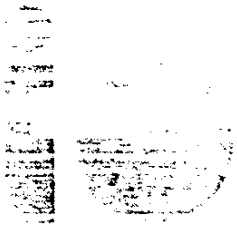

CHAPTER 8

Organizational Productivity

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This chapter explores a number of issues about organizational productivity. Reasons why productivity has become so important are first discussed, with special emphasis on the importance of productivity growth. Next, the conceptualization of productivity is considered and the confusion in the literature is noted. A number of specific conceptual issues are discussed, such as disciplinary perspectives, efficiency versus effectiveness, the organizational model used, and the unit of analysis used. A conceptual approach is presented that attempts to integrate these issues. To do this, the major question that must be addressed is the purpose for measuring productivity. Issues associated with measuring productivity are then presented, including the importance of complete measurement, reliability and validity issues, the use of objective and subjective measures, measuring things people have control over, and the types of work where measurement is feasible. A list of important characteristics for a good productivity measurement system is then presented, including having both an overall index of productivity and subindices, maintaining differing importance and nonlinearities in the measures, allowing for aggregation across organizational units and for direct comparison of different units, and being able to use both efficiency and effectiveness measures. Specific approaches to productivity measurement are then summarized and compared. In a final section, conclusions about the field are offered.

Introduction

IN THE LAST 10 years, productivity has received so much attention that it is now a household word. We talk with our spouse about how productive our day was. Computer software is advertised as being an aid to productivity. Companies search for programs to improve productivity. The national news contrasts the productivity of the United States with Japan. We write justifications of our work as behavioral scientists by invoking ties to productivity.

Productivity has become so important that it has been formally identified as a national priority. In 1984, a White House conference on productivity was held. Tuttle and Weaver (1986a) cite a 1985 message from President Reagan asking Congress for support of a government-wide program to improve productivity in the federal government and to pass a joint resolution that would make the improvement of productivity a national goal. When a concept in behavioral science gets this sort of national attention, it has indeed become an important societal issue.

The purpose of this chapter is to explore the concept of productivity. First, the reasons for the importance of productivity will be examined, along with the effects of productivity growth. Next, definitions of productivity will be explored, as will the confusion that exists about the conceptualization of organizational productivity and the major conceptual issues involved. An integrated conceptualization will then be presented. Next, measurement issues associated with the concept will be identified and design features of measurement systems noted. Specific approaches to measuring productivity will then be summarized. Finally, conclusions about the field will be offered.

Importance of Productivity

The importance of productivity needs some historical context to be understood. Data on labor productivity have been collected since 1909 (Riggs & Felix, 1983). For many decades, these data were largely within the purview of labor economists and were not particularly of concern to many others. In the 1950s and 1960s, the United States was the most productive country in the world, and there was little doubt that this state of affairs would continue.

However, by the early 1970s, it was clear that this superiority was threatened, especially by Japan and some western European countries. While the United States was still the most productive country, its rate of productivity growth was declining, and a number of other countries were improving their national productivity at a faster rate than the United States (Kendrick, 1984; Mahoney, 1988; Sink, 1985; Taira, 1988; Tuttle, 1983). This led the American Productivity Center (1979) to state that if the trends occurring at that time continued, the productivity of the United States would actually fall behind Japan, West Germany, Canada, and France by the end of the 1980s.

During the 1970s, the reality of this problem became clear to more than just the economists. The effects of these productivity changes started to be felt nationally. The success of the Japanese in U.S. automobile and steel markets led to plant closings and lost jobs. Major U.S. companies were in severe financial difficulties. Unemployment was rising. What had historically been a trade surplus became a trade deficit, and the deficit was increasing. While many causes were responsible for these problems (e.g., Kopelman, 1986), loss of clear U.S. superiority in productivity was seen as one of the major causes.

The productivity issue was picked up by many segments of our society, from the media to labor unions, and was presented as a serious issue. In a special report on productivity, NBC concluded that "unless we solve the problem of productivity, our children will be the first generation in the history of the United States to live worse than their parents" (National Broadcasting Company, 1980). Productivity had become a national issue.

Effects of Productivity Growth

There are very good reasons why this concern for productivity is appropriate. Productivity has a major impact on our lives. Its effects can be seen at three major levels: (a) national, (b) industry and firm, and (c) individual.

Effects at the National Level. There are clear ties between productivity and important economic outcomes. Productivity growth is an important factor in controlling inflation (Kendrick, 1984; Mahoney, 1988; Riggs & Felix, 1983; Tuttle, 1983). In a market economy, the prices paid for goods are determined largely by the costs of the inputs used to produce the goods and the profit margin of the producer. There is a constant upward pressure on the cost of these inputs. For example, the price of labor is continually increasing as we receive pay raises each year. If profit margins are assumed to be roughly constant over time, then increases in the cost of the inputs must be offset by increases in productivity if costs are to be kept constant. More output must be produced with the same, more expensive input. If the increases in the costs of inputs are not offset, the prices of the same goods must go up and inflation occurs.

This description is an oversimplification, since inflation is also influenced by other factors, such as fiscal policy, political decisions at home and abroad, and spending attitudes (Riggs & Felix, 1983). However, productivity growth is an important factor in determining inflation levels.

Another way to look at this same set of relationships is to focus on wages. We all want higher wages. If higher wages are achieved without increased productivity, the cost of the goods goes up, increasing inflation (Kendrick, 1984; Kopelman, 1986). If wages increase with a corresponding increase in productivity, no inflationary pressure is created. This logic is confirmed empirically when economists study growth in real income, that is, change in income relative to change in inflation. Studied over time, productivity growth appears to be responsible for the increase in real income per capita (Kendrick, 1984).

The real cost of goods is also influenced by productivity (Kendrick, 1984; Mali, 1978). Productivity growth results in producing the same goods for lower costs. Again assuming a roughly constant profit margin, the real cost of goods decreases as productivity increases (Fleishman, 1982; Mahoney, 1988).

There are also some important noneconomic factors that are influenced by productivity growth (Fleishman, 1982; Kendrick, 1984; Kopelman, 1986; Mali, 1978; Riggs & Felix, 1983). Increased productivity means generating the same goods and services with less inputs. Thus, it is a way of conserving societal resources ranging from trees to human labor. Looked at another way, increased productivity allows for more available outputs for the same inputs. Thus, we can be closer to a society of plenty while using less of our societal resources.

Productivity growth can also increase the quality of our lives. Kopelman (1986) puts it well by saying that without productivity growth, the economic pie that is divided is of a fixed size. This means that one demand cannot be met without sacrificing another. For example, the cost of social security or medicaid must be contained or taxes increased. A pie of a fixed size results in battles between factions fighting over the resources—for example, environmentalists versus manufacturers, workers versus retirees, majority versus minorities, and so forth. Productivity growth creates the money to continue to increase the size of the pie. Thus, the size of each slice can increase without taking resources from someone else.

Effects at the Industry and Firm Level. Productivity and productivity growth are also important at the level of the industry and the individual firm. If productivity growth of an industry or a firm is higher than its competitors, that industry or firm survives better (Craig & Harris, 1973; Kendrick, 1984; Tuttle, 1983).

If the productivity growth of an industry or firm is higher than the average of its competitors, this leads to lower costs and prices, thus making those products and services more competitive. This leads to higher sales, higher profits, and more job opportunities. The reverse is true for below-average productivity growth. Another way to look at the relationships is from the cost of inputs. When increases in wages or the costs of other inputs exceed gains in production efficiencies, the goods produced from labor and capital become more expensive. Competitiveness is decreased in the world or national marketplace (Riggs & Felix, 1983).

Effects at the Individual Level. Finally, productivity and productivity growth are important to individuals. Aside from the quality of life issues raised above, increasing productivity leads to better use of our time and more leisure time and is a key to advancement in organizations (Kendrick, 1984). Equally important, people like to be productive. It is a central aspect of self-fulfillment and self-respect.

Problems With Defining Productivity

There is agreement that productivity is important and why it is important. In sharp contrast, there is very little agreement on what the term *productivity* means (e.g., Bullock & Batten, 1983; Campbell & Campbell, 1988a; Craig & Harris, 1973; Kopelman, 1986; Tuttle, 1983). It is used as a measure of the efficiency or effectiveness of individuals, groups, organizational units, entire organizations, industries, and nations. It is used as a synonym for output, motivation, individual performance, organizational effectiveness, production, profitability, cost effectiveness, competitiveness, work quality, and what a new product will enable you to increase if you buy it. Productivity measurement is used interchangeably with performance appraisal, management information systems, production capability assessment, quality control measurement, and the engineering throughput of a system.

