AN INVESTIGATION AND EVALUATION OF WORK MEASUREMENT
AS AN ADMINISTRATIVE CONTROL
(WITH EMPHASIS UPON THE MILITARY SITUATION)

DISSERTATION

Presented in Partial Fulfillment of the Requirements
for the Degree Doctor of Philosophy in the
Graduate School of The Ohio State
University

By

Richard Thompson Rudduck, A.B., M.B.A.
The Ohio State University
1954

Approved by:

Ralph Davis
Adviser
ACKNOWLEDGEMENTS

The writer wishes to acknowledge first the aid of his adviser, and co-director of the Navy project, Professor Ralph C. Davis, under whose direction and guidance this study in work measurement was carried on. Besides his guidance in the area of general policies and method of approach, his emphasis upon basic concepts and principles has led to a greater appreciation of the full potentialities of a system of administrative work measurement in the management of a large enterprise.

Acknowledgement is due also to the other two readers of the dissertation, Dr. Harold H. Maynard and Dr. Clifford L. James. Their constructive analysis of the early drafts brought a broad point of view to the study, which certainly was beneficial to the writing of the dissertation.

The acknowledgements would not be complete without mention of the fellow researchers on the Navy project, the staff specialists in the Bureau of Naval Personnel, and the great number of individuals at the three Naval stations studied who so willingly and patiently co-operated in the management surveys and pilot studies. For the opportunity of working with them and close bonds formed during the project, the writer wishes to express sincere gratitude to Dr. Frank M. Fletcher, Jr., Director
of the Project, to Dr. Willis L. Tompkins, to James E. Smith, and to James E. Wert.

The Navy project, which was the primary research for this dissertation, cannot be mentioned without recognition of the civilian specialists who were responsible for the general guidance of the project. For his cooperation and helpful suggestions throughout the period of the contract, acknowledgement is due Dr. George D. Price, Head, Personnel Analysis Section, Bureau of Naval Personnel. To Karl Wirth, civilian specialist in the Bureau of Naval Personnel, who worked with relentless energy and enthusiasm on the project, nothing less than a Navy "well done" will do. To Mr. Wirth's assistant, John Kelso and the others in his office, the writer wishes to express thanks for contacting Naval activities and the several different offices of other Services in the search for information and publications on work measurement.

Of course, without the interest and backing of the Center Commanders and their staffs where the primary research was conducted the study would have been impossible. To Captain J. D. Kelsey, U.S.N., Commander, USNTC, Great Lakes, and Captain F. Monroe, U.S.N., Commander, USNTC, San Diego, go sincere thanks. The outstanding cooperation of the Management Engineering Offices at both stations warrant recognition, especially
the cooperation of Ensign Roger G. Todd, U.S.N.R., who even after the termination of the contract, has worked with the writer on basic work measurement problems.

Richard T. Rudduck
Columbus, Ohio
TABLE OF CONTENTS

CHAPTER | PAGE

PART I - SIGNIFICANCE OF WORK MEASUREMENT TO THE INDUSTRIAL ORGANIZATION

I  THE SCOPE OF THE STUDY ........................................ 1

II  INTRODUCTION TO WORK MEASUREMENT ........................ 13

PART II - ESTABLISHMENT OF ACCOUNTABILITY AND PREVENTIVE CORRECTION

III  BASIC PRINCIPLES OF MANAGEMENT CONTROLS (PLACE OF CONTROL IN ORGANIZATION AND MANAGEMENT) ........................................ 65

IV  BASIC PRINCIPLES OF MANAGEMENT CONTROLS (CONT'D.) (SUBFUNCTIONS OF CONTROL ANALYZED; COORDINATIVE STAFF, AN AGENCY OF CONTROL; RELATION OF ADMINISTRATIVE WORK MEASUREMENT TO OTHER CONTROLS) ........................................ 96

V  THE SEVEN STEPS IN THE DEVELOPMENT OF A CONTROL SYSTEM ........................................ 153

VI  STANDARDS AND METHODS OF COMPARISON .................. 190

VII  CONTINUOUS REVIEW AND FOLLOW-UP ACTION DEPEND UPON AUTOMATIC CONTROL AND EXTENSIVE PARTICIPATION ........................................ 252

VIII RELATIONSHIP OF BUDGETARY CONTROL TO ADMINISTRATIVE WORK MEASUREMENT ........................................ 285

IX  RELATION OF STATISTICAL QUALITY CONTROL TO WORK MEASUREMENT ........................................ 303

X  RELATIONSHIP OF MOTION AND TIME STUDY TO ADMINISTRATIVE WORK MEASUREMENT ........................................ 330
<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>PART III - ANALYSIS AND EVALUATION OF FIELD SURVEYS AND PILOT STUDIES ON ADMINISTRATIVE WORK MEASUREMENT</td>
<td></td>
</tr>
<tr>
<td>XI ANALYSIS AND EVALUATION OF FIELD SURVEYS ON MANAGEMENT PROBLEMS AND DIFFICULTIES</td>
<td>358</td>
</tr>
<tr>
<td>XII ANALYSIS AND EVALUATION OF PILOT STUDIES IN DEVELOPMENT OF AN ADMINISTRATIVE WORK MEASUREMENT SYSTEM</td>
<td>360</td>
</tr>
<tr>
<td>PART IV - CONCLUSIONS AND RECOMMENDATIONS</td>
<td></td>
</tr>
<tr>
<td>XIII CONCLUSIONS FROM THE STUDY</td>
<td>414</td>
</tr>
<tr>
<td>XIV RECOMMENDATIONS</td>
<td>438</td>
</tr>
<tr>
<td>BIBLIOGRAPHY</td>
<td>451</td>
</tr>
<tr>
<td>APPENDICES</td>
<td></td>
</tr>
<tr>
<td>APPENDIX A &quot;Command Management Check-List (Form II)&quot;</td>
<td>460</td>
</tr>
<tr>
<td>APPENDIX B &quot;Work Measurement Information Form&quot;</td>
<td>461</td>
</tr>
<tr>
<td>APPENDIX C &quot;Small Group Meeting Evaluation Form&quot;</td>
<td>467</td>
</tr>
<tr>
<td>APPENDIX D &quot;Materials Evaluation Form&quot;</td>
<td>469</td>
</tr>
<tr>
<td>AUTOBIOGRAPHY</td>
<td>471</td>
</tr>
</tbody>
</table>
## LIST OF FIGURES

<table>
<thead>
<tr>
<th>FIGURE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The Organic Functions of Control</td>
</tr>
<tr>
<td>2</td>
<td>Examples of Basic Control Techniques</td>
</tr>
<tr>
<td>3</td>
<td>Facilitative Uses of Work Measurement as a Control Technique</td>
</tr>
<tr>
<td>4</td>
<td>Relationships in Organization</td>
</tr>
<tr>
<td>5</td>
<td>The Koppers Company, Inc., Control Section</td>
</tr>
<tr>
<td>6</td>
<td>Outline Chart Top Management, American Enka Corporation</td>
</tr>
<tr>
<td>7</td>
<td>Outline Chart Top Management Organization Esso Standard Oil Company</td>
</tr>
<tr>
<td>8</td>
<td>Coordinative Staff</td>
</tr>
<tr>
<td>9</td>
<td>Relation of Top Line and Staff Organizations</td>
</tr>
<tr>
<td>10</td>
<td>Decentralized Staff Control</td>
</tr>
<tr>
<td>11</td>
<td>Coordinative Staff Keeps Basic Administrative Measures of Performance in &quot;Balanced Adjustment&quot;</td>
</tr>
<tr>
<td>12</td>
<td>Examples of Comparison and Corrective Action Control Systems</td>
</tr>
<tr>
<td>13</td>
<td>Analysis of Recruit Transfer Orders Work Measurement Performance Data</td>
</tr>
<tr>
<td>14</td>
<td>Transfer Division, Personnel Department Work Measurement Performance Data, Index of Productive Efficiency</td>
</tr>
<tr>
<td>15</td>
<td>Automatic Control of Activities</td>
</tr>
<tr>
<td>16</td>
<td>Example of a Quality Control Chart (A machined part process)</td>
</tr>
</tbody>
</table>

-vii-
### LIST OF TABLES

<table>
<thead>
<tr>
<th>TABLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Transfer Division, Personnel Department Work Measurement Performance Data</td>
<td>211</td>
</tr>
<tr>
<td>2 Transfer Division, Personnel Department First Monthly Summary</td>
<td>212-213</td>
</tr>
<tr>
<td>3 Transfer Division, Personnel Department Monthly Performance Rates</td>
<td>223</td>
</tr>
<tr>
<td>4 Transfer Division, Personnel Department Standard Rates</td>
<td>224</td>
</tr>
<tr>
<td>5 Transfer Division, Personnel Department Standard Rates (Standard Deviation Below Arithmetic Mean)</td>
<td>225</td>
</tr>
<tr>
<td>6 Branch &quot;Y&quot;, Staff Department &quot;X&quot;</td>
<td>231-232</td>
</tr>
<tr>
<td>7 Computation of Time Charges by Activities and Work Unit Branch &quot;Y&quot;, Staff Dept. &quot;X&quot;</td>
<td>233</td>
</tr>
<tr>
<td>8 Selection of Standard W.P. Float Time for Activity &quot;B&quot;, Branch &quot;Y&quot;, Department &quot;X&quot;</td>
<td>234</td>
</tr>
<tr>
<td>9 Summary Tabulation of Typical Management Problems Found at Large Naval Stations</td>
<td>362</td>
</tr>
<tr>
<td>10 Work Measurement Pilot Studies--Installation Progress of Nine Groups</td>
<td>392</td>
</tr>
<tr>
<td>11 Work Measurement Pilot Studies--Effectiveness Ranking of Methods of Approach</td>
<td>393</td>
</tr>
</tbody>
</table>
PART I - SIGNIFICANCE OF WORK MEASUREMENT TO
THE INDUSTRIAL ORGANIZATION

CHAPTER I
THE SCOPE OF THE STUDY

I. OBJECTIVES OF THE DISSERTATION

Work measurement has the inherent potentialities of establishing accountability and controlling follow-up activities—a force that cannot help but result in stimulation of positive executive leadership, improved management, and overall organizational effectiveness. That these inherent potentialities are far from being employed to the full extent possible will be illustrated during the discussion of the present state of development of work measurement, as analyzed in Chapter II. Analysis shows that need and method have been the primary consideration in the present body of literature on work measurement, and work measurement systems now in use reflect this emphasis. This leaves untouched the important field of staff management and administrative control. The present application of work measurement is found largely in the control of but a few of the total staff processes or operations. Primarily it is used only to measure highly repetitive clerical work. Using work measurement as one of the main tools of control in the management of staff operations is a concept that receives but passing, if any, attention in the literature.
in the field. Its application in industry and government agencies is likewise confined, for the most part, to a reporting device. Practically no use is made of work measurement data in the management of the total staff operative and administrative work of the organization.

The primary objective of this dissertation is a contribution in the field of staff management. This contribution is related specifically to the place of statistical work measurement in the administrative control of staff operations in a large organization. The potential contribution is in the areas of (1) development and trial of a work measurement system which will operate as a control over staff work, and (2) an explanation of how such a system can increase the effectiveness of an organization. Such a contribution is contingent upon the successful accomplishment of the following three objectives:

1. To develop a "method of approach" for the installation of a work measurement system.

2. To analyze the effectiveness of such a work measurement system as an administrative control.

3. To evaluate proper application of work measurement to increase the effectiveness of an organization.

The first of these objectives has been accomplished as a result of the primary research conducted during the last year. The second objective of analysis entails the application of the principles of management in setting up valid criteria by which to judge the effectiveness of the system. The third objective of evaluation and application
of the work measurement system to industry involves secondary research on what has previously been done and the proper place and use of work measurement as one of a number of controls.

II. BRIEF DESCRIPTION OF PRIMARY RESEARCH ON RESEARCH FOUNDATION NAVY PROJECT

The Ohio State University Research Foundation entered into a contract with the Office of Naval Research for a period 30 June 1952 to 29 June 1953. The title of the contract was as follows:

"EXPERIMENTAL DEVELOPMENT AND EVALUATION OF CERTAIN MANAGEMENT AND PERSONNEL ADMINISTRATION TECHNIQUES IN THE NAVAL SITUATION"

Dr. Frank M. Fletcher, Jr., Director, Occupational Opportunities Service and Associate Professor of Psychology, The Ohio State University, was the Director of the Project. Co-director of the Project was Ralph C. Davis, Professor of Business Organization, The Ohio State University. In the fall of 1952, the full-time operating staff consisted of two Research Associates, Mr. Willis L. Tompkins and the writer. In January, 1953, two more researchers were added: Mr. James E. Smith and Mr. James E. Wert.

Problem Surveys and Pilot Studies Were Conducted

In September, 1952, seventy-five personal interviews were conducted with officers at the U.S. Naval Training Centers, Great Lakes and Bainbridge. Pilot studies also were conducted at Great Lakes and San Diego later in the
Project. These are the three largest naval shore stations, not including shipyards and other industrial establishments. The interviews led to an analysis of the management problems and difficulties, which provided the basic information for a more formal, systematic management survey. The survey (a presentation of questionnaires and follow-up interviews) was conducted at Great Lakes 13-20 November 1952.

During September and December, progress reports were submitted to the Research Division, Bureau of Naval Personnel and trips were made to Washington for the purpose of formulating future plans. Manpower utilization was of utmost concern to the Bureau and to the officers in the field. Did the Navy have enough; just the right amount; or too little manpower? Were they using what they had effectively?

**Work Measurement Was Subject of the Project**

From the standpoint of our field surveys at Great Lakes and Bainbridge as well as the situation at the Bureau level, work measurement seemed a proper study for our Project. The Director of the Research Division of the Bureau of Naval Personnel concurred in this judgment and directed the Project to conduct research in work measurement at the local command level. The Project developed, tried out, and revised a complete program of introducing work measurement at the local command level. The ultimate objective was to give the Navy a method of approach which would result in the use of work measurement as an administrative control to increase
the effectiveness of management of shore stations.

The work measurement program was introduced at Great Lakes 9-19 February 1953, and follow-up periods were 23-24 March and again 25-26 May 1953. The program was introduced at San Diego 25 March to 15 April 1953, with a final follow-up period 25-29 May 1953.

Both stations, Great Lakes and San Diego, have decided to continue their work measurement programs in most activities, and as of 15 June 1953 plans were for staff people in the Bureau of Naval Personnel to use the manual developed by the Project to install the program at another large naval shore station.

Methods and Procedures Used in This Study

The methods and procedures used in the field work will be described in more detail in Chapters XI and XII.

Throughout the Project emphasis was placed upon what the local command could do to improve the management of shore stations. The local command became the focus of attention, because it is charged with the responsibility for proper utilization of manpower. Also, if any improvements in management are to be made, in the final analysis they must be accomplished at the local command level.

Following the above line of reasoning, emphasis was placed upon: (a) studying actual conditions in the field relative to the management of naval shore stations; (b) developing materials specifically for the people in the
field and continually revising them on the basis of suggestions from naval personnel concerned with the day-to-day operations of shore stations; and (c) encouraging local officers to participate to a high degree in the management surveys and work measurement pilot studies.

The basic techniques used in introducing work measurement to local commands are: (1) use of the work measurement manual, (2) use of the small group meeting, and (3) staff assistance in "helping local personnel to help themselves" in the development of details of their systems.

The effectiveness of the work measurement systems established by local commands is evaluated on two distinctly separate bases: (1) the judgment evaluations of personnel on the Project and the officers in the field, and (2) the pragmatic test of results from the systems.

The judgment evaluations use as criteria sound methods and procedures prescribed by the principles of Industrial Management. The evaluations were made from the results of questionnaires, tests, follow-up interviews of naval personnel, and observations by Project personnel.

The evaluation of the pragmatic results of the systems is based upon an analysis conducted after the systems were in operation for a time. An analysis was made of the reports that were being submitted as a part of the systems established. Also an analysis was made of the action already taken as a result of these reports, although some systems had
been in operation less than three and one-half months.

The findings, conclusions, and recommendations of the primary research have been analyzed in the light of sound management principles. This analysis includes an evaluation of the factors and forces in the organizational situation. It includes also an analysis of the problems in planning, organizing, and controlling the work of an organization that are created by these factors and forces. The discussion concludes with an analysis of the proper uses of work measurement in the solution of management problems, and offers recommendations for establishing a work measurement system.

Limitations of the Study

The study is concerned primarily with work measurement as it applies to staff operative and administrative work. It is concerned with the measurement of primary operative work only as the cumulative totals of such work are used as an administrative control of group progress of organizational programs. The study analyzes, however, the basic differences between the motion and time study approach to project work measurement and the simple statistical method of group or organizational work measurement. The latter is obviously a form of administrative work measurement. The study is limited, furthermore, to the development, analysis, and evaluation of such administrative work measurement in large organizations.
The study itself is limited by the scope of the primary research that it was reasonable to conduct. The writer is indeed fortunate to have had the unusual opportunity of studying thoroughly three very large organizations. Any individual organization has specific peculiarities of organizational structure and objectives. These specific organizational differences will present limitations in the application of the findings of this study to a particular organization.

The principal limitations of the study are found in three different areas of factors and forces in the organizational situation to which the primary research was applied. They are: (1) the organizations studied are assumed to be typical, (2) the extent of subjective judgment in measuring performance of an organization which performs primarily staff functions, and (3) the inherent limitations of any system of work measurement.

Assumption Organizations Studied to be Typical

The large naval stations surveyed and tested are presumed to be typical of any large organization. In one way the three Naval Training Centers are very good examples for studying administrative work measurement, for their activities are primarily staff functions serving the fleet. Their primary problems are concerned with supporting or justifying the manpower needed to perform the managerial work of the station. For example, how many yeomen for
clerical duties are needed in the Personnel Department. On the other hand, in a shipyard or industrial organization producing physical products, management would be more concerned with the number of primary line operatives needed to turn out their finished product. That management would not be so concerned about number of staff people needed to keep the payroll, hire-and-fire, and transfer operative workers. Nevertheless, the need of administrative work measurement is present in all large organizations, and their problems are similar even if they do differ somewhat in degree; so if the limitations are recognized, it seems logical to conclude that the three large organizations studied are typical.

Subjective Judgment in Measurement

The second limitation of the study is that the element of judgment in measuring the performance of a naval training station is larger than in organizations producing physical products. For one thing, the performance of a military organization is not always represented by what it did do during a specific period of time; but more by what it was capable of doing. Any military organization is keenly aware of its responsibilities for preparedness and the temptation for over-staffing is found basically in the fear of being under-prepared. This is a problem of top echelon planning. The problem is inherent in administrative work measurement for all types of organizations, nevertheless.
Inherent Limitations of Work Measurement

The third limitation of the study deals with the inherent nature of work measurement as an administrative control. A work measurement system can locate areas of management problems needing attention, and as time passes it can measure trends in performance. These trends can be compared with past performance; the performance of similar organizations (if they are sufficiently similar); or trends can be compared with statistical and/or judgment standards. Such data, however, cannot measure everything. They cannot take the place of other controls. They cannot substitute for organizational analysis, nor judgment on action to be taken. They can provide some important facts to help in all of these processes, however. The inherent limitations of work measurement as an administrative control may be summarized as follows:

(a) It measures quantity, relative to time, but not the quality of work.

(b) It is a weak control of expenses, measuring only the indirect expense of personnel wages and salaries.

(c) It does not aid in deciding if the work should be done in the first place.

(d) It can result in improved manpower utilization at undue costs in quality, time and other expense.

III. SUMMARY OF THE CHAPTER

The primary objective of the dissertation is a contribution in the field of staff management. This
-11-

contribution is related specifically to the place of statistical work measurement in the administrative control of staff operations in a large organization. The scope of the study includes the following:

1. Development of a "method of approach" for the installation of a work measurement system.
2. Analysis of the effectiveness of such a work measurement system as an administrative control.
3. Evaluation of proper application of work measurement to increase the effectivity of an organization.

The first of these areas has been accomplished. The second entails the application of the basic principles of management in the establishment of criteria by which to judge effectivity; and the third area involves secondary research in the field of administrative controls.

The primary research consisted of a one-year project, studying management problems and development of a system of work measurement applicable to the management of a large local naval shore station, such as one of the three Naval Training Centers at Bainbridge, Great Lakes, or San Diego. Throughout the project emphasis was placed upon what the local command could do to improve the management of shore stations.

The basic techniques used in introducing work measurement to local commands are: (1) use of the work measurement manual developed by the project; (2) use of the small group meeting; and (3) staff assistance in "helping local personnel
help themselves" in the development of details of their systems. The effectiveness of the systems established was evaluated on the basis of the evaluations of naval personnel in the field using them; by evaluations of personnel on the project; and the pragmatic test of results.

The limitations of the study are found in the following areas: (1) the three naval organizations studied are assumed to be typical, (2) subjective judgment is of necessity a relatively large element in evaluating performance of staff functions, and (3) the inherent limitations of any system of work measurement. The latter may be summarized in the following four points:

(a) Work measurement measures quantity relative to time, but not the quality of work.

