The Business Roundtable

MEASURING PRODUCTIVITY IN CONSTRUCTION

A CONSTRUCTION INDUSTRY COST EFFECTIVENESS PROJECT REPORT

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MEASURING PRODUCTIVITY IN CONSTRUCTION

TABLE OF CONTENTS

I. SUMMARY 1

II. OBJECTIVES 3

III. INTRODUCTION 3
- Measurement Concepts 4
- Measuring Construction Productivity 5

IV. HOW STUDY WAS MADE 7

V. FINDINGS 7
- General 7
- Site Productivity Measurements 7
- Site Productivity Indicators 8
- Government Productivity Measurement 9
- Government Productivity Indicators 11

VI. CONCLUSIONS 12

VII. RECOMMENDATIONS 13

VIII. REFERENCES 15

IX. APPENDICES 17

A. A Plan for A National Construction Productivity Center 17

B. Supplemental Material (Separately published) 21

B-1. Construction Industry Size
B-2. Construction Site Productivity Measurement
B-3. Work Sampling & Foreman Delay Surveys

I

SUMMARY

The decline of productivity in the construction industry during the past decade has led to the recognition that better ways of measuring construction productivity are needed. Measurements of productivity are probably prerequisite to improving it — by quantifying both current performance and the effects of changed methods or conditions. Construction project managers require productivity data to guide their efforts, and owners need to know how effectively their projects are being managed.

Unfortunately, construction productivity data for nationwide use is not available. The Bureau of Labor Statistics (BLS) productivity data for construction, unlike the data for other industries, is considered unreliable by BLS and is not published. Moreover, a single measure of productivity, even if accurate, is insufficient for such a diversified industry as construction. Logical segments of the industry should be examined separately and several measures devised for each. This will then enable owners to compare performance on their projects against industry norms.

Our studies show that much of the information for deriving reasonably sound productivity indexes for selected construction industry segments already exists since it is collected at construction sites by individual owners and contractors. Thus the need is not to develop new site productivity measurement systems but rather to find ways to effectively disseminate data from the existing systems to owners and contractors.

Our studies also indicate that the construction industry is larger than the widely-accepted figures reported monthly and annually by the Commerce Department. The true dollar value of new construction put in place may be a shocking 30% greater.

The team proposes two productivity-measurement programs, one to be developed by private industry to provide productivity data from selected construction industry segments and the other based on improved government data for aggregate industry measurement. The systems would be independent of each other, but there would be a potential for information exchange.

Primary recommendations are:

- Private industry should establish a program to collect and correlate site-level productivity data from owners and contractors and issue periodic reports on productivity in those construction sectors of concern to private business. A central source should be established to define the data to be collected, devise procedures, and help owners and contractors in setting up and carrying out their part in the program.
- Government agencies should develop a long-term plan to improve their construction statistics and productivity measurement programs. Construction owners should cooperate with the agencies and offer suggestions where needed.

II

OBJECTIVES

Productivity in the construction industry has declined in the last decade. The extent of the drop is not clear, but many authorities believe it to be about 20% at the aggregate industry level. There are also indications that the decline has not been the same in the various segments of the industry and that productivity in industrial and power construction has fallen the most.

The objective of this study was to review present construction productivity measurement procedures and to devise a program that will:

- Provide systems to measure productivity in construction at the aggregate industry, industry segment, and site levels.
- Collect and disseminate construction-productivity data on a national basis.

A secondary objective was to examine current data and suggest procedures to determine more accurately the size of the construction industry and its segments.

III

INTRODUCTION

Measurement plays an important role in improving labor productivity in construction. It provides a way of determining trends and levels of productivity and the response to corrective actions and/or inactions. Appropriate construction-productivity measurement will help owners (and construction managers) to:

- Determine how effectively ***their*** projects are being managed.
- Detect adverse trends quickly so corrective actions may be taken.
- Determine the effects of changed methods or conditions.
- Identify both high and low areas of productivity and reasons for the differences.
- Compare the performance of different contractors.
- Provide a means to assess the results of the CICE program.

