workers has remained close to 80 percent.

A trend to larger plant size has resulted in an increase in the average number of employees per establishment. Between 1958 and 1977, the average number of employees per establishment rose from 40 to 65. The number of establishments with 500 employees or more almost tripled during this period, growing from 8 to 22. However, despite the trend to larger plant size, most establishments in the industry remain small. In 1977, 59 percent had fewer than 20 employees, although they only accounted for 5 percent of the shipments. The larger firms (100 employees or more) accounted for 79 percent of industry shipments.

Markets

Automotive distributors, industrial distributors, and consumers constitute the major markets for handtools. The largest group of handtools consists of mechanics' hand service tools, the bulk of which is marketed by automotive jobbers or distributors. Some of these vendors are "wagon peddlers" who sell the tools directly to garages and professional mechanics, providing quality tools and service-oriented marketing. Mechanics' hand tools are a fast growing segment of the industry. Demand is generated from the design changes made by automakers (including the conversion to metric) necessitating the purchase of new tools by the professional mechanic.[2]

Table 1. Productivity and related indexes for hand and edge tools, 1958–80

[1977 = 100]

Year	Output per employee hour	Output	Employee hours	Employees
1958	74.0	47.2	63.8	64.5
1959	79.0	55.0	69.6	67.9
1960	77.0	52.1	67.7	66.2
1961	79.8	55.7	69.8	68.1
1962	81.5	60.8	74.6	71.7
1963	84.0	56.9	67.7	67.0
1964	86.1	61.5	71.4	69.6
1965	91.2	70.2	77.0	75.1
1966	88.8	75.6	85.1	80.9
1967	93.9	73.3	78.1	76.4
1968	95.5	74.4	77.9	76.6
1969	97.2	80.4	82.7	81.1
1970	91.0	74.7	82.1	80.2
1971	94.4	72.7	77.0	75.7
1972	101.2	85.1	84.1	83.6
1973	101.8	92.2	90.6	89.8
1974	96.9	87.1	89.9	89.4
1975	93.9	75.8	80.7	80.9
1976	97.6	85.1	87.2	87.7
1977	100.0	100.0	100.0	100.0
1978	100.6	107.8	107.2	106.8
1979	104.3	112.1	107.5	108.7
1980	99.0	95.5	96.5	100.4
	Average annual rates of change (in percent)			
1958–80	1.3	3.3	2.0	2.2
1975–80	1.4	6.1	4.7	5.2

Distribution to industrial users creates another market for handtools. Demand in this segment generally follows overall economic trends—rising during industrial expansion and slackening during economic downturns. Construction activity also has an impact on sales of handtools, especially heavy forged tools such as sledges and picks.

The burgeoning do-it-yourself market has influenced some domestic producers to orient their product lines toward the household market. Rising interest rates and declining housing starts have generated more remodeling and self-improvement projects which require tools. Expenditures for maintenance and repairs tripled during 1965–79, and construction improvements quadrupled.[3] In the 1970's, some companies redesigned their line of specialized professional tools to provide the amateur with popularly priced, good-quality versions. The proportion of the population in the household-forming years has been increasing, thus providing the industry with a potentially good future market. The do-it-yourself market is somewhat countercyclical, providing some cushion to the companies during economic downturns. Do-it-yourself sales grew 27 percent during the 1974–75 recession.[4]

Competition from imports has been intensifying in recent years and is becoming an increasingly important factor in the domestic market. Imports of all handtools as a percent of new supply (domestic shipments and imports) have increased considerably since 1968, rising from about 6 percent to 11.5 percent in 1979.[5] The export market has declined in relative importance during the last few years. Exports as a percent of domestic product shipments reached a peak during 1974 and 1975, rising to ratios of 15 and 16.2 percent. The ratio has declined steadily since then, falling to 12.4 percent in 1979.

Technological advancement

The hand and edge tools industry produces a wide variety of products ranging from wrenches of all types and sizes to striking tools such as hammers, axes, and sledges. The industry also makes garden equipment such as hoes, rakes, and forks.

Although the basic processes involved in the production of hand and edge tools have changed little over the period, there have been improvements in the equipment and methods used. Many of these changes have been evolutionary in nature and have occurred on an in-house basis, with individual plants developing much of their own equipment to improve productivity. The result has been faster equipment speeds, increasing automation of certain processes, and more rapid materials flow. The introduction of robots by some manufacturers has been part of the effort to achieve more complete mechanization of the production processes. Robots are an integral part of an automated materials handling operation. They are used to help move workpieces to and from forging presses and to and from the forging press dies, and to assist with other operations such as the movement of workpieces to and from the oil quenching process.

One of the most basic processes involved in the production of products requiring a high degree of strength and hardness is forging. The objective of forging is to "hot work" the steel into specific shapes, concentrating the grain structure and fiber formation at the point of greatest shock and stress. This results in the achievement of the utmost strength and toughness inherent in the specific grade of steel that is used. This is especially important for striking tools.

To make hand and edge tools, a steel bar is sheared to the desired length and is then heated in an electric, oil, or gas-fired furnace. The bar is heated to a plastic condition and is then transferred to the forging hammer. Typically, drop forging hammers using closed impression dies perform the actual forging operation. (However, forging presses can also be used.) Intermittent blows of the hammer refine the steel billet or bar through a series of cavities in the die attaining the required shape in the finishing impression. A matched set of dies is used, with the lower die remaining stationary while the upper die vertically strikes the steel bar. Separate die impressions are used for preliminary and final forming operations.

Improvements in the ovens used to heat the metal for the forging operation have contributed to faster production rates. The speed with which these ovens can raise the temperature of the metal to the necessary level has improved, thus reducing the time needed for heating. Improved ovens have also reduced the amount of excess metal that needs to be removed from forged pieces, resulting in less finishing work.