At least there is general agreement that the use of the term productivity is imprecise (e.g., Campbell & Campbell, 1988b; Craig & Harris, 1973; Muckler, 1982; Tuttle, 1983). Dunnette (1982) put it well when he said, "Productivity indices currently used are diverse, somewhat primitive, and often unclear" (p. 9).

To understand why the term productivity has become so confused, it is necessary to consider the history of the concept. Most of our behavioral concepts are of our own making and attain a more or less agreed upon definition. Productivity is different. It started with the economists and did not become a widespread issue until it became clear that the United States was in danger of losing the industrial superiority that Americans had come to expect. When the effects of the loss of this superiority became apparent, productivity suddenly became a hot issue.

When this happened, a number of disciplines realized that they had something to contribute to solving the problem. Academics such as economists, accountants, industrial engineers, sociologists, psychologists, and management specialists all believed that the content of their disciplines had something to offer to the problem. Practitioners such as managers and management consultants of every description applied their knowledge to this problem.

These people looked at the problem and its potential solutions from their own perspectives, and these perspectives were very different. The economist's definition of productivity and the methods he or she uses for measurement and improvement are very different from those of an industrial engineer (Brief, 1984; Tuttle, 1981).

The confusion in the literature is the effect of this process. Given all the types of people who have been working on productivity, it is not surprising that the exact meaning of the term is unclear. In fact, one response to this literature is to conclude that it is a confusing, unorganized

conceptual morass wherein the unwary can venture and never be heard from again. However, this is too pessimistic. A better view is that here is an area where scholars and practitioners from many different disciplines have made contributions, and this is a wonderful opportunity to see and integrate what has been done in areas where psychologists do not often venture. It is a challenge, but much can be learned from the process.

Conceptual Issues

What Productivity Is *Not*

One way to start understanding productivity is to deal with what technical writers agree that productivity is *not*. Productivity is not the same thing as individual performance (Ilgen & Klein, 1988; Mali, 1978; Pritchard, Jones, Roth, Stuebing, & Ekeberg, 1988, 1989; Tuttle, 1983). Individual performance is a measure of how well the individual fulfills his or her role. It is usually an index of the outputs of the individual (e.g., dollars of sales) or, more commonly, an evaluation of how the individual's behavior compares to organizational expectations (e.g., performance appraisals). Such measures are used to evaluate the contribution of a single individual to the functioning of the organization, typically for the purpose of making decisions about how that individual should be treated in areas such as raises, promotions, or training.

In contrast, productivity is an index of output relative to goals (*effectiveness*) or output relative to inputs (*efficiency*). In addition, productivity more explicitly acknowledges that the functioning of a unit or organization requires interdependence between individuals to achieve the organization's objectives. Because of this interdependence, the productivity of the unit or organization is not the simple sum of the performances of the individuals involved. Productivity also includes factors such as how well they cooperate with each other, how well the personnel are coordinated and managed, the availability of needed resources, and how well priorities are set so that organizational objectives are reached.

There are also some other things that productivity is not. Productivity is not output (Kendrick, 1984; Mali, 1978). Output is the amount of products or services generated by a system. While outputs are part of productivity, productivity also includes inputs or a measure of outputs relative to objectives or goals. Productivity is not profitability (Kendrick, 1984; Kopelman, 1986; Mali, 1978). Profitability includes measurement of the degree of cost recovery; productivity does not (Kendrick, 1984; Mali, 1978). Finally, productivity is not a measure of capability. Concepts like *production capacity* or *output capability* are measures of the potential outputs of a system. Productivity deals with actual output.

Key Issues Across Disciplines

Trying to develop a good conceptualization of productivity from reading the literature is not an easy task. One way to help organize this material and develop a framework for integration is to identify key conceptual issues that cut across this literature. A number of such issues will be discussed in turn. After that, an attempt will be made to integrate and synthesize the issues.

Disciplinary Perspectives. The first of these core issues involves the various disciplinary perspectives from which productivity can be viewed. Many disciplines have made contributions in the area of productivity, each from a very different perspective. For example, in a book of essays on productivity edited by Brief (1984), chapters are included that are written from the perspective of accounting (Denison, 1984; Kaplan, 1982; Mahoney, 1984), sociology (Berg, 1984; Hage, 1984; Pennings, 1984), psychology (Hackman, 1984; Schneider, 1984; Weiss, 1984), and management (Guth, 1984; House, 1984; Kerr, 1984). Tuttle (1981, 1983)

formally identifies five distinct perspectives: the economist, the accountant, the industrial engineer, the psychologist, and the manager.

The Economist. The economist sees productivity as the ratio of outputs over their associated inputs, where both outputs and inputs are expressed in real physical volume units (Kendrick, 1977, 1984; Kopelman, 1986; Mahoney, 1988; Silver, 1984). Put another way, productivity is the efficiency of the transformation of inputs into outputs. Outputs are the products created by the process—the cars, the coal, the potatoes. Inputs include all the things needed to produce the outputs—labor, energy, intermediate products purchased as raw materials or supplies, and capital. These outputs and inputs should be expressed in *real physical volume units*. In other words, measures of the amount used or produced should be objectively quantifiable and represent physical entities.

Unfortunately, it is not possible to combine physical measures of inputs and outputs to form such ratios. One cannot take the sum of 1,000 refrigerators, 500 dishwashers, and 2,000 toasters and divide that by the sum of 10,000 hours of labor, 10 tons of sheet metal, and 50,000 kilowatts of electricity. To overcome this problem, each input and output is converted to a common metric—dollars. One can divide the *value* of the refrigerators, dishwashers, and toasters by the *cost* of the labor, materials, and energy.

When all the input and output factors are included in the ratio, the resulting measure is termed *total factor* productivity. When selected measures are used, the result is termed *partial* factor productivity. The most common type of partial factor productivity measure is labor productivity, where outputs are divided by some measure of the amount of labor used to produce them.

The Accountant. Approaches to productivity based on an accounting perspective (e.g., Denison, 1984; Hurst, 1980) attempt to describe and improve the financial performance of the organization. This is done through the construction of a series of financial ratios, such as dollars of sales divided by the cost of labor or dollars of profit divided by the capital employed to produce it. Most of these measures have an output/input format and are thus a type of efficiency measure, but they are focused primarily on financial efficiency. Typically, multiple measures are constructed to get an overall picture of organizational functioning.

The Industrial Engineer. The industrial engineer (e.g., Norman & Bahiri, 1972; Rosow, 1981) views productivity as the efficiency of throughput as measured by output to input ratios. It is based on the model of a machine, where productivity is the ratio of useful work (the output) divided by the energy used to produce the work (the input). As such, it has a maximum value of 1.0. Measurement is typically focused on the operational units within the organization rather than the total organization and usually attempts to assess the functioning of a "man-machine" system.

The Psychologist. What Tuttle refers to as the *industrial and organizational psychologist approach* (more properly termed the *behavioral approach* to include our organizational behavior colleagues) focuses primarily on the aspects of productivity that the individual can control, that is, behavior (e.g., Campbell & Campbell, 1988c; Guzzo, 1988; Guzzo, Jette, & Katzell, 1985; Ilgen & Klein, 1988; Schneider, 1984). The assumption is that by changing individuals' behavior, productivity will be changed. Some behavioral researchers inaccurately equate individual behavior/performance with productivity, while some argue that behavior and performance are a component of productivity. It is also assumed that all our interventions, such as selection, training, feedback, and gainsharing, can influence productivity.

The Manager. The broadest but least precisely identifiable perspective is that of the manager (Tuttle (1981, 1983). In this perspective (e.g., Preziosi, 1985; Shetty & Buehler, 1985), productivity includes all aspects of the organization seen as important to effective organizational functioning. It includes efficiency and effectiveness, but also includes quality of output, work disruptions, absenteeism, turnover, and customer satisfaction. No one specific definition of what productivity is nor how it should be measured are specified. Anything that should make the organization function better ipso facto deals with productivity.