Measurement Concepts

Productivity measurement is commonplace in many industries. The basic concept is a ratio which relates some volume of output to some volume of input. It measures the use of resources or the degree of their use.

$$\text{Productivity} = \frac{\text{Output (units of products)}}{\text{Input (resources)}}$$

The two sides of the ratio can be quantified in different ways. The most common productivity measures relate output to the quantity of labor used, that is, to hours. This is so partly because statistics of hours are easier to get than other input measures but also, and more importantly, because hours of human labor are our prime economic resource.

Productivity may also relate output to capital input. In measuring the change in capital productivity over a period of several years, the capital input figures must be stated in constant dollars. This is difficult for an individual enterprise and even more difficult at higher levels of aggregation.

The most common concept of productivity expresses output in physical units; e.g., numbers of cars or tons of steel. But as we move from a simple, one-product type of operation to more complex multicomponent outputs, as, for example, from a project, firm, or industry, this concept becomes more difficult to measure with adequate accuracy. Different kinds of output have to be equated in some way so they can be added together. A frequently-used method is to use dollar values, but adequate price deflators are needed to measure changes in real (i.e., physical) terms over a period of time.

A productivity ratio does not necessarily measure the efficiency of the specific resource being used as the input measure but rather the combined effect of a number of factors. An everyday example of an output/input ratio is an automobile and its gas mileage. The miles per gallon are usually not affected by the brand of gasoline but depend on the size of the automobile's engine, quality and efficiency of the mechanical equipment, its speed, and how and where the car is driven. The same principle applies to measuring most outputs per man-hour input. The capabilities of labor are usually not being measured. What is being determined is the effectiveness of the system in converting man-hour efforts into useful products.

Measuring Construction Productivity

The measurement concepts apply not only to industry in general but also to the construction industry. Because of the unique character of the construction industry, some points need special emphasis.

The use of a labor-productivity measure (e.g., output per man-hour) is important for construction because labor constitutes such a large part of the cost of construction. Moreover, the quantity of labor required is more susceptible to the influence of construction management than are quantities of either capital or materials.

Output is a particular problem in measuring construction productivity. There is no single and broadly applicable physical term, such as a ton of steel, that describes the product. Single-family houses and nuclear power plants are both outputs, as are roads, office buildings, and manufacturing plants. But hardly any two of them (except for some houses) are alike. However, there are several types of output that are common to all these different products.

- *Dollar value* of construction put in place is a convenient measure of output and has the advantage that all kinds of outputs can be added together. It is useful in deriving productivity figures at national aggregate levels, for industry segments, and for individual projects.
- *Functional units* such as plant production in terms of pounds or kilowatts or buildings in terms of square feet are convenient but are applicable only to specific types of construction.

Construction site managers need measurements that apply more specifically to their work, such as:

- *Construction tasks* — that is, the measurement of cubic yards of concrete or square feet of some surface, or tons of steel, or linear feet of welds. When related to man-hours and wage rates, these measurements are called unit costs. One problem in using such data is that there are so many different unit costs to monitor.
- *Larger units of construction* — One way to simplify the complexity of monitoring a large number of construction tasks is to combine some tasks and develop a higher level measure of the work. For example, measure a mile of highway as an output rather than the yards of concrete, tons of steel reinforcing bars, square feet of forms, and many other items involved in building a mile of highway. Larger work blocks of

this sort can be developed for almost all categories of construction, though it is difficult to maintain common definitions of the work included.

On the other side of the equation – inputs – by far the most readily available and most important are man-hours of labor. This is the only input we are considering for our productivity ratios at this time. If the data are available, capital and other factors can be considered as parameters that affect the man-hour ratio.