(b) It is a weak control of expenses, measuring only indirect expense of personnel wages and salaries.

(c) It does not aid in deciding if work is in accordance with objectives.

(d) It can result in improved manpower utilization at undue costs in quality, time and other expense.
CHAPTER II
INTRODUCTION TO WORK MEASUREMENT

I. INTRODUCTION

Frederick W. Taylor, working for the Bethlehem Steel Works in 1898, conducted his now-famous shoveling experiments. This work led to his definition both of the objectives and procedure for developing standard data, as applied to repetitive, direct labor processes involving primary operative workers. It should be of interest to the business historian that at the midway mark of the century, it is the Government which is taking the lead in studying the problems of work measurement. Much of the measurement, however, is of indirect labor consumed in repetitive staff operative work, not direct labor.

There are at least two good reasons for this trend: First, the Federal Government is the largest single employer of people who perform staff operative work; and second, the Government is the largest organization in the United States. Its size alone demands some kind of measurements of performance.1 The Bureau of the Budget is charged with the

---

1 The U. S. Navy alone is "five times as large and many times as complex as eight of the largest corporations in the United States." See "The Navy Shore Establishment Work Measurement Interim Manual," Office of the Secretary, SECNAVINST 5202.1, 31 July 1950, p. ii.
responsibility of checking on the efficiency of Government offices and to take steps to improve methods of operations. To do this, the Executive Office of the President (a subdivision of the Bureau of the Budget) has issued several publications. In its bulletin on the development and use of a work measurement system, it points out that the problems of management grow more baffling as organizations grow more complex. The bulletin recognizes the status of management in the following quotation:

"The problems have grown faster than have the means of measuring the factors involved—the controlling forces and the resources and the impact of organized effort. You can't expect to solve the problems without some means of measurement."  

The point is stressed that some kind of measurement is necessary to cope with these problems:  

"We say "some kind" of measurement because different kinds of work are measurable in varying degrees and in different ways; but, formally or informally, precisely or roughly, some stab at measurement must be made if any activity is to be managed."

Harold B. Maynard, President of the Methods Engineering Council, puts it this way:


3 Ibid.
Scientific management is measurement plus control. Before control is possible, measurement must take place.4

Two Purposes for Measurement--To Measure Administrative Work and Operative Work

Operative measurement is concerned with measuring the work of project execution, rather than measurement of group accomplishment of programs. Such measurement is in terms of productivity, output per unit of manpower applied. Administrative measurement is concerned with progress of programs. Such measurement is in terms of long-range planning and programing. It is an expression of total group accomplishment. Both forms of measurement are important to controlling the activities of an organization. One system may be needed for measuring total accomplishment or program progress; and a different system may be used for measuring efficiency of workers. Operative work,

4 Ibid., p. 1. This definition obviously is not meant to be a comprehensive definition of Scientific Management. It does emphasize the important place of measurement in carrying out the organic management functions of planning, organizing and controlling, however. Harold B. Maynard is the co-author of the "M.T.M." system. (See Maynard, Stegemerten, and Schwab, Methods-time Measurement, New York: McGraw-Hill Book Co., Inc., 1948) A more comprehensive concept of Scientific Management is the one which conceives it to be the application of reflective thinking to determined facts and principles in the solution of business problems. (See Ralph C. Davis, Industrial Organization and Management, pp. 14-15. Also see Chester I. Bernard, The Functions of the Executive, pp. 285-289, and Elmore Petersen and E. Grosvenor Plowman, Business Organization and Management, pp. 365-366.)
However, is cumulative into group accomplishment or administrative work, and to this extent administrative work may be measured by the cumulative totals of the operative work involved.

Two Methods of Work Measurement—Motion and Time Study and Statistical Work Measurement

There are two principal methods of work measurement—(1) the traditional motion and time-study systems, and (2) the simple statistical method, based upon manhours expended on work units completed. Primarily the differences between these systems are ones of degree and the purposes for which they are established. Chapter X, "Relationship of Motion and Time Study to Administrative Work Measurement," discusses the two systems in further detail. The primary differences are mentioned here in order to orient the reader in regard to the scope of the subject of this study.

For the most part, motion and time study have been used to establish standard times of performing primary operative work on projects or individual job orders. Such data are used to set piece rates and as a basis for other wage incentives for primary operative workers. Motion and time study have been used to measure that portion of labor costs of a manufacturing organization represented by the direct labor applied to the end product or service. The unit of measure is typically expressed in very refined
units of time, often thousandths of a minute. The investigational methods are observational, and the work measured is expressed in absolute times.

Simple statistical work measurement enters into administrative control, since it is concerned with group accomplishment in program progress. Thus it provides a basis for management improvements. This measurement of performance is less refined than in the case of motion and time study, often expressed in hours per work unit completed or work units per hour. The investigational methods used are statistical, and the performance rates established are relative. Thus as operational methods improve, standards are improved. In this sense, the standards are drifting standards.

Simple statistical work measurement is applicable to much of that work which is usually classified as indirect labor and is concerned with the performance of staff operative functions. Clerical workers such as stenographers, bookkeepers and accountants, and general office workers perform work that facilitates the performance of managerial functions. Those whose efforts also may be classified as indirect labor are set-up men, time study, and observers. Common laborers such as clean-up men and truckers in machine shops also contribute indirectly to the end product, and so are classified often as indirect labor. The classification is on basis of whether the work
Managerial work is basically mental rather than manual. Since a great deal of indirect labor is mental or is otherwise difficult to measure in terms of physical units produced, standards of staff operative performance cannot usually be set as accurately as performance standards for primary operative functions. The latter deal chiefly with mechanical and manual functions involving the handling of physical forces and factors. Such functions lend themselves to more refined measurement than most of those classified as indirect labor.

Definitions of Terms

The Executive Office of the President defines work measurement in the following terms:

Work measurement is a method of establishing an equitable relationship between the volume of work performed and the manpower utilized in completing that volume. The essential ingredients of work measurement are the measures of output and the measures of employee time.  

The originators of work measurement systems have worded their own definitions somewhat differently, but they agree on basic elements. All systems relate input (manpower time) to output in terms of products or services rendered. The Sixth Army has developed a very comprehensive system. An effort is made to save clerical work by using data that

5 Ibid.
is already being collected in existing accounting procedures. Their definition of work measurement is as follows:

Work measurement is a technique which provides for the continuous collection of manhours expended and work units accomplished within specifically prescribed operational and functional accounts and (also provides for) the development of work standards for those operations.²

The Sixth Army manual goes on to express the idea that work measurement "makes it possible to obtain the maximum benefit and results from all other programs."⁷ Work measurement accomplishes this end by bringing together in a meaningful manner the data from other managerial controls. In the Foreword of "The Navy Shore Establishment Work Measurement System Interim Manual," this problem is analyzed:

Today the principal management control techniques, "Cost Accounting," "Work Simplification," "Employee Job Analysis," and "Work Measurement," are almost invariably administered apart from one another, as though they were unrelated and were not contributing to a common end. If business administration is to be considered an art, in an all-inclusive sense, then some skillful and systematic arrangement and adaptation of manpower figures of all principle management control techniques and programs must be conceived and installed. This observation introduces the "Navy Shore Establishment Work Measurement System," the keystone for effective management control.⁸


⁷ Ibid.

⁸ SECNAVINST. 5202.1, op. cit., p. ii.
The Interim Manual for the Navy-wide system defines its work measurement system in the following terms:

Work Measurement—The basic means of defining all work in tangible quantitative terms and relating amounts of work and manpower in managing and budgeting for manpower.9

Reports of work output in terms of products or services and also reports of manhours expended are used separately with considerable value. Such reports are not work measurement, however. Work measurement brings these two together at a point where it is possible to tell what manhours of input were spent on which products or services rendered. These data are not only useful to first line supervisory personnel, but also at each succeeding level of management, in original form or in consolidated reports.

The definition developed by The Ohio State University Research Foundation Navy Project for use of first line supervisors as well as those on higher echelons is in simple terms:

Work Measurement is a management tool which shows you facts about work turned out and the manpower it took to turn out that work.10

---

9 Ibid., p. 7.
Explanation of Basic Work Measurement Terms

Besides the definition of work measurement, there are certain basic terms that need to be defined to facilitate clarity of understanding. Some of these terms have already been used. The more important terms are listed below:

Work Unit - a tangible and countable expression of work turned out. For example: transfer orders written; men processed; tons moved; rations fed; pages typed.

Performance Rate - the number of manhours expended divided by the number of work units completed. The performance rate gives you the number of manhours spent per work unit. Example:

\[
\text{Performance rate} = \frac{\text{Manhours expended}}{\text{work units completed}}
\]

\[
= \frac{100 \text{ manhours}}{50 \text{ reports completed}}
\]

\[
= 2 \text{ manhours per report completed.}
\]

Function - a general type of work distinguished by the specialized skill or knowledge required for its accomplishment. Example: Public Works.

Sub-function - A group of related processes or divisions of work within a single work function. For example, WAVE Sales might be a sub-function of Clothing and Small Stores; Correspondence might be a subfunction of the administrative section of the Personnel Department; typing might be a
subfunction of an office. \(^{11}\)

**Uses of Statistical Work Measurement**

There is a whole area of industrial engineering and management, which is well advanced and which deals with standards of performance of primary operative work, involving time studies. Primary operative work is project or job order work that results directly in salable goods or services. Time study work is done in large and in small concerns; intermittent or continuous manufacturing; and in assembly or process type industries. It is applicable, furthermore, in non-manufacturing industries when the requisite conditions exist. The prime requisite is that the work be repetitive and in reasonably large volume.

This study, however, is concerned with operative work measurement only as such data are used in cumulative totals to control group progresses of programs. Work measurement of primary operative work employs motion and time study methods almost exclusively.

\(^{11}\) See "Local Command Work Measurement Manual," op. cit., Appendix E, pp. II-63 to II-65 for a more comprehensive glossary of work measurement terms. It should be noted that the term "Performance Rate" is used instead of "Production Rate," because the interest in work measurement developed from the necessity for a more accurate method of estimating manpower requirements. The term "Performance Rate" in industry is the inverse of the ratio illustrated above. Also in industry common practice is to use the term "Production Rate" or "standard rate of production," which is expressed in units per machine-hour.
This study is concerned primarily with the uses of what has been referred to as simple statistical work measurement. Such a system measures the output of staff operative workers and also may present data on administrative work, which is concerned with group progress of programs. Simple statistical work measurement finds its application in industry primarily to problems of office management.

1. To Control Staff Operative Work

The primary research of this study consisted of The Ohio State University Research Foundation Navy Project. Suffice to note at this point that the one year project aided in establishing work measurement systems at naval shore stations, and that the uses of work measurement cited are actual practical applications reported to the project. One of the first facts that work measurement reports disclosed was the existence of overload periods and slack periods. This led to more effective control of manpower by better planning and allocation of personnel. The example of the tabulating machine unit is given in the "Local Command Work Measurement Manual." The essential facts of the use of work measurement as an administrative control in this case are related in the following quotation:

A look at the Work Measurement facts for the Tabulating Machine Unit revealed that while the "reports" subfunction had a heavy workload at the beginning of each month, the "key punching" and "daily processing" subfunctions actually experienced a "slack" period during this time. The discovery showed the section head where men could best be pulled at the beginning of the month to work on the
peakload job in getting out the monthly reports.\textsuperscript{12}

2. To Bring Management Problems Into Focus.

Another use of work measurement as an administrative control is that of bringing management problems into focus or attention. The importance of such a control is that it does not rely upon chance discovery of the problem, and further, attention is called to the problem before it becomes serious. This is an improvement over the method of management that is constantly calling for "fire fighting," leaving little time for planning and reflective thinking on ways of improving management.

Again, an example from the project serves to illustrate the point. In this case the problem was found in an area that was pre-judged not too applicable to work measurement, namely, gate guards. It was reasoned that there must be gate guards, so why bother with work measurement. Nevertheless, an hourly analysis of the traffic load indicated the possibility for reducing manpower in the early morning hours when more seamen guards than were needed to handle the traffic were on duty.\textsuperscript{13}

3. To Determine Manpower Requirements.

One of the most effective uses of work measurement is


\textsuperscript{13} Ibid., pp. II-7 to II-8.
as an aid in determining manpower requirements. With factories becoming more and more automatic in their operations, direct labor costs become relatively less and less important compared to indirect labor costs. The number of workers whose service can be classified as indirect labor costs have increased over the years. The increase in white-collar workers is an important factor. There are now as many in this white-collar class as there are agricultural laborers.\textsuperscript{14} Work measurement gets at the very heart of the problems of how many staff operative workers are needed to perform the functions of a staff organization. It brings to focus the manhours that are expended on a given quantity of output of services or goods produced.

Work measurement reports were used as a basis for determining the number of additional instructors needed to teach an increased enrollment in one Navy service school. The work measurement report reflected the duties and time expended by the instructors on a class. Some subfunctions such as examination writing, do not increase

\textsuperscript{14} Emmett J. Leahy, Wall Street Journal, September 18, 1953 p. 1. "In a special survey of industrial paper work and office costs, Mr. Leahy told the Society for the Advancement of Management here that, for every one of the 8 million productive farm workers, there is another worker who spends all his or her time in a morass of invoices, job orders, warehouse receipts, bills of lading...."
in proportion to students. By determining the manhours for each subfunction, a forecast of the number of instructors needed to handle the increased enrollment was determined.15

4. To Indicate the Trend of Group Performance

Through work measurement, a department head is able to see whether the utilization of his manpower is increasing, decreasing, or staying about the same. When his manpower utilization is decreasing, (that is taking more manhours to turn out each work unit) work measurement indicates performance to be sub-standard. It does not automatically show why the decrease in utilization. The facts should cause the department head to begin to wonder "why" the downward trend. Is it due to inefficient work methods? Is it due to low morale? Is it due to lack of training? or is the downward trend due to a drop in the workload? If the downward trend is due to a drop in the workload, is it a seasonable or temporary drop, or is it the result of a long-term policy to cut down workload? If it is the latter, plans should be considered to make a systematic reduction in personnel, with the least disruption possible in the organization, preferably through normal resignations and retirements.

In this manner work measurement becomes an executive motivator, because it encourages executives to discover problems and to take action to overcome them.

5. To Establish Accountability

In every well-managed business organization authority is delegated to lower echelons of the management for the performance of certain functions. In turn, these lower echelons are held responsible to higher authority for performance of their functions. Some method of accountability is necessary to establish how well responsibilities are being discharged. Work measurement is a method of establishing accountability for the use of manpower. It shows higher authority what it is getting for its manhour dollars. It removes manpower accountability from the realm of opinion to statement of fact.

Work measurement not only analyzes manpower utilization, but it affords the data necessary for the establishment of performance standards. Such standards facilitate comparison of performance of an activity and so aid in establishing accountability. Setting standards is one of the most important aspects of work measurement,
and methods of doing so will be discussed in detail later.  

6. To Improve Communications

Communications (the meeting of minds of what should be and is going on in an organization) is a subject that has come in for a great deal of consideration in industrial management circles. A decade ago Roethlisberger and others conducted their very comprehensive studies into the psychological and sociological problems involved in the behavior of industrial groups at the Westinghouse Hawthorne Plant.  

An important aspect of their study dealt with group communications. Russell Davenport and others have written at length on group communications, and a few years ago Fortune magazine devoted considerable space to the problem. The most familiar of its articles was, "Is Anybody Listening?" One of the conclusions upon which apparently all authorities agree is that it is important

---


not only to communicate down the line organization, but also to be able to communicate from the operative level up.

Work measurement is an aid to communication because it puts in concrete terms what an activity is doing with its manhours. It no longer leaves it to opinion that a department is doing a good job, or a fair job, or perhaps a poor one. Work measurement defines the subfunctions and substitutes mathematical quantities for adjectives in describing the degree of manpower performance.

The writer was surprised at the eagerness of a good many first line supervisors for a work measurement system that would enable them to communicate to their supervisors the performance of their groups. For example, one of the Navy service schools studied on the project was eager to disclose the subfunctions it performs in addition to classroom instruction. The officer in charge of mess halls welcomed a system that would enable her to reflect the work load of her groups. Further, the mere experience of the frankness and apparent enthusiasm with which supervisors told the writer of their management problems was sufficient to indicate the need for some method for the lower echelon supervisors to communicate their problems to superiors on higher echelons. Work measurement provides such a medium of communications, particularly in regard to manpower utilization.
7. To Show Departments or Areas for Possible Improvement

One of the outstanding contributions of work measurement is to show the departments or areas where improvements in managerial or operative methods probably can be effected. When work measurement reports indicate a department does not compare favorably with other departments, the responsible subordinate executive should be called upon for an accounting. The comparison can be of department to department, or by trends in performance. In either event, unfavorable work measurement reports should be followed up by an explanation into the causes.

The key to this problem is the application of the principle of limiting factors. By analyzing the management problem in terms of limiting factors, basic causes can be identified. The next step is a program devised to correct the existing conditions. Thus, work measurement reports should lead directly to improvements in organization structure, working conditions, subordinate leadership, work simplification, and other management improvement programs that might be dictated by the limiting factors in the problem.

8. To Check Results of Action Taken

Work measurement can be used as a measure of management improvements by indicating organizational effectiveness. If action has been taken in regard to improvements in
organization, procedures, methods, equipment, or training, work measurement facts can be used to evaluate the effectiveness of these improvements. For example, facts showing the relation between manhours expended and work units completed before and after installation of a new work flow plan would be a good check on its effectiveness.

One of the naval activities, with which the project worked, planned to use its work measurement reports to show the need for some new office machines. It felt sure that future work measurement reports would show improvements in performance more than sufficient to justify the expenditure for the new machines.

Summary of Uses of Work Measurement

This discussion is not meant to cover all the uses of work measurement. Specific applications will be cited throughout the study. Uses are listed here under eight general headings to give an indication of the practical application of work measurement as an administrative control. They may be summarized into the following eight areas:

1. To control staff operative work.
2. To bring management problems into focus.
3. To determine manpower requirements.
4. To indicate the trend of group performance.
5. To establish accountability.
6. To improve communications.
7. To show departments or areas for possible improvement.
8. To check results of action taken.

II. PRESENT STATE OF DEVELOPMENT OF WORK MEASUREMENT

Developments in Office Work Measurement

Perhaps the best indication of the state of development of work measurement as it applies to staff operative work in offices is to be found in the papers presented at the Office Management Conference of the American Management Association held in New York City, October 16-17, 1952. "Developments in Office Work Measurement" was the topic of four executives representing a bank, a life insurance company, a mutual property insurance company, and an oil refinery. The panel chairman was H. F. van Gorder, Director, Methods Planning Division, United States Steel Company. The panel members were Robert E. Fendrich, Methods and Standards Division, Chemical Bank and Trust Company, New York City; John C. Morris, Secretary, State Farm Life Insurance Company; Charles H. Dent, Methods Research Manager, Hardware Mutuals; and William H. Brush, Chief Administrative Industrial Engineer, Atlantic Refining Company, Philadelphia.

Types of Work or Functions Being Measured

The functions being measured are almost entirely in the category of highly repetitive, clerical staff operative work, and for the most part the workers operate different kinds of business machines. The operations mentioned by the above executives include the following: tabulating (which includes key punching, verifying, sorting, printing, collating, reproducing, and related manual operations), calculating, mechanical bookkeeping, addressographing, typing, verification of typing, billing, payroll compilation, timekeeping, cost distribution, filing, stock and inventory records, sales statistics, and duplicating operations.

Throughout the panel discussion there were expressions of the basic belief that work measurement of office work is in its infancy and that there are many clerical operations which it is as yet difficult, if indeed, not
The clerical work measurement systems discussed were not yet advanced to the point where the more difficult operations such as composition of letters is being measured. Supervisory time and other administrative management duties are not being measured by these companies through the medium of work measurement. Quite correctly, it seems to this writer, such administrative work is judged indirectly on the basis of the performance of the group being supervised.

The Size of Groups Being Measured

Two of the chief speakers on the panel did not explain in detail the work measurement systems in operation.

---

20 Robert E. Fendrich makes the point, "Work measurement while well established in industry, by contrast is in its infancy in the office." *op. cit.*, p. 20. This statement is the conclusion of the members of the panel discussion. The present writer agrees with reservations. He feels that work measurement can be applied to a great deal of office work that is not highly repetitive in nature, as long as agreement can be reached regarding some measurable unit that is "representative" of the total output of the group. For instance, his advisor informs him that one of the country's largest manufacturers has been applying work measurement to its engineering departments for some time. Likewise, some drug firms apply a form of work measurement to their salesmen, and several examples will be given from the primary research of its application to dentists, lawyers, and even to the chaplain, all professions which will deny their work is repetitious.
in their companies, but discussed instead clerical work measurement in general and outlined practical methods of introducing work measurement.

