DOCUMENT RESUME

ED 222 763 CE 034 303

AUTHOR Drewes, Donald W.
TITLE Working for America: A Worker-Centered Approach to Productivity Improvement.
INSTITUTION Conserva, Inc., Raleigh, N.C.
SPONS AGENCY Office of Vocational and Adult Education (ED), Washington, DC.
PUB DATE Sep 82
CONTRACT 300-81-0352
NOTE 68p.; For related documents, see ED 219 527, ED 219 586. and CE 034 304-313.
PUB TYPE Viewpoints (120)

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS Coordination; *Educational Cooperation; *Human Resources; Industry; Labor Force; *Labor Force Development; Postsecondary Education; *Productivity; School Business Relationship; *School Role; Secondary Education; *Vocational Education
IDENTIFIERS *Productivity Improvement

ABSTRACT

This report examines worker-centered productivity and discusses the organizational and educational strategies for its improvement. Chapter 1 explores the meaning and measurement of productivity and the benefits of productivity improvement--profits, a weapon against inflation, success in international trade, increased standard of living, improved quality of life, and equality of economic opportunity. In chapter 2, the nature of the productivity problem is examined. International comparisons are made and causes that are commonly regarded as contributing significantly to the plunge in productivity performance are considered, including the amount of capital available to the worker, changes in labor force structure, sectional shifts in the economy, and management. Chapter 3 outlines a general participative strategy for worker-centered productivity improvement. Techniques are discussed for carrying out the four stages--information, communication, understanding, and involvement--of infusing an organizational commitment to productivity. Chapter 4 looks at human resources and the impact on productivity improvement through education and training. Recommendations are offered to strengthen joint business, industry, and vocational education commitments to productivity improvement. (YLB)

WORKING FOR AMERICA: A WORKER-CENTERED APPROACH TO PRODUCTIVITY IMPROVEMENT

by

Donald W. Drewes

CONSERVA, Inc.
401 Oberlin Road
Raleigh, NC 27605

September, 1982

Contract No. 300810352
U. S. Department of Education
Office of Vocational and Adult Education

The preparation of this report was supported in whole by the U. S. Department of Education, Office of Vocational and Adult Education. However, the opinions expressed herein do not necesarily reflect the position or policy of the Department of Education, and no official endorsement by the Department of Education should be inferred.

FOREWORD

Productivity is a critical economic concern. Sagging productivity growth coupled with rising costs and heightened foreign competition are placing American business and industry in an increasingly vulnerable position. In an effort to strengthen its competitive position, American business and industry is investing heavily in capital-intensive technology which can have a significant positive effect on productivity growth. However, productivity is people-dependent and its improvement conditioned upon their possessing the technical and organizational skills necessary to utilize technology to its fullest advantage. The development of the work skills required to contribute to the revitalization of America is the central challenge to vocational education.

This report is the result of a contract with the U. S. Department of Education, Office of Vocational and Adult Education to investigate the role of vocational education in productivity improvement. It explores the meaning and measurement of productivity, examines the nature of the productivity problem, outlines a general participative strategy for worker-centered productive improvement and offers recommendations to strengthen joint business, industry and vocational education commitment to productivity improvement.

Seven companion reports: "Technologies of the '80s: Their Impact on Vocational Agriculture Occupations; . . . Distribution Occupations; . . . Health Occupations," etc. describe major new and emerging technological innovations that can be effected to influence

worker skills. A separate monograph, "Vocational Education: Its Role in Productivity Improvement and Technological Innovation," addresses productivity and technology from the perspective of state vocational education agencies.

TABLE OF CONTENTS

CHAPTER I

PRODUCTIVITY--THE KEY TO CONTINUING PROSPERITY

Productivity is on a downhill slide. In less than a decade, U.S. annual productivity growth shifted from a 3.6 percent gain to a -0.4 percent loss. Productivity for the private business sector fell for three consecutive years with workers actually producing less at the end of the year than at the beginning. The U. S. in comparison with other major industrialized countries shifted from first to sixth place in capital available per worker and from second to seventh in percentage of skilled workers in the workforce.

This condition cannot continue without undermining America's position both at home and abroad. Productivity is indeed the key to prosperity. The challenge is to assume responsibility for reversing the trends and moving America to renewed greatness.

Tackling the productivity problem requires an understanding of productivity and the forces that support or block its growth. Productivity derives its meaning within the context of a production system. A production system is any organization that uses resources to produce goods and/or services. As shown in Figure 1, resources are the input to the system and goods and/or services the output of the production sytem.

Figure 1: An Input/Output Model

Given this notion of a production system, productivity is defined as:

$$\text{PRODUCTIVITY} = \frac{\text{OUTPUT (SYSTEM PRODUCTS)}}{\text{INPUT (RESOURCES USED)}}$$

Thus, productivity measures the efficiency with which the production system transforms resources into products. Improved productivity means that the system produces more products per unit of resources consumed.

Increased productivity, however, does not always imply increased output. The direction of productivity change as a function of changes in resources used and outputs produced is shown in Table 1. As shown, productivity may increase even in the face of falling output, provided that resources used declined at a more rapid rate than output produced. Conversely, productivity may be increasing for those cases in which output is increasing at a faster rate than resource use.

It should be emphasized that the definition of productivity as the ratio of products produced to resources consumed is basically a measure of the efficiency of the production system. The efficiency with which products are produced is independent of the effects achieved through product use (effectiveness). To do otherwise, runs the risk of diluting the production orientation connoted by the concept of productivity and imposes responsibilities on the production system for the achievement of outcomes for which it has no direct control.

Table 1. The Direction of Productivity Change as a Function of Changes in Resources and Output

RESOURCE USE	OUTPUT: Decreasing	OUTPUT: Constant	OUTPUT: Increasing
Decreasing	Decreased productivity if outputs decreasing at a faster rate than resources; increased if outputs decreasing at a slower rate.	Increased productivity	Increased productivity
Constant	Decreased productivity	Unchanged productivity	Increased productivity
Increasing	Decreased productivity	Decreased productivity	Increased productivity if outputs increasing at a faster rate than resources; decreased if outputs increasing at a slower rate.

By defining productivity as a measure of the efficiency of the production system, productivity becomes a characteristic of the production system. The implication is that productivity is an organizational rather than individual measure. In contrast to performance appraisal which provides management with information on individual performance, productivity measures provide information at the organizational resources are being utilized.

PRODUCTIVITY MEASUREMENT

The notions of system resources and system products need to be expanded in order to provide a basis for measurement. System resources utilized in the production of goods and services can be further classified according to materials, labor, capital, and energy. These categories are frequently referred to as the factors of production. Thus, following the general definition of productivity, it would make sense to define:

A. Materials Productivity = $\frac{\text{System Output (Products Produced)}}{\text{Materials Used}}$

B. Labor Productivity = $\frac{\text{System Output (Products Produced)}}{\text{Labor Used}}$

C. Capital Productivity = $\frac{\text{System Output (Products Produced)}}{\text{Capital Used}}$

D. Energy Productivity = $\frac{\text{System Output (Products Produced)}}{\text{Energy Used}}$

E. Total Factor Productivity = $\frac{\text{System Output (Products Produced)}}{\text{Input (Total Amount of Resources Used)}}$

It is worth noting that individual factor productivity need not equal total factor productivity. Nor need all the individual factor productivity indicators be equal.

System output is generally measured according to three major measurement units. Output may be measured simply by counting the number of physical units produced or by computing some aggregate total such as pounds or tons produced, square feet or board feet produced, total number of gallons or other such physical measures. Output may also be measured by determining the dollar value of goods or services sold. A variant is to measure output in terms of value added by the productive

process. Value added is defined as the dollar value of goods and services produced less the cost of materials and contracted services performed outside of the system.

System input and output may be measured in either physical quantity or in dollar value. Measurement in terms of physical units is generally preferable in that physical units represent a more direct measure of system performance. However, there are situations in which differences in physical units preclude aggregation. A typical example is that of capital productivity. Because of the differences in equipment and machinery utilized, the most meaningful measure is to convert machines and equipment to a common dollar base and to measure capital utilized according to dollar value. A similar situation is likely to occur for materials, especially for products that require a diverse mix of materials. Outputs may also have to be converted to dollar value if productivity is to be computed on the total product mix of the productive system. Converting output to dollar value, either in terms of dollars sold or value added, will create a common measurement unit and allow aggregation across diverse products.

Four types of productivity measures can be developed, depending upon whether outputs and/or inputs are computed in physical or dollar units (Tuttle, 1981). These four types are:

$$\frac{\text{Output in Physical Quantity}}{\text{Input in Physical Quantity}} \qquad \text{(Form I)}$$

$$\frac{\text{Output in Dollar Value}}{\text{Input in Physical Quantity}} \qquad \text{(Form II)}$$

$$\frac{\text{Output in Physical Quantity}}{\text{Input in Dollar Value}} \qquad \text{(Form III)}$$

$$\frac{\text{Output in Dollar Value}}{\text{Input in Dollar Value}} \qquad \text{(Form IV)}$$

Examples of total factor and factor productivity measures for each of the above forms are presented in Table 2.