All of these measures – and their combinations – are useful. As John T. Dunlop, former Secretary of Labor, has observed:

> "There is no sense in arguing over the question of what single measure of productivity we need to use. It is very clear that there is, and we need to use, a large family of measures. Some of these should be aggregative. Some should be applied to particular and narrow segments of the industry, such as residential construction. Some of these measures should refer to highways, pipelines, power generation plants, or other segments of the industry. Some of them ought to be narrow enough so that they are concerned with particular localities, metropolitan areas, or regions.
>
> The use of these various factors requires one to be very acutely aware that their meaning and their purposes vary a great deal. One should not, I think, look for a single-purpose measure. Some measures are more appropriate for manpower planning and manpower utilization. Some measures are more appropriate for comparing localities and branches of the industry, appropriate for a contractor who wants to know something about the efficiency of workers in San Francisco as compared to Centralia, IL, or as compared to other places we might mention. Some difficulties have been created because we have assumed that a measure of productivity has only one purpose, when the actual purposes may dictate quite different measures."

IV

HOW STUDY WAS MADE

The study team began by reviewing available construction productivity measurement information. Contractor and owner members of the team provided confidential data and other information not publicly available. A consultant was engaged to prepare a comprehensive summary and critique of data from government agencies and other sources. The inadequacies of current industrywide construction productivity information quickly became apparent. The team then directed its effort toward:

- Defining the data needed by owners, contractors, and others.
- Obtaining assistance from the Joint Center for Urban Studies (Harvard/MIT) for an in-depth examination of construction productivity measurement by federal government agencies.
- Contacting major contractors and owners to explore the availability of their data.
- Preparing several manuals to assist in the measurement and control of productivity at construction sites.

V

FINDINGS

General

No satisfactory measures of aggregate construction industry productivity data are currently available. The Bureau of Labor Statistics (BLS), the source of productivity data for many industries in the United States, does not publish construction productivity data because they consider it unreliable. More important to construction owners is the site productivity data which many owners and contractors are now using to monitor and improve productivity on their projects.

Site Productivity Measurements

Site productivity data is at the level where construction management can achieve timely, effective results in maintaining or improving

productivity trends. Measurement is necessary to assess the results of management action. Since there are no productivity performance standards, owners do not have the benefit of comparing their project performance to similar projects of others.

Discussions with a number of construction owners and contractors indicate that:

- Most large contractors have a formal program for measuring labor productivity on job sites.
- Some owners routinely monitor site productivity as they or their construction managers oversee projects.
- There is no one best way to measure site productivity. The most effective systems, however, have similar basic procedures. Work quantities (cubic feet of concrete, feet of pipe, etc) are determined and man-hours of effort recorded as increments are completed.[1]
- Some owners and contractors have developed productivity indexes which they use to track trends over time and/or in varied locations.
- At least one owner group began not long ago to collect, correlate, and share among its members productivity data about the construction of their similar-type plants.

Except for the actions of a few individual large contractors and owners, there have been no efforts to collect and correlate this information nationally or regionally. None of these data are included in the construction statistics of the government bureaus.

Site Productivity Indicators

Some owners and contractors derive an indication of site productivity through programs that measure the time spent on ***work activities*** rather than ***work output.*** The programs usually supplement direct productivity measurement and have the desirable features of providing information rapidly and at low cost.

Two frequently-used techniques are work sampling and foreman delay surveys.[2] They are similar in that they obtain data of time spent on direct work activities as opposed to time expended on

[1] Appendix B-2 is a separately published manual on construction site productivity measurement & control available from The Business Roundtable.

[2] Appendix B-3 is a separately published manual on work sampling & foreman delay surveys available from The Business Roundtable.

nonproductive activities or delays. Work sampling has been a tool of industrial engineers for decades. It collects data about activities through statistical procedures based on the laws of probability. The forman delay survey is a recent development from within the construction industry. It is a formal, uniform procedure for obtaining and analyzing information from construction foremen about problems that have created delays in job-site work and how much lost time each problem has caused.

Government Productivity Measurement

The federal government is the primary source of national productivity data, but the coverage and statistical adequacy for the construction industry leaves much to be desired. However, their data about construction is extensive and has a potential usefulness which should not be ignored.