Efficiency Versus Effectiveness. Another core conceptual issue is whether an efficiency or an effectiveness approach should be used in measuring productivity. *Efficiency* is a ratio of outputs to inputs. Number of tons of steel produced divided by number of personnel hours used to produce that output would be an efficiency measure. *Effectiveness* is defined as the outputs relative to some standard or expectation. Tons of steel expressed as a percentage of the goal for that month would be an effectiveness measure.

Productivity scholars agree that efficiency is part of the concept of productivity. They disagree on whether effectiveness is also part of productivity. Many see productivity as just efficiency (e.g., Campbell & Campbell, 1988c; Craig & Harris, 1973; Kendrick, 1984; Muckler, 1982; Werther, Ruch, & McClure, 1986). The majority, however, believe that productivity should include both efficiency and effectiveness (e.g., Balk, 1975; Bullock & Batten, 1983; Coulter, 1979; Deprez, 1986; Elkin & Molitor, 1985–1986; Engle, 1979; Guzzo, 1988; Hayes, 1977; Hurst, 1980; Joint Financial Management Improvement Program, 1976; Letzkus, 1973; Mali, 1978; National Center for Productivity and Quality of Working Life, 1977; Neugarten, 1985; Peeples, 1978; Pritchard et al., 1988, 1989; Riggs & Felix, 1983; Tuttle, 1981, 1982, 1983; U.S. Air Force, 1982).

Both efficiency and effectiveness have their advantages and disadvantages (cf. Deprez, 1986; Kendrick, 1984; Kopelman, 1986; Norman & Bahiri, 1972; Tuttle, 1981). Efficiency is widely known and much easier to standardize across organizations, industries, and nations. When we hear that productivity growth in the United States has declined over the last 20 years (e.g., American Productivity Center, 1981), it is an efficiency ratio that is being quoted (i.e., price-deflated gross national product divided by worker hours).

Efficiency is easy to calculate, easy to understand, and is accepted by organizational personnel. Another major advantage is that productivity, when defined as dollar value of physical outputs divided by dollar value of physical inputs, is directly reconcilable with profitability, since productivity (by this definition) multiplied by price recovery equals profitability (Kendrick, 1984; Kopelman, 1986). This feature of the efficiency conceptualization makes it especially attractive to managers.

There are also a number of disadvantages to efficiency measures. An important one is that being highly efficient may be very dysfunctional in the long run. Getting high output with minimal inputs may be done by not expending resources on important long-term needs. For example, lowering quality, failing to cultivate customers, letting equipment deteriorate, and failing to expend resources on training may result in a short-term increase in efficiency, but to the long-term detriment to the organization.

The efficiency conceptualization of productivity also ignores the demand for the product or service. Efficiently generating large amounts of products for which there is no need or market is not helpful to the organization.

Another important disadvantage is that it is very difficult to develop efficiency measures for all the units of the organization. The dollar value of the output/input approach is usable if the unit has outputs that can be converted to dollars. It is not easily usable for units such

as a personnel department or for a research and development function.

One common solution to this problem is to measure the organizational outputs that can be valued in terms of dollars and use all costs as inputs, including the costs of units like the personnel department and research and development. However, this solution has the problem that separate units must be combined to calculate the efficiency measure. Thus, the productivity measures coming from such a system are quite macro in nature. This tends to make them insensitive to small changes in productivity, of little benefit to the unit personnel as a guide to operating more productively, and of little value in evaluating the effects of organizational changes on productivity. Another solution to the problem is to express the outputs of the unit in whatever units can be quantified and divide these by inputs. This produces an efficiency measure, but cannot be compared to other units nor aggregated across units.

Another disadvantage of an efficiency approach is that the ratio of the dollar value of outputs to dollar value of inputs is too simple to give an accurate index of efficiency. The costs of some of the inputs are partially a function of costs the organization pays for the parts, supplies, consultants, and other purchased items used to produce the outputs. There are also differences across outputs in selling expenses and markups. In addition, inflation makes comparisons of costs over time difficult. In order to deal with all these complicating factors, efficiency approaches must become substantially more complex than the simple dollar output/dollar input notion. This decreases their initial advantages in the areas of ease of calculation, understandability, and personnel acceptance.

Efficiency measures have other disadvantages as well. They may fluctuate due to factors beyond the control of the organization. An example is the price of raw materials the organization buys. If this price variation is significant, interpreting an efficiency measure is difficult. Part of the variance in the measure is caused by factors outside the control of the organization, thus its meaning as a descriptor of the organization's functioning is decreased. Another disadvantage is that it is difficult to include quality in an efficiency measure. For an input or output to be included in a traditional efficiency ratio, it must be convertible to dollars. Scaling variations in quality in terms of dollars is difficult, and because of this, measures of quality are frequently omitted from efficiency ratios.

Effectiveness is a much broader concept because it includes other factors such as standards, objectives of the organization, expectations of interested parties (e.g., shareholders, regulatory agencies, and customers), and the viability of the organization relative to its competition. Effectiveness is also understandable and easily accepted by personnel. In principle, it can be applied to any unit, from the smallest work group to the entire organization. As such it can be sensitive to small changes in productivity and useful to the operational manager and can serve as a way to evaluate organizational changes. Quality can readily be included, and it does not have the problem of getting accurate and meaningful inflation-adjusted prices for all inputs and outputs of the unit.

Effectiveness measures also have their disadvantages. To use effectiveness, it must be possible to identify meaningful organizational goals and develop measures that are consistent with these goals. Another problem with effectiveness is that meeting organizational goals without consideration of the resources used to do so may not be in the best interests of the organization. An organization could meet its goals very well but use far too many resources in doing so. Thus, effectiveness used alone can be just as dysfunctional as efficiency used alone.

Organizational Models. A third issue that cuts across the productivity literature has to do

with the model of organizations used as the basis for conceptualization and measurement. This is really an issue that comes from the organizational effectiveness literature (e.g., Steers, 1975), but also applies to productivity. While a variety of organizational models have been identified (e.g., Cameron & Whetten, 1983; Quinn & Cameron, 1983; Quinn & Rohrbaugh, 1983), I will focus on three: (a) the natural systems model (Campbell, 1977), (b) the multiple constituency model (e.g., Connolly, Conlon, & Deutsch, 1980; Keeley, 1978; Pennings & Goodman, 1977), and (c) the goal-oriented model (Campbell, 1977).

The Natural Systems Model. This model (e.g., see Georgopoulos & Tannenbaum, 1957; Katz & Kahn, 1978; Yuchtman & Seashore, 1967) assumes that the demands on an organization are so complex and changing that it is not possible to identify a finite set of organizational goals that are definable in any meaningful way. Instead, the natural systems approach assumes that the overall goal of the organization is survival. To maximize survival, different natural systems models propose or assume that specific organizational characteristics must be maximized. Examples of such characteristics include openness of communication, participation in decision making, and organizational trust. In this view, organizational effectiveness is thought of as the degree to which the organization is high on these critical variables.

The Multiple Constituency Model. This model considers the organization as being influenced by groups of individuals (*constituencies*) internal and external to the organization, such as managers, employees, customers, and so forth. These different constituencies have different goals based on their own self-interests. This model of organizations implies that there is no single set of goals or objectives for the organization and organizational effectiveness must be considered and measured from the perspectives of the different constituencies.

The Goal-oriented Model. This model (e.g., see Barnard, 1938; Etzioni, 1964; Perrow, 1970) assumes that the organization is run by a set of rational decision makers who have a manageable set of goals for the organization that can be defined well enough to be understood and that it is possible to develop a strategy to achieve these goals. Organizational effectiveness can be thought of as the degree to which these goals are met.

Issues of Which Models to Use. The issue of which organizational model to use is more than just a theoretical concern. It is the basis from which the productivity measurement proceeds. If the natural systems or multiple constituency models are accepted, it is not meaningful to assume that a single set of usable goals exists and then try to identify them from the organizational members. Thus, the effectiveness approach to productivity is not really possible using these models, because no single set of goals or objectives can be identified upon which to base the measures. Efficiency measures have a similar problem, since they tacitly assume a fixed and useable goal of producing the most of what the organization already produces with the least amount of organizational resources. In contrast, the natural systems model would require identification of the crucial variables such as openness of communication, and productivity would be measured as the degree to which these variables are maximized. Multiple constituency models would require identification of multiple sets of goals and some integration of them into an overall measurement system.