Table 2. Illustrations of Possible Productivity Measures

Labor Productivity

Physical quantity of output/Labor hours
Dollar value of goods sold/Labor hours
Dollar value added/Labor hours
Total standard hours earned/Actual hours worked
Dollar value of goods/services sold/Labor payroll
Dollar value added/Labor costs
Dollar value of goods (services) produced/Labor hours

Capital Productivity

Physical quantity of output/Depreciation cost
Dollar value of goods sold/Depreciation cost
Physical quantity of output/Machine hours
Dollar value added/Dollars of capital invested
Total standard machine hours earned/Actual machine hours worked

Material Productivity

Dollar value of goods sold/Cost of materials consumed
Physical quantity of output/Material costs
Physical quantity of output/Units of material consumed

Energy Productivity

Dollar value of goods produced/Cost of energy consumed
Dollar value of goods produced/Physical quantity of energy consumed
Physical quantity of output/Physical quantity of energy consumed

Total Factor Productivity

Physical quantity of output/Weighted sum of resource costs
Dollar value of goods produced (sold)/Weighted sum of resource costs
Dollar value added/Weighted sum of resource costs

MEASUREMENT PROBLEMS

Measurement of productivity is susceptible to bias from several major sources. Use of dollar value to measure either output and/or input is a function of price as well as quantity. Because price is subject to inflationary pressures, an increase in dollar value may be due totally, or in large part, to a price increase rather than an increase in real output. If the effects of price changes are not controlled, productivity measures taken at different times are not directly comparable since they would reflect price variability as well as changes in price variability as well as changes in productive efficiency. The effects of price changes can be controlled by maintaining a price series for the output and deflating the dollar value of current output to a selected base year price. The deflated value of output and/or input would represent the best estimate of the real value independent of price changes.

Total number of hours paid for is frequently used as a measure of resource utilization when computing labor productivity at the national level. This measure is subject to several well-known sources of potential bias. One source is the increasing number of working hours that are not devoted to producing goods and services. This results in part from increased vacation time and other activities that serve to increase the nonproductive time spent on the job. Use of hours paid for as an indicator of labor contribution assumes that an hour worked is equally productive regardless of the skills level. Thus, an hour worked by an unskilled laborer is treated for productivity purposes as equivalent to an hour's worth of labor from a skilled craftsperson or professional employee.

Sources of bias exist in the measurement of product output as well. Measurement of output in terms of the dollar value of products sold may be influenced by market conditions rather than the contribution of resources used. Similarly, a rise in labor productivity, rather than reflecting an increase in the contribution of labor, may instead result from increased capital being provided to the workers. Conversely, a decline in labor productivity may not necessarily signal a diminution in the quality of labor. Such a condition might arise from falling outputs and an inability of employers to reduce correspondingly the size of the labor force.

An associated problem in the measurement of output is the difficulty in assessing the contribution of indirect labor, i.e., labor not directly involved in the immediate production of goods and/or services. Problems in the definition of output have impeded efforts at establishing productivity indices for management and supervisory workers as well as for federal, state and local government employees.

Most of the currently available productivity statistics are collected at the macro level. The Bureau of Labor Statistics of the U.S. Department of Labor measures labor productivity in terms of total output measured in dollar value per hour of employment paid for. This measurement, while useful as an indicator of the productivity of the national economy considered as a productive system is subject to major sources of measurement bias previously discussed. Although indicative of the productivity condition of the national economy, the information is frequently too global to direct management efforts at productivity improvement at the establishment level.

THE BENEFITS OF PRODUCTIVITY IMPROVEMENT

Profits are traditionally defined as the difference between revenue and cost. Given this definition, common sense indicates that profits will increase if product revenues increase at a more rapid rate than product costs. Carl Thor (1981) of the American Productivity Center incorporates this notion in his concept of total profitability, which is defined as follows:

$$\text{Total profitability} = \frac{\text{Total revenue}}{\text{Product costs}} = \frac{\text{Product quantity sold x Unit price}}{\text{Resource quantity used x Unit}}$$

Alternatively, total profitability can be rewritten as:

$$\text{Total profitability} = \frac{\text{Total revenue}}{\text{Product cost}} = \frac{\text{Product quantity sold}}{\text{Resource quantity used}} \times \frac{\text{Unit price}}{\text{Unit cost}}$$

$$= \text{Productivity x Price recovery}$$

The implication of this relationship is that the total profit picture of a firm is a function of 1) productivity and 2) the ratio of product price to resource price. This ratio is termed price recovery and represents the amount of product price recovered per unit cost of resources used. Price over-recovery is said to occur when a product price increases at a more rapid rate than the resource price. Conversely, price under-recovery is said to occur when resource price increases at a faster rate than product price. Assuming that productivity remains constant, short-term profitability will increase in the case of price over-recovery and decrease in the case of price under-recovery.

As an example of the interaction of productivity and price recovery in determining total profitability, consider the following situation. A firm sells 40 units of a product at a unit price of $3. Twenty units of resources were consumed in producing the products at a unit resource cost of $5. The total profitability is, therefore,

$$\text{Total profitability} = \frac{40 \times \$3}{20 \times \$5} = 1.2$$

Suppose now the firm management undertakes to achieve profit growth by adopting a price under-recovery. The firm lowers its per unit product price to $2.90 and sells 45 units. Twenty-one units of resources are required to produce the product and, in conjunction with its price under-recovery strategy, per unit resource costs are increased to $5.18. Accordingly,

$$\text{Total profitability} = \frac{45 \times \$2.90}{21 \times \$5.18} = 1.2$$

Total profitability remains the same in both cases. That is, the firm continues to receive $1.20 in revenues for every $1 of cost expended. However, profit as the difference between product revenues and product costs has increased from $20 to $21.72--a gain of nearly 9 percent.

An interesting point is that profit increased at the same time that resource costs were increasing. Resource costs increased from $5 to $5.18, which reflected a gain of nearly four percent. Since resource costs arise from a charge for the use of resources, this increase in resource costs represents an increased return to the factors of production in the form of wages, interest and rent.

The reason why both profit and return to the factors of production show an increase rests in the interaction between productivity

and price recovery. Price recovery declined from \$3/\$5 = .6 to \$2.90/\$5.18 = .56. All other things equal, a decline in price recovery would have resulted in the profit position. However, this decline was offset by rising productivity. Total factor productivity increased from 40/20 = 2.0 to 45/21 = 2.14. This rise in productivity was sufficient to offset the reduction in price recovery and provided the margin that supported both an increase in profits and an increased rate of return to labor and capital.

Had the firm undertaken a strategy of price over-recovery, a different set of outcomes could be hypothesized. Increased product prices may well have resulted in fewer units of products being sold, thus decreasing revenues. Unused capacity and/or difficulties in adjusting the size of the labor force would likely cause decreases in total factor productivity. If productivity fell at a more rapid rate than the price recovery ratio was increasing, the overall result would be a decline in total profitability. The implication is that, in many situations, a reduction of price recovery resulting from a decrease in product prices and/or an increase in resource costs is conducive to productivity gains with resulting benefits in the form of increased profits and accompanying returns to labor and capital.

Whereas the example is at the firm level, the principles generalize to the national scene. In a capitalistic society, economic growth is dependent upon the ability to show a profit. As the example indicated, productivity is the key to profitability. Without the ability to produce more products through the improved utilization of resources, total profitability cannot be maintained. Since maintenance of total

profitability is a necessity for economic growth, productive use of scarce resources is of critical urgency. In order to maintain the margin of profitability, increased demand must be satisfied through the use of proportionately less resources. This is the heart of the productivity challenge.

Productivity is the chief free market weapon in the fight against inflation. In the absence of productivity growth, firms are forced to adopt a price over-recovery strategy. Although beneficial to profit in the short run, this strategy has long-term deleterious effects in that it exerts inflationary pressure on the economy. Dependency upon changes in price recovery rather than changes in productivity to achieve changes in the profit picture place upward pressures on the price structure. As product prices are increased, there is corresponding pressure to increase resource prices, thus triggering a wage-price spiral. Enhanced productivity on the other hand, is noninflationary in that it represents an increase in real output that can be used to offset corresponding decreases in the price recovery ratio. As shown by the example, total profitability can be maintained and the return to labor and capital increase while at the same time product prices are held constant or reduced provided that productivity shows a compensating gain.

International trade is coming to constitute an important sector of demand. If our economy is to compete for this important market, it must be priced competitively with other foreign suppliers. This means that American firms must increasingly turn to pricing under-recovery as the source of profit growth. Success in international markets will depend in large part upon our ability to supply quality products at a

competitive price structure. The capability to maintain profitability and competitive pricing will depend upon the extent to which productivity can be depended upon to give us the competitive edge.

The standard of living for society flows from the stock of goods and services that the economy is able to produce. The more goods and services (cars, stereos, homes, medical care), the higher the standard of living. The capacity of a society to provide an increasing array of goods and services for its members is a direct function of the efficiency of its resource utilization. To the extent that more can be produced with proportionately less resources, the standard of living will increase. Productivity improvement, as illustrated in the example, supplies the critical edge that allows for increased returns to productive resources in terms of wages, rent and interest.

Quality of life reflects a subjective judgement of the ability of society to satisfy personal needs. The capability of a society to provide a satisfying environment for its inhabitants is a function of both the effectiveness and the efficiency with which resources are used. Since productivity deals only with efficiency, its contribution to quality of life is bounded accordingly. However, effectiveness and efficiency are interrelated to the extent that resources must be efficiently used in order to be truly effective. Since quality of life is an evaluation of the effectiveness of society in achieving its goals, productivity makes its contribution to the achievement of selected goals through improved efficiency of resource utilization towards achievement of selected ends.

Equality of economic opportunity has become an avowed national purpose. Productivity contributes to this end by promoting economic

growth and an enhanced standard of living. Economic growth requires increased resources needed to supply an expanding pool of goods and services. The increased demand for resources translates into increased economic opportunity for disadvantaged segments of the society. As the stock of real outputs produced by the society increases, so does the amount available to all segments.

Chapter II

THE PRODUCTIVITY MALAISE AND ITS DIAGNOSIS

THE PRODUCTIVITY PROBLEM

Labor productivity as measured by output per employee hour is on a downhill slide. The extent of this decline can be determined by examining the annual rates of productivity growth. Annual percent changes for the private business sector for the years 1948-1981 are given below:

1948 - 3.8%	1965 - 3.8%
1949 - 1.6%	1966 - 3.2%
1950 - 7.9%	1967 - 2.0%
1951 - 2.8%	1968 - 3.3%
1952 - 2.8%	1969 - 0.2%
1953 - 3.1%	1970 - 0.7%
1954 - 1.6%	1971 - 3.6%
1955 - 4.0%	1972 - 3.5%
1956 - 1.3%	1973 - 2.7%
1957 - 2.8%	1974 - -2.3%
1958 - 2.5%	1975 - 2.3%
1959 - 3.2%	1976 - 3.3%
1960 - 1.6%	1977 - 2.1%
1961 - 3.1%	1978 - -0.2%
1962 - 4.5%	1979 - -0.3%
1963 - 3.8%	1980 - -0.2%
1964 - 4.0%	1981 - 1.0%

Source: Bureau of Labor Statistics data as reported in a Statement of the Chamber of Commerce of the United States on Productivity presented to the Subcommittee on the Senate Committee on Labor and Human Relations, April 2, 1982.