The Bureau of Labor Statistics (BLS) of the Department of Labor publishes productivity measures quarterly for the total private business economy and some major subdivisions using gross national product data for the output side of the ratio. BLS attempts to break this down into industry sectors — manufacturing, transportation, etc — using data from the Department of Commerce on gross product originating in the sector. The latter is roughly equivalent to the value added by the sector; i.e., it excludes the value of purchased materials and equipment which constitute a part of the final output.

The contract-construction industry is one sector for which the BLS has constructed indexes of gross product originating per hour. However, the BLS recognizes that serious deficiencies may exist in this measure and consequently for many years has declined to publish it.[3] It has made the indexes available to individuals, on request, with reservations and with strong admonitions about their weaknesses. There are three major problem areas: understatement of volume, inadequate price deflators (cost indexes), and incompatibility of output and input.

Volume — The gross product originating figures put together by the Commerce Department are derived from Bureau of Census' estimates of the dollar volume of construction put in place. Census' estimates for industrial and commercial construction are based on F. W. Dodge

[3]In 1981, the Department of Commerce published a set of construction industry productivity indexes, despite their statistical deficiencies (***Construction Review,*** May-June, 1981). These show that productivity in new construction put in place fell from an index number of 100 in 1972 to an index number of 82.9 in 1979. This trend agrees with the CICE concept, but the exact figures are debatable because of the questionable data.

reports of contract awards; from these a sample of projects is selected and their owners are asked to provide monthly progress reports. This study team has convincing evidence that this method of collecting statistics leads regularly to a high understatement of the volume of industrial construction and some other segments of the industry.

A detailed analysis of the construction-industry size has been prepared by the study team and is available separately from The Business Roundtable (see Appendix B-1). Briefly, our examination concludes that the Government's procedures are not collecting all the data they are intended to collect. The term "construction" in the government procedures is defined in a way that does not reflect construction work as understood by the industry. A particular issue is the distinction between "structures" and "equipment".

A measure of the size of the construction industry in the U.S. is commonly based on the Census Bureau figures for the value of new construction put in place during a calendar year. The team has augmented these figures with the new plant and equipment expenditure data collected by the Bureau of Economic Analysis of the Department of Commerce. The government figures and the team's estimate are compared in Table 1. They suggest that the government's official figures for total construction value should be increased by more than 30%, with almost all of the change in industrial, office, and commercial construction. In the study team's estimate, industrial construction increases more than fourfold; office and commercial buildings construction rises 50%. The figures for public utilities construction are not changed since published government data are derived from capital expenditures reports and not through the survey methods used for the other segments.

The study team held several discussions with Census Bureau officials about these seemingly gross discrepancies. They were receptive to our comments aimed at improving their construction statistics. We hope over time improvements will be made.

TABLE 1
U.S. CONSTRUCTION INDUSTRY SIZE

	1979 Government Figures (billions)	Study Team Estimate (1979) (billions)
Industrial	$ 14.95	$ 69.0
Office Buildings	9.46	14.2
Commercial Buildings	15.46	23.2
Other Private Business	2.99	4.5
Farm and Private Institutional	11.59	14.6
Public Utilities	26.47	26.5
Residential	99.03	99.0
Government	49.00	49.0
TOTAL NEW CONSTRUCTION	$228.95	$300.0

Defects in Price Deflators - The work-put-in-place figures are in dollars, initially collected in current dollar values. These are converted to constant dollars to allow meaningful approximations of the changes from one year to any other in physical volume of output. Most price deflators for construction are made by developing price indexes for materials and labor (i.e., wage indexes), then adding the two together. Thus, any relative savings arising from the improved productivity of labor or, alternatively, from improved methods or materials are not captured. Over a period of time, such deflators tend to overstate increases in construction costs and, consequently, to understate the physical volume of the indexed work.

Output and Input — A Statistical Misfit? - The gross product originating estimates (output) are based on data adjusted by the Commerce Department to reflect only contract-construction volume. The man-hour figure (input) collected by BLS came from construction contractors. But the data may not really be compatible because 1) the output and input data come from two different sources, and 2) the dates for work put in place may not correspond with the dates covered by the man-hour figures.