Mr. Morris of the State Farm Life Insurance Company related that their work measurement system was originated in the fall of 1947 when his firm had a few more than 200 employees. This company's system is based upon the work measurement programs of the Prudential and the Metropolitan Life Insurance Companies. It is pointed out, however, that the first attempt at evaluating clerical work was begun with the writing of duty cards for clerical operations. At that time the company had fewer than twenty employees. Mr. Morris said "that the writing of the duty cards by our supervisors was the beginning of both work measurement and job classification in our company." 21

The Atlantic Refining Company is one of the pioneers in the field of clerical work measurement. Its program dates back to 1929. The work of 1,200 clerical workers has been subjected to measurement during this period. On the basis of this experience Mr. Brush estimates that "such measurements can be expected to yield an average cost reduction of approximately five dollars for every

21 John C. Morris, op. cit., p. 22.
The panel chairman opened the discussion period by posing the question: "To how small a concern or segment thereof can we effectively apply work measurement?" Mr. Brush volunteered the following answer:

Within a program you can apply performance standards and time data to as few as four people. We found that in some of our 31 district sales offices we had no more than that. The key point, I think, is that the small office must be handled as part of a program. I should question whether it would be economical to use work measurement in, say, a local real estate office with only three employees.23

The above discussion should give the reader some idea of the size of the organizational units to which clerical work measurement is being applied. Determination of what size of an organization work measurement should be applied involves a number of considerations. They relate to the purpose for measurement. If the purpose is control of work load by the first line supervisor, then work measurement need not be applied until the number of employees under the supervisor exceeds the number he can personally observe. Even under these conditions it may still be valuable to use work measurement reports to show which supervisors are improving the operating

22 William H. Brush, op. cit., p. 29.
23 Ibid., p. 32.
effectiveness of their groups. If the purpose is for centralized control at higher echelons, then work measurement may be mandatory, regardless of the number of employees reporting to the supervisor.

The Types of Work Measurement Used

The method of measuring work performed used by the State Farm Life Insurance Company is basically the same as the method that the project recommended to most of the naval activities studied. As pointed out previously, there are basically two methods of measuring work: (1) through standards set by motion and time study, and (2) simple statistical work measurement of manhours consumed for each work unit completed. The State Farm Life Insurance Company uses a variety of simple statistical work measurement. Employees time themselves on batches of clerical work. (The project recommended independent timing by the supervisor or some other means). The standard is selected at the median of all the time values that have been computed. Mr. Morris explains how his company compares present performance to "standards" set on basis of past performance, and points out a little of the company philosophy in using such a system:

We then compare the theoretical hours with the clerical hours worked by all employees and thereby obtain a performance rate. It must be emphasized that this is not an absolute measure of efficiency. Its value lies primarily in describing the trend of performance in the past, the present, and the future. For this reason we do not use the rates
to compare departments. In fact, we have gone to the other extreme and have converted this performance rate into a performance index by dividing by a base rate, which is different for each of our administrative departments. In this way we obtain an index which is unlike any other departmental performance index in the company.24

Mr. Brush explained that the Atlantic Oil Refining Company is using a method of measuring work that is primarily an application of motion and time study to set standards for clerical operations. The system was not described in detail, other than to indicate that "time studies, production studies, standard data, and other techniques are used."

Mr. Brush said that his company had looked into micromotion study, but "could not justify its use." He points out the extent of motion and time study under the Atlantic system as follows:

It takes four to five industrial engineers to maintain standards for our 300-odd clerical workers on wage incentives. Remember that we

24 John C. Morris, op. cit., p. 24. The present writer feels that one of the chief advantages of work measurement is lost by not comparing departments. In the systems developed by the project, time was used as the common denominator. Comparison was made between departments on the basis of their performance ratios. The performance ratio for each department consisted of standard time to perform the job compared to actual time consumed, or clock time. Thus, each department had its own performance ratio in terms of time, which then could be compared to the performance ratios of other departmental groups. The competition between departments proves a healthful motivator.
operate on an individual basis and that probably we have to follow up on standards more than with the group type of measurement. Also, to explain our situation a little more, we provide a specific procedure for every job. That procedure is quite detailed; and, when a change takes place, the supervisor notifies us and we alter the standard, if that is necessary, as quickly as we can. That, too, requires the services of our industrial engineering staff.25

As was pointed out in the panel discussion, the refinement of the method of measuring is dependent upon the purpose of the system and the extent or volume of repetitive work to be measured.

**Purposes of the Systems**

The work measurement system of the Chemical Bank and Trust Company has two purposes: (1) the evaluation of monthly performance—"good, not so good, or otherwise"—by departments, and (2) analysis of "trends which indicate whether that department is understaffed or overstaffed in light of budget requirements."26

Mr. Morris indicates that the State Farm Life Insurance Company is primarily interested in having their systems provide a measure of clerical efficiency by departments. They do not compare departments with each other. They are also interested in personnel utilization from the standpoint of budgeting work load.

There are "by-products" which are of benefit to the firm also. Mr. Morris explains some of them in the following quotation:

It is our opinion that work measurement must precede effective work simplification. It must be a tool to help the supervisor to devise better departmental methods. The aid of the staff assistant in helping the employees time the operations is all the more valuable, since the responsibility for improving those methods still remains with the supervisor. Work measurement is also an invaluable tool for the group administrator in evaluating the performance of the supervisor.27

The Atlantic Refining Company has three primary uses for their work measurement system: (1) determination of manpower utilization; (2) establishment of standard costs; and (3) as wage incentives to increase labor productivity per manhour. These latter two purposes call for more refined units of measurement than the first, and this is no doubt a contributing factor in the decision to set standards by motion and time study.

A.M.A.'s Evaluation of Status of Work Measurement

At the close of the panel discussion the chairman presented an evaluation of the state of development of office work measurement. This statement by H. F. van Gorden, Director of Methods Planning Division, United States Steel Company, represents the conclusions drawn from the panel discussion on "Developments in Office Work Measurement."

Coming as it does from outstanding members of the American Management Association, it probably is as good an index of the status of office work measurement systems presently in operation as it is possible to present. He said:

To sum up, I think we have proved first of all that work measurement is desirable, to whatever degree it is employed. We feel it benefits both the worker and the company, and we have all experienced immediate cost reduction and the possibility of keeping costs permanently in line through work measurement.

We are not sure, on the other hand, whether incentives are good or bad. We do not see clearly as yet the importance or the necessity of time-study standards versus time estimates or performance averages. After all, work measurement as applied to clerical jobs is fairly new.

However, any means of measuring, as long as it permits us to judge the effectiveness of an individual, or a group of individuals, and therefore to judge the number of personnel we shall need under varying circumstances, is a worth-while management tool.28

State of Development of Literature on Work Measurement

The review of the development of work measurement as applied to staff operative work in the office reveals it is in its infancy and that both motion and time study and simple statistical work measurement are used in measuring performance. It would be expected that there is a cause and effect relationship between the state of development of programs in use and methods recommended in the current

body of literature on the subject. An analysis of the literature available bears this out. In the limited literature in the field of office work measurement, both time and motion study and simple statistical work measurement are recommended, but the emphasis is placed upon an adaptation of motion and time study to measurement of office work. 29

Early Literature Discusses Measurement of Typing
As early as 1918 Galloway recognized the need for work measurement of office functions. He recognized the advantages of work measurement, but apparently felt it could not be applied successfully to any office duties

29 Bureau of the Budget, op. cit., p. 2. This booklet explains the dearth of literature thus: "On the stop-watch method there is a well established body of literature. In fact, so well known is it, so poorly documented is the know-how on other forms of work measurement, and so widespread is the need for some kind of measurement, that stop-watch methods are often seized upon and applied to work for which they are ill suited." The writer solicited the aid of the Encyclopedia Britannica and the George F. Baker Library at the Harvard Business School for references on simple statistical work measurement, and their reference lists bear out the above statement. The Bureau of the Budget pamphlets on the subject represent some of the most useful literature for business executives who may be interested in basic concepts, principles, and practical procedures for establishing work measurement as an administrative control. Titles of these pamphlets are referenced in the bibliography and are mentioned later in this chapter. Copies are available from the Superintendent of Documents, Washington 25, D. C.
except highly repetitive stenographic work. Measurement of typed pages by the square inch method is compared to use of measurement based on number and length of lines. Standards of performance and allocation of lead or non-productive time are not discussed in the book.

Galloway recognized the need for work measurement and suggested that if one work unit cannot be found to measure output, then several units can be used. These ideas are reflected in the following quotation:

There is no more difficult problem in the whole field of office management than the determination of standard units of measurement whereby the output and efficiency of a department may be measured. Management means control, and control means the making of decisions, while decisions in turn rest upon the comparison of facts. But facts cannot be compared unless they are all reduced to a common denominator and this can only be done by means of a unit of measurement. Where sets of facts cannot be reduced to a common basis for comparison, separate units of measurement must be adopted for each set of facts.30

Treatment of Work Measurement in Current Office Textbooks

The subject of office work measurement is discussed in quite some detail in Leffingwell and Robinson's Textbook of Office Management and the handbook, Office Management, published under the auspices of the National Office Management Association and edited by Maze. Leffingwell's


The 1950 edition points out the importance of office work measurement and then deals primarily with two aspects of work measurement: (a) a simple statistical method based upon work count, and (b) a discussion of standards of performance set by motion and time study.

**Simple Statistical System**

The simple statistical system is based upon the measurement of one work unit, orders, and is expressed in clerical minutes per order (CMO). The time unit is the hour. The standard rate of production is determined (presumably by past performance) and current production rates are compared to the standard. Such a statistical system reveals information about the production of one subfunction or element, namely, orders. However, it is recognized that there are few offices which perform only one subfunction. To account for the other subfunctions it is suggested similar ratios of performance to standard could be figured for them. A great many subfunctions under this system would be considered "unstandardized operations." Time spent on these subfunctions simply would not be considered.

In the writer's opinion, such a system is of value in providing an overall measurement of productivity on one
single work unit, but it is so broad a measure that it fails to pin-point areas where improvements can be made, or account for the other subfunctions involved in the operation.

The 1950 edition of *Textbook of Office Management* itself points out the great range of times used to process orders:

The National Office Ratios Survey, under the chairmanship of Mr. Leffingwell, revealed a variation in the clerical minutes per order of from 18 minutes—the best record—to 3,456 minutes—the worst. There are many offices where 480 minutes are expended on each order.  

From this large range of times it is difficult to believe that standards set on them will be an effective indication of performance. Especially is this true if the office processing orders performs any other functions, which is often the case.

**Setting Standards by Time Study**

The *Textbook of Office Management* explains procedures for setting time standards for individual operations. It is not recommended that these standards be used in establishing the standard rates of production referred to in the above. Rather, it is recommended that standards

---

of operation set by time study be used only to improve methods of operation in improving standard operating procedures and as part of a program of work simplification. This belief that time study should not be used to establish standards for comparative application in a work measurement system apparently led to the following statement:

Time study should never be used in an office except for analytical purposes or for the setting of standards. A time study is an analysis of the time required to perform each element of an operation. Since the length of time required to perform the entire operation is not being considered except as the individual studies are combined, the timing of an operation "to see how long it takes a clerk to do it" is in no sense a time study.32

The basic ideas on work measurement are the same in the handbook, Office Management, as those expressed in the Textbook of Office Management. Maze, however, expands the discussion of uses of a ratio system of work measurement.33 It is pointed out how an hourly work count can be used to control scheduling work as well as for comparison to standard production ratios.

Time Study as a Basis of Work Measurement

H. Barrett Rogers advocates strongly the use of time study in establishing standards for clerical work. In his article, "Time Study and Wage Incentives for Clerical Work,"

32 Ibid., p. 562.

(1948), he points out the need for: (1) analyzing the objectives of office work, (2) establishment of proper (standard) procedures, and (3) application of standards of performance set by time study. The following quotation expresses the emphasis placed upon time study:

As a short-cut in setting up time standards, one might be tempted to use records of past performances; but past performance records are seldom reliable, and never indicate possible capacity under favorable standard conditions. If records of past performance are used for setting time standards, the manager can be assured of early failure of the system.

The only safe method of setting up the output standards is by careful time study. Time study procedures in the office will be identical with those in the shop. The operators studied must be convinced of the fairness of accurate time studies, and that the individual study is not intended as a performance should be. Careful timings should be made for each of the detailed elements of the operation, for some elements will occur more frequently than others and this frequency of occurrence must be considered when establishing the time standards.34

Need for "Application" of Work Measurement

The body of literature on statistical work measurement is found to be limited. The works referenced above (A.M.A. report and literature on office management) are believed to represent the scope and basic thinking presently available on office work measurement. The emphasis has been placed on need and method. Little has been written, apparently,

on work measurement as an administrative control. Reference is made again to the panel discussion of the American Management Association on "Developments in Office Work Measurement." Mr. Dent made a point that is particularly applicable to the state of development of work measurement of staff operative work and administrative work. He was pointing out some of the common errors in work measurement:

The second mistake is in putting more emphasis on the methods and techniques used in determining the time values in work measurement than is put on the purpose of work measurement. I do not believe that the techniques are as important as the results. They are not even as important as the desire to achieve the results for which work measurement is only one tool.  

The literature reviewed above all but overlooked Mr. Dent's important point. This is one of the areas that will be emphasized in succeeding chapters. Emphasis will be placed upon the fundamental concepts of management, which apply to the proper use of work measurement as an administrative control. Effort will be directed toward an analysis of the basic concepts of administrative control and the potential contribution of work measurement to more effective administrative management.

Status of Work Measurement in Federal Government Agencies

During World War II, agencies of the Federal Government,

35 Charles H. Dent, op. cit., p. 25.
particularly the armed forces, grew to gigantic size in numbers of personnel. Under the exigencies of war, time was naturally more important than economic utilization of manpower. With the cessation of hostilities came the demand for more efficient use of personnel. Work measurement is one of several management improvement programs that were established at that time. The real impetus to development of work measurement came in 1946 when the Bureau of the Budget was made responsible for establishing civilian personnel ceilings. This brought to a focus the need for work measurement. For some time there had been a growing desire on the part of the President, the Congress, and the Bureau of the Budget to be able to tie budget estimates to something more concrete than adjectives about the size of the job to be done. There was a need to put into budget estimates a factual relationship between work to be done, personnel required, and money needed. As a result of this background and the great stress being given to efficiency and economy in the use of manpower, the Army, the Air Force, and the Navy, along with other Federal agencies, developed work measurement systems.

Impetus of the Hoover Commission Report

In 1949, as a result of a specific recommendation of the Hoover Commission Report, the President issued Executive Order 10072 dated 29 July 1949. This Executive
Order prescribed that Federal department and agency heads review plans of their organizations for management improvement. It also provided for the establishment of an Advisory Committee on Management Improvement to assist the President. The action taken by this Committee resulted in the enactment of Public Law 429, 81st Congress, dated 28 October 1949. To implement Title X of Public Law 429, the Bureau of the Budget, in conjunction with the President's advisory committee, issued Circular A-8, which suggested useful techniques for improving management. The Bureau of the Budget published the following three pamphlets in March 1950 as an aid to Federal agencies in establishing their work measurement systems:

(a) "Techniques for the Development of a Work Measurement System."

(b) "Work Measurement and Performance Budgeting and Management Improvement."

(c) "A Work Measurement System—Development and Use (A Case Study)."

These three pamphlets provide the basic principles and concepts from which agencies were to fashion their own work measurement systems, designed to meet their particular situations. The first pamphlet, "Techniques for the Development of a Work Measurement System," contains a hypothetical case study covering: (1) the analysis of needs for work measurement in relation to program planning,
budget administration, and general management, (2) the selection of valid work units, and (3) the development of necessary forms and reporting procedures.

The second publication, "Work Measurement and Performance Budgeting and Management Improvement," is primarily a booklet of visual charts for orientation of executives and supervisors on the purposes, uses, and main steps in the development of work measurement. The third pamphlet is a case study of the application of work measurement in one large agency, the Office of the Adjutant General. It points out that one program failed primarily because of lack of participation and understanding on part of the employees on the local level to whom the system was applied. The booklet is a comprehensive statement of the principles of development, installation, and use of work measurement for management improvement, program scheduling, and performance budgeting.

**Work Measurement Used by the Navy**

In letters dated 4 April and 24 April 1950, the Secretary of the Navy directed the bureaus and offices of the Department of the Navy to bring together their efforts in the field of work measurement. Each bureau and major office was to proceed with the development of a work measurement program designed to serve its own needs. As each bureau developed its own work measurement program, provision was made for collecting facts in common service
areas of major interest to bureaus having technical responsibility in such areas. The Bureau of Ordnance, for example, has its own work measurement program, but in the common service areas of (1) Public Works, (2) Supply, (3) Industrial Relations, and (4) Fiscal—areas in which other bureaus have technical responsibilities—the Bureau of Ordnance collects such data as these other bureaus require.

The next historical development in work measurement came on 16 April 1952 when the Under Secretary of the Navy established the Navy Shore Establishment Work Measurement System. This system is actually a set of correlated bureau and office programs. The responsibility for coordinating the Integrated Program is assigned to the Management Engineer of the Department of the Navy. There is a Navy Integrated Work Measurement Coordinating Committee which assists the Management Engineer in exploring possible areas of standardization, application, and inter-bureau agreement. They agree on the standards used Navy-wide. The coordinating committee is composed of representatives from all the thirteen bureaus and the major offices.

At the present time all naval shore activities report work measurement data to the appropriate bureaus and offices. These bureaus and offices then report the work measurement data in a consolidated form to the office of
the Under Secretary of the Navy. The various performance
rates (manhours expended divided by work units completed)
are compared to standard rates, and thus each local
activity receives a periodic report showing how its
performance compares with the standard and with other
stations of a similar type.

Success of the Navy-wide System

Although the Navy-wide work measurement system
(applicable only to the four common service functions
mentioned, being performed only at shore stations) has
been in operation but for a short time, great savings are
reported to be resulting.

The Bureau of Yards and Docks, the first bureau to
use the new Public Works standard rates developed
by the system, produced a $2,000,000 savings at 19
shore activities under its jurisdiction in the
United States and overseas areas. This economy was
realized during the last quarter of fiscal year
1952 when the bureau used standard rates as the
basis for allocating operating funds. One of this
Bureau's West Coast activities now performs its work
with 150 fewer people.36

For purposes of Navy-wide budgetary control of
functions performed in like manner at all shore stations,
the integrated system is making a tremendous contribution
to management of the shore stations all over the world

36 Report on Manpower Controls and Utilization--United
States Navy. Prepared by the staff of the Deputy to
the Under Secretary of the Navy for Manpower (128
pages) July-December 1952, pp. 3-4.
which compose the Naval Shore Establishment. There is a need, however, for a work measurement system that will act as a tool for the local commander to exercise more exacting administrative control over his command. It was in this area that the project did its research, about which more later. Besides the Navy-wide work measurement system, in the fiscal year 1952, the Navy had nearly sixty other programs of management improvement. They include programs of self-audits, activities of the Inspector General, and work simplification and methods improvement.

Work Measurement Used by the Army

Acting in accordance with the provisions of Public Law 429 (July 29, 1949) the Army Work Measurement Program was established. One of the most complete publications on the program is "The Sixth Army Work Measurement Performance Evaluation Manual," M6-18, dated 1 July 1951. The basic references for this manual are, again, the three Bureau of the Budget publications mentioned above. The Army's system is tied in closely with their accounting system. Like the Navy-wide system, the Army program of work measurement almost entirely employs simple statistical techniques rather than motion and time study. Standards are being established on the basis of classes of installations, and the work measured includes staff operative workers (for example, the personnel administration office)
as well as line operative work, such as workers in armament shops.

Work Measurement Used by the Air Force

Like the Navy, the Air Force has a service-wide system on common functions. The Air Force Integrated Work Measurement Production Control Systems cover common functions performed in air installations and every echelon of materiel maintenance. Most of these systems cover line operative work, such as depot maintenance of aircraft, armament maintenance and inspection, and repair work on other equipment.

Besides the integrated system, separate commands have their own work measurement systems as a part of their management improvement program. Most of the line operative work, such as repair shops, is measured by motion and time study methods. Simple statistical methods are being considered for application to staff operative work. An example is the research and experimental work presently being conducted by the Eastern Air Procurement District. Statistical work measurement is being considered for application to government inspectors in airplane factories.

The Manpower and Organization Division of the Comptroller's Department under the Headquarters, Air Materiel Command have an extensive three-phase program concentrating on improved manpower utilization. The first phase deals with long-range planning, involving broad
standards used to establish planning tables for personnel requirements. The second is the establishment of functional manning tables. The third is a work measurement program.

They are developing functional manning standards for all activities under their command. These standards are to be developed by function instead of by organizational component. Once established, a basic manning standard is "a management tool which indicates for a given function the manpower required to accomplish specific workloads."37

The refinement and development of each of these three programs of improvement of utilization of manpower is interdependent. This point is emphasized by the Air Force, and is one reason for their extensive research, development and application of work measurement. The Air Materiel Command began their work measurement program with the largest segment of manpower, which is also the most convenient to measure, namely, manual operative work in large machine repair shops. Standard performance rates

are being established largely through motion and time study. A program for measurement of staff operative and administrative work through application of simple statistical methods is in the experimental stages.