Compared to most of the conceptual issues, there is considerable agreement about which organizational model to use in conceptualizing productivity. The majority of the literature on productivity assumes the goal-oriented approach to organizations (American

Productivity Center, 1981; Joint Financial Management Improvement Program, 1976; Kendrick, 1984; Kim, 1980; Kopelman, 1986; Mali, 1978; Muckler, 1982; Peeples, 1978; Riggs & Felix, 1983; Tuttle & Weaver, 1986a, 1986b; Tuttle, Wilkinson, & Matthews, 1985).

Units of Analysis. Another core issue in the conceptualization of organizational productivity is what unit of analysis to use. In popular literature, the term productivity is used to refer to a unit of analysis ranging from the individual to entire countries. In technical literature, however, the units of analysis typically used range from the work group, which is the smallest (Norman & Bahiri, 1972; Tuttle, 1983; Tuttle, Wilkinson, & Matthews, 1985) to the level of national economies.

Some authors (e.g., Campbell & Campbell, 1988c; Gabris, Mitchell, & McLemore, 1985) go so far as to say that productivity should not be used at the individual level of analysis. One argument for this position is that the vast majority of work is done interdependently and thus it is difficult if not impossible to identify the contributions of individuals to the joint process. The contrasting position (e.g., Kopelman, 1986) would be that it is just as conceptually meaningful to discuss the efficiency or effectiveness of an individual as an organization or country.

An Integrated Conceptualization of Productivity

Identifying these broad issues that cut across the productivity literature should serve as a framework for understanding where any given approach to productivity fits into the larger picture. However, it is very tempting to go further and ask what the optimal conceptualization of productivity is. However, this is as dangerous as it is naive. It is dangerous because assuming that the question is worthy of an answer leads to a conceptual dead end. Productivity is an evaluative concept. It is an index of how well some organizational entity is operating. No matter how you conceptualize it, higher productivity is better than lower productivity. However, the organization has many different functions. This suggests that we must identify and agree on what functions we are interested in before we can agree on how to measure them.

The issue becomes clearer if the idea is applied to individuals. If one asks how good an individual is, the obvious answer is: How good *at what?* We may be interested in the person's scholastic performance, mechanical aptitude, or ability at Ping-Pong, but it makes little sense to deal with the *overall* goodness of an individual. Thus, it is inappropriate to try to answer the question of how good an individual is.

Yet we have a history of doing exactly that in other areas. The best example is in the area of organizational effectiveness. Here researchers took the position that organizational effectiveness was a reasonable construct and, with enough work, agreement could be reached on what it meant. Once that was accomplished, the determinants of organizational effectiveness could be examined and this would be a major theoretical and practical contribution. In retrospect, it is not surprising that the area reached a conceptual dead end, most strikingly articulated by Goodman (1979) when he requested "a moratorium on all studies on organizational effectiveness, books on organizational effectiveness and chapters on organizational effectiveness" (p. 4). The problem was that researchers assumed that it made sense to ask how good (effective) the organization is overall, and not how good the organization is *at some function*.

I like to call this approach the "Holy Grail" model. It is the assumption that there is one true conceptualization and measurement approach that can be found if enough scholarly knights overcome enough definitional dragons. The productivity literature abounds with the Holy Grail model. It is subtle but

distinctly present. It is most clearly seen when an author implies that there is one best way to conceptualize or measure productivity.

Rather than fall into the trap of the Holy Grail model, my position and that of others (Belcher, 1982; Campbell & Campbell, 1988c; Mahoney, 1988) is that one must first identify the purpose for measuring productivity. There are different purposes, and the different purposes suggest different approaches—no one approach is best.

Identifying Purposes for Measuring Productivity. An exhaustive list of all the possible purposes for measuring productivity would be a long one. However, these multiple purposes fall rather nicely into five major categories, which serve as a useful taxonomic structure:

- *Comparing large aggregations of organizations.* Comparing national economies such as the United States with Japan or comparing the electronics industry to the health care industry are examples. The goal is to see, for example, which nation is more productive.
- *Evaluating the overall productivity of individual organizations for comparison with each other or with some standard.* Assessing the productivity of individual organizations in order to decide whether a particular firm would be a good financial investment would be an example of this application. Comparing organizations to other similar organizations in order to assess their competitive position is another example.
- *Gaining management information.* Here the focus is on a single organization, and productivity deals with the functioning of the human/technological system. Such measurement is used by top management for strategic planning and policy making. The main question is how well the entire organization or major parts of it are functioning and whether this functioning is improving or declining. Decisions that will be made have to do with allocation of resources to the various organizational functions and with the growth or reduction of these functions.
- *Controlling parts of the organization.* This purpose is often overlooked, especially by psychologists (Weiss, 1989). However, controlling the movement and timing of both material resources and output products is quite important to the efficiency of the throughput process. Under this heading are included such activities as production engineering, quality control, production scheduling, physical distribution, materials management, logistics, and inventory control. Also included would be controlling the functioning in other areas such as the profitability of the organization's capital investment strategy.

  The intent of such a productivity measurement system is to assess the quality of functioning of a part of the organization by monitoring that functioning. The goal is to identify whether problems are developing or to assess the effect of changes made in the operations. The major distinction between the management information system and control function is that the management information system is done on a larger part of the organization and typically deals with more macro measures. The control function is typically done on a single, identifiable function using very specific measures unique to that function.
- *Use as a motivational tool* (Algera, 1989). The objective is to improve productivity, and the assumption is that if individuals change their behavior appropriately, productivity will increase. One example of this approach is measuring productivity and feeding the productivity data back to unit personnel, with the

assumption that this will produce the appropriate behavior change that will lead to the increase in productivity.

The assumption in measurement for motivational impact is that the personnel in the organization have a great impact on the productivity of the organization. While the technical subsystem is also important, the focus is not on that part of the system directly, but rather on how the technical subsystem is used by the personnel. Therefore, to increase productivity one needs to increase the productivity of the personnel in the organization.

This productivity increase would occur through changes in motivation, where motivation is broadly defined to include amplitude, persistence, and direction of behavior (e.g., Campbell & Pritchard, 1976). Personnel would exert more effort and be more persistent in their efforts. They would work more efficiently; their efforts would be more directly related to organizational objectives. They would also improve their work strategies and would use their own and others' time and efforts with less waste.

Implications of the Various Purposes. Each of these purposes requires a productivity measurement system that is quite different from and largely incompatible with the others. For example, if one wants to compare national economies, the economic approach is the only really practical method. This means using an efficiency approach with its advantages and disadvantages, because measuring the effectiveness of large numbers of organizations is not feasible. In addition, because of the practical constraints, only very macro measures of inputs and outputs can be used. Because such measures are so broad, they are not useful for management information systems or for day-to-day management. In addition, these macro measures will not be useful for guiding resource allocation within an organizational unit or for providing information useful for motivational purposes. To be comparable across organizations doing very different things, the only measures that can be used are those that are common across all organizations and for which data are available. This typically limits measures to partial productivity measures, typically focusing on labor productivity. Such measures will not give a complete picture of organizational functioning since they measure only some of the inputs and outputs. Finally, to compare national economies, the goal-oriented model of organizations must be used since the economic approach assumes that all organizations have the goal of generating maximum outputs with the least inputs.

If the purpose is to compare specific organizations to each other, then an economic or accounting approach is most appropriate. With these approaches, indices of productivity could be generated reflecting the functioning of the entire organization, and these indices could be used for comparison purposes. If the comparison is on the financial health of the organizations, then the accounting approach is more appropriate; if the comparison is on more general functioning, the economic approach would probably be chosen.

One main difference between measuring productivity for use as a motivational tool and the other purposes relates to the issue of separating out the effects of factors that personnel can control from those that personnel cannot control. In the other four applications, it is desirable to assess the combined effects of the personnel and the technology (management information system, organizational control) or the combined effects of the personnel, the technology, and the environment (organizational comparison or aggregated organizational comparison). Measuring productivity for motivational purposes implies measuring those aspects of the organization's productivity that the personnel can control. The principle is that to be maximally effective,

feedback should be limited to aspects of the work that personnel can control.

There are a number of other differences between the motivational purpose and the other purposes. One difference is that all aspects of the work should be measured. For example, both quantity and quality should be measured if they are both important. The other approaches must frequently be satisfied with incomplete measures of productivity, since measuring all important functions is not feasible. Another difference in the motivational purpose is that the productivity measurement system should be applicable to all units of the organization, not just production or areas where outputs are easily measured. Both effectiveness and efficiency are typically important in the motivational approach, since using just efficiency can produce the significant disadvantages discussed above.