Government Productivity Indicators

BLS for some years has regularly published reports on labor and materials requirements for selected segments of construction that are wholly or partly federally-supported: one-family housing, college dormitories, hospitals, highways, schools, and a few others. With a few exceptions, they have not covered industrial, utility, or commer-

cial constructions, the types in which The Business Roundtable has the most interest.

BLS does not call these ratios productivity indexes. The constant dollar estimates are subject to the inherent defects of price deflators, which are at best approximations. The output data are affected by changes in design, structure, materials mix, and prefabrication, all of which can affect productivity.

VI

CONCLUSIONS

- Greater use of site productivity measurement systems is needed. Owners should insist that all large- and moderate-size projects have an effective site measurement system.
- Present construction statistics and aggregate productivity measurement systems are inadequate.
- A single industry measurement of productivity is insufficient. While it might provide useful information for economists and planners, it would not meet the need at the level where decision making and action are taken to produce improvements in productivity.
- The construction industry needs a series of productivity indexes. These indexes should be designed to permit owners to compare the performance of their projects with similar projects. The indexes should also provide the ability to compare parameters such as craft productivity, type of work, and performance by geographical area.
- Existing owner/contractor data can be used to derive productivity indexes. The information has to be collected systematically and presented in varied forms to fit the needs of both owners and contractors. This is unlikely unless owners take the initiative.
- Improvements in government collection of construction data and aggregate productivity measurement systems are highly desirable.

VII

RECOMMENDATIONS

General

Government agencies should take appropriate steps to improve the accuracy of current construction industry statistics. These data are important to construction users and economists and are essential for eventual development of aggregate construction industry productivity measures.

While aggregate construction industry productivity is important, owners are more concerned about productivity at the site level. A system independent of government sources should be established to measure site-level productivity in selected private construction sectors.

Specific Recommendations

For Owner Action:

1. A privately funded and operated national productivity center[4] is needed to:
   - Assist site construction managers in establishing site productivity measurement and control programs.
   - Collect site productivity data from various construction owners, owner groups, and contractors in business-related construction areas.
   - Correlate and analyze data and issue periodic reports of productivity in industrial, public utility, commercial, and office-building construction (data compiled to show the effects of geographic location, project size, type of projects, open- or union-shop, performance of major crafts, and other major project influences).
   - Encourage business firms to cooperate with government agencies in providing appropriate construction data.
2. Owners should insist that adequate productivity measurement systems be used on their construction projects.

[4]See Appendix A for a more detailed discussion of such an organization.

For Government Action:

1. The Census Bureau needs to adopt a more accurate system for collecting the facts about the value of industrial construction and construction that it classifies as "other nonresidential". This can be done by minor revisions in the procedures already used by the Commerce Department's Bureau of Economic Analysis for its quarterly figures on private expenditures for new plant and equipment and substituting these figures for the present Census figures. The changes would also reduce the burden of reporting to the government for some companies.

   The Census Bureau should also regroup some of the categories presented in its reports of the value of construction put in place so that logical segments of construction are more readily apparent. The most important change is to separate industrial construction from its present position as one component of nonresidential buildings.

2. The Bureau of Labor Statistics should expand the areas of construction covered by its programs to include, among other things, such segments of construction as industrial, utility, and commercial, which are now inadequately covered. At the same time, the Bureau could reduce the amount of data it collects for each project in order to keep the cost of the statistical effort within bounds.

3. The Commerce Department and the Bureau of Labor Statistics should develop a long-term plan for improving statistics and aggregate productivity indexes for construction. Current procedures were devised to utilize data which were available but had been developed for other purposes, and these data have proven to be inadequate and unreliable for productivity measurement.

VIII

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3. *"Construction Work Sampling,"* October 1981, prepared by H. Randolph Thomas, associate professor, Penn State University, under contract to The Business Roundtable.

4. *"An Examination of the Productivity Decline in the Construction Industry,"* April 1980, H. Kemble Stoker (Department of Commerce).