As part of their management improvement program, to take another example, the Air Force Finance Center has developed its own system. The following paragraph from the annual report on the management improvement program of the entire Air Force describes the system briefly:

During the report year, a work measurement program was developed and implemented which covers all employees of operating segments, or 81% of the Center's population. Approximately 270 work units have been established and defined, and are currently being measured. The program is so designed as to furnish not only production statistics, but also cost, time and leave, and machine utilization data.38

Summary of Federal Agencies' Work Measurement Activities

The President and the Congress have responded to public opinion for increased efficiency and economy in government in a number of ways. Work measurement is an

---

important aspect of the Federal Government's Management Improvement Program. The Bureau of the Budget is charged with coordination and facilitation of the program. Accordingly the Bureau of the Budget pioneered in publication of the basic principles and concepts of work measurement, applicable to Federal agencies. The military organization, representing as it does the lion's share of the Federal budget, has come in for primary consideration, work measurement-wise.

The Army, the Navy, and the Air Force have initiated extensive management improvement programs. Besides attention to factory production type functions, in the area of staff operative and administrative work, the armed forces have all types of programs for improvement in forms control, accounting procedures, organizational surveys, and simple methods and work simplification programs. In the area of work measurement, extensive systems have been developed to measure line operative work. Standard performance rates have been established for many common functions. The Air Force, for example, has standard rates on repair and maintenance work. By collecting and analyzing labor and material cost data at command maintenance activities, yardsticks, cost per flying hour by type of model of engine and factors per horsepower flying hour, have been developed which provides accurate work measurement data to serve in forecasting
budget requirements in both supply and maintenance activities. The basic standards are established primarily through motion and time study and apply to tangible work units such as engines repaired and the like. The Army and the Navy-wide systems are basically simple statistical work measurement. They, like the Air Force, have initiated work measurement in areas that are primarily concerned with line operative work, although real effort is being made to extend their systems to staff operative work that is highly repetitive and is also universally performed throughout the majority of the military activities in this country and overseas. Due largely to the fact that establishment of these systems was founded on the need for justifying the large numbers of military personnel, the systems are primarily accounting and budgetary devices. From this standpoint they serve admirably their purposes; but as a tool with which the local commander can do a better management job, they leave untouched a vital area of management improvement. That area is a local work measurement system which will enable the local commander to establish accountability and follow-up on performance of the management functions of his command.

The reader is warned not to interpret the above statements as meaning the Armed Forces are not abreast of the times, work measurement-wise. As a matter of fact, they are way out in front of the work measurement
developments in most industries. Few firms can make the statement that 81% of its population is covered by work measurement, as does one activity of the Air Force. Nevertheless, both in industry and Federal agencies work measurement of staff operative work is just beginning to receive the attention it deserves. More, the concept of using work measurement data as an administrative control to indicate group progress on specific programs is indeed in its infancy.

SUMMARY OF THE CHAPTER

I. INTRODUCTION TO WORK MEASUREMENT

Private industry, beginning with Taylor's shoveling experiments, has made great strides in work measurement of direct labor, applied to products by primary operative workers and measured through motion and time study methods. With the advent of the gigantic organization (as typified by large Federal agencies) there arises the need for measures of administrative effectiveness as well as operative effectiveness. "Before control is possible measurement must take place." Simple statistical work measurement is such a tool, facilitating administrative control.

Operative measurement is concerned with measurement of projects or operative work. Administrative measurement is concerned with progress of programs. It is an expression
of total group accomplishment. Both operative and administrative measurement are important to controlling the activities of the organization. This study, however, is primarily concerned with administrative work measurement.

There are two methods of work measurement—(1) the traditional motion and time study, and (2) the simple statistical method, based upon manhours expended on work units completed. Motion and time study are usually applied to primary operative work. The investigational methods are observational and work measured is expressed in absolute times. The simple statistical method lends itself to administrative work measurement of group activity. Its investigational methods are statistical and performance rates are relative.

Such work measurement reveals facts about work turned out and the manhours consumed in completion of that work. The uses of simple statistical work measurement can be summarized in the following eight:

1. To control staff operative work.
2. To bring management problems into focus.
3. To determine manpower requirements.
4. To indicate the trend of group performance.
5. To establish accountability.
6. To improve communications.
7. To show departments or areas for possible improvement.
11. PRESENT STATE OF DEVELOPMENT OF WORK MEASUREMENT

The status of developments in office work measurement was the subject of panel discussion at the Office Management Conference of the American Management Association in New York City, October 16-17, 1952. The functions being measured are almost entirely in the category of highly repetitive clerical, staff operative work, such as typing and the operation of other kinds of business machines. Office work measurement was described as being in its "infancy" and the belief prevailed that many clerical operations cannot be measured. Indeed, the idea was expressed, it may be inadvisable to measure these functions.

The size limit in number of personnel to whom work measurement can "profitably" or effectively be applied is contingent upon the purposes of the system. If the firm is a small one, administrative management may be control by personal observation and communication on the part of top executives. If the firm is large enough for "absentee" controls, all employees regardless of the size of the local organizational unit, should be included in the work measurement report.

Both motion and time study and simple statistical work measurement methods are in use by different firms. Again, the purpose of the system is the determining factor.
For closer measurements, motion and time study are used.

The systems discussed at the A.M.A. meeting had as their purposes or objectives one or more of the following:

1. The evaluation of monthly performance (or for some other time period).
2. The analysis of trends.
3. Budgetary control.
4. Determination of manpower requirements.
5. Establishment of standard costs.
6. Wage incentives to increase productivity.

The panel chairman summed up the discussion with the following points, which are a good index of the status of office work measurement.

1. We have proved first of all that work measurement is desirable, to whatever degree it is employed.

2. We are not sure, on the other hand, whether incentives are good or bad. We do not see clearly as yet the importance or the necessity of time study standards versus time estimates or performance averages. After all, work measurement as applied to clerical jobs is fairly new.

3. However, any means of measuring, as long as it permits us to judge the effectiveness of an individual, or a group of individuals, and therefore to judge the number of personnel we shall need under varying circumstances, is a worth-while management tool.

State of Development of Literature on Work Measurement

Textbooks and the handbooks on office management have made a contribution to work measurement by indicating
the need and discussing elementary methods of both motion and time study and simple statistical work measurement. Little has been written on work measurement as an administrative control. The point was made at the A.M.A. conference that it is a "mistake" to put more emphasis on the methods and techniques...in work measurement than on the purpose. Emphasis in succeeding chapter of this study will be placed upon purpose--the uses of work measurement as an administrative control.

Status of Work Measurement in Federal Government Agencies

Work measurement is an important part of the Federal Government's Management Improvement Program. The Bureau of Budget is in charge of coordination of programs sponsored by the different agencies. Both motion and time study and simple statistical methods are used by the Armed Forces. The greatest progress has been in the measurement of primary operative work and in the area of highly repetitive clerical, staff operative work. Little has been accomplished in the area of administrative work measurement, although the Armed Forces are pioneering in this field.
PART II -- ESTABLISHMENT OF ACCOUNTABILITY
AND PREVENTIVE CORRECTION

CHAPTER III

BASIC PRINCIPLES OF MANAGEMENT CONTROLS
(PLACE OF CONTROL IN ORGANIZATION AND MANAGEMENT)

I. CONTROLS ARE NECESSARY FOR PROPER PERFORMANCE OF
MANAGEMENT FUNCTIONS

Part I is made up of Chapters I and II and spells out in quite some detail the significance of administrative work measurement to the industrial organization. The need for administrative work measurement as a control is discussed in the section headed, "Uses of Simple Statistical Work Measurement." The uses of work measurement in solving management problems are summarized into the following eight areas: (1) to control staff operative work, (2) to bring management problems into focus, (3) to determine manpower requirements, (4) to indicate the trend of group performance, (5) to establish accountability, (6) to improve communications, (7) to show departments or areas for possible improvement, and (8) to check results of action taken. Practical examples, taken from the primary research, are given to illustrate each of these points. Discussion of the present state of development of administrative work measurement points out that both the Armed Forces and industry recognize the need for administrative work measurement.
This present chapter has as its objective the clarification of the proper place of control, with emphasis upon administrative work measurement, in the organizational structure and management of an enterprise. Without an understanding of these basic concepts of the relation of control to organizational structure and management, executives look upon work measurement as just another report. The potential effectiveness of the system, thus, is greatly dissipated. Analysis of control entails an overall look at the administrative process involved in running an organization.

It will be shown that in the administrative process there is need of both the application of the principles of organization and management, and a need also for emphasis on methods of motivating employees to act in a manner executives desire.

The importance of such an overall analysis of the administrative process was revealed in the primary research of this study. It early developed that one of the main reasons for initiating the Research Foundation Navy Project was the need, generally, for a better understanding of basic concepts and principles of management. There was available for local officers in executive positions an abundance of literature on techniques of administration, but there remained the need for a better explanation of methods of approach for using these techniques successfully.
Administrative work measurement is simply one of many management control techniques. Its successful application depends upon its proper use in the organizational situation. Field surveys confirmed and strengthened this hypothesis.¹

On the basis of this hypothesis members of the Navy project began to realize that their problem was more basic than simply installing an administrative work measurement reporting system. Basically, the problem was how to make better administrators from the standpoint of manpower utilization. The problem was defined in different terms from time to time. One of the first efforts used the expression "how to get the story across." The psychological

¹ Final Report, op. cit., pp. 6-8. A detailed tabulation and analysis of the findings of the Great Lakes Command Management Survey are presented in "Research Progress Report No. 3 to BuPers.," Unpublished progress report submitted to the Research Division of the Bureau of Navy Personnel, by The Ohio State University Research Foundation Project (ONR 495(05), 19 December 1952. The following two conclusions from the referenced report (page 3) substantiate the need for emphasis upon basic concepts and principles: It was concluded....... B. That solution or improvement in areas of the problems and difficulties of command management depends on improved administrative practices and use of proper management techniques by naval officers at the local command, especially in regard to more effective manpower utilization.

C. That something in addition to traditional manuals and directives is needed in order to "get the story across" on a Navy-wide, continuously sustained basis.
aspects of the problem were finally described as developing "a method of approach to promote (1) understanding, (2) acceptance, and (3) use of work measurement." It soon became clear during the course of the pilot studies that before an executive could "understand," "accept," or "use" work measurement, he must understand the general concepts of administration, especially that of the proper place of control in the administrative process.

An Analysis of the Administrative Process

The writer sees the administrative process neither as confined to psychological and sociological problems nor as a process determined solely by rules or principles pertaining to organization and management. Rather the administrative process is concerned with keeping the factors and forces in the organizational situation in balanced adjustment so that the resultant effects are in accord with the objectives of the organization. To do this is an art that requires not only an understanding of the principles of scientific management, but also the exercise of rare executive ability. Executive ability entails being able to evaluate the potential of many different forces that come into play in the organizational situation. Fayol was one of the first to present the concept of administration as being a matter of keeping factors in proper balance. He expressed the idea that
"it is all a question of proportion." In his book on General and Industrial Management, he said:

For preference I shall adopt the term principles whilst dissociating it from any suggestion of rigidity, for there is nothing rigid or absolute in management affairs, it is all a question of proportion.²

Management, Administration, Organization, and Control--Defined and Analyzed.

There is much loose use of the terms management, administration, organization, and control. They are often used interchangeably when their meaning is not the same. Not only that, each of these terms is used to connote action as well as indicate an institution. Thus "the management" is commonly thought of as a group of people; but it is equally common to speak of "the management of his affairs or the process of managing his affairs.

Not only do these terms have double meanings, but they are used commonly to mean the same thing. Thus "the management," "the administration," and "the organization" are often used to mean the same group charged with the responsibility of running a business firm. Nor is the confusion confined to common usage. Writers in the field themselves indulge in the same practice. Mooney and Reilley point out that the present-day literature on industrial

---

² Henri Fayol (Translated by Constance Storrs), General and Industrial Management, p. 19.
management is a source of confusion:

Even those authors, however, who employ the word "organization" in their titles, concentrate their attention mainly on management, with organization usually treated as a subordinate theme.3

"Control" is used by some authorities as synonymous with "coordination." Urwick, when discussing Mary Parker Follett's principles of "control," explains that by definition she uses "coordination" to mean "control."4

An analysis and definition of these terms is relevant to our study, since definitional clarity is a prerequisite to the explanation of the proper place of work measurement as an administrative control in the management of an industrial organization. Effort will be made to define organization, management, and control, so that their relationships may become more clear.

Concept of Organization and Management

Organization has been called the formal side of management; likewise the machinery of management. It operates as the channel through which the work gets done.


4 L. Urwick, The Elements of Administration, p. 113. He says: "These considerations led her to four broad rules or principles, which should guide the administrator in securing coordination, which, by definition, is control."
Organization is also the framework, the skeleton of the business structure. Organization differentiates and defines duties; but it also relates to the dynamic aspect of procedures. It is the motive power by which an undertaking moves toward its objectives.

Mooney explains organization in this manner:

Two men unite their strength to move some object that is too heavy or bulky to be moved by one. Here we have associated effort, which is synonymous with organization, and likewise coordination, the first principle that underlies all such effort.

This illustration indicates the exact definition of organization. Organization is the form of every human association for the attainment of a common purpose.5

Davis uses the term "organization structure," and thus avoids the pitfall of having his concept confused with that of "management." He says:

By organization structure we mean the relationships between functions, individuals or groups, and physical factors, that combine the various units of executive and operative responsibility into an effective whole. Its development involves two important problems: (1) grouping similar functions in a manner that will promote effective cooperation, and (2) determining the proper relationships between functional groups and organization elements, with a view to promoting both cooperation and effective executive leadership.6

Organization and management have often been compared

6 Ralph C. Davis, Industrial Organization and Management, p. 22.
to the physical body. Management is the activity which runs the organization. It is the psychic complex, while organization is the physical body.

**Concepts of Management and Administration**

Davis defines management "as the function of planning, organizing, and controlling the activities of an organization in whole or in part, to the end that it may achieve its objectives with reasonable economy and effectiveness." This definition is in harmony with the above analysis of organization and management. He puts the breath of life into this definition by explaining that management is the function of executive leadership.

There remains to be pointed out what is meant by "administration." It will become apparent in the quotations, which are to follow in this chapter, that some authors in the field are not thorough in their analysis. When they speak of "administration" they are really discussing "administrative management." Mooney and Reiley trace the terms "management" and "administration" back to old Roman times. They point out:

Administration in Latin means general direction or supervision; management means handling or manipulation; thus the manager executes, under the general direction of the administrator.


Inferred in these definitions is the basis of difference between administrative management and operative management. The former is concerned with running group activities and is usually of a higher order than the latter, which is concerned with management of projects. Thus administrative management is group management, and operative management is project management.\(^9\)

II. CONCEPT OF CONTROL

Fayol wrote with clarity, conciseness, and depth of understanding that grew out of long years of executive experience. Fayol has defined control very simply:

In an undertaking, control consists in verifying whether everything occurs in conformity with the plan adopted, the instructions issued and principles established. It has for object to point out weaknesses and errors in order to rectify them and prevent recurrence.\(^10\)

Brecht, in speaking of office work, offers the following definition:

Control may be defined as "the manipulation of internal forces, existing in men, machines, and materials so as to achieve a maximum volume of work of the right quality at the lowest possible cost, and in a manner and at a speed to promote the overall objectives of the business."\(^11\)

---

9 See Davis, \textit{op. cit.}, p. 36.

10 Fayol, \textit{op. cit.}, p. 107.

Srecht's term "the manipulation of internal forces" infers the execution of more functions than Fayol defines as the proper work of control. To Fayol, control is a verification of what is going on in the organization. Control points out weaknesses, but the act of correcting them is the follow-up which entails commencing the cycle of management functions all over again. It calls for planning and organizing the men, materials, and machines in such a manner that the values set forth in the objectives of the organizational plan will be reached.

Thus in the narrower sense, control is verification of actual performance compared to a standard, which, in turn, is dictated by the organizational plan. In a broader sense, however, the executive functions of planning, organizing, and controlling are like the fingers on the hand, all must be coordinated for effective operations. Control, which consists only of verification, without any form of follow-up correction is useless. When control is analyzed in light of its subfunctions later in the next chapter, this point should be more self-evident.

This interdependence of the executive functions has led Mooney to describe coordination as the "first principle" of management. He explains the idea in these words:

Coordination, therefore, is the orderly arrangement of group effort, to provide unity of action in the pursuit of a common purpose.

When we call coordination the first principle, we mean that this term expresses the principles of
organization in toto; nothing less. This does not mean that there are no subordinated principles; it simply means that all the others are contained in this one of coordination.12

Control - One of the Executive Functions

Outstanding present-day writers in the field conceive control as one of the basic functions of management, or executive leadership. They do not all agree on the number of basic functions of management, nor do they designate them by the same terms. Nevertheless, there is general agreement that no matter how described the following three functions must be performed: (1) there must be a plan; (2) the organizational structure must be set in motion to carry out the plan, and (3) arrangements must be made to see that the activity of the organization is in accordance with the basic plan, in other words, control to meet the plan.

Writing about "Organization Controls in Industry," General Somervell says:

Once we have an organization in which there is a logical division of effort, providing for clean-cut lines of authority and responsibility, we must establish means of control by which the organization can be kept on its course and by which we can measure the results achieved.13

12 James D. Mooney, op. cit., p. 5.

Newman sees control as one of the basic functions of the executive. His definition of "administration," it will be seen from previous analysis in this chapter, is really a definition of "administrative management." He says:

Administration is the guidance, leadership, and control of the efforts of a group of individuals toward some common goal. 14

Newman goes on to explain his definition by pointing out that one way to analyze administrative management is to think in terms of what the executive does. He divides executive functions into five basic processes: (1) planning, (2) organizing, (3) assembling resources, (4) directing, and (5) controlling. He defines control in the following terms:

Controlling—that is, seeing that operating results conform as nearly as possible to the plans. This involves the establishment of standards, motivation of people to achieve these standards, comparison of actual results against the standard, and necessary corrective action when performance deviates from the plan. 15

Later in his book Newman divides the activities of the executives into three parts which coincide with planning, organizing, and controlling. Under planning is included "assembling resources." "Direction" and "control" are both included under the term "supervising." 16

Petersen and Plowman have a little different breakdown of executive functions. It is worthy of note again, that all these authorities include control. Their classification of the functions of management is explained in the following quotation from their book on Business Organization and Management.

As we have already seen, in present-day business organization, there tend to be five distinct types of management activity as follow: (1) trusteeship, or management of ownership considerations, (2) coordination, or the guidance and integration of all managerial activities, (3) direction and control, or general oversight of all activities of the business, (4) supervision, or detailed oversight of performance, and (5) performance of the actual work of the enterprise.17

The difference in analyses of what functions should be included in the concept of control go back to the discussion of the organic functions of management. There are at least two schools of thought concerning the functions involved: Those who contend there are only three organic functions—planning, organizing, and controlling. This group is represented by General Brehon Sommervell; Balderston, Karabasz, and Brecht at the Wharton School, University of Pennsylvania; R. C. Davis and the group at the Ohio State University, and a large group of the American Management Association. There are those who

contend that the organic functions are planning and organizing, plus some combination of such functions as commanding, coordinating, directing, motivating and controlling. The latter group includes Fayol, Newman, Holden, Urwick, Petersen and Plowman, Barnard, and others. As pointed out above, this group differentiates certain functions that are included in control by the former group. They have a narrow view of the control function as a consequence. The group who takes the narrower view, first expressed by Fayol, are generally limiting their concept of control to comparison and corrective action. The quotation from Brecht represents the groups who hold the more inclusive concept of control.

The writer holds that besides comparison and corrective action, the other six basic subfunctions of control--routine planning, scheduling, preparation, dispatching, directing, and supervising--must be performed as well. The eight subfunctions of control will be discussed thoroughly in the next chapter. These are the functions that enable executive management to control the process, to plan and organize their thinking and actions of the organization so that future end products and/or services will be up to standards, which executives have set for the enterprise. This is the broader concept of control. The narrower concept includes only comparison and corrective action. Often it is not too clear how, under the narrower concept,
"corrective action" is to be anything other than "after the fact."

III. CONTROL BY INTEGRATION AND COOPERATIVE EFFORT

Current thinking on organization and management as in the case of control, can be divided into two broad schools of thought. Most of the writers just mentioned above tend to emphasize principles pertaining to organization and management. Their concepts place emphasis upon leadership by command, although many recognize that to be effective leadership must be a motivating force. Nevertheless, for all practical purposes, their concept of how an organization operates is primarily one of a group of executives deciding what is to be done, ordering and directing the activity, and checking to see that results are in accordance with the plan.

To them, "the organization" is made up of the operative employees and the executive employees who go to the plant and office to perform the operative and administrative work. This activity is necessary to produce the goods and the services to satisfy customer wants. Goods and services are the source of revenue from whence come the wages and salaries, the dividend checks, and the funds to carry on social security and employee benefit programs, as well as pay taxes. These writers are aware that the corporate entity owes its life to the state, its charter to do
business having been granted by the government of the people. Nevertheless, their concept of "the organization" does not emphasize "outside interests" of the customers, competitors, and the general public.