Thus, it is clear that to ask what is the optimal conceptualization of productivity is the wrong question. The proper conceptualization depends on the purpose of measurement. Once the purpose is identified, decisions about which approach to take (e.g., economic vs. behavioral or efficiency vs. effectiveness) or which unit of analysis to use become much easier.

A Definition of Productivity

With all this discussion of the conceptual issues surrounding productivity as background, a definition of productivity can now be presented. *Productivity is how well a system uses its resources to achieve its goals.*

Embedded in this simple definition are a number of important points. First, productivity is a systems concept that can apply to various entities ranging from an individual or a machine to a company, industry, or national economy. The term *productivity* is and can be applied to any of these.

The definition also implies that productivity is a description of how well the system does something. As such, it is an evaluative concept. A productivity measurement system can evaluate how well the system does a variety of different things. A given measurement system can answer a number of questions about a system, but since different systems with different functions are present in an organization, one measurement system cannot evaluate all the systems and all the functions.

Thus, the developer or user of the productivity measurement system must ask what system and what functions of that system are to be evaluated. One could evaluate how efficiently national economies translate inputs into outputs, how efficiently the supply function works, or how effectively human efforts are translated into meeting organizational goals. These are very different systems and very different characteristics that are being evaluated.

This definition of productivity also includes both efficiency and effectiveness as part of productivity, in that both efficient use of inputs to produce outputs and producing outputs that meet organizational goals are included. As described earlier, some define productivity as simply an efficiency concept, expressed as outputs/inputs. However, this definition has severe limitations, especially in that efficiency alone ignores what the organization needs to produce and what the market is and implicitly devalues the need for allocating inputs to functions that do not have immediate effects on outputs. Another argument in favor of using both efficiency and effectiveness is that a definition of productivity broader than just efficiency has clearly been accepted by scholars and more popular sources. Ilgen and Klein (1988) make a good point when they state that "the definition used by society is much less restrictive (than just efficiency). As a result, this restricted definition is likely to confuse rather than enlighten" (p. 144).

While both efficiency and effectiveness are included in the definition, productivity is different from the concepts of output, production, profitability, production capability, and

performance. Output and production refer to the raw amount of output produced without regard to inputs or goals. Production capability is the organization's potential maximum output without regard to inputs or goals. Profitability refers to the difference between revenues and costs. Performance is a fairly nebulous term that typically refers to simple output or an evaluation of behavior.

This definition of productivity also accepts a goal-oriented model of organizations, with some revisions from the natural systems and the multiple constituency models. Like the natural systems model, the definition assumes that all systems in organizations have survival as their primary goal. However, beyond this overriding goal, they also have goals that are identifiable and describable and that are stable enough to guide action. This definition also agrees with the natural systems and multiple constituency approaches that it is inappropriate to think that these goals are totally the product of rational decision making and are the sole determinants of organizational actions. These goals and objectives are frequently determined after considerable activity has taken place rather than before (Simon, 1964; Starbuck, 1965; Weick, 1969). In addition, the determination of objectives is a developmental, evolutionary, and highly political process that is less than totally rational, and objectives sometimes must be set for an unknowable future (Pennings & Goodman, 1977; Pfeffer, 1977; Pfeffer & Salancik, 1977, 1978). Finally, objectives are indeed the result of a process of negotiation of different constituencies with different needs and varying influence (Pennings & Goodman, 1977). However, with all these complexities, the position I have taken is that for the practical purpose of measuring productivity, goals can be identified for the vast majority of organizations that are accurate and relatively stable indicators of the system's objectives.

The specific goals that the productivity measurement system will be based on depends on the objectives of those developing the system. The developers determine the system that will be measured and then identify the goals of that system. If the measurement is for a work group, the ultimate source of the system's goals is typically the management of the organization. However, one could just as easily talk about the productivity of that unit from the perspective of customers or the labor union represented in the work group. If such a group were developing the productivity measurement system, they would identify somewhat different goals for the system (the work unit), and the measurement would assess how well those goals were being met given the resources available.

This definitional approach has definite advantages. It avoids the conceptual bind of needing to specify what unit of analysis is productivity and what is not. For example, a question in the productivity literature is whether it is meaningful to speak of individual productivity. In my approach, an individual is a system with inputs, processing, and outputs just like a group, unit, organization, industry, or national economy. Since we can talk of the productivity of any system, an arbitrary specification of what unit of analysis is appropriate for inclusion in the concept of productivity becomes meaningless. It will typically be impractical to actually measure the productivity of individuals because of the difficulty of such measurement and the interdependencies of individuals in organizations, but in principle, individual productivity is an appropriate concept.

This definition also allows for any disciplinary perspective. The assumption is that all perspectives are valuable for evaluating certain aspects of certain systems. Once the system is identified and the functions or goals to be assessed are determined, whatever disciplinary perspective offers the best tools for the job should be used.

Measurement Issues Relevant to Productivity

Issues of Measurement

With these conceptual issues in mind, we can now turn to some measurement topics that must be considered in dealing with productivity. Some of these issues are unique to productivity measurement, while others are traditional issues that take on new twists when applied to productivity.

For the remainder of this chapter, I shall assume the behavioral perspective. That is, the purpose for measuring productivity is to improve it through the behavior of individuals in the organization. However, many of the issues raised will also apply to the other purposes.

Scope. A clear message that comes from both the feedback and the productivity literature can be stated simply as *What you measure is what you get.* The idea is that what is measured and especially what is fed back will produce behavior changes that will produce improvements in those things measured (Duerr, 1974; Peeples, 1978; Pritchard et al., 1988, 1989; Tuttle & Weaver, 1986b). This is a powerful phenomenon and has important implications.

One implication is that it is crucial that the system include measurement of all the important functions of the organizational unit, whether that unit be an individual, a group, a department, or an organization. Many authors have argued this point (Algera , 1989; Alluisi & Megis, 1983; Mahoney, 1988; Mali, 1978; Pritchard et al., 1988, 1989; Shetty & Buehler, 1985; Stein, 1986). The point is that because of the power of measurement and feedback, those functions measured take on particular importance in the operation of the unit. Functions not measured are implicitly given a lower priority. It is thus very risky to measure only a subset of the important functions and then expect personnel to focus equal attention on unmeasured functions. For example, measuring quantity and not quality and then expecting unit personnel to carefully attend to both would be a risky expectation. It is very common for this partial measurement to occur, usually because only those organizational functions that are easily measured are used, while those functions that are difficult to measure are ignored.

A second implication of the phenomenon that you get what you measure is that great care must be taken in what is measured so as not to result in unintentional negative consequences. What seems like a perfectly reasonable measure of a function may have negative consequences if unit personnel improve on that measure. Consider a unit that repairs equipment used by other parts of the organization. If a piece of equipment malfunctions, this unit must repair it as quickly as possible to get it back into operation. As a measure of the repair unit's functioning, one could divide the number of pieces of equipment repaired by the number of personnel in the unit. This would be a typical labor efficiency index and would seem to be a reasonable measure. However, to improve on the measure the unit should (a) do each repair faster, (b) make sure it has plenty of work to do so that there will be no idle personnel time, and (c) reduce the number of personnel.

The problem is that if the goal of the unit is to get equipment repaired quickly so that production can continue, labor efficiency is probably not very important. What is important is that the repairs be done rapidly so that down time is minimized. Consequently, reducing the number of personnel or developing a backlog of work so that there will be no idle personnel will in fact be the exact opposite of what should be done to improve the contribution of the repair unit. Both results would increase the time it takes the unit to complete the repairs. Thus, the labor efficiency measure has unintended negative consequences if the unit improves on it.

Reliability and Validity. Reliability and validity are the old standby criteria for good measures. Clearly, these concepts apply to productivity measurement as well. However, applying them to productivity is not a straightforward process.

Reliability estimates of productivity measures are complicated by the fact that productivity is a *state* rather than a *trait* concept. Variation in productivity over time would be expected due to changing work demands, number of personnel, availability of raw materials, and effort levels of personnel. Thus, any sort of test-retest or odd-even reliability measures would be inappropriate. Using these forms of reliability for productivity would be analogous to measuring the temperature each day and concluding that variation was an indication of the unreliability of the thermometer.