This series covers four rather distinct time periods. The decade 1948 to 1958 reflects the emergence from World War II. The period 1959 to 1968 roughly corresponds to a guns-and-butter effort to engage in the Viet Nam war abroad and the War on Poverty at home. The period

1969 to 1973 was one of internal stress as resistance to the war increased and mounting inflation signalled the country's inability to wage war on both fronts. The years 1974 to 1981 saw increasing foreign competition, double-digit inflation and a stagnating economy. As noted in the following statistics, average annual productivity growth declined precipitously during this latter period.

Years	Average Annual Productivity Growth
48-58	3.1%
59-68	3.3%
69-73	2.1%
74-81	0.7%

Source: Bureau of Labor Statistics Data as presented by Chamber of Commerce, op. cit.

For the period 1974 through 1981, productivity exhibited an absolute decline in four out of the eight years. For three consecutive years, the average American worker produced less per hour worked at the end of the year than at the beginning.

Examination of outputs and hours employed as separate components provides additional insight into the productivity decay.

Years	Average Annual Growth in Outputs	Average Annual Growth in Hours
48-58	3.2%	-0.1%
59-68	4.6%	1.4%
69-73	3.7%	1.5%
74-80	2.2%	1.6%

Source: Employment and Training Report of the President, Table 6-1, 1982.

Rate of growth in output peaked during the period 1959-68 and then exhibited a steady decline. In contrast, number of hours employed showed a steady rate of increase from 1959 on. Thus, with outputs growing at a

diminishing rate and hours employed growing at an increasing rate, productivity fell accordingly.

The fall in productivity signaled the economy's inability to convert increased hours of employment to corresponding increases in real output. With declining productivity, compensation per hour rose as wages followed price increases.

Average Annual Increase In Compensation Per Hour

48-58 - 5.7%
59-68 - 5.0%
69-73 - 7.1%
74-80 - 9.1%

Source: Employment and Training Report of the President, Table 6-2, 1982.

Unfortunately for our economic health, as the increase in compensation per hour accelerated, productivity growth stalled. The corresponding disparity between rates of compensation and productivity growth exerted upward pressure on unit labor costs. Examination of available data revealed a dramatic escalation.

Average Annual Increase in Unit and Labor Costs

48-58 - 2.4%
59-68 - 1.7%
69-73 - 4.8%
74-80 - 8.5%

Source: Employment and Training Report of the President, Table 6-2, 1982.

With insufficient productivity gains to absorb increased labor costs, these costs could be expected to be passed on in the form of increased prices. Examination of the Consumer Price Index for the corresponding period showed a remarkable correspondence between rates of increase in prices and labor costs.

Average Annual Rate of Increase
of the Consumer Price Index (CPI)

48-58 - 2.4%
59-68 - 1.9%
69-73 - 5.0%
74-80 - 9.3%

Source: Employment and Training Report of the President, Table 6-6, 1981.

Increasing prices cause corresponding pressures for wage increases which, in the absence of sufficient productivity gains, are translated into another round of corresponding price increases. Unfortunately, increases in worker compensation in a period of rising prices result in negligible gains in real wages. Without corresponding gains in productivity, the real return to factors of production can be expected to continually erode.

INTERNATIONAL COMPARISONS

The United States is not alone in its productivity dilemma. Comparison of productivity trends for other major industrial nations shows the same downward pressures.

Average Annual Productivity Rates

Country	1960-73	1973-80
United States	3.4%	1.3%
Canada	4.7%	1.5%
Japan	10.5%	6.4%
France	5.8%	4.4%
West Germany	5.5%	4.5%
United Kingdom	4.3%	1.6%
Italy	7.3%	3.8%

Source: Recent Productivity Trends in the U.S. and Japan. Bureau of Labor Statistics, 1982.

Although the United States is currently experiencing the slowest rate of productivity growth of the major industrialized nations, it remains the leader in absolute productivity. Relative productivity for the major industrial countries using the United States as a standard indicates that the United States has the lead position, but that other countries are closing rapidly.

Country	Relative Productivity for 1980
Japan	68.4
West Germany	88.7
Italy	60.6
France	89.4
Canada	92.1
United Kingdom	60.8
United States	100

Source: Bureau of Labor Statistics data reported by the United States Chamber of Commerce, 1982.

Given the continued disparities in the rates of productivity growth, the United States stands a good chance of relinquishing its premiere position in absolute productivity within the next four to six years.

Considering the emerging eminence of Japan, it is worthwhile to compare the relative productivity growth rates of the two countries.

Average Annual Change

Years	Capital Productivity		Labor Productivity		Energy Productivity		Materials Productivity		Multi-Factor Productivity	
	U.S.	Japan	U.S.	Japan	U.S.	Japan	U.S.	Japan	U.S.	Japan
1965-1973	-0.49	-4.0	2.45	11.08	0.05	1.49	-0.13	1.0	0.54	0.79
1974-1978	-1.98	-0.15	1.83	5.42	-0.71	3.27	0.00	1.1	.33	1.43

Source: Recent Productivity Trends in the U.S. and Japan, Bureau of Labor Statistics, 1982

In nearly every comparison, Japan exceeds the United States, both in growth of individual factor productivity as well as total factor productivity growth. An interesting point of comparison is that for both the United States and Japan, capital productivity declined (negative growth rate) over the period 1965 through 1978. For the United States, this decline in capital productivity accelerated more than four-fold, whereas in Japan the decline in capital productivity decelerated during the period 1974-78.

The intriguing question is how Japan can maintain its industrial momentum with decreasing capital productivity. The answer seems to be that increases in productivity of other factors of production compensate sufficiently so that Japan achieves a small but positive multi-factor productivity increase. The most notable difference between the U.S. and Japan is in the area of labor productivity with the Japanese posting a considerable advantage. Japan has also managed to show an increase in energy productivity during the period 1974-78 in the face of mounting energy shortages. The U.S. during that same period of time experienced declining energy productivity. The U.S. was able to reverse a decline in materials productivity but fell far short of the Japanese record. When compared against the multi-factor productivity, the U.S. experienced a 38 percent decline in comparison with an 81 percent increase for the Japanese economy.

PROBLEM DIAGNOSIS

If one thing definite can be said about the productivity problem, it is that no single cause dominates. Rather, it is as economist Lester Thurow (1981) so aptly puts it, "Death by a thousand cuts."

There are, however, causes that are commonly regarded as contributing significantly to the plunge in productivity performance.

One such factor is the amount of capital available to the American worker. Capital in the form of plant and equipment provides the tools used by labor to produce the output of goods and services. A measure of capital available to the employed work force is provided by the capital-labor ratio. This ratio indicates the amount of net capital per employed worker. Other things being equal, a rapidly rising rate in the capital-labor ratio indicates increased capital investments in new technology and automation which should be expected to result in productivity gains. When analyzed over the same four time periods used to assess productivity performance, average annual rates of increase in capital-labor ratio show the same downward tendencies.

Average Annual Increase in the Capital-Labor Ratio

48-58	-	3.4%
59-68	-	2.1%
69-73	-	2.6%
74-80	-	1.3%

Source: U.S. Department of Commerce data as reported in the United States Chamber of Commerce Statement on Productivity, op. cit., 1982.

As a result of the definition, changes in the capital-labor ratio can be due to changes in capital investment and/or in the numbers of employed workers. Examination of the data indicates

Years	Average Annual Growth Rate of Real Net Capital Stock	Average Annual Increase in Employment
48-58	4.5%	.4%
59-68	4.3%	1.6%
69-73	4.4%	2.0%
74-80	3.2%	2.2%

Source: Chamber of Commerce Statement on Productivity and Employment and Training Report of the President, Table 6-2, 1981.

As shown, the rate of net capital formation has dropped significantly since 1974. Several explanations can be offered. Increases in the purchase price have made new capital relatively more expensive and have acted to encourage the substitution of labor for capital. The purchase price of new capital equipment relative to wages and fringe benefits decreased only 0.7 percent per year during the period 1972-78 in comparison with a 2.7 percent per year drop from 1948 to 1965 (Thurow, 1980). A second factor accounting for a drop in capital investment is the surge in energy prices that occurred during this period. Throughout most of the industrial development of America, capital had been substituted for labor in increasing amounts as evidenced by a steady rise in the capital-labor ratio. Energy shortages, however, have served to curtail pressure on capital expansion. Since capital requires large amounts of energy, rising energy costs have made capital more costly. As a result, the rate at which new capital has been acquired has declined.

While net capital investment grew at a constant and then declining rate, the rate of work force growth increased nearly five-fold. The implication was not that Americans were not investing, but simply that they were not investing rapidly enough to equip each new worker added to the work force with a constant share of capital. Energy shortages, by making capital more expensive, have contributed to the acceleration of work force growth. As Harvard University economist Dale Jorgenson argues, rising energy prices cause producers to cut back on amount of capital. Because energy and labor appeared to be fairly good substitutes, rising energy prices tend to increase the demand for labor (Business Week, June 1, 1981).

Restricted growth in the formulation of new capital has an impact on the quality of existing capital. Statistics indicate that the average age of plant and equipment in the United States is 16-17 years in comparison to 12 years in West Germany and 10 years in Japan (Congressional Hearings, November 4, 1981). In a survey of the U.S. stock of machine tools, Production magazine (January 1980) found that 34 percent of the United States' stock was over 20 years old while only 31 percent was less than 10 years old. This compared with Japan which had 18 percent over 20 years old and 61 percent of their stock under 10 years old.