The writer realizes that he runs the risk of being grossly misunderstood in what he is about to say. It is not all black or all white; but some shade of gray. His purpose is not to call one philosophy of management wrong, the other right. It is his purpose to point out that at least two distinct schools of thought exist, and that both have principles and concepts which are applicable to the administrative process.

The second school of thought places emphasis on motivation of the individuals who represent some of the different forces and pressures in the organizational situation. There are the pressures from labor, from suppliers, from customers and from public opinion. There are also other forces and factors in the situation which are due to physical conditions and economic circumstances. Mary Parker Follett and Colonel Urwick, to mention two of many who discuss the problem, refer to all these pressures playing upon the organization in a continuing bombardment, as the law of the situation. If the law of the situation is not to become rule by expediency, then executive decisions must include in their analysis of what to do, both the expected short-run and long-run results.
The administrative process involves an analysis of the pressures from all these different groups, and then deciding what action to take as a consequence. Each of the groups has its own objectives and goals in mind. The customers want the greatest satisfactions from the goods and services of the firm, at the lowest possible price. The operative workers and the administrative workers want high wages and salaries. The stockholders want dividends, and the executives know the means to dividends is economic and effective operations. These objectives are conflicting, and the administrative process is the complex direction of activities that will come as close as possible to keeping all the pressures in balanced adjustment. Otherwise, employees strike, customers take their business elsewhere, stockholders sell their interest in the corporation, and the public demands needed services and goods be supplied by someone else.

Donham, Barnard, Tead, and a long list of other authorities insist that the first prerequisite of successful operations is an economically healthy organization. By that they mean an organization which has sound depreciation policies, pays "fair" wages, salaries, and dividends and sells its products and services at a "fair" price. Since investment in a corporation is a risk activity, there are those who do not feel dividends should be the accepted rule. They feel that, at least some of
the time, stockholders should expect losses, not profits. Most of these writers, however, feel that in the long run there must be profits and there must be dividends. How could Barnard, President of New Jersey Bell Telephone Company, feel any other way?

The above is an attempt to explain the concept of the organizational situation. There is a school of thought which holds that the primary concern is with methods of motivating labor, customers, stockholders, and the public present in the situation. Manpower-wise it is a labor relations problem, and advocates of such motivation are often apt to neglect possibilities of leadership through better organizational structure and management procedures and policies. This second school of thought concerns itself primarily with the problem of motivating employees.

Petersen and Plowman, for instance, in the quotation above refer to control as something which executives exercise over the organization. They emphasize procedures, and principles of organizational structure. Writers who emphasize control by cooperation on the other hand, see that the control is not so much by executives as it is over them. Barnard makes this point in his The Functions of the Executive:

Control relates directly, and in conscious application chiefly, to the work of the organization as a whole rather than to the work of executives as such. But so heavily dependent is the success of cooperation upon the functioning of the executive organization
that practically the control is over executives for the most part. If the work of an organization is not successful, if it is inefficient, if it cannot maintain the services of its personnel, the conclusion is that its "management" is wrong; that is, that the scheme of communication or the associated personnel or both, that is, the executive department directly related, are at fault.18

Barnard explains his concept of cooperative organization in his book on Organization and Management in the following quotation:

The conception of organization at which I arrived in writing The Functions of the Executive was that of an integrated aggregate of actions and interactions having a continuity in time. Thus I rejected the concept of organization as comprising a rather definite group of people whose behavior is coordinated with reference to some explicit goal or goals. On the contrary, I included in organization the actions of investors, suppliers, and customers or clients. Thus the material of organization is personal services, i.e., actions contributing to its purposes. In stating what was required to elicit such services from the individuals, however, it was convenient to make the application and to use the terms appropriate to the relationships of those contributors usually called employees or "members" of the organization. Thus I said, (The Functions, p. 227):

The second function...is to promote the securing of the personal services that constitute the material of organizations. The work divides into two main divisions: (1) the bringing of persons into cooperative relationship with the organization; (2) the eliciting of the services after such persons have been brought into that relationship.

As executive functions they may be distinguished as the maintenance of morale, the maintenance of the scheme of inducements, the maintenance of schemes of deterrents, supervision and control, inspection, education and training.19

19 Chester I. Barnard, Organization and Management, pp. 112-113.
It is interesting to note the place Barnard gives control as an executive function. What Barnard sees in control, which others have failed to express, is that once comparison has been made between actual performance and standard performance, correction depends upon gaining cooperation of the subordinate executives and operative employees.

So stated, without presenting much more of Barnard's theory of "cooperative systems," this statement that correction depends upon cooperation is oversimplification. Actual performance may fall short of the standard for a number of reasons. An example is a power failure due to an act of God. To trace all the reasons back to cooperation seems to the writer highly theoretical; yet cooperation, or coordination as Barnard presents it, is such an important concept of good management that the reader is urged to give it full consideration. When writing on the executive process, Barnard emphasizes the importance of coordination:

The creative side of organization is coordination. The securing of the appropriate combination of the elements of the organization to produce utilities is the basis for the endurance of cooperative systems... Under most circumstances, therefore, the quality of coordination is the crucial factor in the survival of the organization.20

---

20 Chester I. Barnard, The Functions of the Executive, p. 256.
In one of the above quotations, Barnard presents his concept of executive functions as "an integrated aggregate of actions and interactions having a continuity in time." "Thus," he says, "I rejected the concept of organization as comprising a rather definite group of people whose behavior is coordinated with reference to some explicit goal or goals." It is difficult for the writer to conceive of an organizational situation where there is effective service without goals or objectives. If this is what Barnard means, then the writer must part his company, because the concept is out of line with experience and other authorities quoted herein.

What the writer sees of value in this quote from Barnard, however, is his wider perspective of the pressures from different groups in the organizational situation. They extend beyond the limits of people on the company payroll to include suppliers, customers, competitors, and the general public. Also in another place, Barnard indicates he is mindful of the specific objectives of the organization. He says in writing an explanation of his theory "of cooperative systems and of organization:"

Among the most important limiting factors in the situation of each individual are his own biological limitations. The most effective method of overcoming these limitations has been that of cooperation. This requires the adoption of a group, or non-personal purpose. The situation with reference to
such a purpose is composed of innumerable factors, which must be discriminated as limiting or non-limiting factors:21

So it would seem that Barnard, almost taking the present-day organizational structure and principles management for granted, places emphasis upon the importance of motivating all the people concerned with the organization to cooperate to the end that all their objectives may be attained.

Simon conceives administrative management as entirely a problem in social psychology. He calls the principles of organization and management "proverbs," and goes on to point out that there is a need for a set of principles by which to determine what is to be done as well as the principles for doing it. Simon criticizes the principles of organization on the basis that they are contradictory. He points out, for instance, that it is a principle of organization that an employee shall be responsible to but one superior; yet at the same time there is the principle of division of work by functions. To Simon this is inconsistent. Apparently Simon does not agree with Fayol's idea of proper "proportion" being the essence of the application of the management principles. It is almost as though Simon had listened intently to what Barnard has

21 Ibid., p. 60.
to say about social values, status systems, and coordination, but had not heard a word he spoke about the principles of organization structure and procedures. But let Simon speak for Simon:

Administration is ordinarily discussed as the art of "getting things done." Emphasis is placed upon processes and methods for insuring incisive action. Principles are set forth for securing concerted action from groups of men. In all this discussion, however, not very much attention is paid to the choice which prefaces all action—to the determining of what is to be done rather than to the actual doing. It is with this problem—the process of choice which leads to action—that the present study is concerned.

A general theory of administration must include principles of organization that will insure correct decision-making, just as it must include principles that will insure effective action.

If this is a correct description of the administrative process, then the construction of an efficient administrative organization is a problem in social psychology. It is a task of setting up an operative staff and superimposing on that staff a supervisory staff capable of influencing the operative group toward a pattern of coordinated and effective behavior.22

The writer must have made it clear that he feels Simon has blind spots in regard to the application of the principles of organization. Nevertheless Simon, with his emphasis upon the point of view of the operative worker, sounds a warning of the importance of social values which no present-day executive can afford to overlook. It seems to the writer that Simon is really talking about the

22 Herbert A. Simon, Administrative Behavior, pp. 1-3.
principle of participation—perhaps without fully realizing it.

Social Responsibilities of the Organization

One of the forces or "proportions" that is demanding foremost attention of the executive is the relative place of social responsibilities in the organization. Only within recent years has this matter begun to receive proper attention. It is perhaps unnecessary to place a definite date on social change. For example, when did women gain equal rights, or child labor cease? Colleges and universities have touched on the importance of social responsibilities in industry, in one way or another for a good many years, but the full impact of the importance of social responsibilities as we think of them today was not articulate in business until the wave of "New-deal" legislation that came with the first Franklin D. Roosevelt Administration. Those were dark days for industrial capitalism and our system of free enterprise almost collapsed. Many lay much of the blame to poor executive leadership. Perhaps this is one reason why Dr. Gras, while professor of business history at the Harvard Business School, suggested that businessmen should erect a huge

---

23 See Wallace B. Donham, Administration and Blind Spots and also Harwood F. Merrill, ed., The Responsibilities of Business Leadership.
monument to Franklin D. Roosevelt; for it was he who shook the American business executive out of his lethargy toward social consciousness.

This social consciousness took the form of codes of "fair practice". It is a little ironic to see free-competition-minded businessmen sitting down together, writing rules of competition aimed at making the game a little less competitive. And all this at the invitation of the Federal Government, which for years has kept open an eagle eye to see that trusts were not formed.

At the same time business became more cognizant of the "rights" and wants of labor. Labor no longer is considered just another factor of production.

Donald Kirk David has written a clear statement of his ideas of the businessman's responsibilities in the "Introduction" to the little book on Responsibilities of Business Leadership. He points out there are two major objectives toward which the administrative capacities and attitudes of the "ideal" businessman should be directed. First, he must furnish society with material satisfactions. On the point, he says:

To do this, he must be a maker of jobs and therefore a maker of profits. In thinking of profits he must not be a slave to the annual financial statement, but must take the longer view. The competent business administrator must know that in a free society his enterprise can maintain profits over any considerable period of time only by a proper balance among the real holders, suppliers, customers, and all others
directly affected by the activities of the business.24

The second objective Dean David lists is an even greater responsibility. It is the responsibility for increasing "all the human satisfactions of the group with which they (business leaders) are associated." This, of course, includes on-the-job satisfactions of employees.

Current thinking on the place of social responsibilities relative to the organization varies widely among authorities. By all however, social responsibilities and human needs and wants in industry receive recognition, even if their opinions vary.

To the writer's way of thinking, Simon carries the importance of the employees' wants to the extreme; because he views the administrative situation apparently solely from the point of view of operative workers. One immediately begins to wonder about the impact of other forces and factors in the organizational situation, namely, the long-run and the short-run economic and social pressures of the customers and stockholders. Simon describes his proposition in the following quotation:

The central theme around which the analysis (his book) has been developed is that organization behavior is a complex network of decisional processes, all pointed toward their influence upon the behaviors of the operaties—those who do the actual "physical" work

of the organization. The anatomy of the organization is to be found in the distribution and allocation of decision-making functions. The physiology of the organization is to be found in the processes whereby the organization influences the decisions of each of its members—supplying these decisions with their premises.25

Simon points out, and rightly so the writer feels, however, the importance of executive perception of social values that operative workers want. He says on the subject:

The higher we go in the administrative hierarchy, and the broader becomes the range of social values that must come within the administrator's purview, the more harmful is the effect of valuational bias, and the more important is it that the administrator be freed from his narrower identifications.26

Emphasis upon social consciousness is recognized by others than the proponents of the psychological and sociological aspects of management. President of the American Management Association, Lawrence A. Appley, has said it ably for his contemporaries:

We, the contemporaries of the age, are coming to realize that management is a career and that its effective exercise is based upon the understanding of human motivations, sensitivity to the means of securing human responses, and skill in supplying human satisfactions. For those who still cling to the outdated belief in progress through exploitation, the verdict has been written. The evolution of social progress makes them anachronisms in our day. Sound leadership is now plainly dependent upon statesmanship—a statesmanship which in its highest sense is a standard for measuring the conduct of

25 Herbert A; Simon, Administrative Behavior, p. 220.
those who have responsibility for the activities of other people...

An important step is made in the life and thinking of any executive when he shares with Dr. Tead the deep conviction that "to lay it down as an unassailable dogma that considerations of profit-making constitute the all-controlling and simon-pure aim of administration is just not the truth."27

Urwick emphasizes the social aspects of organization also. In his The Elements of Administration, he explains it thus:

The first step is undoubtedly a recognition that social organization, on whatever scale, can only prove successful in so far as it is social. That is to say, the aim which is pursued by all concerned in the administration of each group is an objective enlisting the interest of the group as a whole, and consistent with the interest of all larger groups of which it is a part, not some extraneous purpose desired by certain individuals in that group, either as individuals or as members of some other professional or social grouping. Administration can only be based on principle in so far as this underlying principle is accepted. And since it is only by the development of administration based on principle that humanity can hope to make headway against the problems created by power driven machinery, individual opportunism is, in the conditions of today, as immoral as destructive of orderly, secure, cooperative living, as lying, deceit and other forms of personal corruption.28

Likewise, Dean Donham expresses the need for social consciousness, which he and those who have followed him have tried through the years to instill in the students


at the Harvard Business School:

The need was never greater for socially conscious trained administrators in government, business, and labor; for men who can act wisely through cooperative human organizations with reference to the constantly shifting scene, to the end that multitudes of our people feel the enduring satisfactions of life. To this end, government, business, and labor administrators must work together or we shall lose our chance for national stability under freedom. No generation ever faced heavier responsibilities, more stimulating challenges, or more dangerous adventure. 29

IV. SUMMARY OF PLACE OF CONTROL IN ORGANIZATION AND MANAGEMENT

Out of this discussion of the basic factors of organization and management the place of control should become clearer. The views of a number of authorities have been presented--Fayol, Brecht, Appley, Tead, Barnard, Urwick, Donham, Mooney and Reiley, Davis, Newman, Petersen and Plowman, and Simon. We have seen that their concepts may be classified into two schools of management thought. One emphasizes the relations with the individual, and the problems of motivation involved in social psychology. Examples of this are found in Simon, Donham, Barnard, Fayol, Urwick and Tead. The others emphasize the relations of the formal group, organization structure, procedures and a functional analysis of executive leadership.

The writer agrees with the authors who hold that all

29 Wallace B. Donham, Administration and Blind Spots, pp. 32-33.
these factors come into play in the organizational situation and it is the proper function of the executive to keep all the factors and forces in "balanced adjustment" so the results will be progress toward the accomplishment of the objectives of the enterprise. In the accomplishment of the management of the enterprise basic functions must be performed. They are the creative planning, organizing, and controlling the execution of the organization plan to the end that the objectives of the organization are accomplished.

Accomplishment of the objectives of the organization we have seen to be a compromise process. Pressures are brought to bear on the organization by labor, customers, stockholders and public opinion. The executive must so organize, plan, and control the activities of the organization that these pressures are kept in balanced adjustment.

Control is the function of constraining and regulating activities. The next chapter deals with the eight sub-functions of control. The last two are comparison and corrective action. The forward-looking aspects of control are found in these two functions. They enable control to be before-the-fact, instead of after-the-fact. Control has as its purpose the control of the process or procedure, not control of the final product or service; because control of the final product is simply a sorting operation.
It does not insure better future products. It is only as the causes of present defective products are discovered and corrected, that control is effective. Administrative work measurement facilitates all the eight subfunctions of control, as will be seen in the next chapter, but it primarily is concerned with comparison and corrective action. Work measurement provides the data for comparison of actual to standard performance. As a result of comparison, programs of improvement should be installed. They take the form of improvements in organization structure, training programs, and work simplification projects. Such are the corrective actions. Work measurement again provides the data by which progress resulting from the programs of corrective action can be noted and measured.

Having described the place of control in management of the organization, we turn now to analysis of what is involved in performing the function of control.
CHAPTER IV

BASIC PRINCIPLES OF MANAGEMENT CONTROLS (CONT'D.)

(SUBFUNCTIONS OF CONTROL ANALYZED; COORDINATIVE STAFF, AN AGENCY OF CONTROL; RELATION OF ADMINISTRATIVE WORK MEASUREMENT TO OTHER CONTROLS)

I. INTRODUCTION

Chapter III discusses concepts of organization and management, with special emphasis upon the place of control. The purpose of this chapter is to discuss the proper place of work measurement in performing the functions of control. This calls for an analysis of the subfunctions of control, and an explanation of how administrative work measurement can facilitate these functions. Certain of these functions are organic and must be performed by the line organization; others are facilitative and are the proper functions of a staff organization. A logical agency to perform staff control functions is the coordinative staff.

Performance is measured in terms of quality, quantity, expenses, and/or time. The place of administrative work measurement is analyzed, too, in relation to other control techniques available to measure performance.

II. THE EIGHT BASIC SUBFUNCTIONS OF CONTROL

Definitions and concepts of management and executive functions of representative authorities in the field are
discussed in Chapter III. All authorities mentioned recognized control as an executive function; and while different terms and classifications were used, there is agreement at least that the three organic functions of planning, organizing, and controlling must be performed.

Some authors prefer to think of direction, supervision, dispatching, and other classifications which are quoted in Chapter III as being among the basic functions of the executive. These functions, it will be shown, however, logically fall under the organic function of control.

Davis orients this problem of control by explaining that "management is the function of executive leadership. It is a mental activity. Its organic functions are the creative planning, organizing, and controlling of the activities of an organization, both mental and manual in accomplishment of its objectives. Planning determines and specifies the factors, forces, effects, and relationships that are required for achieving the objectives of an assigned mission." The function of control is the work of "constraining and regulating action in accordance with plans for the achievement of specified objectives." 1

Davis' concept classifies control under eight sub-functions: routine planning, scheduling, preparation, dispatching, supervision, comparison, and corrective action.

Routine Planning

Routine planning for control purposes involves only a secondary or re-determination of planning information. It consists of the provision for information to subordinate executives who are charged with the responsibility of execution of the original creative planning. Creative planning is the original determination of a basis for action. Such planning consists of formulation of the original decisions concerning what should be done, how, what factors are involved, and who should be responsible for the work. Routine planning originates the information concerning the requirements for an effective, economical execution of the plan. It commences the issue of such information to those charged with responsibility for execution. Thus routine planning establishes the basis for the subsequent constraint and regulation of action. For control purposes, then, routine planning involves only a secondary or re-determination of planning information.

An example of routine planning is the activity of registering students and making arrangements for classrooms at the beginning of a semester. The creative planning consisted of planning what courses should be offered, who should teach them, and the like. How to carry out the plan is part of the routine planning.
Scheduling.

Scheduling is the function of determining when or at what rate the principal phase of the plan must be completed to meet the final time objective of the undertaking. It is concerned with the time of performance. It translates time elements to perform projects or job orders (quantitative times) into chronological time values, which are necessary for controlling the activities of an organization.

An example is the shop schedule which calls for operation "X" to be completed by January 30; operation "Y" to be completed by February 5; so that the semi-finished products of operations "X" and "Y" may be scheduled for assembly by another department on February 7.

Preparation

Preparation is the function of assuring that factors and conditions required for execution of the plan will be available as needed, and in the proper proportions. For example, an automobile manufacturer must prepare for new models by having new dies and molds available, as well as having made provision for the proper number and kinds of parts that go into assembling cars. The function of preparation is the concern primarily of the level of management responsible for operative work. Davis makes the point that the other subfunctions of control are concerned largely "with problems of coordination within
the principal chain of command."  

Routine planning is the control function which coordinates the information supplied by technical staff planning groups with the requirements of the line organization for such information. Preparation coordinates certain technical staff services of facilitation with the needs of the line organization for such services. For example, technical staff services develop the process of manufacturing an article. Routine planning calls for specifying the work shall be done in accordance with that process, and preparation makes sure the necessary equipment, men, and materials are available to do the work.

Dispatching

Dispatching is the function of maintaining coordination through control of the release of the authority to act. Orders and other instruments of communication are used to initiate action. They are backed by the necessary authority and contain the information needed to indicate what and how the work is to be done. The function of dispatching is performed for the most part by the employees who perform the planning, scheduling, and preparation functions. However, if the volume is sufficient, dispatching may be differentiated from the other staff functions of control.

It is desirable to fix staff responsibility and accountability for the initiation of action.

Time is the essence of dispatching. Enough time must be allowed to accommodate orderly routine planning on the part of parties receiving the communications; and, on the other hand, a time limit must be established to maintain proper flow of activities and materials through the organization.

**Direction**

Direction is the function of instruction concerning the requirements for proper execution of the plan. Before the work is begun, the executive or operative employee must be told what to do and how to do it. Such instructions are based on the information from a higher level of command. In cases of repetitive operations direction is not necessary each time, but only to new employees or in case of changes in procedures performed by old employees.