Internal consistency estimates of reliability would also be inappropriate. The internal consistency logic would dictate that the various measures of overall productivity should be considered items on an instrument and the intercorrelations between the measures should be the basis of the internal consistency estimate. This approach is inappropriate since there is no reason to expect that the ability of the unit personnel to attend to paperwork should be correlated with the amount of output they produce. One might even expect a negative relationship between indicators of productivity, since increasing the resources applied to one aspect of the work would typically mean removing resources from another.

Validity information is also a more complex issue in productivity measurement. The main problem is that there is no criterion against which to compare the productivity measure. If the unit has a good criterion for productivity, it would be pointless to develop another. Even if this were done, which of the two should be the ultimate criterion is not clear. If the new system does not correlate with the old one, is it because the new system has considerable error or because the old one does? Another explanation for the difference is that one system might include important functions of the unit that the other does not.

Part of the problem is that productivity measurement is an operational definition of organizational policy. Thus, a key validity issue is how well the measurement system captures the policy for that unit. Assessing this is not an easy task.

Objective Versus Subjective Measures. An unfortunate development in our field has been the artificial dichotomy between objective and subjective measures. We make a clear distinction between the two and argue or at least strongly imply that objective measures are better than subjective measures. There is actually much less difference between the two types of measures than this distinction implies (Campbell, 1977; Guion, 1965; Muckler, 1982; Seashore, 1972).

The term *subjective* connotes error, bias, and generally low-quality data. Subjective actually means that judgment is involved in the measurement process. But subjective judgment is involved in any measurement process. As Muckler (1982) noted, "it is not possible to measure anything without the intervention of the human at some point in the measurement process.... Human intervention is rampant in all...steps" (p. 25).

The subjective nature of measurement is particularly an issue in productivity measurement. What measures are chosen is a subjective process: It is based on judgment. The measures represent judgments made by organizational personnel regarding what the unit should be doing. If labor efficiency is measured and fed back to an organizational unit, a judgment has been made that high labor efficiency is an important thing for the unit to have. This is a subjective judgment, making the resulting measurement at least partially subjective in nature.

In addition, most productivity measurement systems attempt to combine the individual measures into an overall index reflecting productivity. To combine measures requires that they be expressed on a common metric and be aggregated. Choice of the common metric is by definition a value judgment. Economists use money, converting each input and output to its value in dollars. This sounds quite objective, but it is actually a subjective decision. It assumes that the financial status of the organization is the only thing of importance and that all functions of the organization can be converted to a dollar equivalent. Neither of these assumptions is completely true, but the decision has been made that they are true enough to make conversion to dollars a useful approach. The choice of an aggregation strategy is also subjective. For example, if different measures are combined according to their importance, judgment is required to decide the relative importance.

The real issue here is that any measurement system is a reflection of organizational policy. The measures reflect (a) what the unit should and should not be doing, (b) how important these functions are relative to each other, and (c) how the functions are combined to produce the overall contribution of the unit. Productivity measures are operational definitions of organizational policy, and policy is by nature subjective. No matter how objective the actual data are, the decisions that were made to select those measures and how they would be combined are subjective judgments. Consequently, the final measurement system must by definition have a strong subjective component.

Thus, whether a measure is subjective or objective is really an irrelevant point. Since all measurement systems are in part subjective, attempting to develop a totally objective system is futile.

What is important is the quality of the data, not its objectivity or subjectivity. Subjective data is seen as suspect because of its potential for bias. In the productivity area, the subjectivity of the measures is a special concern because of the possibility of intentional bias. If the subjective nature of the data can allow unit personnel to fake the data, or if individuals who make the subjective judgments can bias the measurement to inflate or deflate the contribution of a unit, the measurement system will be weakened. The solution is to conduct the measurement so that the data will be unbiased. The issue is not subjectivity—it is data quality.

Controllability. If the purpose of measuring productivity is to increase it through behavior, it is important that the measures be under the control of the personnel. The measures should be such that if personnel change their behavior, the measures change in predictable ways. Giving a unit feedback using measures over which they have little control weakens the power of the feedback system to motivate. In expectancy theory terms (e.g., Campbell & Pritchard, 1976), the relationship between effort and performance is reduced if the unit does not have control over the measures, thus weakening motivation.

Range of Application. Another issue in measurement is the types of work that are applicable for productivity measurement. Such measurement can be seen by many behavioral types as largely applicable to production-oriented settings, where objective measures of output are readily available. This perception is natural since most applications of productivity measurement have historically been made in such settings, and most descriptions of systems use production settings as examples. However, productivity measurement is applicable to almost any type of work. It can be done with professional, administrative, or scientific personnel doing cognitive, creative, or service activities. Measures such as units of scholarly work completed, success in meeting deadlines, number of corrections needed to the work later in the process, degree of customer satisfaction, number of return customers, success in

meeting budgets, and number of requests for corrections to paperwork are all perfectly appropriate output measures.

Such measures can be successfully used for productivity measurement in many types of work. For example, the approach to measuring productivity developed by my students and me (Pritchard, 1990; Pritchard et al., 1989) has been successfully developed for production-oriented work but has also been successful for measuring productivity of maintenance personnel, managers of insurance agents, bank personnel at several organizational levels, college professors, and air traffic controllers, as well as for measuring the productivity of an in-house library research unit, and a bar in a restaurant.

When measurement is proposed to personnel in these nonproduction jobs, their first response is typically, "You can't measure what we do." However, if you ask such people if they have any idea how well the unit is doing its job and whether they are doing better or worse than they used to do, they can usually answer. If they can, they are indeed measuring the productivity of the unit. The task of the measurement specialist is to get the information that is in their heads into a quantifiable measurement system.

Design Criteria for a Productivity Measurement System

Productivity measurement presents some unique issues not always present for other measurement problems. Many issues about specific productivity measures are raised in two excellent discussions by Mahoney (1988) and Tuttle (1981). I will deal here with more general issues. Ideally, a productivity measurement system should meet a number of design criteria to be maximally useful in changing productivity through behavior change.

Overall Index of Productivity. A productivity measurement system should produce an overall index of productivity. One reason a single index is important is its motivational value. A single index provides personnel with a sense of improvement or decrement. This allows them to see the results of their efforts and strengthens the ties between behavior and outcomes. A single index is also beneficial for its information value. A large number of pieces of information about organizational functioning can be very difficult to assimilate and use for making decisions.

A single index is also useful for attempts at organizational change. It is valuable for designing interventions such as goal setting and incentives because the single index can readily be used for setting the goal and as the basis for awarding the incentives. Multiple measures require multiple goals and make awarding incentives difficult. Having a single index also makes it fairly easy to evaluate the effects of behavioral, structural, or technological change efforts. Many approaches to measuring productivity use a single index (e.g., Joint Financial Management Improvement Program, 1976; Kim, 1980; Peeples, 1978; Pritchard et al., 1989; Riggs & Felix, 1983; Rowe, 1981; Tuttle & Weaver, 1986a, 1986b; Tuttle, Wilkinson, & Matthews, 1985).

Subindices of Productivity. Related to the use of an overall index of productivity is the use of subindices. Since the vast majority of organizational units do multiple activities, it is important to use multiple indices of productivity that provide information on the separate functions of the unit. Personnel can then see how they are doing on the different functions and change their behavior accordingly. Information on subindices is also useful for identifying problem areas and determining strategies to increase productivity.

Importance Weighting. The various things an organizational unit does are not of equal importance, and this differing importance must be preserved in the measurement

system. Measures of quantity, quality, extent to which preventative maintenance is done on schedule, and timeliness of paperwork may all be aspects of the work, but these activities would vary considerably in importance. Thus, some method of importance weighting must be used so differing importance is communicated and so that the measures can be aggregated into the single index in such a way that the differing importance is maintained.

Maintaining Nonlinearities. Another issue in productivity measurement has to do with the fact that there is frequently not a linear relationship between how much an organizational unit does of a given activity and the amount of contribution that level of the activity makes to the overall functioning of the unit. One situation in which this frequently occurs is where the value of the unit's output gets higher and higher until it reaches a point of diminishing returns. For example, a point of diminishing returns is frequently met once a large number of units are being produced and further increases in quantity are not as valuable. Another example occurs in the area of training. Training may be a crucial function in the organization, but training more people than needed to do the work becomes counterproductive.