Savings represent a significant source for investment funds. However, America tends to be a consumption-oriented society with less proclivity to invest in long-term capital acquisitions. Americans save barely 5 percent of the Gross National Product in comparison with the Japanese who save nearly 1/3 of their Gross National Product each year. Whereas Americans tend to invest about 11 percent of their Gross National Product in nonresidental fixed investments, the Japanese invest on the average a quarter of their annual Gross National Product in the private sector (Congressional Hearings, op. cit.). Inflation and easy credit have conditioned the American buyer to consume now and pay later with dollars of diminished purchasing power.

In addition to capital-related factors, productivity decline can be related to changes in labor force structure and sectorial shifts in the economy. As the labor force expanded, the proportion of youth and women employed increased. The 16 to 24 year old segment of the work force increased from 21 percent in 1970 to 23.5 percent in 1980. Like-

wise, the proportion of women in the labor force increased from 38.8 percent to 42.6 percent between 1970 and 1980. Since many of these had little or no previous work experience, the effect was to depress productivity gains.

A major sectorial change with significant productivity implications occurred with the massive shift from agriculture to industrial employment. During the period from 1948 to 1965, some 9.1 billion man-hours of labor transferred from agriculture to industrial employment (Thurow, 1980). The contribution to productivity arose from the fact that agricultural productivity was only about 40 percent that of manufacturing productivity. As a result, every worker that transferred out of agriculture increased national productivity, on the average, by 60 percent.

A similar situation existed with respect to service industries, with the exception that the effects on productivity were reversed. During the 30-year period 1948 to 1978, productivity in the service industry averaged only 38 to 70 percent of that in the private business economy. During that same period of time, employment in the service industry increased by some 230 percent. The effect of this transfer was to shift more employees into a sector of the economy with below average rates of productivity increase. Not all experts, however, agree that the service sector is responsible for lackluster productivity gains. A study conducted by the American Productivity Center shows that output per hour worked in the service industry adjusted for 1972 purchasing

power was 20¢ higher than comparable figures for goods-producing industries, and 8¢ higher than the hourly output level for all private business (The Wall Street Journal, June 19, 1981).

While the causes of productivity decline previously discussed are rather far removed from the workplace, there is growing concern that management itself must share a major responsibility for declining productivity. As Secretary of Commerce Malcolm Baldridge told a group of senior business executives, economists and labor leaders at the first meeting of the National Productivity Advisory Committee, "We've got to get our managers back into entrepreneurial thinking and away from financial reports, or into research and development and less 'Let's get the product out of the door.'" (Washington Post, January 7, 1982).

How then does management hinder productivity? The answers are emerging slowly--in part assisted by a comparison with the Japanese style of management. A concern for productivity and a focus on the internal work processes have not been popular management topics. Rather than concentrating on production management, American managers have tended to place more emphasis on external factors such as market penetration, market share, and overall return on investment. By focusing on the big picture, there is a growing consensus that management may be losing sight of the importance of people. As H. Ross Perot, Chairman of Electronic Data Systems, states, "It's the people in the first-line jobs that make or break a company. Lose them and you're out of business" (Government Executive, June 1981).

American management has been criticized for being preoccupied with short-run concerns. Organizational performance tends to be judged

according to the quarterly financial statement and investment options evaluated in terms of annual or biannual payback returns. This emphasis on short-run optimization has reduced the capacity of management to assume risks associated with long-run capital ventures.

James O'Toole in his recent book entitled Making America Work (1981) argues that a restrictive management culture has evolved that stifles productive endeavors. Restrictive management cultures, according to O'Toole, are characterized by a rigid adherence to formal norms and practices even though they may interfere with more productive work organization. Restrictive cultures tend to be closed to new ideas, resistant to change and characterized by distant and formal personal relations. Decision-making tends to be authoritarian; the organizational climate is one of distrust and suspicion; employee participation in work decisions is minimal; and adherence to procedure more important than quality of the final product. Admittedly, these characteristics represent the extreme of organizational bureaucracy. They are, however, useful in communicating those management characteristics that are considered detrimental to productivity improvement.

Howard J. Samuels, a productivity consultant, in testimony before Congress supports the contention that management practices are inhibiting productivity growth. According to Samuels,

> Experience of over a decade of productivity consulting indicates that the adoption of more efficient management techniques can improve private sector productivity by a minimum of 10-20 percent without any additional capital spending on technical innovations (Congressional Hearings, January 27, 1982).

Additional evidence that part of the fault for productivity decline rests on management's shoulders is supplied by a recent survey from the American Machinists Inventory (American Machinist, June 1981). Their results show that the percentage of machine tools less than 10 years old is higher in small plants than in large ones. If one assumes that small plants are more likely to be run by entrepreneurial managers less dominated by pressures for immediate profit and the pressures for short-term financial gains, then the premise appears well-founded.

At cross purposes with the restrictive management culture is a growing rights and entitlements consciousness of the American worker. These rights and entitlements include:

- The right to blow the whistle on illegal and unethical practices of employers;
- The right to privacy (e.g., confidentiality of personal files);
- The right to conscientious objection to unethical orders;
- The right to freedom in outside activities (e.g., political activity);
- The right to sexual freedom (e.g., homosexual rights);
- The right to freedom from sexual harrassment by superiors;
- The right to vote on plant relocations;
- The right to participate in all decisions directly affecting one's job;
- The right to self-actualization on the job (i.e., the right to develop one's full productive potential);
- The right to reject a cross-country transfer; and,
- The right of all employees to full access to information about corporate activities. (O'Toole, 1981, op. cit.)

According to O'Toole, the important consideration is not that the rights per se are intrinsically good or bad, but rather whether productivity growth will be sufficient to sustain their implications. O'Toole characterizes the values of the younger, better-educated workers as change, flexibility, choice, options, variety and diversity. The challenge is whether American management can adopt an organizational style that can successfully fuse rights with responsibilities in a manner to allow the economy to prosper and individuals the freedom to exercise their values.

CHAPTER III

PRODUCTIVITY IMPROVEMENT STRATEGIES

Based upon an analysis of the causes of productivity decline, a two-factor framework for productivity improvement is presented in Figure 2.

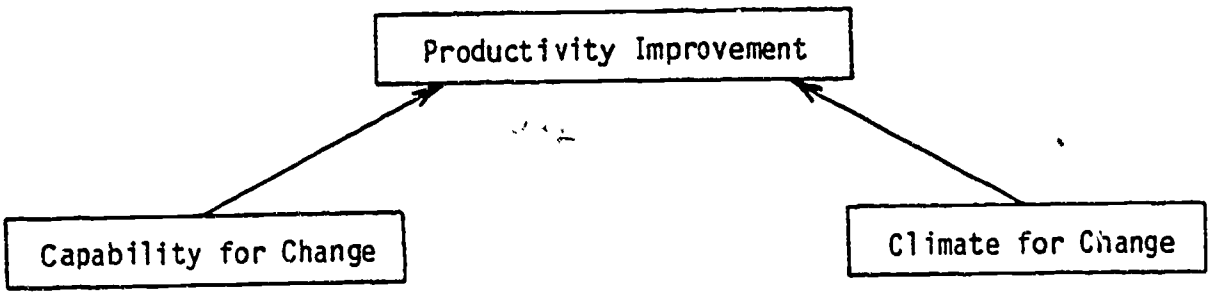

Figure 2: A Framework for Change

As presented, productivity improvement results when there is both the capacity and the climate for change. Capacity refers to the necessary resources required to increase production. Climate refers to the organizational, cultural environment that may either help or hinder the translation of capacity to productive gain.

The human contribution to productivity improvement is central. As Robert A. Cowie, Vice President of Public Affairs for the Dana Corporation said in testimony before Congress:

> Investment and technology are important ingredients in the productivity equation but, by themselves, they do nothing. Investment unutilized and technology unapplied will not increase productivity. They represent only potential. The essential ingredient in productivity has

> always been human. The people must use the tools. Using new tools or using old tools in new ways always involves change. So our job really is to foster change (Congressional Testimony, April 2, 1982).

Given the centrality of human work and the fact that work is performed in organizational settings, strategies for productivity improvement will focus on the creation of organizational climates supportive of a worker-centered approach to productivity improvement. Development of the capability of individual workers to function in a productivity-oriented environment will be the subject of Chapter IV.

Infusing an organizational commitment to productivity is envisioned to occur in four overlapping and mutually reinforcing stages: information, communication, understanding, and involvement. Techniques for carrying out each of these stages will be discussed in subsequent sections.

DOCUMENTING THE PRODUCTIVITY SITUATION

A prerequisite for productivity improvement is to have available sufficient information to document the existing productivity condition. Since productivity is a measure of the efficiency of a production system, the first requirement in measuring productivity is to define the production system for which measures are desired. This work system may encompass the entire organization, a division of the organization, a department or even a component work group. The important consideration is that the system derives its identity from a joint responsibility for the performance of a specific organizational function. This is important in order to ensure that group members have a shared identification resulting from having interrelated organizational roles and responsibilities.

Labor-factor productivity ratios should be defined for each production group identified. Workers in each of the production groups should be provided the opportunity to participate in the selection of appropriate input and output measures. Input and output measures should be chosen based upon considerations of:

- The organizational function of the work group;
- The availability of existing indicators of output and/or input;
- The credibility of existing output and/or input indicators; and
- Estimated collection costs of new output and/or input data, if satisfactory indicators do not currently exist.

Output indicators should be selected that measure the performance of the production group functioning as a group. Group output should be measured in objective terms. Care should be taken to avoid the use of subjective performance appraisals and the summation of these individual performance appraisals as the measure of group output. To do so will do violence to the concept of productivity as a measure of the efficiency with which a work group transforms resource inputs into work output.