**Supervision**

Supervision is the function of assuring that current execution is taking place in accordance with plans and instructions. Supervision consists of checking up periodically to see that the directions are being carried out properly. It is concurrent with performance of the work. Training is really a special form of direction and supervision.
Comparison

Comparison is the function of determining the degree of agreement between actual and planned results. It is the process of comparing actual performance to standard. To be effective the comparison reports must be timely, accurate, and provide data regarding all four basic measures of quality, quantity, expense, and time for performance. The data must be comparable to the standard, and should indicate whether degree of deviation is significant. (These subjects will be discussed in detail in later chapters.) The results should be transmitted promptly to the proper coordinating executive, and such reports should conserve the executive's time by calling attention to exceptional cases.

Corrective Action

Corrective action is the function of the removal of interferences with planned execution and the restoration of effective, coordinated action, thus returning operations to normal. Corrective action should be an automatic follow-up as a result of comparison reports. Responsibility for results should be established, and steps taken to prevent deviations from reoccurring. Both positive and negative disciplinary action should be taken when the facts call for it. Positive action by way of recognition of a job well done should be as much a matter of policy as negative reprimands in cases of sub-standard performance.
Classification by Time of Performance

These subfunctions can be classified as to order of performance and on the basis of assignment to the line or staff organizations. Figure 1, "The Organic Functions of Control" illustrates this relationship. The first four subfunctions (routine planning, scheduling, preparation, and dispatching) are preliminary control functions and must be performed before the operational process is activated. In fact, the fourth function of dispatching consists of release of the authority to act—to start operations. The last four (direction, supervision, comparison, and corrective action) are concurrent control functions and are performed during the operational process in an effort to increase the effectiveness of the organization.

Line and Staff Assignment of Basic Subfunctions

Three of the subfunctions of control are assigned to the line organization, because they cannot be delegated to a staff organization but depend upon line authority to make decisions and to command action for successful accomplishment. They are the functions of direction, supervision, and corrective action. However, it should be emphasized that even in these line functions the staff organization

---

3 Figure 1 is reproduced from Ralph C. Davis, Fundamentals of Top Management, p. 407, by permission of the author.
FIGURE 1
THE ORGANIC FUNCTIONS OF CONTROL

<table>
<thead>
<tr>
<th>NORMAL ORDER OF PERFORMANCE</th>
<th>CONTROL SUBFUNCTIONS</th>
<th>ORGANIZATIONAL ASSIGNMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preliminary Control Functions:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Routine Planning: A secondary, routine provision of information concerning the plan.</td>
<td>X</td>
</tr>
<tr>
<td>2</td>
<td>Scheduling: The determination of when or at what rate the principal phase of the plan must be completed to meet the final time objective of the undertaking</td>
<td>X</td>
</tr>
<tr>
<td>3</td>
<td>Preparation: The function of assuring that the factors and conditions required for execution of the plan will be available as needed.</td>
<td>X</td>
</tr>
<tr>
<td>4</td>
<td>Dispatching: The maintenance of coordination through control of the release of the authority to act.</td>
<td>X</td>
</tr>
</tbody>
</table>

| Concurrent Control Functions: |                      |                           |
| 5                           | Direction: The function of instruction concerning the requirements for proper execution of the plan. | X |
| 6                           | Supervision: The function of assuring that current execution is taking place in accordance with plans and instructions. | X |
| 7                           | Comparison: The function of determining the degree of agreement between actual and planned results. | X |
| 8                           | Corrective Action: The removal of interferences with planned execution and the restoration of effective, coordinated action. | X |
can assist by facilitating action. Such action usually takes the form of fact finding, analysis, recommendations, and reporting on whatever follow-up action may be taken.\(^4\)

This facilitative data is then used by the line organization in deciding what to do relative to the three control functions of direction, supervision, and corrective action.

---

\(^4\) Ralph C. Davis, ibid., p. 390. This author has a more complete analysis and discussion of basic staff duties. They are classified as (1) investigation, (2) analysis of facts and information, (3) interpretation, including services of information, (4) recommendation, including the formulation of plans, (5) coordination, including assistance in control, and (6) facilitation, including assistance in organizing and execution.

See also James D. Mooney, The Principles of Organization, pp. 33-34. He points out:

"Staff service in organization means the service of advice or counsel, as distinguished from the function of authority or command. This service has three phases, which appear in a clearly integrated relation: the informative, the advisory, and the supervisory.

"The point is that the line represents the authority of man; the staff, the authority of ideas."

The writer questions the last statement, since authority is a derivative of objectives, policies, functions, and factors both human and physical that are involved in the particular mission. They determine what rights an executive should have to make decisions and issue orders. Mooney's concept of staff service being advice, however, is helpful in explaining the difference between Line and Staff.
All the four preliminary control functions (routine planning, scheduling, preparation, and dispatching) can be performed by a staff organization, since they are informative, coordinative, or facilitative in nature and do not depend upon line authority of command over personnel for their proper accomplishment.

The one concurrent control function which can be performed by a staff organization is that of comparison. Comparison consists of the staff duties of investigation and analysis of facts and information, and as such provides informative advice which can then be used in the decision-making process.

III. ADMINISTRATIVE WORK MEASUREMENT—A TOOL OF CONTROL

There are a number of managerial "tools" or techniques available. These techniques can be used to give an indication of the basic measures of performance, namely, degree of quality, quantity, and expense relative to time. Administrative work measurement is but one of these tools. Examples of other techniques used to reflect the four basic measures are illustrated in Figure 2. For example, quality measures can be indicated by statistical quality control; expense measures can be shown by budgetary control, and time measures find expression in production plans and programs.

Control constrains and regulates the action of the organization to meet the requirements of the four basic
measures relative to the values which are the aims of the organizational objectives. The techniques mentioned (including administrative work measurement) are representative of the tools available for the accomplishment of the subfunctions of control.

**FIGURE 2**

**EXAMPLES OF BASIC CONTROL TECHNIQUES**

<table>
<thead>
<tr>
<th>Basic Measures of Organizational Objectives</th>
<th>Operative Control of Projects</th>
<th>Administrative Control of Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity Measures</td>
<td>Time and motion pdn. rates.</td>
<td>Administrative work measurement.</td>
</tr>
<tr>
<td>Quality Measures</td>
<td>Quality inspection.</td>
<td>Statistical quality control.</td>
</tr>
<tr>
<td>Time Measures</td>
<td>Pdn. rates.</td>
<td>Production plans and programs (Performance control).</td>
</tr>
</tbody>
</table>

The eight basic subfunctions of control have been analyzed above as to the duties each entails. Let us analyze now how administrative work measurement can be used to facilitate the control functions. The facilitative uses of administrative work measurement as a control technique are illustrated in Figure 3.


FIGURE 3

FACILITATIVE USES OF WORK MEASUREMENT
AS A CONTROL TECHNIQUE

<table>
<thead>
<tr>
<th>SUBFUNCTIONS OF CONTROL</th>
<th>USES OF ADMINISTRATIVE WORK MEASUREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STAFF:</strong></td>
<td></td>
</tr>
<tr>
<td>1 Routine Planning</td>
<td>- Provides basic data on manpower needed to meet plans.</td>
</tr>
<tr>
<td>2 Scheduling</td>
<td>- Provides quantitative production times and lead times, which can be used in chronological scheduling.</td>
</tr>
<tr>
<td>3 Preparation</td>
<td>- Provides basis for manning tables.</td>
</tr>
<tr>
<td>4 Dispatching</td>
<td>- Provides basis for timetable for entire organization.</td>
</tr>
<tr>
<td>5 Comparison</td>
<td>- Supplies data on actual results to be compared with standard, thus is the basis for comparison.</td>
</tr>
<tr>
<td><strong>LINE:</strong></td>
<td></td>
</tr>
<tr>
<td>6 Direction</td>
<td>- Provides basis for direction of quantity factor.</td>
</tr>
<tr>
<td>7 Supervision</td>
<td>- Provides reports for measuring progress.</td>
</tr>
<tr>
<td>8 Corrective Action</td>
<td>- Provides facts for basis of corrective action, which often include work simplification and organizational improvement programs.</td>
</tr>
</tbody>
</table>
Work Measurement Aids Routine Planning and Scheduling

Work measurement can aid in routine planning by supplying information on the quantity of manpower that is available for different types of work and also by affording past performance data on rate of output. Scheduling is a chronological timetable for determining when, and at what rate, the principal phases of the plan must be completed to meet the final objective of the mission. Work measurement can provide the data on the time elements that different groups need to complete their activities, including lead time. From this data chronological scheduling can take place.

Work Measurement Aids Preparation and Dispatching

The subfunction of preparation is concerned with having the factors and conditions on hand when they are needed for execution of the plan. Work measurement can afford information about manning tables, so it may be ascertained that the proper amount and type of manpower is available for the mission or accomplishment of the objectives.

Work measurement reports are, among other things, reports on current production. Thus it can aid in the function of dispatching by affording data basic to forecasting proper dates for the release of authoritative communications to initiate action.

In connection with operative work of projects, it is
more apparent that the eight subfunctions of control must be performed. For example, the line must be informed concerning the methods to be used in effective, economical execution of the project. This is routine planning. Likewise, preparations must be made to have the equipment, men, and materials available. Production orders must be dispatched, authorizing beginning the project. This is all control of operative work. The point is there is much to be gained by the application of the eight subfunctions of control to administrative work, and this is the primary concern of this section. Administrative control without routine planning, preparation, or dispatching or any of the other subfunctions results in confusion. It leaves performance of these functions to chance.

Here we are concerned with dispatching for purposes of administrative control, rather than operative control. In other words, it has to do with the release of authority to initiate action on programs, rather than projects. Also administrative work measurement aids in establishing lead time for scheduling purposes and for dispatching when target dates have been set for each plan of the program.

Work Measurement Important to Comparison

Work measurement is most important in the function of comparison. It supplies the actual data on results which are compared to standard performance. The subject of standards will be discussed in detail later, but it is
pertinent to note here that work measurement can be used in the development of standards of manpower performance. In fact, from the standpoint of controlling manpower, work measurement is the principal technique for comparison purposes. Such administrative comparison facilitates the comparison of group results with corresponding performance goals.

**Work Measurement Facilitates Line Subfunctions of Control**

The line subfunctions of direction, supervision, and corrective action depend upon work measurement data to provide the facts upon which decisions and actions must be based. Work measurement can point out the areas needing attention. It can show effectiveness is on an upward trend, or is substandard. Work measurement cannot supply the decision of what to do about it or of itself correct the situation. In other words, installation of a work measurement system will not correct management problems. It can point out where improvement is needed, however, and so aids indirectly.

Administrative work measurement facilitates the control functions which are the proper prerogative of the line organization. The uses of work measurement are outlined in Chapter II. They include the uses of focusing attention on management problems and bringing to light departments and areas where possible improvements can be made. This facilitates direction, supervision, and
corrective action. It is accomplished through the application of the principles of (1) attention to exceptional cases and (2) analysis of limiting factors. The former allows executives more time for the important trouble areas. The latter develops in executives a managerial method of approach which ferrets out the important causes and leads to programs of improvement.

When the work measurement report indicates substandard performance, the responsible executive should be called for an accounting. Such an accounting leads logically to a survey and investigation of the limiting factors and forces in the organizational situation to determine the causes. Thus the analysis of the limiting factors should be the basis for corrective action. The management problems may call for programs of work simplification—methods improvement by improved physical working conditions; changes in procedures revealed by flow-chart studies or revised layout of office space. Analysis may call for a training program directed to improve morale through improved subordinate leadership. Again, work measurement data may lead to an organizational analysis, resulting in organizational improvements. Work measurement reports, thus, may become the automatic barometer that indicates the need for work simplification and organizational improvement programs.
IV. COORDINATIVE STAFF PERFORMS STAFF CONTROL FUNCTIONS

Controls are necessary in any organization. They complete the cycle of basic management functions in the accomplishment of a mission: (1) planning what to do, (2) organizing and putting the plan into operation, and (3) controlling the execution of the plan to the end that the objectives of the organization are accomplished. Davis classifies objectives of an organization into three groups: (1) primary service objectives, (2) collateral objectives, and (3) secondary objectives.

The primary service objectives of an organization are customer satisfactions from goods and services produced and rendered by the organization. The collateral objectives are values that the owners or employees want for themselves, or that the government demands. They include profits, salaries, wages, and on-the-job satisfactions and other values of a similar nature. The secondary objectives of an organization are those values that it needs to perform its functions with economy and effectiveness.5

In the industrial business world competition as evidenced in prices, relative to the satisfactions from goods and services, is the stimulator and regulating device. If the organization does not sell anything it makes nothing.

---

in the military situation more and more effort is being exerted by public opinion through Congressional representation for "more for the dollar of Government expenditure."

Control has been defined as the function of constraining and regulating activities that enter into the accomplishment of an objective. The chief purpose of control is a more effective and economical accomplishment of primary objectives through a better accomplishment of secondary objectives. Effort is made to accomplish this end through coordination of all organizational activities. Such coordination entails the performance of the eight basic subfunctions of control. Regardless of the stage of development of the organization these subfunctions must be performed. In the small one-man business, the owner may perform them all. In the large organization the line executive cannot possibly perform all eight by himself. Lack of technical knowledge and physical limitations of time and space prevent it in most large organizations.

6 Elmore Petersen and E. Grosvenor Flowman, Business Organization and Management, p. 57. They say:

"Coordination is the form of leadership required in large enterprises where personal leadership is weakened by many factors. Coordination is a pervasive condition applicable to all the relationships of authority, responsibility, and accountability in an organization."
Need for Coordinative Staff

This need, as it were, to extend the eyes and ears of the chief executives is one of the most perplexing management problems today. As organizations become more gigantic, the problem grows, too. Some industrial firms have sought the answer in some form of decentralization and use of staff personnel to solve technical problems pertaining to the accomplishment of organizational objectives. Technical staffs aid in the executive function of planning. The problem, however, pivots around the need for assistance to the chief executive in performance of the basic control functions.

Mooney recognizes the problem and recommends the coordinative staff to carry out the control functions. Such a staff service he feels is necessary to aid the executive in establishing unity of thought and doctrine throughout the organization. He says:

Industry has already developed its own staff services. The next step is to organize these individual or departmental services into a coordinated staff service. Such a service must be horizontal in relation to the corresponding line authority and scalar in its relation to all similar staff functions in the lower units.

To sum up the matter, this great problem of modern industrial organization, which we have called coordinated decentralization, demands for its solution that the scalar chain of line authority be supplemented by a staff service so organized that it will infuse a unity of thought and doctrine
throughout the whole organization.7

Urwick and Dale's paper before the A.M.A. in June, 1953 is entitled, "Profitably Using the General Staff Position in Business." These authors look to their extensive military background to draw a parallel between the military situation and the business situation. They see a need for an overall advisory staff in business similar to the general staff in the military organization. The point is made that in the past business executives have multiplied the number of technical staffs in a vain effort to solve their problems of coordination.8 The need for some kind of general staff


8 Lyndall F. Urwick and Ernest Dale, "Profitably Using the General Staff Position in Business," pp. 16-17. The authors point out:

"While a leader can delegate the details of coordination he cannot delegate the responsibility for this function, and the more he multiplies specialists--in organization, in control, in public relations, in industrial relations, in management development, and so on--the more he adds to his burden of coordination. For the principle specialist in any function must ultimately bring his problems of coordination back to the chief...However much he may wish to govern with the consent of the governed, situations do arise in executive organization where someone should make the final decision. Indecisiveness assassimates morale....

"So far, they (business executives) have attempted to deal with this problem by leaving coordination to their subordinates, trusting in their powers of self-coordination. But it is, at best, only a partial solution....

"The main reason for this is that self-coordination creates insoluble problems of communication. It ignores the clearinghouse principle...."
to perform coordinative functions is illustrated by relating the primary authority and responsibility of the different types of military staffs to the organization structure. It is explained that in the military there are three principal types of staffs--personal staff, special staff, and general staff.

In business the personal staff has a minor place, organization-wise. If it exists at all, the position is filled with personal secretaries and other aides. These persons are often vital to the smooth operation of the executive department, but they are minor to the present discussion. The authors point out the personal staff has no authority and its responsibility involves only personal responsibility to the executive concerned.

Urwick and Dale's "special staff" had indirect authority and its responsibility is "specialized" or technical advice, whose purpose is to facilitate the accomplishment of organizational objectives. The classification of "special staff" is not exactly the same as the staff which Davis classifies as a top management "technical staff." This "special staff" is more like a specialized technical staff on the operative level. The general staff has "representative" authority and advisory responsibility. The general staff represents the chief executive on the informative details of coordination of overall activities and its responsibility is primarily one
of advice, although Urwick and Dale think it proper for the general staff to conduct technical surveys and research at times. In the case of the line organization the authority is direct and the responsibility is general. Urwick and Dale illustrate these organizational relationships among the line and staffs, on the basis of their primary authority and responsibility, in the following figure.

**FIGURE 4**

RELATIONSHIPS IN ORGANIZATION

A TABLE SHOWING THE KINDS OF AUTHORITY AND RESPONSIBILITY INVOLVED

<table>
<thead>
<tr>
<th>Description of Position</th>
<th>Authority</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Line&quot;</td>
<td>Direct</td>
<td>General</td>
</tr>
<tr>
<td>Personal Staff</td>
<td>None</td>
<td>Personal only</td>
</tr>
<tr>
<td>Special Staff</td>
<td>Indirect</td>
<td>Specialized</td>
</tr>
<tr>
<td>General Staff</td>
<td>Representative</td>
<td>Advisory</td>
</tr>
</tbody>
</table>

9/ Figure 4 is reproduced from L. F. Urwick and Ernest Dale, *ibid.*, p. 13.
Development and Use of the Coordinative Staff

The coordinative staff is a relatively recent development, having gained in use since 1938. In that year, Standard Oil Company of California, one of the early leaders in the field, set up its organization department. Other firms which make extensive use of a coordinative staff are Koppers Company, American Enka Corporation, and Esso Standard Oil Company. 10

1. Kopper's Control Section

George M. Walker, when he was with the Koppers Company in 1951, wrote a pamphlet explaining the purpose, organization, and functions of their Control Section. (See Footnote 10). The Control Section was established to aid top management perform its functions more effectively; so

logically the section was organized on the basis of a thorough analysis of the executive functions in the company. Walker refers to the functions of the chief executive as to "organize, deputize, supervise, and energize." This classification differs from Davis' classification of planning, organizing, and controlling. Actually, a close study indicates that there is no radical disagreement in these two definitions. They both agree on the basic work that must be done if the objectives of the company are to materialize. There is a difference of analysis. It seems to the writer that Walker overlooked mentioning planning; that Walker's concept of deputization could fall within Davis' concept of organizing; and that Walker's idea of supervision and energizing could well be included in what Davis calls controlling.

Walker breaks down the functions of the chief executive into the following seven essential duties:

1. To divide the total responsibility into logical assignments.
2. To select, train, and develop competent people.
3. To establish measures of accountability.
4. To determine or agree on plans and programs for attainment.
5. To guide and coordinate performance.
6. To appraise results.
7. To take steps to correct unsatisfactory conditions.\footnote{Walker, \textit{ibid.}, p. 1.}
The first three functions are recognized as "the type which require personal performance by the chief executive." In other words, Walker conceives them as being Line functions, which cannot be delegated to a coordinative staff organization. The remaining four, Walker says, are beyond performance by the chief executive himself, and so become the proper consideration of the coordinative staff.

General Somervell, now President of Koppers, says:

The work of the Control Section is divided into four main subdivisions: Planning and Policies, Organization, Reports and Statistics, and Procedures. It assists in guiding and coordinating performance throughout the company, in appraising results, and in correcting unsatisfactory conditions.12

The Control Section of Koppers is made up of four subdivisions or organizational units. They are based on the four main subdivisions General Somervell mentions above, namely, (1) the planning and policies unit, (2) the organization and management unit, (3) the reports and analysis unit, and (4) the systems and procedures unit. An organization chart of the Koppers Control Section is illustrated in Figure 5.

12 Somervell, ibid., p. 6
2. Enka Corporation's Administrative Engineering Department

American Enka Corporation also has coordinative staff in its top management organization. Enka is a highly successful undertaking in the rayon industry, employing over 4,500 people. The top management organization of Enka is shown in Figure 6. It is noted for its simplicity. The President has but five executives reporting directly to him. They are the three vice-presidents and two managers in charge of two staff departments. One is a coordinative staff and carries the title, "Administrative Engineering Department." The other is a technical staff and is called, "Business Analysis and Market Research Department."
FIGURE 6\textsuperscript{14}

OUTLINE CHART, TOP MANAGEMENT ORGANIZATION, AMERICAN ENKA CORP.