5. *"Is Construction Productivity Declining?,"* June 1980, Clint Bourdon (Joint Center for Urban Studies).

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7.&8. *"Productivity in the Construction Industry,"* by - J. E. Cremeans and *"Economic Trends in the Construction Industry"* by Patrick H. MacAuley, May-June 1982 issue of ***Construction Review,*** U.S. Department of Commerce (Bureau of Industrial Economics).

9. *"Value of New Construction Put in Place in the United States - 1964 to 1980"* (Construction Reports C30-80S), July 1981, Census Bureau.

10. *"BLS Handbook of Methods for Surveys and Studies,"* Bulletin 1910, 1976, Bureau of Labor Statistics.

11. *"Economics of the Construction Industry,"* 1969, research report prepared by Peter J. Cassimatis for the National Industrial Conference Board (SBE No. 111).

12. U.S. Government Periodicals:

- ***Survey of Current Business,*** monthly, Department of Commerce, Bureau of Economic Analysis.
- ***Construction Review,*** bimonthly, Department of Commerce, Bureau of Industrial Economics.
- ***Monthly Labor Review,*** monthly, Department of Labor, Bureau of Labor Statistics.
- ***Construction Report - Value of New Construction Put in Place,*** monthly, Department of Commerce, Bureau of the Census.
- ***Economic Indicators,*** monthly, Council of Economic Advisors for the Joint Economic Committee (of Congress).

IX

APPENDIX A

A PLAN FOR A NATIONAL CONSTRUCTION PRODUCTIVITY CENTER

The ability to measure construction productivity is of paramount importance in the quest for improved cost effectiveness. It is a commonly accepted premise that the ability to objectively measure performance can and will lead to improvement. Of the three elements in construction productivity measurement—site productivity measurement, industry norms or standards for site performance, and measurement by industry segment—only site productivity measurement exists in a form and degree of accuracy of acceptable quality.

It is apparent from the study team's research that the only realistic short-term approach to developing the other two elements is through a privately-funded and operated construction productivity center.

Such a center would:

- Collect, analyze, and correlate site productivity data provided by owners.
- Define the required data, establish procedures for collecting it, and help owners to set up and conduct their owner job-site productivity measurement programs.
- Issue periodic reports of construction productivity in industrial, public utility, commercial, and office-building construction and some of their subsegments.
- Identify from the data provided the factors that contribute to productivity variations.
- Represent industry in a long-range program to improve government construction statistics and aggregate productivity measurement.

Chart 1 (page 20) provides a schematic diagram listing the major functions of a construction productivity center. It also shows the relationship with other elements concerned with the industry.

The business construction sector, approximately 45% of total annual construction, should be split into logical segments based on type of construction and business similarities. The segmentation should also be compatible with industry statistics available from government

agencies. This could be done in several ways. One suggested scheme is:

Construction Segment	1979 Construction Volume $ Billions
Chemical Process Industries	40
Other Manufacturing Industries	29
Office and Commercial Buildings	37
Electrical Power and Gas Utilities	18
Communications	8
Other	5
	137

It is proposed that trade associations and other groups within the listed segments be asked to organize and coordinate a large part of the data collection for their segment. This will minimize the staff required for the data center and also allow direct participation by knowledgeable persons from each business segment. If the site data are obtained in this manner, we believe the center could begin with a staff of two professional employees (plus clerical help) and a budget of about $250,000 a year. Typical of the organizations that should be asked to work with the center are the Chemical Manufacturing Association, the Edison Electric Institute, the National Petroleum Refineries Association, and similar groups in other construction segments.

Contractor associations can also play a major role by providing cost data and also estimating information. Agreed-upon estimating units could possibly be used as standards to measure actual job performance. The larger specialty groups such as MCA (Mechanical Contractors Association) and NECA (National Electrical Contractors Association) could make a unique contribution, as could ABC (Associated Builders and Contractors), AGC (Associated General Contractors), NCA (National Contractors Association), and others in the general contractor area.