Multiple productivity measures should be established. Since productivity is a complex concept, the use of multiple measures assures that significant areas will not be overlooked. Unless the measures are excessively duplicative or expensive to gather, it is better to err on the side of too many measures than too few. The benefit of multiple productivity measures is to provide a broad band of indicators that, like health measures, will be sensitive to a variety of changes in

organizational output. Use of multiple measures also reduces the risk of biased results since it is unlikely that all multiple measures will be subject to the same biasing factors.

Productivity measures should be interpreted in a comparative mode, rather than in an absolute sense. A base time period should be selected and productivity measures interpreted in comparison with that chosen baseline. By so doing, changes can be more readily determined and their directions assessed. One possibility is to convert the baseline measure into a standard value of 100 and to make comparisons according to percentage changes from that baseline; e.g., 130 would represent a 30 percent increase over the baseline productivity rate.

Rather than combine productivity ratios into a unitary weighted measure, it is suggested that for each work system a measure of labor productivity be selected that is considered the most representative single indicator of work group productivity. An attempt should be made to obtain group member unanimity in selection of this indicator. The purpose of this indicator will become clear in subsequent discussions about group incentives.

In addition to measures of labor productivity, ratios should also be developed to measure the productivity of energy, capital and materials for those work groups in which these factors of production will have material consequences for organizational productivity. Management may wish to exercise greater discretion in the formulation of non-labor productivity ratios, particularly with respect to measures of capital productivity. These factor measures may be of less immediate concern to workers although they provide useful information to monitor the course of productivity improvement.

Total factor productivity can be computed by first combining the various resource inputs into a single measure of resource utilization. Because some resources (namely, capital) will be measured in dollar amounts, it is suggested that all resources used be converted into dollar value as the common measuring unit. A measure of total resource input used can then be achieved by weighting the resources and adding the weighted dollar values. Selection of a corresponding measure of global output will then enable a total factor productivity index to be computed. It is suggested that the measure of total work group output be the same one that was used in the computation of the most global labor productivity index.

Identification of work groups for productivity measurement and the definition of factor productivity for each work group identified will provide a powerful tool for the management of productivity. Productivity measures collected at periodic intervals will provide a productivity series that can be used to chart the course of productivity improvement. Areas of insufficient productivity growth can be readily identified and those work groups and/or factors of productivity contributing to the problem easily targeted. By comparing productivity performance at various levels in the organization, it should be possible to determine whether the productivity gains at one level are being lost at another.

At that level in the organization where outputs can be priced, productivity may be combined with price recovery and used to diagnose the profit contribution of each resource. Those resources that are found to be making less than desired contributions to price recovery can be targeted for specific productivity improvement efforts.

COMMUNICATING A PRODUCTIVITY MESSAGE

Of all the techniques for changing management climate, none are perhaps more effective than creating a sense of shared trust in the organization through the open communication of information. Productivity data provide a ready-made message for communication throughout the organization. Productivity information tells workers what they want to hear--namely, "How is my work group doing and what are its prospects?"; " How is my division doing?" and "How is my organization doing?" Communication of productivity information signals management concern with what is happening on the shop floor and in the office and their openness to share information even though it might not always be favorable.

Whatever the results, the message should convey productivity. Productivity and its quest for improvement provides a ready theme for management communication at all levels. Top management can show their concern and support of productivity efforts by personally visiting groups of employees. Visitations by top management give visible evidence of management support and attest to the importance attributed to the productivity cause.

Communication cannot be limited to periodic visitations by top management. Line supervisors should hold periodic meetings with their employees. The purpose of these meetings should be to discuss productivity problems and to review current productivity performance. By opening the channels of communication and making productivity the topic of concern, a solid base of worker awareness of productivity and its importance for them and their company will be built.

The high visibility given to productivity improvement and the necessity for continued periodic contact argues for the collection of productivity information over relatively short time periods. Productivity indicators collected on a monthly basis would appear to be sufficient to provide management with the information they need and workers with a continuing flow of information to judge their performance.

In addition to management meetings, productivity information can be disseminated by a wide variety of means. Articles on productivity, for instance, could be written for the company newsletter. Productivity results could be displayed on posters conspicuously placed to attract attention. Letters explaining the importance of productivity and the need for its improvement could be written to each employee over the signature of the CEO. One company has even established a toll-free number where employees can call to obtain information.

UNDERSTANDING THE PRODUCTIVITY NEED

The purpose of communication is to promote understanding. This requires that communication be expanded to a two-way dialogue between management and workers with productivity the topic. Management should be willing to face tough questions openly and be prepared to discuss the ramifications of productivity improvement in a frank and candid manner. If management believes that productivity improvements can be expected from specific work groups, then these expectations should be communicated directly. The spirit of the communication should be one of open discussion with the explicit purpose of describing the need for productivity improvement.

Discussions on the need for productivity improvement should center on the concept of productivity, its critical role in organizational survival, and the current ways of measuring productivity. It is important that workers understand how productivity is measured and that there be general consensus on the validity of these chosen productivity measures.

It is of particular importance to come to an understanding as to the overall purpose of productivity improvement. The prevailing notion that productivity is a guise for making workers work harder with no consequent benefits must be dispelled. Workers must be convinced that by working smarter, but not harder, they can share in the increased returns made possible by productivity gains. This requires that managements strive to break down the adversarial relationship, the we-they syndrome, and seek to create an understanding on the part of the workers that productivity profits all.

Increasing worker understanding of productivity and its mechanisms for improvement can be a two-edged sword. By increasing understanding, workers' expectations as to a share in the benefits that accrue are also stimulated. Unless management is fully committed to a joint productivity effort and is prepared to negotiate equitable allocation of benefits, they should not pursue this course.

WORKER INVOLVEMENT IN PRODUCTIVITY IMPROVEMENT

The final stage in the achievement of an organizational climate supportive of productivity improvement is that of worker involvement. If the communication and understanding process is effective, then a de-

sire for involvement in the productivity process will have been kindled. It is management's responsibility to provide the structure for the expression of this involvement. Taking a lesson from the Japanese, the small work group of five to twenty employees provides a direct medium for involvement.

Use of work groups to achieve productivity improvement is a natural outgrowth. Since productivity itself is an indicator of the efficiency of work group performance, the dependency upon work groups to achieve productivity improvements is a logical consequence. The group and the social dynamics that bind it together exert a powerful influence on the behavior of its members. The challenge is to provide a mechanism for harnessing that energy and directing it to the improvement of work group performance.

Communication of productivity information and the associated dialogue regarding its implications should have served to stimulate worker awareness and to promote worker understanding of the need for its improvement. The impetus for the formulation of a network of small groups devoted to productivity improvement should grow out of this foundation of interest and support. The particular form that this growth may take cannot be, nor should it be, exactly prescribed. The pattern and structure must evolve and adapt to meet unique organizational constraints and requirements.

However, general principles can be offered to serve as guideposts for the emerging process. Whether these groups be called Quality Circles, Quality of Working Life, or whatever, is largely immaterial. What is important is that these groups provide the means for

worker involvement in a total commitment to productivity growth. If the productivity theme has been successfully communicated, labels such as Quality Circle or Quality of Work Life may, in fact, prove to be disadvantageous in that they tend to circumscribe the purpose and color expectations. Productivity includes quality but is more than quality. Likewise, productivity is affected by working conditions, but goes beyond matters related to personal comfort.

Organizational Structure

The organization of a work-team approach to productivity enhancement should support three clearly defined functions. The first function is that of executive overview, the second that of management review and approval and the third that of work-team operations.

The executive function should be performed by a select group of executives from the corporate level for multi-firm organizations and should include the top manager and the assistant manager. The purpose of this group is to establish the broad organizational mission statements that will give impetus to a productivity thrust. Formation of this group ensures that productivity has spokespeople at the highest levels of corporate council. The existence of this group testifies to the importance placed on productivity and provides tangible evidence of top-level management support and active involvement.

A management committee should be formulated and assigned the responsibility for review and approval of all productivity improvement strategies that have division or department-wide implications. This committee, at a minimum, should consist of the top manager and/or assistant manager, and the general supervisors. As indicated, the role of

this committee should be to review the productivity performance of all operating units, to review and approve recommendations for productivity improvements and to provide general administrative supervision of productivity efforts.

The management committee should have staff support. The support staff should have responsibility for the collection of productivity measurements and for their routine distribution to operating departments. Productivity staff should also have the responsibility to act as a clearinghouse for all productivity-related information collected from both internal and external sources. External information would include films, audiovisual materials, books, articles, and other general and specific information pertaining to productivity. This information could be collected by attending seminars, maintaining contacts with local universities, community colleges and schools, as well as from productivity experts and the experiences of other organizations.

A network of productivity work groups should be established as the front line in an all-out effort for productivity gains. These work groups should consist of five to twenty members working in close conjunction with a first line supervisor. The purpose of this group is to identify and solve problems at the shop and office level that are interfering with the quantity, quality and flow of work output.

Work Group Functioning

Work groups are built on the premise that the greatest expertise as to how a job should be done is located within a 25-foot radius of where the job is performed. The major purpose of the work group, then, is to provide a medium for workers to bring their expertise

to bear on the identification and solution of productivity problems. These problems may not have the glamour and glitter of the more academic analyses of the productivity dilemma, but collectively, they comprise an area where immediate results may be obtained. These problems deal with the day-to-day barriers to work performance such as work-in-process not being delivered at the right time, job orders being delayed because of parts shortages, involuntary idleness due to nonavailability of work to be performed, or redundancy and duplication in the work process. All serve to diminish work output. The Intel Corporation, by instituting simple reforms in their work procedures, anticipated a gain of 30 percent in productivity (Fortune, June 29, 1981).

Since blockages to work group efficiency are the most vexing to those directly involved, work group members are thus in the best position to identify these barriers and to suggest means for their improvement. Work groups should be encouraged to consider all factors that may be serving to constrict productivity performance. In addition to scheduling, typical topics for consideration might include: materials quality, materials handling, equipment conditions, repair schedules, equipment modification, energy conservation practices, safety procedures, job re-design, or any one of numerous other areas where work changes may be instituted.