- Board of Directors
  - Executive Committee
    - Office of the President
      - Pres.
      - Mgr., Administrative Engineering Dept.
      - Mgr., Business Analysis & Market Research Dept.
        - Finance Division
          - Vice-President, Treasurer & Gen. Counsel
        - Mfg. Division
          - Technical Vice-President
        - Sales Division
          - Vice-President i/c Sales

\textsuperscript{14} Figure 6 is based upon Figure H, L. F. Urwick and Ernest Dale, \textit{op. cit.}, p. 22.
These two staff managers are a part of the "Office of the President." In both instances their responsibilities are company-wide in scope, but are on a staff basis. The Administrative Engineering Department is concerned with "Organizational and procedure Planning, Management Training, Development of Policies, Management Audits, and Management Research." Some of these functions perform the eight subfunctions of control.

The Organizational and Procedure Planning Section is involved in the work of analyzing the organization structure of operating departments and their subdivisions on the basis of the functions performed. It is also concerned with the establishment of sound management procedures by which the operating sections can carry out their functions most economically and effectively, and by which the Management Audits Section can measure effectiveness and establish accountability. Thus the Organizational and Procedure Section works with the Development of Policies Section and the Management Research Section in setting up systems of controls, which will perform the eight subfunctions of control. Management Research tells the line management what kind of controls are needed. The Policies Development Section presents suggested plans on specific management improvement programs in the form of completed staff reports, which are presented in form complete enough to provide the data on which the line executives can make a
decision. The Organizational and Procedure Planning Section develop the procedures to carry out the programs. For example, procedures for communicating the routine planning information regarding an organizational plan or future program is devised by this section. Likewise, the procedures for the other four staff subfunctions of control are facilitated by this section.

The most important control function is performed by the Management Audit Section. This is the comparison function. The section analyzes the results of the control reports and evaluates them, submitting their findings to the proper line executives. The Management Research Section facilitates the line function of corrective action by submission of completed staff reports on recommendations for management improvement programs designed to correct the problems disclosed by the Management Audit Section. The line organization, however, must approve and execute the improvement programs.

It is significant that the top management staff, "The Administrative Engineering Department," is concerned not only with the control functions, but is involved also in the creative planning of the company. This is seen in the emphasis upon planning, development of policies and management research.

The Administrative Engineering Department depends upon the technical advice of the Business Analysis and
Market Research Department in formulating its plans. The reason top management staff services are heavily weighted with technical staff functions is found in the shift of emphasis more and more from control to planning as one analyzes the functions of the levels of management from the operation level to top management.

The other staff is concerned with advice on technical matters, pertaining to planning. It deals with economic forecasting, market research, and the presentation of data to be used in the formulation of policies affecting production, purchasing, sales, finance, labor, and public relations.

Urwick and Dale conclude: "In effect, there are two general staff officers, one handling administrative and the other handling intelligence matters." These authors apparently do not distinguish between the coordinative staff and technical staff, but they do see clearly the need for both the performance of the coordinative functions and technical advisory functions at the top management level. They hold that general staffs perform both coordinative and technical staff functions. They might also argue and be correct that both staffs perform line functions if they have any employees under their chief executives. The point is that the primary work of top

management staffs fall into the two categories of co­
ordinative and technical functions. It is logical to
build up the organizational structure on the basis of
these functions. Otherwise, one is apt to find coordinators
advising on technical matters and technicians doing the
coordinating. It is interesting to note that Enka has
organized its two top management staffs primarily on the
basis of coordinative functions to be performed by one
staff and technical functions by the other staff.

3. Esso's "Assistant to the President" Staff

Another example of use of the coordinative staff is
found in the Esso Standard Oil Company, which employs some
28,000 people. It has a somewhat more difused organization
at the top than has American Enka. A number of senior
executives participate in policy formation through
various committees. The company has, however, given
considerable thought to the position of "assistant to the
president." Urwick and Dale point out that a large
portion "of the president's responsibility for the routine
of control (in the strictly organizational and technical
sense of the term) is lightened by his 'assistant to."

The writer feels that it is fairly obvious that what Urwick
and Dale are saying is that the chief executive is being
relieved of a good many coordinative details of control
through use of the "assistant to the president." who
performs the subfunctions of control.
The top management organization chart of Esso is shown in Figure 7.

**Coordinative Staff Organized on Basis of Control Subfunctions.**

If the coordinative staff is to coordinate and integrate all the activities of an organization through the performance of the control functions, then organization of such a staff on the basis of the functions to be performed is a logical suggestion and conclusion. Of the eight basic subfunctions of control, three (direction, supervision, and corrective action) must be performed by the line organization. The inherent line qualifications of these functions are discussed fully in the sections above. The remaining five staff control functions are a logical division upon which to organize a coordinative staff department. They are, of course, routine planning, scheduling, preparation, dispatching, and comparison.

It will be noticed that there is a close comparison between the organization of a coordinative staff on the basis of the five staff subfunctions of control and the coordinative staff organizations outlined above with the exception that these staffs also perform planning functions. This is particularly evident in the case of Koppers' Control Section. Basically, the same functions are performed in each of the coordinative staffs mentioned above. The organization of a coordinative staff on the basis of the
Figure 7 is based upon Figure I, L.F. Urwick and Ernest Dale, op. cit., p. 24.
five staff subfunctions of control is illustrated in Figure 8.

The reader is reminded that we are considering here the coordinative staff for administrative control, not operative control. We are concerned with control of programs, not projects. To such control the functions of comparison and corrective action are most important. The results of the comparison of actual to standard performance bring to light defects in the system of operation and the overall program. Presence of these defects lead to an emphasis upon creative planning to correct the system and change the programs.

Consider the Koppers Control Section as one specific example. It should be pointed out that their coordinative staff does not confine itself to performing only basic functions of control, but that it also assists the chief line executive in functions of creative planning. Thus the Koppers Control Section performs both assistance in coordination of thought and action. The four duties of the Control Section may be classified on the basis of: (1) creative planning and (2) those duties which are primarily subfunctions of control. The duties which involve the formation of plans and programs fall under the heading of creative planning. The other three functions are: (1) guiding and coordinating performance, (2) appraisal of results, and (3) correction of unsatisfactory
conditions. These three can be classified as control functions.

It is interesting to observe what unit of the Koppers Control Section performs the different subfunctions of control. Routine planning falls within plans and programs and is performed by the "Planning and Policies" unit of the Control Section at Koppers. Scheduling is a part of guiding and coordinating performance. It is performed by the "Systems and Procedures" unit. Administrative preparation is a function of the "Systems and Procedures Unit." Dispatching of orders and memorandums, initiating a new program, set forth the timetable according to which the entire organization is to carry out the program. Administrative dispatching is a function of the "Planning and Policies" unit. Comparison is the primary control function of the Control Section. It compares the progress of programs with the goals set forth in the original plans. The comparison function is performed by the "Reports and Analysis" unit. Program progress at Koppers is compared monthly, quarterly, yearly, and for every five to ten years.

All the units of the Koppers Control Section facilitate the three line subfunctions of control, but being staff organizations, they do not perform any of these line functions. For example, the "Records and Analyses" unit interprets progress reports. The "Planning and Policies"
unit coordinates plans. Neither of these units, however, exercises line authority of direction.

The "Reports and Analyses" unit appraises results, and so facilitates the subfunction of supervision, but the unit does not exercise supervisory authority over line activities.

All of the units of the Control Section facilitate corrective action by making special reports to the chief line executive, and by consulting the operating activity concerned. They make recommendations for corrective action, but execution of corrective action is still a line function.

The techniques of operation through policies and procedures will be discussed in detail later. Suffice to point out here that the coordinative staff performs its five subfunctions by aiding in routine plans and programs; by collecting data relative to performance in accordance with plans; analyzes results, makes reports and recommendations to the top executive and reports on the corrective action taken. In so doing the staff uses all the factual data available—cost accounting, monthly financial reports, personnel statistics, and production reports, including work measurement data.
FIGURE 8
COORDINATIVE STAFF

CHIEF

Coordinative Staff

Objectives:
Secondary organizational objectives of economy and effectiveness of performance of organizational functions

Functions:
Assist in administrative control and perform facilitative functions.

Legend:
—— Line Relationship
Relation of Control to Top Management

The functional division of executive work, on the basis of organizational objectives, has been spelled out in detail above. In the large organization there is need of a technical staff to help top management in the creative planning for the accomplishment of organizational objectives. The duties of this staff should be distinguished from those of technical advisors on lower echelons who are concerned with technical details of project objectives, such as engineering design. To help with the organic function of control there is need for the coordinative staff.

This staff should report directly to the top line executive, usually the president of the organization. It does not have line authority. It only facilitates the organic function of control of the organization by performing the staff subfunctions of control. In a way, it extends the eyes and ears of the chief executive. As pointed out, it gathers information, analyzes, reports, and makes recommendations; but the corrective action phases remain in the functions of the Line organization. This relationship is diagramed in Figure 9, "Relation of Top Line and Staff Organizations."
FIGURE 9
RELATION OF TOP LINE AND STAFF ORGANIZATIONS

Board of Directors--Top Mgt.

- Primary Service Objectives:
  Customer Satisfactions from Goods and Services of the Organization.
- Collateral Objectives:
  Profits, salaries, wages, on-the-job satisfactions and other morale factors.
- Secondary Objectives:
  Economy and effectiveness in performance of business functions.

Top Line Executive

Organic Functions of Management
- Creative planning, organizing, and controlling of organizational activities.

Coordinative Staff

Objectives: Economy and effectiveness in the accomplishment of organizational objectives.

Coordinative Staff Functions
Assist in Control & Perform Facilitative functions.
There are five:
- Routine Planning
- Scheduling
- Preparation
- Dispatching
- Comparison

Technical Staff

Creative planning for the accomplishment of organizational objectives.
Specialized facilitative functions.

Subordinate Line Administrative Executives

Control Functions of the Line:
- Direction
- Supervision
- Corrective Action

Subordinate Operative Executives

Legend:
_____ Line Relationship
Application of Staff Parallelism to the Coordinative Staff

Mooney (see Footnote 7, this chapter) points out the importance of staff services at higher echelons being duplicated at lower levels of management as the organization grows in size. He also expresses the idea that relationship between these two staff organizations on different echelons should be scalar as far as integration and coordination of ideas is concerned. This idea is in accordance with the principle of staff parallelism which is to the effect that parallel development of similar staff functions in higher and lower echelons facilitates the development and maintenance of staff cooperation and coordination.

16 Also James D. Mooney and Alan C. Reiley, Onward Industry, p. 509. They say:
"These principles clearly establish one chain of line authority, and one only. It is evident that no clear and definite line responsibility is attainable on any other basis. A single chain of authority, however, does not, and, according to Mr. Sloan, must not mean a single chain of contacts. On the contrary, it is necessary that those staff contacts which do not carry line authority should be organized in the same way that line authority is organized, and it is only through such organization that what we have called horizontal coordination can be effectuated. This, in brief, is the lesson for industry in military organization."

Relationship of Coordinative Staff to Other Organizational Units

Figure 10, "Decentralized Staff Control" illustrates how the coordinative staff is related to the rest of the organization. This staff reports directly to the top line executive; but it operates in a staff capacity throughout the entire organization. For example, the staff coordinates group plans with the Plant Manager. Also the results of operative data are cumulated, by groups over a period of time and used by the staff in coordinating the administrative planning and organizing of the top management group. This group is usually made up of the president, executive vice-president, and vice-presidents in charge of sales, production, and finance, as well as top staff directors.

The top coordinative staff likewise operates in an advisory capacity, in the case of decentralized staff control, with any other coordinative staffs on lower operative echelons. The top management coordinative staff is responsible for integration of top management thinking on policies and plans of the organization. Primary functions of the coordinative staff on the operative level are concerned with coordination of specific projects or job orders.

The coordinative staff works with top line executives in an advisory capacity, and at the same time facilitates
FIGURE 10
DECENTRALIZED STAFF CONTROL

BOARD OF DIRECTORS

Top Executive
Line Administrative Mgt.
Control of functions:
- Direction
- Supervision
- Corrective Action

Coordinative Staff
Staff functions:
- Routine Planning
- Scheduling
- Preparation
- Dispatching
- Comparison

Technical Staff Assistance

Executive Vice-Pres.

Vice-Pres. Sales
Vice-Pres. Production
Staff Dir.
Staff Dir.
Vice-Pres. Finance

ADMINISTRATIVE MGT.-GROUP MGT.
LONG-TERM PROJECTIONS OF GROUPS
OPERATIVE MGT.-SHORT TIME ACTION
EXECUTION OF SPECIFIC PROJECTS

Plant Mgr.
Line Operative Mgt.
Control functions:
- Direction
- Supervision
- Corrective Action

Tech. Staff

Plant Superintendent

Primary Operative Employees

Legend:
- Line Relationships.
- Staff Relationships.
integration of thought throughout the entire organization by working with a coordinative staff at the operative level. The top coordinative staff is responsible for communicating to the operative coordinative staff, top management thinking on group plans and policies. Such integration of thought and indoctrination make it possible to leave responsibility for execution of specific projects at the operative level, and at the same time have confidence that operations will be in accord with top management plans and policies.

V. RELATIONSHIP OF ADMINISTRATIVE WORK MEASUREMENT TO OTHER TOOLS OF BASIC MEASURES OF QUALITY, QUANTITY, EXPENSE, AND TIME

The foregoing sections of this chapter have outlined the inherent need for control in a large organization. They have described the organizational relationships. In a general way, it has been explained how a coordinative staff can constrain and regulate the action of the organization to conform in the best manner possible to the organizational plan. If the organization is to be constrained and regulated, obviously, it must be constrained and regulated to meet certain standards or measures to meet the model of the plan. In the final analysis the degree of these measures is established by the values and utilities, which are the determining factors of the objectives of the organization. Universally these
standards are expressed in terms of four basic measures:

- Quality
- Quantity
- Expense
- All three in relation to time of accomplishment

These four basic measures are the factors that a motor car manufacturer must take into consideration in planning his new models. The same is true of the services rendered by the corner store, the super-market, the hair dresser, or the broker.

Control constrains and regulates the action of the organization to meet the requirements of these four basic measures of the organizational objectives. Thus control facilitates coordination of action to effect economy and effectiveness of performance, and in this way strives to obtain the conditions of the secondary organizational objectives.

As an administrative control technique, work measurement is in a sense a system of accountability. The relation of work measurement to the four basic measures of organizational objectives and to other primary control techniques, which are used to facilitate comparisons with standards, is shown in Figure 2 above. In brief outline form these basic control techniques will be described in an effort to afford the reader a general idea of the tools
which are available to control the activities of an organization in terms of quality, quantity, and expenses, in relation to time. The purpose is to give the reader a better perspective regarding the potential use of work measurement as an administrative control. It should dispell at the very beginning the notion that work measurement is a panacea for all management problems. It is not, certainly. At the same time the discussion thus far should indicate the usefulness of administrative work measurement in measuring quantity. This section will discuss as well, the potentialities of work measurement in facilitating other control techniques. For example, quantity measures of work measurement data can be related to quality measures of statistical quality control data and budgetary control figures, to keep the organizational performance in balanced adjustment. These subjects are of such importance, separate chapters will be devoted to them.

**Illustrations of Control Tools.**

There are a number of control techniques, including policies and procedures that are available to facilitate the four basic measures. To illustrate their universality, two examples outside the field of production are mentioned. The treasury department uses cost accounting, budgeting, and standard profit and loss accounting to measure expenses. The sales department can use a large number of controls but
the most important is usually the sales budget, which is a result of sales forecasting for the firm. Individual territory and salesmen quotas are based on the overall sales budget.

More progressive firms whose salesmen sell relatively low unit price items and call on a great many customers in the course of a month are relating the cost per call to sales per call to give an indication of the salesman's effectiveness. Analysis of the salesman's activities quickly reveals that a relatively small percentage of his work day is spent talking to customers and often the percentage of this time spent on talking about the product is likewise extremely small. This analysis has led to time and duty study of a salesman's activities, and has resulted in some firms being able to establish rather rough approximations of the standard amount of time a salesman should spend on his different activities. These rough standards are based on past experience and performance. Such techniques in sales control provide the basic measures of quantity and expense relative to time. It is, in a sense, a type of work measurement. Not only does it reflect the effectiveness of the individual salesman, but it also can reveal whether a certain territory has potential sales great enough to warrant a salesman's time.

18 James H. Davis, Increasing Wholesale Drug Salesman's Effectiveness, Chaps. 5 and 6.
Production Control Techniques

The techniques used to control the activities of a production department are of different types altogether, although the functions performed are basically the same for all methods or systems of control. In the production department, quantity measures of direct labor, operative work are established by time and motion production rates.

Quality measures in the production department are established by quality inspection of the operatives' output. For administrative purposes the quality of group effort is assured by statistical quality control. Cost accounting is the technique used to compare actual production costs with standard costs. In a sense cost accounting converts the production figures, resulting from quantity and quality measures into measures of expenses in dollars and cents. This is operative control and gives its answers in costs per unit. So many cents for direct labor, materials, and then so much for indirect labor and overhead on the per-unit basis. The administrative control which is a counterpart of cost accounting of individual products is budgetary control of group expenses.

Measures which reflect time of accomplishment on the operative level are production rates. On the administrative level, time measures are reflected in performance control. The time of accomplishing group activities is expressed in production plans and programs.
Place of Work Measurement as an Administrative Control

Work measurement standards are the administrative counterpart of time and motion production rates. Thus it is a measure of time. Time and motion studies measure operative work; statistical work measurement measures administrative work. This distinction is important, because measures of group work are concerned with the total output of the group during a period of time, not the time taken for one specific project or job order. As a consequence, work measurement is usually based on a less minute unit of measure, and may accomplish its ends by actually measuring only a small part of the total work, as long as this small part is representative of all the work of the group.

Administrative work measurement, as has been pointed out, is also a measure of quantity. As a matter of fact, it expresses quantitative output in terms of time. The performance rate is the basic ratio of a work measurement system. It is expressed in the number of manhours (time) expended per work unit (quantity factor). As such, administrative work measurement can be used as a tool of control to establish accountability for the quantity output of a group or organizational unit.

Necessity of Relating and Regulating the Four Basic Measures.

As a practical matter, it must be apparent almost
Immediately that the four basic measures of organizational effectiveness must be related to each other. Otherwise, the performance of the activities of the organization will soon be out of "balanced adjustment." This is a dynamic aspect of management of which examples from experience abound in profession. For example, if work measurement is introduced as a management control, without any controls over quality or expenses, it can be expected that quantity-wise the undertaking will have an excellent production record, but it probably will be at the overwhelming expense of poorer quality and increases in other expenses, such as waste materials, and undue wear and tear and replacement costs of capital equipment.\(^{19}\)

To integrate and coordinate the activities of an organization to keep it in "balanced adjustment" from the standpoint of organizational objectives is the business of the coordinative staff. The details of the method of operation of the coordinative staff are the subject of the

\(^{19}\) "Defective Shell Charge Blamed on Employees Trying to Beat Quotas," *The Wall Street Journal*, Nov. 2, 1953, p. 2. This article illustrates the point. The article reads in part: "In a statement yesterday Mr. Hughes (general manager of the Bryant Heater division of Affiliated Gas Equipment Co.) said, 'Indications are that certain employees trying to beat Government production quotas, allowed shipment of some shell components which had dimensional deviations.' It is understood the 'deviations' referred to are in the nature of thinner shell housings than specifications call for."
above sections. Administrative work measurement data, however, can be used as a tool to facilitate the integration and correlation of data relative to the four basic measures. This relationship is illustrated in Figure 11.

**FIGURE 11**

COORDINATIVE STAFF KEEPS BASIC ADMINISTRATIVE MEASURES OF PERFORMANCE IN "BALANCED ADJUSTMENT"

For example, the statistical quality control chart can be used in connection with a chart showing the trend of quantity control as reflected by work measurement data. As the work measurement performance rate improves, up to a point, quality should stay the same, or improve. If, however, quantity output is stressed too strongly, quality then will fall. In chart form, quantity and quality data can thus be related. As a practical matter, one of the problems of top management in introducing work measurement has to do with the question of how far to "push" for output.
Some firms find they have to restrain their supervisors to avoid the pitfalls of the so-called "efficiency experts" of yesteryears.

The facilitative uses of work measurement data, it can be said with almost complete accuracy, are limited only by the imagination of the coordinative staff and other executives. At least, in any control problem that involves quantity and time of labor, work measurement has a facilitative place. In cost accounting and budgetary control the time per work unit is a basic factor in determining costs. Labor costs, then, simply become the dollar and cent extension of work measurement data. In the final analysis, work measurement is a refinement that


"Edgar T. Speer, methods analyst, reported a 20% increase in production after installation of work measurements in the average clerical section at Prudential Life Insurance Co. of America, Newark, N.J. The increase, he said, resulted 'not from pressure to work harder or faster but from successful efforts of managers and section heads to eliminate delays and to persuade the average clerk to spend more hours of her working day actually working.'

"The fact that clerks know that individual production rates exist motivates them to attain 'at least a respectable rate,' Mr. Speer said, and supervision is able to use the rates to let clerks know what is expected of them."
is a step forward in determining, for administrative work, in more exacting manner, "what is a fair day's work."