Pritchard et al. (1989) refer to this as the nonlinearity issue because the function relating amount of output to value or effectiveness of that output is not linear. This means that attempting to get overall importance weights for combining measures is not the most valid approach, since the importance of a measure changes as a function of the existing level of the output. For example, suppose a unit manufactures a product and must also maintain its equipment. Overall, the amount of output is more important than doing preventative maintenance on the equipment. However, if number of units produced is already high and many pieces of equipment are overdue for maintenance, maintenance may become more important than further improvements to the number of units produced.

This problem has been recognized before. Campbell (1977), Kahn (1977), Seashore (1972), and Campbell and Campbell (1988c) have made similar arguments that more is not always better. A solution to the problem has been offered by Pritchard et al. (1989), who have developed a method of accounting for nonlinearities in measures of performance and productivity. Pritchard and Roth (in press) compared a productivity composite that accounted for nonlinearities with one based on a linear system and found that the nonlinear system produced information leading to very different decisions on how to improve productivity than did the linear system. Sawyer, Pritchard, and Hedley-Goode (1990) found similar results when they compared linear and nonlinear composites in performance appraisal measures.

Aggregation Across Units. Another desirable feature of a productivity measurement system is the ability to aggregate the measurement systems of different units into a single broader measurement system. For example, suppose one department of a community mental health organization has six sections. It would be desirable to develop a measurement system for each section and then aggregate those systems upward to produce, first, a single measure for the department, and then a single measure for the multiple departments.

Such aggregation requires that the separate functions of the smallest units be measured and that the measurement for the separate units be expressed in a common metric. Next, since not all units are equal in their contribution to the broader organizational unit, a determination of the relative importance or contribution of each of the units must be made in doing the aggregation.

Comparison of Units. It would also be desirable to be able to directly compare the

productivity of units doing quite different things. For example, it would be very informative to be able to compare a maintenance unit with a production unit in the same part of the organization. Such a comparison would be useful for allocating resources, producing competition between units, and awarding outcomes such as incentives and recognition to the units.

What is needed is some way of determining how well the unit is functioning given its resources, compared to other units given their resources. Such a comparison would indicate how good a job each of the units was doing.

Combining Efficiency and Effectiveness Measures. An ideal productivity measurement system should also be able to accommodate both efficiency and effectiveness measures, since both have advantages. A system that could only accommodate one or the other would not be as useful. It is also possible to combine efficiency and effectiveness measures in an attempt to get the advantages of both. One way to do this is to express output on a measure relative to goals or expectations (effectiveness) and then divide that index by the inputs required to produce the output. For example, suppose number of clients served was an important index of the quantity of output for a unit and that the expectation was serving 50 clients per day. If the unit averaged 55 clients per day, an effectiveness index might be 55/50 x 100 = 110%. This could then be divided by an index of labor hours expended to get a measure combining effectiveness and efficiency.

Approaches to Measuring Organizational Productivity

A number of specific approaches to measuring organizational productivity have been suggested (e.g., Craig & Harris, 1973; Deming, 1986; Joint Financial Management Improvement Program, 1976; Kendrick, 1984; Kopelman, 1986; Mali, 1978; National Center for Productivity and Quality of Working Life, 1978; Peeples, 1978; Pritchard et al., 1989; Riggs & Felix, 1983; Rowe, 1981; Sink, 1985; Tuttle & Weaver, 1986a, 1986b; Tuttle, Wilkinson, & Matthews, 1985). In this section, a sample of these approaches is discussed and compared to the desirable productivity measurement characteristics described above.

Kendrick. Kendrick (1984) discusses several types of measurement systems for single organizations, comparing different firms, and for industry and economy comparisons. Here the focus is on his discussion of a system for measuring the productivity of a single firm. He refers to this system as the American Productivity Center performance measurement system.

This productivity measurement system applies a combination of the economic and the accounting perspectives to the single organization. It is an attempt to develop productivity measures that are reconcilable with profitability measures. Kendrick (1984) makes the assumption that "any form of measure other than profitability risks being sidetracked if it is not reconcilable directly with profitability planning data" (p. 57).

The system starts with the following equation:

Profitability = productivity x price recovery

Profitability is the relationship between the value of the output and the value of the inputs used to produce those outputs. *Productivity* is the relationship between the amount of inputs used and the amount of outputs sold. *Price recovery* is the relationship between unit price and unit cost. It is an index of the ability or desire of an organization to pass on its unit cost changes through price changes.

To conduct the measurement, data are needed on the value, quantity, and price for each time period for each output and input of the unit being analyzed. Using this data, a

series of ratios are formed and compared over time. Kendrick notes that there are a number of complexities in using the approach and that sophisticated accounting techniques are required to use it.

The productivity part of the measurement system is an example of the economic/accounting approach, considering productivity to be the efficiency of the translation of inputs into outputs. It has all the advantages and disadvantages of such an approach that were discussed above. Another major advantage of this approach is the reconciliation with profitability. Such approaches also have a significant number of problems when applied to a single firm analysis. Kendrick discusses some of these as does Tuttle (1981) and Mahoney (1988). Essentially, a number of major assumptions have to be made for such approaches to provide valid measurement. For example, when the mix of products changes over time, comparisons of the output/input ratios are difficult to interpret. This would occur when new products or new models of existing products are introduced. One has to assume that such factors will have negligible effects or develop very complex correction factors to account for them.

Deming. One could argue that the Deming (1986) approach, known as *statistical process control*, is not really a productivity measurement system, but rather a method to improve quality. However, because it has considerable application in industry and is a very different approach than most others, it is worth discussion here.

The Deming approach is the outgrowth of his experience since 1950 helping Japanese organizations improve quality. It is based on the assumptions that (a) every goods- or service-producing operation can be viewed as a system with inputs, process, and outputs; (b) quality is what customers want; (c) quality and productivity are related because higher quality leads to decreasing scrap, rework, duplication, and wasted effort; (d) only management can change the system; and (e) people want to do a good job—that is, the desire to have pride in one's work is a powerful motivator.

Improving quality is the focus of this system. *Statistical process control* (SPC) is the primary means of accomplishing this improvement. The basic technique is to plot multiple measures of quality over time and compare this performance with expected variation in the measures. When the quality measures exceed the expected/acceptable range, personnel are expected to bring the measures back to the acceptable range. This is done by examining rejected units and determining the reason for the rejection. Causes are then prioritized and changes made to correct them. Identification of the causes are based on a series of problem-solving and evaluation techniques.

The measurement part of this approach is essentially the industrial engineering approach of control by measuring system output. What is unique is the focus on quality, the clear specifications of acceptable quality ranges, and the formal problem-solving techniques that take place when variation outside the limits occurs.

Rowe. Rowe (1981) developed a productivity measurement system for white collar workers at Westinghouse. The unit of analysis is the department, and the basic process is to use nominal group techniques to brainstorm ideas for ways of measuring productivity. Departmental management then selects the measures that best meet the departmental objectives. A composite departmental index is generated by weighting the measures by their importance and summing them into an overall index. An overall index aggregating all the different departments into a division-wide index is generated by weighting each department according to its importance.

Peeples. Peeples (1978) describes a productivity measurement system developed for data processing units at GTE. First, the overall

objectives of the units were established. In doing this, it became clear that both efficiency and effectiveness measures were needed. Next, measures of each of the objectives were developed. A point system was developed for each measure and points were awarded for different levels of performance on each measure: The higher the performance, the more points awarded. The more important indicators were given more points. The overall index was the sum of the points earned during a given period.

Tuttle. The *methodology for generating efficiency and effectiveness measures* (MGEEM) was developed by Tuttle and his associates (Tuttle & Weaver, 1986a, 1986b; Tuttle, Wilkinson, & Matthews, 1985). This approach is based on a well-developed conceptual foundation with a strong systems orientation. The methodology calls for using a formal measurement coordinator, someone external to the organization who is skilled at group process activities such as running meetings, facilitating group discussions, interviewing, and listening. MGEEM is a top-down approach where the objectives of the unit—termed *key results areas*—are first identified by management. Some of these top managers and their subordinates meet to develop indices that would measure how well the objectives are met. Group discussion and nominal group techniques are used to accomplish this.