Output of the group should be in the form of identified problems, a suggested solution or alternative solutions, an accompanying rationale of why the solution should work and what it would be expected to accomplish, and a statement of required changes necessary to make the solution effective. This output should be the product of joint work

group activity and not the sole contribution of a unique individual. In this sense, suggestions developed by work groups differ from that of typical suggestion systems in which an individual makes an impromptu suggestion and drops it in a suggestion box. In contrast, the working group should come to a consensus that a problem does indeed represent a significant problem for group consideration, and that the solution proposed flows from the group's collective experience. Recommended production improvement strategies should be forwarded to the management committee with a request for a decision.

Group functioning can be enhanced through the application of standard group problem-solving techniques. Two techniques with rather universal application are brainstorming and nominal group techniques. In brainstorming, the group is given a problem and group members asked to volunteer solutions. Members are encouraged to offer any solution that occurs to them on a spontaneous basis without regard to the feasibility of the idea. The intent is to generate a pool of possible solutions that can be refined and fine-tuned a later date. Nominal group technique differs to the extent that each group member is required to write a proposed solution to a problem and to describe his/her solution verbally to the group. In a pure application of this technique, group members are instructed to confine their questions only to those that help clarify the intent and ramifications of the proposed solution. Another approach termed 'Pareto Analysis' seeks to identify problems by asking the group to identify a list of common problems and to prioritize problems according to frequency of occurrence. Once problems are identified and prioritized, potential solutions may be identified using brainstorming, nominal group or other similar techniques.

Group size should be normally restricted to five to twenty members. Membership should be restricted to those workers belonging to a single common work group. In this manner, a shared experience base will be generated and group members will share a commonality of purpose. Group membership should be voluntary with workers attending and participating in work groups out of interest and commitment rather than compliance with company regulations. Because of differences in individuals, not all can be expected to take advantage of the opportunity for increased participation. Some may prefer to wait and see what happens. By making work team membership voluntary and by issuing an open invitation to all workers, the door is left open on a continuing basis for those workers who wish to drop in, or drop out as the case may be.

Role of the First-Line Supervisor

First-line supervisors should function as work group leaders. This responsibility will require that they coordinate the group problem-solving sessions, moderate group discussions, motivate group members to participate, provide factual information in answer to group requests, interpret company policy and otherwise act to provide group support and maintenance. This is a somewhat different role than many first-line supervisors are used to. Rather than issuing orders and commands and expecting obedience, this role requires supervisors to work directly with people in a dynamic decision-making process and to solicit their inputs as to recommended system changes. This role places more emphasis on team building and the ability to involve the workers in work-related decisions. Rather than a challenge, this is regarded by some super-

visors as a dilution of their organizational power and a direct threat to their personal integrity. Also, some supervisors belittle the capabilities of the workers to come up with constructive suggestions and regard group meetings as "sewing circles" that must be presided over to satisfy the whim of top management. If this view prevails, the program is doomed to failure and management deserves the blame for its demise.

Training As a Support Function

Training is an important ingredient in determining the success of a worker-oriented productivity effort. Training should be directed at all levels of the organization and should perform an ongoing developmental function. Top level executives in the management committee need training as to what to expect from the program, how the program should generally be organized, pitfalls to be avoided, expected results and the time frame for their occurrence. Expecting too much too soon is a common source of difficulty and contributes to withdrawal of management support because of unwarranted expectations. First-line supervisors require skills development in group leadership, team building, group motivation, group dynamics, organizational development and other topics that could be used to address productivity through group participation. Training a first-line supervisor in the art of group participation and support is critical to the success of the venture and should be given priority consideration.

The effectiveness of worker participation in productivity work groups can be enhanced considerably with appropriate training. Workers can go only so far in drawing upon their personal experiences for solutions to productivity problems. Beyond that, they need additional

insights and techniques that will open up new areas for analyses and provide the basis for continued creativity. Unless group members are provided with additional training, the productivity gold mine can be expected to peter out. Additional training, however, can be expected to provide a payback in the form of a continuing stream of strategies for improvement. The responsibility of education in developing the capability of workers to assume this role will be discussed in the next chapter.

Implementation of Productivity Work Groups

Implementation of productivity work groups should be the responsibility of productivity facilitators. These facilitators should be drawn from the staff supporting the management committee. In this manner, there will be a direct link between the management committee and the productivity work groups. Facilitators should hold a series of awareness sessions with first-line supervisors and interested workers. The purpose of these awareness sessions should be to discuss the role and function of productivity work groups and to encourage their formation. Facilitators should work closely with fledgling work groups to make sure that work groups are starting in the right direction. In addition to this awareness and orientation function, facilitators should also perform a continuing technical assistance role. This role should include the provision of productivity information, both internal and external, to productivity work groups, provision of assistance in overcoming organizational difficulties, and working with those supervisors who feel threatened or are otherwise not favorably disposed to participate.

Meetings of productivity work groups should be regularly scheduled and held on a routine basis. Weekly meetings of an hour in duration should provide sufficient time. Productivity statistics should be reviewed to determine areas where improvement seems warranted. Problem-solving techniques should be utilized to identify possible solutions to prioritize problem areas. Individual solutions should be discussed, their pros and cons weighed, and a recommended solution developed. The supervisor should serve as group leader but should otherwise not act in his or her formal capacity as supervisor and should not attempt to impose personal feelings, beliefs and attitudes upon the group other than as opinions offered as a participating group member.

Output of productivity work groups should be in the form of recommendations and a request for consideration by the management committee. The management committee should act upon all recommendations received. Those recommendations that involve only the particular work group and have minor cost implications should be routinely approved unless there are mitigating circumstances to the contrary. Those recommendations that have merit, but whose implementation extends beyond the originating work group, should be submitted to other work groups for their consideration. Following the pattern of the Japanese, those who are impacted by the decisions should be given opportunity to participate in their formulation. Although the process takes longer to accomplish and is thus subject to criticism, implementation is likely to be more readily achieved since consensus has been obtained from those who must be depended upon for the implementation. Recommendations that are rejected should be returned to the originating work group, along with

reasons for their rejection. The work group should be encouraged to review the comments and to incorporate them in revised suggestions if desired.

Participation Incentives

A common criticism of participation endeavors is that the early enthusiasm cannot be sustained. There is much truth in that charge as witnessed by the unfavorable experiences of some organizations. However, this criticism may reflect more on the lack of appropriate incentives than on the shortness of worker commitment; money remains a major work incentive. However, relatively few plans exist for use of financial rewards which are tied to group performance.

Three major types of group monetary incentive plans so exist. These are the Scanlon Plan, the Rucker Plan and the Improshare Plan. Each plan can be characterized by: (a) frequent bonuses, (b) computation of bonuses based on production, rather than sales; (c) an emphasis on employee involvement and on elimination of individual employee incentives.

The most commonly known, the Scanlon Plan, bases its bonuses on a base ratio formula. This base ratio is defined as payroll costs to be included divided by the value of production. The base ratio is derived from a historical study. For those months in which the actual labor costs are less than the standard labor costs computed using the base ratio, a bonus is paid. For instance, suppose that historical records indicate that labor costs should account for 35 percent of the total value of production produced during a given time period, say a month. If the value of production during that month turned out to be $200,000 (sales minus the inventory balance), then the anticipated labor share would be 35 percent of $200,000 or $70,000. If the actual labor costs

were $55,000, then the difference ($70,000 minus $55,000) would be placed into a bonus pool. Some of the bonus pool would be retained to pay for deficit months, a portion would be retained for the company, and the remainder would go to the workers in the form of a bonus. As originally conceived by Scanlon in the 1930s, the plan was to be put into effect if a majority of the workers approved it, and was to be voted on periodically to ensure that it retained worker support.

The Rucker Plan is similar although an employee vote is considered optional. In the Rucker Plan, the base-ratio formula is defined as the payroll costs included divided by value added by production. Because the Rucker Plan is based on value added by production, employees are encouraged to save on materials and supplies since they stand to benefit from such savings.

The Improshare Plan incorporates two key areas--work hour standards and a base productivity factor. Work hour standards assign standard hours to each piece produced. A base productivity factor is included to incorporate the contribution of indirect labor. For example, if an indirect labor rate of 50 percent is assumed, then for every hour of standard labor time, half an hour is added, giving a total of 1.5 standard units. The total number of standard hours is found by multiplying the work hour standards times the total units produced times the base productivity factor to determine the number of standard hours. If the actual number of hours required to produce a certain amount of production is less than the standard hours, the difference is allocated to a bonus pool and a proportion returned to the employees in the form of bonuses.

The General Accounting Office conducted a survey of industrial firms to determine the impact of group financial incentive plans to productivity improvement. Thirteen firms with average annual sales of less than $100 million reported savings averaging 17.3 percent. Eleven firms with annual average sales of $100 million or more reported savings averaging 16.4 percent (GAO Report, March 3, 1981). According to the GAO, the vast majority of firms reported satisfaction with their productivity sharing plans and believed that the plans warranted continuation. Both employees and union representatives surveyed cited increased wages as the most important reason for improved climate between management and labor.

Although of considerable importance in sustaining worker interest, financial incentive systems in and of themselves are no guaranteed panacea. Bonuses cannot be paid when the market conditions do not warrant. Long periods of bonus drought may be translated into employee dissatisfaction with negative results. However, nothing is a guaranteed success. American management must be prepared to take risks in order to overcome the productivity crisis. While not a sure thing, group financial incentives do seem to provide a mechanism whereby group efforts to improve productivity can result in financial reward. The possibility of continued reward would seem to be a powerful incentive for maintaining sustained worker interest in productivity improvement.

CHAPTER IV

EDUCATION AND PRODUCTIVITY[1]

Productivity improvement through changing the organizational climate was the subject of the previous chapter. In this chapter, the attention will turn to human resources and the impact on productivity improvement through education and training. A supportive role will be outlined and strategies for improved industry-education linkages suggested.