Although it is desirable that data be collected and screened by appropriate groups before being sent to the center, there will be circumstances where the center will receive data directly from individual owners or contractors. Also, current users' groups could be an all-important data organizing source.

The exact form of the productivity data and how it will be correlated is not clear at this time. The data from each of the construction

sectors must emphasize the predominant work in that sector. The importance of specific unit-cost information will obviously vary from one type of construction to another. For instance, the cost of labor for installing piping is significant for chemical-process plants and oil refineries but much less important in commercial or office buildings where steel and concrete unit costs are more significant. Groups representing various segments of construction should decide what data are most important to them and work out uniform ways to obtain and issue relevant information.

The center must assure the confidentiality of the sources of the data provided to them. Owners should expect to receive reports that show a number of individual data points, various correlations, calculated averages, etc, of productivity performance in areas of interest to them; they do not need to know who provided them. They, of course, will be able to identify their own data and how it compares to the performance of others.

In addition to correlating, analyzing the data, and issuing periodic reports, the center should help owners initiate or continue their site productivity measurement programs and oversee the data-collection effort. Agreed upon definitions must be developed, data-collection procedures established, and data sources organized so that the results will have statistical soundness. The data should be compiled so as to show the effects of geographic location, project size, type of project, open- or closed-shop operation, and other parameters at the project and major craft levels.

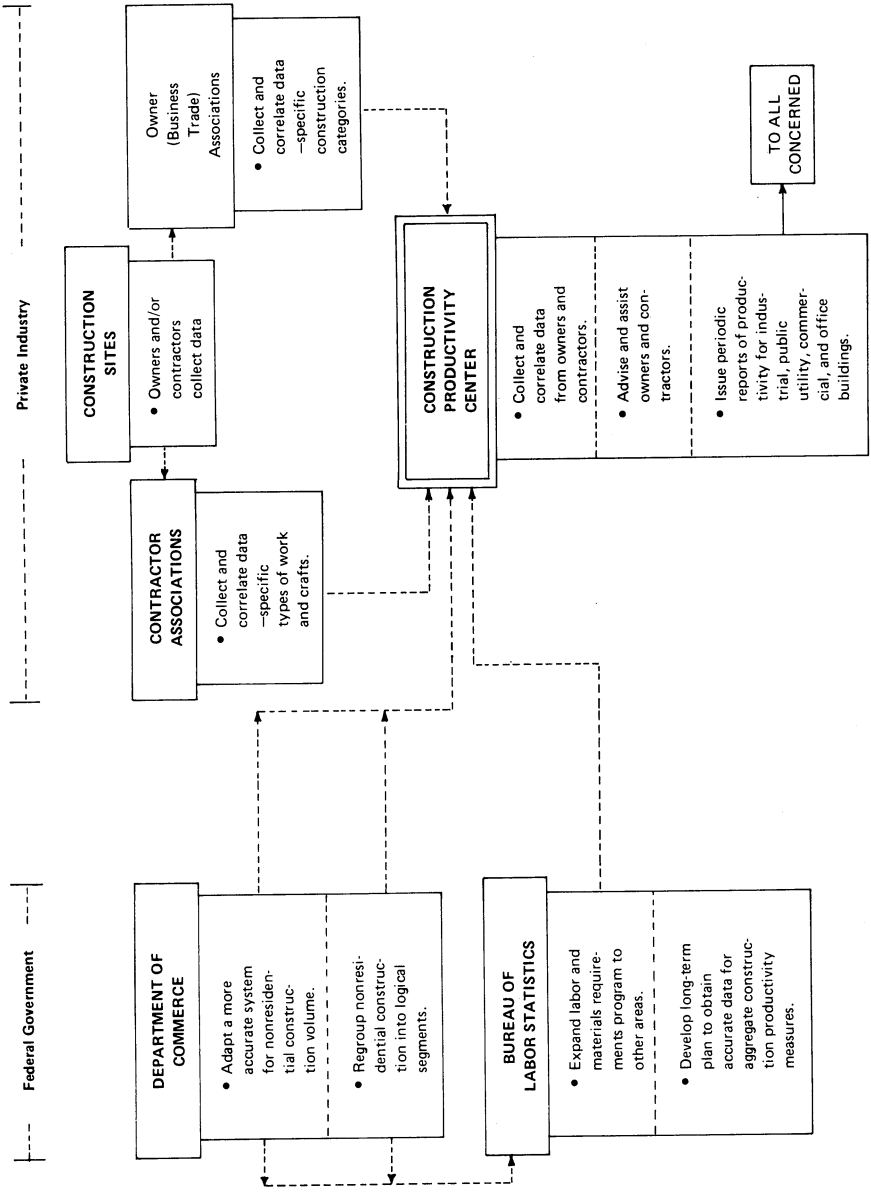
Federal Government
Private Industry
DEPARTMENT OF COMMERCE
• Adapt a more accurate system for nonresidential construction volume.
• Regroup nonresidential construction into logical segments.
BUREAU OF LABOR STATISTICS
• Expand labor and materials requirements program to other areas.
• Develop long-term plan to obtain accurate data for aggregate construction productivity measures.
CONSTRUCTION SITES
• Owners and/or contractors collect data
CONTRACTOR ASSOCIATIONS
• Collect and correlate data —specific types of work and crafts.
Owner (Business Trade) Associations
• Collect and correlate data —specific construction categories.
CONSTRUCTION PRODUCTIVITY CENTER
• Collect and correlate data from owners and contractors.
• Advise and assist owners and contractors.
• Issue periodic reports of productivity for industrial, public utility, commercial, and office buildings.
TO ALL CONCERNED