There has been increasing mechanization in the "feeding" of metal to the forging equipment. Correspondingly, the operating speed of the forging equipment has also been improved. It is important that the proper temperature for the particular metal and the specific job be maintained throughout the successive stages of forging. The faster forging equipment has facilitated this and has thus reduced the problems associated with reheating.

In recent years, some plants have adopted horizontal impact forging equipment, which provides a high degree of automation. The piece of metal being worked is moved along by an electrically controlled manipulator. The dies, which are attached to pneumatically powered rams, act on the metal pieces horizontally as they shape them. The pieces are automatically moved from impression to impression within the die as successive stages of forging are carried out. The automatic control of the dies and the movement of the workpieces results in reduced labor requirements.

After forging is completed, a trimmer press may be used to remove the excess (flash) metal squeezed out by the impact pressure. Grinding and polishing operations may subsequently be performed on the forged piece of metal. Improvements in grinding and polishing equipment have also contributed to productivity gains; both procedures were formerly done with hand-fed and hand-held equipment. However, manufacturers have increasingly been adopting equipment which permits these operations to be performed on a continuous flow basis. Further reduction in the time required for grinding and polishing has been achieved through redesign of the product to reduce the surfaces which need to be worked on.

Heat treating of the forged pieces is frequently performed for various reasons such as achieving a more uniform grain structure, relieving stresses, hardening the surface, and increasing the ease of machining. Improvements in heat treating ovens, including better controls, have aided productivity. Increasing automation in heat treating has reduced the operators' work in this process.

The adoption of cold forming techniques is also aiding productivity. In the cold forming process, dies are still used to give the workpieces their final shape. However, advancements in the feeding mechanisms permit preforming of the pieces to such an extent that they can enter the dies without the usual need for heating. This technique is becoming increasingly popular, especially in the production of mechanics' hand tools.

Some manufacturers have achieved additional efficiencies through the use of edge hardening equipment. For items whose strength requirements are primarily limited to edge strength, such as hedge shears, this can mean faster production because the hardening of the workpiece is concentrated only on critical edges versus the whole piece.

Efficiencies have also occurred in the broaching operation, which is the metal cutting process that enlarges or changes the contour of the tool openings (for example, wrench openings). The increased use of manipulators, which control point-to-point movement of workpieces, has reduced the work performed by operators.

Computers have encouraged productivity growth in several ways. In addition to helping with administrative functions such as payroll and inventory, the computer has proven valuable for production planning. Its use enables many of the activities involved in daily production operations to be scheduled more efficiently. Computers also aid in coordinating the setup of production lines and the scheduling of die changes and downtime. This contributes to better utilization of die shops and other related in-house functions.

The outlook

Productivity should benefit from continued mechanization of production processes and gradual improvements in equipment. Continued introduction of robots and the increasing adoption of cold forming techniques should be contributing factors, as will the expanded use of computer technology.

Horizontal impact forging equipment may be a factor in future productivity increases as more plants adopt this technology, especially where long production runs are involved. The cost and setup time associated with this equipment, however, may hinder its adoption. The demand for industry output has benefited from growth in the do-it-yourself market and demographic factors suggest that this trend could continue. However, competition from imports, as measured by the import penetration ratio, has been increasing—as a percent of new supply they rose from 7.5 percent in 1975 to 11.5 percent in 1979. □

——— *FOOTNOTES* ———

[1] The hand and edge tool industry is composed of establishments primarily engaged in the manufacture of files and other hand and edge tools for metalworking, woodworking, and general maintenance. The industry is designated as SIC 3423 in the *Standard Industrial Classification Manual, 1972.* Establishments primarily engaged in the manufacture of saws are classified in industry 3425 and power-driven hand tools in 3546. All average annual rates of change are based on the linear least squares trends of the logarithms of the index numbers. Extension of the indexes will appear in the annual BLS Bulletin, *Productivity Measures for Selected Industries.*

[2] See Kathleen Wiegner, "Quality Still Matters," *Forbes,* Aug. 21, 1978, pp. 114–15.

[3] *Residential Alterations and Repairs,* Construction Reports C50 (Bureau of the Census).

[4] "Stanley Works: Capitalizing on the homeowner do-it-yourself trend," *Business Week,* Feb. 26, 1979, pp. 125–26.

[5] The import penetration ratio is calculated by dividing the value of shipments of imports by the value of new supply, where new supply is defined as the sum of the value of imports and domestic product shipments.

APPENDIX: Measurement techniques and limitations

Indexes of output per employee hour measure changes in the relation between the output of an industry and employee hours expended on that output. An index of output per employee hour is derived by dividing an index of output by an index of industry employee hours.

The preferred output index for manufacturing industries would be obtained from data on quantities of the various goods produced by the industry, each weighted (multiplied) by the employee hours required to produce one unit of each good in some specified base period. Thus, those goods which require more labor time to produce are given more importance in the index.

In the absence of adequate physical quantity data, the output index for this industry was constructed using a deflated value technique. The value of shipments of the various product classes were adjusted for price changes by appropriate Producer Price Indexes to derive real output measures. These, in turn, were combined with employee-hour weights to derive the overall output measure. The result is a final output index that is conceptually close to the preferred output measure.

Employment and employee-hour indexes were derived from data published by the Bureau of the Census because BLS data were not available. Employees and employee hours are each considered homogeneous and additive, and thus do not reflect changes in the qualitative aspects of labor, such as skill and experience.

The indexes of output per employee hour do not measure any specific contributions, such as that of labor or capital. Rather, they reflect the joint effect of factors such as changes in technology, capital investment, capacity utilization, plant design and layout, skill and effort of the work force, managerial ability, and labor-management relations.