THE NATURE OF WORK

Pope John Paul II devoted his third papal encyclical to the subject of human work. According to John Paul, work can be understood from both an objective and subjective sense. In the objective sense, work can be viewed as the dominion by man over earth with the aid of technologies. The emphasis is on the objects (goods and services) produced by work and the value of work is judged according to the relative value placed on goods and services produced. In the subjective sense, man, as a purposeful active being, is the subject of work. Work has innate value, not because of the intrinsic value of the goods and services produced, but rather it because it is the result of a free person exercising conscious choice. As the encyclical states,

> This [subjective] dimension conditions the very ethical nature of work. In fact, there is no doubt that human work has an ethical value of its own which clearly and directly remains linked to the fact that the one who carries it out is a person, a conscious and free subject, that is to say, a subject that decides about himself (The North Carolina Catholic. September 27, 1981).

[1] This topic is addressed in greater detail in a companion project paper "Vocational Education: Its Role in Productivity & Technological Innovation," (CONSERVA, Inc., 1982).

The objective-subjective approach to work has direct relevance to the productivity problem. Work-oriented education, as exemplified by public-funded vocational education, has approached work from an objective consideration. The emphasis has been upon the development of the knowledges and skills required by an industrial society. In order to create a realistic approximation of the real world, vocational educators adopted the job shop model in which classrooms and shops sought to duplicate the organization of the real work world.

Their greatest failure was that they succeeded too well. In attempting to provide a realistic proxy, they also imported the prevailing organizational structure and supportive management philosophies. Job structure was rigidly defined and based upon the job simplification theories espoused by Taylor's principles of scientific management. Jobs were regarded as fixed entities with well-defined performance requirements. People were to be shaped to fit the job requirements and to be directed away from those jobs where the match between personal attributes and job requirements was not congruent. The proliferation of program offerings directed at occupationally-specific training bespoke a confidence in the stability of job definitions and a constancy of skills requirements. By an implicit acceptance of a prevailing industrial organization, vocational education took as its mission the training of a cadre of labor force entrants ready to shoulder their responsibilities.

As vocational education was addressing the objective side of work through skills development, a parallel concern for the worth and dignity of the human being slowly began to emerge. This movement represented a growing belief that work need not be debasing and that

society had a responsibility to provide the opportunity for meaningful and self-fulfilling work for all of its citizens. The principles of economic materialism that equated labor with capital and treated both as substitutable factors of production with the right of decision belonging to those who owned the capital came to be seriously challenged. The act of working, per se, entitled the worker to certain inalienable rights that transcended those of private property ownership. The principle was put forth that the right of private property was subordinate to the right of common use and that ownership of capital did not carry with it the free privilege of exploitation.

Expectations were developed as to the personal returns to accrue from work and the principle espoused that the individual had a right to these returns. O'Toole (op. cit., 1981) summarizes these expectations in terms of diversity, choice, flexibility, and mobility. The developing work morality assumes that the workplace has the responsibility to offer a wide variety of tasks and that these tasks be so structured as to permit performance by individuals differing in competencies, motivation and commitment. Workers, in their quest for expanded job meaning, are seeking work opportunities that provide them free choice in the selection of activities to be performed. As a result, the organization's right to select and match individuals to jobs is being challenged. To accommodate to the unique requirements of individuals, increased job flexibility is being sought to allow the job to be structured around the requirements of the individual in terms of hours worked, working conditions, and career development opportunities. Increased mobility is being sought to allow workers increased opportunity for self-development.

Mobility is defined both in terms of enhanced geographic as well as occupational mobility. Women, for example, are seeking entree into occupations that heretofore have been blocked for no apparent reason other than sex bias.

The transition from an objective to a subjective approach to work has not been easy. Workers, in their zeal for the establishment of worker rights have failed to recognize that rights always have corresponding duties and obligations. The over zealous quest for rights has prompted a self-indulgence and self-centeredness with an overemphasis on the entitlements of work, while ignoring the corresponding duties of work. The lesson that is slow to be learned is that nothing comes free. The question, then, is not whether workers are entitled to these rights, but rather, how can they be paid for? The answer to that question will depend upon the extent to which increased opportunities for diversity, choice, flexibility and mobility are translated into productivity gains in the workplace. The willingness of industry to entertain workplace reform that offers opportunity for productivity returns signals a willingness of the private sector to negotiate. The acid test is whether the workers have the skills, knowledges and commitment to assume the responsibilities that the granting of these rights entails.

Productivity improvement, then, poses a direct challenge for vocational education. If workers are expected to work not necessarily harder but certainly smarter, then vocational education has a part to play. Ensuring that workers are smarter requires that those seeking jobs for the first time or those who desire to upgrade their skills have access to quality education and training programs. These education and

training programs must impart not only the technical skills required to function in a rapidly changing technological society, but also the organizational skills needed to make productive use of the increased freedoms being provided by ongoing work reforms. Providing both the technical training and the organizational skills necessary to put this technical training to most effective use represents vocational education's major contribution to solving the productivity crisis.

Vocational Education for the New Workplace

The new workplace organized for productive efficiency will be characterized by two major features: (1) more intensive use of capital and (2) a more open and participatory work structure designed to give workers an increased voice in the production process. Both increased capitalization and the organization to promote the more effective use of this capital will be required in order for the society to rise above its current crises. Capital investment without a corresponding concern for the development of human resources represents a myopic view of progress and a rejection of the basic rights of humans to have access to work that is self-fulfilling, provides personal dignity, and contributes to the well-being of others.

To promote productivity, vocational education must produce people who are capable of functioning in a work organization characterized by increased diversity, choice, flexibility and mobility. Workplace diversity will tend to diminish the concept of a job as a fixed collection of task activities. As the emphasis shifts to the performance of tasks, and the assembly and reassembly of tasks to better match worker and organizational needs, job boundaries will become more

fluid. Job responsibilities, as fixed properties of the job, will gradually become an archaic concept. Vocational education, to be responsive, must focus on generic component competencies that transcend traditional job definitions. By training for generic work competencies, workers can be assured of having skills that will allow them to perform in a workplace characterized by a diversity of worker activities and an absence of formal structure. As envisioned by Theory Z Management, a perfectly integrated Z organization would have no organizational charts, no divisions and no visible structure (Ouchi, 1981). Rethinking the implications of this change on contemporary vocational education should be a matter of first order priority.

The new workplace is to be designed to give workers greater freedom of choice in decisions affecting how their work is scheduled, structured and performed. Freedom of choice, like any other freedom, requires a discipline of self and purpose lest freedom degenerate into anarchy. Vocational education's role is to provide workers with the knowledges, skills and dedication to use this freedom in a manner that benefits both the worker, the employer and ultimately, society. This will require that vocational education include in its training emphasis not only on the technical skills of production, but also upon decision-making activities and questions of ethics, morality and values. Docility and passivity are not the characteristics of the new worker and do little to contribute to the creative use of new technology.

Increased flexibility of working arrangements, coupled with technological advancements in information and communication, bode to change the structure of work significantly in the next decades. The shift from manual to knowledge production will tend to provide greater

flexibility in work organization in terms of hours and work location. Vocational education must assume responsibility for expanding learner awareness as to the impending changes in organization, their impacts on job restructuring and the range of options available. These options should include career trajectories as well as flexibility within a given career at a specific time.

Increased mobility will be a central characteristic of the new workplace. The press for mobility will emanate from shifts in technology and a corresponding organizational structure that will accommodate a more fluid allocation of human resources. Rapid technological change requires a mobile work force. Much of the technological advancement can be expected to occur in small businesses. As businesses seek to increase their competitive position through technological change, a great deal more churning can be expected in the work force. As some small businesses fade, others will rise to take their place. As a consequence, increased mobility between firms can be expected. The impact for vocational education is that workers must be trained to function as technical generalists capable of adapting to a wide variety of technical demands. As the technologies become more knowledge intensive, "hands-on" experience will become more of an anachronism. Escalating technological costs will make it impossible for vocational education shops and classrooms to maintain an inventory of modern equipment. Furthermore, training for specific pieces of equipment will be non-efficient since the life span of particular pieces of equipment will be shortened by escalating technological developments and the quest for firms to maintain their competitive edge through the application of state-of-the-art technology.

Significance for Vocational Education

These conditions will necessitate improved vocational education responsiveness. Vocational education must be prepared to develop a more process-oriented approach to work education that will permit rapid accommodation to the changing work organization. Specifically, it is recommended that:

1. Vocational education should incorporate the concept of productivity and its economic and social implications in all courses and program areas. The role of productivity as the arbitrator in determining the standard of living should be made apparent to vocational students through appropriate curricular and instructional materials. The topic of productivity should be infused throughout the vocational education skills and knowledge domain and students encouraged to consider the importance of productivity and its consequences on their future. The operation of the American enterprise system should be a topic of learning and no vocational students should complete a vocational program without having an awareness and understanding of the current productivity problem and contributions that they can make towards a collective solution.

   The approach to productivity should go beyond mere awareness. Emphasis should be placed on an understanding of methods that can be used for measuring productivity, the information that these methods communicate and the relation of productivity to profit. The importance of profit in a capitalistic society should be a matter of concern as well as the issues involved in the division of wealth based on some equitable allocation in accordance with value of effort expended.

2. Vocational education should concentrate on educating technical generalists who are capable of functioning in a variety of organizational roles. This will require that vocational education place greater emphasis on the related instructional model used in apprenticeship programs. The related instructional model assumes that the role of education is to develop proficiency in the understanding and application of basic models and theories to a range of tasks encompassed by the broad boundaries of an apprenticeable craft. The craftsperson of old with a bag of tools and generalized knowledge as to how to apply these tools to specific applications is becoming a viable training model with broad applicability. Physical tools will be replaced by knowledge tools that will enable the worker to move

through a variety of applications of more basic knowledges and skills. These more basic knowledges and skills will include the basics of mathematics, science, and communications. Computer skills will be of vital importance and computer literacy will rise to equal that of reading and writing.