CHART 1

APPENDIX B

1. REPORT ON SIZE OF CONSTRUCTION INDUSTRY
2. MANUAL ON CONSTRUCTION SITE PRODUCTIVITY MEASUREMENT
3. MANUAL ON WORK SAMPLING AND FOREMAN DELAY SURVEYS

The above items are available, upon written request, from The Business Roundtable, Suite 2222, 200 Park Avenue, New York, NY 10166.

CONSTRUCTION INDUSTRY COST EFFECTIVENESS PROJECT

This Project is a long-range, four-phase effort to develop a comprehensive definition of the fundamental problems in the construction industry and an accompanying program for resolution of those problems leading to an improvement of cost effectiveness in the industry. It is focused primarily on improvement in the industrial, utility, and commercial segments of the industry and has been developed from the point of view of owners or users of construction. Efforts by all segments of the industry, however, are vitally necessary if major improvement is to result.

This report is one of a series of reports from study teams researching individual problem areas. The report series includes:

Project Management – Study Area A

- A-1 Construction Productivity Measurement
- A-2 Construction Labor Motivation
- A-3 Improving Construction Safety Performance
- A-4 First and Second Line Supervisory Training
- A-5 Project Management Education and Academic Relations
- A-6 Application of Modern Management Systems
- A-7 Contractual Arrangements

Construction Technology – Study Area B

- B-1 Integrating Construction Resources and Technology into the Engineering Process
- B-2 Technology Advancement in the Construction Industry
- B-3 Construction Technology Needs and Priorities

Labor Effectiveness – Study Area C

- C-1 Exclusive Jurisdiction in Construction
- C-2 Scheduled Overtime Effect on Construction Projects
- C-3 Contractor Supervision in Unionized Construction
- C-4 Constraints Imposed by Collective Bargaining Agreements
- C-5 Local Labor Practices
- C-6 Absenteeism and Turnover
- C-7 Impact of Local Union Politics

Labor Supply and Training – Study Area D

- D-1 Use of Subjourneymen in the Union Sector
- D-2 Government Limitations on Training Innovations
- D-3 Utilization of Vocational Education in Construction Training
- D-4 Training Problems in Open Shop Construction
- D-5 Labor Supply Information

Regulations and Codes – Study Area E

- E-1 Administration and Enforcement of Building Codes and Regulations