Once the specific efficiency and effectiveness measures have been developed, they are combined using the approach suggested by Riggs and Felix (1983). The Riggs and Felix approach is a sophisticated productivity measurement system in its own right. In this approach, the current level of functioning on each indicator is given a value of 3 and the goal for that indicator is given a value of 10. Subgoals are established in between, with point values from 4 to 9. Levels of performance below the current level are given values from 0 to 2. Overall importance weights are established for each indicator. Productivity for each indicator is the obtained point value multiplied by the importance weight. Overall productivity is the sum of these products. To aggregate across units, the overall productivity score of each unit is weighted by the importance of each unit, typically determined by the number of personnel in each unit.

Pritchard. The last productivity measurement system to be discussed was developed by Pritchard et al. (1989) and is referred to as the *productivity measurement and enhancement system* (ProMES). The most complete description of the system can be found in Pritchard (1990). This system is based on the conceptualization of motivation and roles developed by Naylor, Pritchard, and Ilgen (1980). The first step in the development of this system is for a group of first- and second-line supervisors and representative incumbents to develop the objectives of the unit through group discussion. Next, measures of how well the unit is accomplishing each of the objectives are identified. When consensus is reached by the group, the objectives, termed *products*, and the measures, termed *indicators*, are presented to higher management for approval.

After measures are approved, they are combined into a single index by developing what are termed *contingencies*. A contingency is a graphic function representing the relationship between the amount of an indicator and the contribution that amount of the indicator makes to overall productivity. In essence, the possible values of the indicator are scaled as to how much contribution each value would make to the overall effectiveness of the unit. A series of steps are used in developing contingencies, but the basic process is for the group of supervisors and representative incumbents to go through a set of discussions that result in a step-by-step building of the contingencies and getting them approved by upper management.

The contingencies have two noteworthy features. First, the overall slope of the function

expresses the relative importance of the indicator. A steep slope implies that variations in the indicator result in large variations in productivity; a less steep slope implies that variations in the indicator result in smaller variations in productivity. A second noteworthy aspect of the contingencies is that they can be nonlinear. A contingency allows for a constant amount of change in the indicator to result in a differential change in productivity.

Actual applications of the system have indicated that nonlinearities are the rule rather than the exception. For example, Pritchard et al. (1988, 1989) found that none of the 45 indicators in their study of five organizational units were linear.

Once the contingencies are completed and approved by higher management, the overall index of productivity is generated. First, the indicator data for a given time period is collected. Then the corresponding effectiveness score for each indicator is determined from the contingency. For example, if 23 units were produced, there would be a corresponding effectiveness value for that level of output. An analogous effectiveness value for each of the indicators would be calculated from the corresponding contingency. These values are then summed to obtain an overall measure of productivity.

From this basic information, feedback reports are generated and fed back to unit personnel and management on a regular basis. Meetings between incumbents and supervisors are then held to evaluate the reports and identify strategies to improve productivity.

This system also has other features. It will accommodate both efficiency and effectiveness measures. It will allow for aggregation of the measurement system from individual units into larger organizational units and for direct comparison across units doing different things. It also has a mechanism for identifying in quantitative terms what the priorities should be for improving productivity.

Comparison of the Systems

These representative productivity measurement systems vary considerably in the purpose of measurement, the sophistication of the measurement process, and the features the systems include. The similarities and differences are summarized in Table 1. The table starts with the primary purpose of the system from among the five primary purposes described earlier in the chapter. While the primary purpose of each is indicated, a number of the systems are capable of being used for the other purposes as well.

In addition, the desirable characteristics of productivity measurement systems reviewed above are used as the factors against which to compare the different systems. If a system provides an *overall index* of productivity for the unit measured, this is indicated. The next comparison factor is whether the *subindices* measured by the system are *on a common metric*. All the systems described use subindices. The issue here is whether the system can express each of the subindices or multiple measures on a common efficiency or effectiveness metric. *Important weights* and *nonlinearities* refer to whether the system has a formal way of dealing with the varying importance of measures and their nonlinear characteristics. *Aggregation across units* is an indication of whether the system has a described methodology for combining units into broader organizational units. *Direct unit comparison* refers to whether a method of comparing the productivity of units doing different things is presented. The last comparison factor is whether a system accommodates both *efficiency and effectiveness* measures.

In making the comparisons, if a system formally includes a feature such as direct comparison across units, it is so indicated by a "Yes" in that cell. If a feature is not formally discussed by a given system, it gets a "No" in the table. However, it should be noted that it is possible to modify some systems from their original formulation using procedures

	Kendrick	Deming	Sink	Riggs	MOFAM	ProMES
Primary purpose	*Management Information*	*Control*	*Motivation*	*Motivation*	*Motivation*	*Motivation*
Overall index	Yes	No	Yes	Yes	Yes	Yes
Subindices on a common metric	Partial	Partial	Yes	Yes	Yes	Yes
Importance weights	No	No	Yes	Yes	Yes	Yes
Nonlinearities	No	No	No	No	No	Yes
Aggregation across units	Partial	No	Yes	No	Yes	Yes
Direct unit comparison	Yes	No	No	No	No	Yes
Efficiency and effectiveness	No	No	Yes	Yes	Yes	Yes

suggested by other approaches to achieve a given feature. A system is given a "Partial" if it has the feature in some methods of its application, but not in all.

Conclusions

A number of conclusions can be drawn from the productivity literature.

- *Without productivity growth, our nation will ultimately have severe problems.* It is clear that productivity growth is vitally important to our economy, our organizations, and our overall quality of life. Thus, the importance that has been placed on productivity and productivity growth is most appropriate.
- *Perspectives on productivity vary widely.* Many different disciplines have made contributions to productivity. These disciplines have very different perspectives on what productivity is, what questions should be addressed in productivity research, and how productivity measurement should be conducted. It is thus important to know the other person's perspective when talking about productivity. Furthermore, it is not uncommon for some individuals to assume that their perspective and approach is the correct one and that others are interlopers in their productivity domain. One should be sensitive to this attitude when dealing with others about productivity.

- *Do not confuse performance with productivity.* Performance and productivity are different things. While definitions of both vary, there is a clear consensus in the productivity literature that they are different. Performance is simply output or, in the case of performance appraisal, an evaluation of behavior. Productivity is output relative to inputs or relative to goals. Psychologists are frequent abusers of this distinction. The terms should not be used interchangeably.

- *Changing performance may or may not change productivity.* With the heavy emphasis on behavior in productivity, it is easy to assume that changing something about individuals will change productivity. For example, one might speak of how selection will improve productivity. However, the link between the individual and productivity is not that simple. For example, suppose we focus on the productivity of a work group. Here individual knowledge, skills, and abilities are translated into individual behavior through a process of training and motivation. The individual behavior is then combined through role perceptions, cooperation, leadership, group level motivational factors, and various constraints such as availability of materials and equipment functioning to result in group output. When this output is reflected against goals or inputs or both, productivity results. Thus, changes in knowledge, skills, and abilities or changes in training or individual motivation have their effects on productivity only indirectly. Consequently, it is a bit simplistic to assume that simply changing individuals will have a strong and direct effect on productivity.

- *Positive [illegible] conceptualization and measurement.* Many of the lessons learned from areas such as criterion development, personnel selection, and organizational effectiveness are quite appropriate for the conceptualization and measurement of organizational productivity. However, there are a number of issues that are unique to productivity. One should not simply assume that a good knowledge of our more traditional content areas will automatically lead to a complete grasp of the productivity area. It is too easy to assume that productivity is really a slight variant on performance appraisal or criterion development. It is not that simple.

- *Good methods of productivity measurement are available.* There are a number of distinct methodologies for measuring productivity, some of which are quite sound.

- *We can have a major impact on productivity.* Powerful methods of productivity measurement have been developed that are especially geared to providing feedback to increase productivity. In addition, while we have not focused on interventions in this chapter, many powerful interventions, such as goal setting, incentives, quality circles, and gainsharing, are available. If used with a good productivity measure, such interventions can result in major increases in productivity.

While we can have a powerful impact on productivity, we must be aware of our limitations. The impact we can have with the behavioral approach is limited by the amount of variance in total organizational productivity attributable to behavior, as opposed to factors such as technology and factors external to the organization. Where variations in behavior do

not have much impact on productivity, our contribution will be limited.

Productivity is an area that is important, where we have much more to contribute, and where these contributions are welcomed. It is clear that the behavioral approach has made major contributions already, and we can make many more. The future looks very bright.

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