3. Related instructional skills should include organizational as well as technical skills. This reflects the changing emphasis in organizational structure that requires that workers have the skills to utilize their opportunities to participate in the decision structure to greatest advantage. Without participatory skills, workers will be crippled in their ability to contribute to improved organizational performance and thereby run the risk of having the reform judged a failure because of human inability to capitalize on the opportunity. The implication for vocational education is that organizational skills be infused into the existing curriculum. These organizational skills should include an understanding of the theory and practice of participatory management, development of interpersonal skills, the ability to function in group problem-solving settings, team-building skills, organizational development and other such interpersonal and organizational skills that contribute to an improved functioning in a participatory management setting. In order to fuse rights with responsibility, the applications of these skills to productivity improvement should be stressed in vocational education program content and case studies of actual applications analyzed to determine reasons for their success and/or failure.

4. Vocational education at all levels should conduct an intensive campaign to familiarize vocational education professionals with the nature, impact and importance of productivity to our standard of living and way of life. Vocational education agencies should assume the responsibility of including productivity as a topic in pre-service and in-service training of vocational professionals. Teacher educators should be encouraged to include productivity and the role of vocational education in i ducing improvement in the teacher training curriculum. In-service training, oriented to an increased understanding of productivity, should be provided for vocational education administrators, supervisors and instructors. State agencies of vocational education should make an active effort to provide in-service training and should give serious consideration to holding a series of productivity workshops for the purpose of providing in-service training to practicing vocational educators.

EDUCATION-EMPLOYMENT LINKAGES

The extensiveness of the contribution of vocational education to productivity improvement is dependent upon the communication linkages established between education and industry. These educational linkages serve a dual purpose. They enable vocational educators to gain a better understanding of private sector efforts at productivity improvement and private sector expectations as to the contribution of human resources to achieving that improvement. Conversely, linkages serve employer interest in that they provide a means that employers can use to induce desired change in the educational system.

What the Educational System Can Do

1. Area vocational centers and post-secondary institutions can intensify efforts in offering short-term training for management employees upon request. The content of the courses may be either the development of technical and/or organizational skills. Short-term training is being provided by vocational education to a greater extent, particularly in conjunction with industrial development. The emphasis proposed here is somewhat different in that vocational education is being proposed to serve as a training provider to private businesses on a continuing basis. This would be especially beneficial to many small businesses that cannot afford to maintain full-time training staff capabilities. Vocational education staff could assist businesses in training first-line supervisors to function in a more participatory management mode. This training could include skills and organizational development, team building, motivation and group dynamics. These skills are not foreign to community college and technical institute staff at the postsecondary level, particularly in adult continuing education. Workers could be provided training to develop skills in group decision making, quality control, inventory control and planning and other techniques that would facilitate their effectiveness in contributing to organizational productivity improvement efforts. Vocational education should continue to seek ways to provide improved funding for continuing education efforts and to publicly expose those funding constraints that tend to limit their capability to deal with business and industry on an indi-

vidual request basis. Vocational educators should also more actively seek to establish training contracts with the private sector for the provision of in-plant training. As an incentive for business to contract with local education agencies and/or institutions to provide training, these agencies may be able to utilize existing funding sources to subsidize training costs.

2. Vocational education centers and institutions should establish a productivity resource center on a local service basis that could be used to provide productivity-related information and services to local employers. One immediate function would be to serve as a clearinghouse for productivity-related information. Books, articles, films, pamphlets, etc., pertaining to productivity could be collected, cataloged and made available as a reference source. Existing information centers such as the National Network for Curriculum Coordination in Vocational and Technical Education should be contacted for assistance in identification of productivity related materials. This information should be of great benefit to management committee staff personnel who have liaison responsibility to work with productivity work teams. Another service to be provided would be a listing of all the community resources that could be elicited for assistance in productivity improvement. One immediately useful resource would be a listing of all local productivity experts who would be willing to offer their services on a voluntary or fee basis. Classification of these experts by source of expertise would provide a useful service to employers who are seeking assistance in productivity problems. A research service might also be offered in which participating employers could request that problems of common concern be researched and all information pertaining to that problem identified and summarized. Depending upon the services provided, a fee could be assessed local employers. The service could then be provided to cooperative members at a reduced rate. In this manner, vocational education agencies could provide a direct service to employers who, because of their size, could not afford to maintain this expertise.

3. Vocational education institutions, to promote the training of technical generalists, could move into a related instructional mode similar to that used in an apprentice program. The notion of apprentice could be broadened to include technicians as well as craftspersons. Educational agencies could play a lead role in working with local employers to identify their pressing skills needs and could set about to design and offer a related instructional curriculum based on a task-competency approach. Employer requirements could be analyzed using more generic work competencies. Learning activities could be developed that would support the learning of these competencies required for on-the-job activities. Management of this instructional procedure would

require close linkages with employers since the effectiveness of the program would depend upon the extent to which the related knowledges and instruction served to support those current work activities. This process is essentially cooperative education with a more systematized procedure to ensure that the related instruction be articulated with on-the-job performance--an area in which many so-called cooperative programs often come up short.

What Employers Can Do

1. Employers can take a more active interest in vocational education programs. Employers can influence educational decisions in at least four modes. Employers can seek positions on local school boards or on the boards of community colleges. In many instances, this is an elected position which, once obtained, would ensure an active voice in school and/or institutional policies. Another avenue is to volunteer to serve on school program or craft advisory committees. These committees are advisory and are frequently used by vocational education to act as a sounding board for the need for new programs, however; they are not restricted to this limited use. Active advisory councils could be used in an evaluative and an accountability function to review the performance of the program and to make recommended policy and curriculum content changes. A third approach is for interested employers to set up a task force to assess educational resources and their allocation to serve local business and industry needs. Task force recommendations could be made to the superintendent and the school board or the local board of a community college. Press coverage is always a powerful tool to encourage attention to task force recommendations. Finally, individual business and industry representatives may volunteer their services to work in conjunction with school and/or community college personnel. As volunteers, business and industry representatives may work at the policy level or at the level of the classroom serving to interject their viewpoints and concerns directly into the instructional process.

2. Businesses and industries should think seriously about expanding the apprenticeship model as a means of providing the skills necessary to support the technological changes needed to revitalize our industrial processes. Since business and industry are the sponsors of the program, they have full discretion as to the content of related instruction and the training deliverers selected to provide that instruction. Training delivery may be provided in-house, by private consultants, private vocational schools or public vocational schools. Through selection of training service providers and requiring potential training deliverers to bid by competitive process, the most effective means of providing training can be determined.

REFERENCES

Harris, L. and Associates, Inc. and A. Etzioni. Perspectives on Productivity: A Global View. A Sentry Study, Stevens Point, WI: Sentry Insurance Company, 1981.

John Paul II. "Laborem Exercens: On Human Work." The Third Encyclical of Pope John Paul II reprinted as a supplement in The North Carolina Catholic, September 1981.

Jorgenson, D. in "America's Restructured Economy." Business Week, Special Issue, June 1, 1981, p. 60.

"The Key to Productivity is People, Not Machines." Highlights of an interview with H. Ross Perot. Government Executive, June 1981.

Lippman, T. W. "Managements Blamed for Output Drop." Washington Post, January 7, 1982, p. D10.

Main, J. "How to Battle Your Own Bureaucracy." Fortune, June 29, 1981, pp. 54-58.

Malabre, A. L., Jr. "Study Disputes View that Growth of Service Jobs Crimps Productivity." The Wall Street Journal, June 19, 1981.

"Old Machines Contribute to Declining U.S. Productivity." Productivity, January 1980, p. 7.

O'Toole, J. Making America Work: Productivity and Responsibility. New York: Continuum Publishing Company, 1981.

Ouchi, W. "How Japan Gets the Most From Its Workers." San Francisco Chronicle, Tuesday, July 21, 1981.

Riche, R. W. "Impact of Technological Change." Presented to OECD's Second Special Session on Information Technology, Productivity, Working Conditions and Employment. Paris, France, October 19-21, 1981.

"The Right Equipment." American Machinist, June 1981, pp. 186-190.

Thor, Carl in "Solving the Mystery of Productivity Measurement," Industry Week, January 26, 1981, p. 62.

Thurow, L. C. "The Productivity Problem." Technology Review, November/December 1980, pp. 40; 42-51.

Thurow, L. C. Death by a thousand cuts. (Review of Making America Work by James O'Toole) The New York Review, December 17, 1981.

Tuttle, T.C. Productivity Measurement Methods: Classification, Critique, and Implications for the Air Force. Manpower and Personnel Division, Brooks Air Force Base, TX: Air Force Systems Command, September 1981.

U.S. Chamber of Commerce. Statement of the Chamber of Commerce of the United States on Productivity, presented to the Subcommittee on the Senate Committee on Labor and Human Relations by Dr. Ronald D. Utt on April 2, 1982.

U.S. Congress, Joint Economic Committee. Hearings before the Subcommittee on International Trade, Finance, and Security Economics, November 4, 1981.

U.S. Department of Labor, U.S. Department of Health and Human Services and U.S. Department of Education. Employment and Training Report of the President. Transmitted to the Congress 1981. Washington, DC: U.S. Government Printing Office, 1981.

U.S. House of Representatives, Committee on Banking, Finance and Urban Affairs. Hearing before the Subcommittee on Economic Stabilization. Testimony by Howard J. Samuels, January 2, 1982, p. 63.

U. S. Senate. Labor and Human Resources Committee, Subcommittee on Employment and Productivity. Testimony by R. A. Cowie, April 2, 1982.

U. S. Senate. Labor and Human Resources Committee, Subcommittee on Employment and Productivity. "Recent Productivity Trends in the U. S. and Japan." Testimony by J. R. Norsworthy, April 2, 1981.

United States General Accounting Office. Productivity Sharing Programs: Can They Contribute to Productivity Improvement? Washington, DC: GAO, March 3, 1981.