VI. SUMMARY OF THE CHAPTER

Work Measurement Facilitates Control Subfunctions

There are eight basic subfunctions of control. The four preliminary control functions are routine planning, scheduling, preparation, and dispatching. They are all staff functions. The four control functions, performed concurrently, are direction, supervision, comparison, and corrective action. They are all line functions, except comparison, which is, of course, staff.

Administrative work measurement acts as a facilitative tool in the performance of all eight control functions. One of its most important roles is to provide a basis for comparison of present performance to a standard. Equally important is the facilitative action of work measurement in focusing attention on management problems and bringing to light departments and areas where possible management improvements can be made. This facilitates the functions of direction, supervision, and corrective action. It is accomplished through application of the principles of attention to exceptional cases and the analysis of limiting factors.

Coordinative Staff Performs Staff Control Functions

Control completes the cycle of the three organic
management functions in the accomplishment of a mission. Regardless of the stage of development of an organization, the eight subfunctions of control must be performed. Lack of technical knowledge and the physical limitations of time and space prevent the chief executive in the large modern day organization from performing all these functions himself. The line functions he cannot delegate; the five staff control functions are the proper work of the coordinative staff.

The use of the coordinative staff is increasing. Three examples of the application of the coordinative staff are found in the Koppers' Control Section, Enka's Administrative Engineering Department, and Esso's Assistant to the President.

A logical organization of a coordinative staff is on the basis of the five staff control functions of routine planning, scheduling, preparation, dispatching, and comparison. An analysis of coordinative staffs reveals that successful ones are so organized. It should be noted, however, that they also include the function of creative planning.

The head of the top management coordinative staff reports to the chief executive, but the staff operates in a staff, advisory capacity throughout the entire organization. The top management coordinative staff is responsible for integration of top management thinking
on policies and plans throughout the entire organization. It works with top line executives in an advisory capacity relative to performance of control functions involved in the administrative management of programs. At the same time, it facilitates integration of thought throughout the entire organization by working with any coordinative staff at the operative level. In case there is none, it works directly with executives in charge of operative work.

The coordinative staff at the operative level is concerned with coordination of specific projects or job orders. The top coordinative staff is responsible for communicating to the line operative executives top management thinking on group plans and policies. Such administrative integration of thought and indoctrination make it possible to delegate responsibility for execution of specific projects to the operative executives, with the confidence that operations will be in accord with top management plans and policies.

Relationship of Administrative Work Measurement to Other Tools of the Basic Measures of Quality, Quantity, Expense, and Time

The values and utilities, which are the determining factors of the organizational objectives, are measured in terms of quality, quantity, expense, and time. Control constrains and regulates the action of the organization to meet the requirements of these four basic measures.
Thus control facilitates coordination of action to effect economy and effectiveness of performance.

Administrative work measurement is a tool of administrative control. It facilitates control by affording a tool for establishing accountability for the manpower that is expended on both operative and administrative work. Work measurement facilitates, and can help regulate, the four basic measures. It relates quantity and time directly. It can facilitate the analysis of expenses that are concerned with both direct or indirect labor. Administrative work measurement can be related to quality measures, and thus aid in the "balanced adjustment" of all four basic measures. Relating and regulating the activities of the organization in terms of the basic measures is the principal work of the coordinative staff.

Work measurement is an administrative tool which is basic to any control problem involving quantity and time factors of labor. Likewise, it can be related indirectly to the other two basic measures, and thus affect the dynamic "balanced adjustment" of the organization. Without administrative work measurement, administrative control involving labor is at best a guess. Its use is a step forward in the science of management.

Thus Chapter IV has discussed the place of administrative work measurement in the performance of the functions of control. The next chapter deals with the
steps necessary for the development of a control system.
CHAPTER V
THE SEVEN STEPS IN THE
DEVELOPMENT OF A
CONTROL SYSTEM

I. INTRODUCTION

Chapter III outlined the place of control in organization and management. Emphasis was placed upon proper performance of the functions of control in order to create the values and utilities prescribed by the organizational objectives. Chapter IV dealt with the place of administrative work measurement as a facilitative aid to control. The chapter discussed line and staff relationships, and the proper use of the coordinative staff in performing the functions of control, with particular attention to the inherent potentialities of statistical work measurement.

The present chapter has as its subject the analysis of the necessary steps in the development and establishment of a control system. The hypothesis is that there are certain developmental steps which are universal to the establishment of any type of control system, including administrative work measurement. Authority will be cited where it is available, but much of the proof is dependent upon analysis from illustrations typical of control systems in use.
II. ESSENTIAL ELEMENTS ARE UNIVERSAL TO ALL TYPES OF CONTROL SYSTEMS

There are two prerequisites of a successful control system which receive but passing attention, if any at all; yet they are so important that their omission must be a case of overlooking the obvious. The first prerequisite is that top management have analyzed the objectives of the organization in detail. The second is that the top, middle, and first line executives all have a thorough understanding of their functions and their relationship to the other functions of the organization.

These prerequisites seem obvious to the student of management and organization. They are not so obvious to many in executive positions, especially among the middle and first line group, who depend upon guidance from the top. They do not ask "why," but "do" because the boss says "do." The field work of this study, as was to be expected, disclosed examples of this. The lack of understanding of the objectives and functions of an organization was reflected in many instances in a lack of appreciation of what control is, why it is necessary, and what reasonably may be expected from such a system.¹

¹ As a result of personal interviews and tabulation of a list of management problems submitted by Naval officers, members of the Navy Project came to this conclusion. See: "Progress Report No. 3 to BuPers," dated 19 Dec. 1952, p. 29. That "Junior officers receive little administrative training" was indicated a "very important" problem.
The point is that the problems of business organization, including the design of the organizational structure, should be solved satisfactorily before an attempt is made to solve the problems of business operation, including the design of business procedure. The use of excellent methods by a poor organization will probably produce poor results. Administrative work measurement, as a tool of an administrative control, indicates the effectiveness of manpower utilization by the firm. Work measurement facilitates the functions of control. It indicates areas of the total organization that are effective or ineffective in its use of manpower. It does not indicate "why." An executive can tell by looking at the work measurement report of a department it is making ineffective use of its manpower. He cannot tell from the work measurement report the cause for the low performance. The cause may be multiple causes; poor organizational structure, weak methods and procedures, or numerous morale problems. In any event, the first logical step is to establish a sound organizational structure and effective methods and procedures of operations.

Balderston, Karabasz, and Brecht emphasize the importance of a good organizational structure. They consider it the most important of all means of control. These authors are using the concept of control here in the more inclusive sense. In another book referenced later in this
chapter, Brecht refers to control as execution of the comparison and corrective action functions, but in this reference the authors have a more inclusive concept of control. They say:

Dealing as it does with human relationships, organization is at once the most intriguing and the most difficult of all phases of management. In spite of the difficulty of comprehending its nature, organization must be recognized as the most important of all the means of direction and control that the chief executive of a business has at his command. If an analogy is permissible, the organization is the nervous system of a company.2


Without a sound organization structure control will not be as effective as it would otherwise. Nevertheless, organization structure is not control.

It should be pointed out that organizational planning, including structural design, sets up the general objectives of each job, and then:

(1) Defines duties for specific work assignments, or jobs;
(2) Specifies the nature and extent of responsibility for each duty;
(3) Specifies the authority that is necessary for proper discharge of responsibility for each duty;
(4) Establishes the lines of authority and accountability for results and;
(5) Establishes the organizational basis for cooperation between the groups making up the organization.

Control through its comparison function, evaluates results and assesses accountability therefor. It is in this manner that administrative control is related to organizational structure; but organization structure is not a control.
Chapters III and IV deal at length in the basic concepts of organizational structure and the relationships of control to the management of the enterprise. The point is emphasized that development of the organizational structure is concerned with two problems. They are the problem of grouping similar functions in a manner that will promote effective cooperation, and the problem of establishing proper relationships between functional groups and organization elements, in order to promote cooperation and successful executive leadership. Dennison explains the importance of this second problem of organization in the following quotation:

All the strength of an organization comes from its members. The incentives, the habits, and the traditions which guide and move the men and women of a nation, an army, a church, or a corporation are its sources of power. . . . The organization will be "using" men, but its success will exactly correspond to the extent to which this use results in their free, interested, and spontaneous activity.

As pointed out in Chapter IV, the objective is the fundamental determinant of the organizational structure. The design of the organizational structure is determined

3 See Chapter III, where this concept of organization structure is discussed. The prominent place that organizational objectives play in determination of the structure of the organization is discussed in Chapter IV. Particular reference is made to Figure 9: "Decentralized Staff Control," and the attendant discussion for an illustration of the complexity of internal organizational relationships from the standpoint of control.

4 H. S. Dennison, Organization Engineering, p. 393.
by the functions to be performed in reaching the objectives. The organic management functions of an organization are planning, organizing and controlling. Control consists of the performance of the eight basic subfunctions. Administrative work measurement facilitates these eight subfunctions. It is concerned primarily with the last two concurrent control functions of comparison and corrective action. If the relationships of the organizational structure are not well defined and understood, and if the management procedures are vague, then results of the best administrative work measurement system will be reduced in effectiveness, because if it is not clear from the organizational structure who is responsible, it will be equally difficult to establish accountability. There will be confusion regarding who is to do what, and how it is to be done. And until these basic matters of organizational structure and management procedures are clarified performance of the control functions of comparison and corrective action cannot reach their potential of effectiveness. In light of this fact, it can well be stated along with Balderston, Karabasz and Brecht, that a sound organizational structure and efficient management procedure are prerequisites of effective control.

Without accomplishment of these two prerequisites any control system is operating in a precarious position, like a ship without a course or a firing machine gun without a
The objective may be reached, but it will be mere happenstance.

Once the objectives of the organization and the functions to be performed are analyzed, then the purpose of the control system can be established. The purpose or objective of the control system to perform the comparison and corrective action functions obviously must be in terms of degree of performance of specific functions. When these two fundamental prerequisites and the purpose of the system are clearly in mind, management then is ready to develop and establish a system of control that will be in accord with its purpose.

A point of clarification needs to be made. We have just concluded a discussion of control, in which it is used in the more comprehensive sense. The writer has been analyzing organization and management on the functional basis. There are three organic functions of management. They are planning, organizing, and controlling. Control, in turn, consists of the performance of eight basic sub-functions. There are the preliminary control functions of routine planning, scheduling, preparation, and dispatching. There also are the control functions which are performed concurrently with each other. They are direction, supervision, comparison, and corrective action. In the discussion that is to follow we will be considering the seven steps which are necessary to setting up a system to perform the
control functions of comparison and corrective action. For convenience such a system will be called a control system, but the reader is warned that it is a control system in the limited sense that it primarily is concerned with the control functions of comparison and corrective action.

Holden expresses his concept of the elements of a plan of control in the following statement:

Each plan of control embraces the following elements: an objective establishing what it is desired to accomplish; procedure specifying how, when, and by whom the plan is to be executed; criteria as to what constitutes good performance; and appraisal as to how well it was done.5


After it has been decided what is to be controlled, there remains the practical problem of how to accomplish the work of a control system. This leads to an analysis of the essential elements involved. We are concerned here

5 Paul E. Holden, Top Management Organization and Control, p. 9. In another place in the book (p. 77) the universality of the elements of any control system are expressed:

Control is a basic process and whatever the type or whatever the subject, it embraces the following elements:

1. Objective - what is desired.
2. Procedure
   a) Plan--how and when it is to be done
   b) Organization--who is responsible
   c) Standards--what constitutes good performance.
3. Appraisal--how well it was done.

(The writer's views on the soundness of this concept are expressed in footnote 7 that follows)
with establishing a system to perform the comparison and corrective action functions. Reference is made once again to the basic definition of control. It is "the function of constraining and regulating action in accordance with the requirements of a plan for the accomplishment of an objective." If activity is constrained and regulated, it must be accomplished in relation to some standard. The comparison of actual performance to standard having been made, some action must follow or the controlling procedure has been a waste of time. It should be pointed out that if the system is functioning normally, the action which follows comparison, of course, will be the decision to leave the system alone and take no action. The decision to take no action is often as important as the decision to act.

Newman sums up the matter in the following quotation:

There are three essential steps in any control process:

1. Setting standards at strategic points.
2. Checking and reporting on performance.

---

3. Taking corrective action.


The writer agrees with Newman only to the extent that these three essential steps apply solely to the comparison and corrective action functions of control. It does not apply to the other six control functions. The writer's position is that the establishment of a system to facilitate comparison and corrective action through these three steps is sound in principle, but that the reader needs to be warned that if control is not to be of "after-the-fact" variety, the other six control functions must be performed also.

Thus the above quotes Newman as listing "the three essential steps in any control process: 1. setting standards, 2. checking and reporting on performance, and 3. taking corrective action." These, therefore, are the three steps in a system designed to perform the comparison and corrective action functions. Again, the writer maintains that this is sound for the establishment of a system of comparison and for a system to initiate action after the process is out of control; but it leaves out other functions necessary for effective control. Effective control plans and organizes for control of the process before it goes into operation. This latter concept of control calls for the performance of all eight basic subfunctions of control.

A similar criticism can be made of Holden's "plan of control" which is a plan for the execution of the comparison and corrective action functions. (See footnote 2 quoting Holden.) To the writer, Holden confuses factors, objectives, and procedures. His plan is also a process and it includes two basic factors in any business problem, objectives and procedures, plus one control subfunction, "appraisal," which is a phase of the comparison function. It really is a plan for setting up a system of comparison and corrective action. What the writer sees of value in Holden's plan is the same value he sees in Newman's, namely, that a system of comparison and corrective action must have three steps: (1) setting standards, (2) comparison of actual performance to a standard, and (3) taking corrective action.
Brecht and Wylie, writing on office management point out that the effectiveness of the supervisor is increased markedly through the use of control techniques. Their three steps of a control system coincide closely with Newman's. Their views are brought out in the following quotation:

The capacity of the supervisor for direction is increased tremendously if he is provided with adequate supporting information—control mechanisms.

These control mechanisms or devices are embodied in records, reports, and charts. The process of control consists of three steps: (1) the discovery of the need for remedial action, (2) the analysis of the causes of such needs, and (3) the determination and application of appropriate corrective action.

8 Harry L. Wylie and Robert P. Brecht, Office Organization and Management, p. 103.

Wylie and Brecht say in their book Office Organization and Management, pp. 102-103: "Control in its broadest meaning includes all features of office methods, work, and planning." They go on to enumerate seven points: (1) Standardization of systems and routines, (2) Improvement of methods and office layout, (3) Selection of machines and equipment, (4) Standardization of office supplies and forms, (5) Preparation of office manuals, (6) Control of the flow of work as much as possible, (7) Introduction of flexibility into the office force and office work. Then they comment on the use of the term "control" as used in the quotation to which this discussion is the footnote. They say on page 102: "Control in its restricted meaning...contemplates the savings that can be effected in the execution of plans already made, the determination of the accomplishment under systems actually in use, and conscious direction and redirection of the business forces lying within the grasp of the office manager." The writer interprets the last statement to mean that control in its restricted meaning is the performance of the comparison and corrective action functions.
As part of their field work, the Navy project team aided local Naval personnel at selected Naval shore stations in the development and establishment of their own administrative work measurement systems. These systems were designed to perform the comparison and corrective action functions of the control of manpower utilization. The experience of the project indicates that the development and operation of such a system of comparison and corrective action fall within three general functions:

I. Planning the control system, which includes the steps essential to measuring actual performance.

II. Organizing for the introduction of the system, which includes steps necessary to compare actual results with a standard.

III. Operating the control system, which includes steps necessary to reach decisions of what to do about findings of results, and further those steps necessary to bring about action to comply with decisions.9

Participation and Division of Responsibility - Both Help

It was found basic to the understanding, acceptance, and use of the control systems developed during the Navy project, that personnel at all echelons participate in discussions of the system. Real benefit came from the experiences of people in the field, and wherever possible such ideas were used in designing the details of their

system. As a practical matter of operation, however, it was also found that not all the people in the field had the time, inclination nor ability to perform all the steps in the system. For instance, foremen or supervisors at the first level of operation could best give information on actual performance. They could understand how standards were set and how to figure reports; but they had neither time nor inclination to perform these duties. The planning and organizing phases of the system should be performed by the coordinative staff or some executive with industrial management background and training. Early reports were full of mathematical errors when first line supervisors were charged with the responsibility of performing the task of preparing reports which compared actual with standard data.

Further, when it came to the third division of steps in the system (decision and action), first line supervisors found it unrealistic for them to decide and act, because these are the responsibilities and authority of higher echelons.

The practical answer to the problem of establishing a control system in an organization is for all echelons of personnel to be in on the explanation and determination of the details of the system, but for the operation of the system to be divided among the echelons of authority in the organization. Collecting data of actual performance
can best be performed by supervisors on the first echelon of operations. The organizing phase includes setting standards and designing reports analyzing actual results with standards. All echelons concerned must understand and accept standards as reasonable and realistic; but the actual report composition and analysis should be the duties of the coordinative staff or some individual supervisor or group whose background and training have prepared them to perform these duties. The action phase must be performed by the top echelon which has the authority to make decisions and take action. The first line supervisors who will be affected by the decisions should have the opportunity, however, of participating to the extent of giving top management the benefit of their first-hand knowledge of the situation and making suggestions and recommendations.

III. THE SEVEN STEPS IN THE DEVELOPMENT AND THE OPERATION OF A CONTROL SYSTEM

The three phases of development and operation of a control system, designed to perform the comparison and corrective action functions, may be analyzed on the basis of seven distinct and separate steps. Furthermore, in Section IV of this chapter the universality of these seven steps will be illustrated with examples of comparison and corrective action control systems used in the sales department, the production department (with an
example of administrative work measurement), cost control (an operative control), a budgetary control system, and an example of statistical quality control. Here in Section III the purpose is to describe briefly, in general terms what is involved in each of these seven steps.

The seven steps in the development and operation of a comparison and corrective action control system may be classified as follows:

I. Planning the system, which includes measurement of actual performance:
   1. Selection of activities to be controlled.
   2. Definition of units of measurement.
   3. A reporting system for measuring and summarizing actual performance.

II. Organizing for the introduction of the system, which includes analysis of the data:
   5. Planning and organizing for analysis and interpretation of the difference between actual performance and a standard.

III. Operating the control system, which includes review and follow-up action:
   6. Continuous or periodic review and decision on action to be taken as a result of an analysis of data.
   7. Follow-up action to comply with the decision.

**FIRST STEP: Selection of Activities to be Controlled**

The first step in setting up any control system is to establish the objectives—what is it that needs controlling? There is little point in having a control system just for
the sake of the system. The area of activities to be controlled may be in connection with (1) the administrative management of groups or (2) operative management of projects or job orders. Within these two broad classifications it may be concerned with a number of processes found in carrying out the activities of an enterprise. It may be regulation of the timetable of production; it may be a problem of controlling expenses; it may be a quality control program; or it may be in the area of controlling use of manpower. In any event it is necessary that the objectives of the control system be established, otherwise it will be impossible to tell what part of the organizational plan is being controlled and the results will be of little significance.

Our discussion is concerned primarily with administrative control. It is significant to recognize, however, that operative control data can often be used in cumulative form for administrative control. Sales controls afford an example. A system of operative control may measure the performances of individual salesmen. One of the purposes or objectives of the system may be to determine the incentive pay of the individual salesman. Cumulative totals of this operative control system may well constitute the data for a sales system of administrative control. In this case the cumulative totals from the operative control system could be used as an administrative control
to measure the effectiveness of a group of salesmen.

As pointed out above, the objectives of an administrative control system are determined by an analysis of the business problems and procedures. For example, the objectives of the administrative work measurement systems installed at naval bases were based upon a management survey of the problems and difficulties of those stations. The objectives of the systems grew out of the needs of the executives for certain types of administrative control. Foremost was the need to justify or support requests for personnel, in other words, to determine manpower requirements in a more factual manner. Another need was to have a closer measure of the effectiveness of staff operations. One of the most important needs was to establish accountability for manpower utilization. The question was who is responsible for using a certain group of personnel, and what is the effectiveness of the group's performance.

Administrative work measurement, as we have seen from the discussion of its uses in Chapter II, is a management tool which facilitates these objectives.

The objectives determine the activities to be measured. If the objective is to support requests for manning tables, then the manhours expended by the group must be measured and related to the services or goods produced by the group.

SECOND STEP: Definition of Units of Measurement

The second step is one of the most important in the
planning phase. It usually is the most difficult upon which to gain agreement among the supervisors concerned. Definition of the unit of measurement is essential in conveying in specific terms what the organizational plan proposes should be produced or the services rendered.

Five criteria are set forth in the work measurement manual developed by the Navy Project. These requirements for usable units of measurement are summarized in the following terms:

(1) Is it countable?
(2) Is it representative of the work to be accomplished?
(3) Is the quality of the work unit consistent?
(4) Is the terminology consistent and familiar?
(5) Does the work unit measure what you want to control?

In Section IV illustrations of practical units of measurement will be given for a number of different types of comparison and corrective action control systems. The specific problems involved in developing work units for an administrative work measurement system will be discussed in Chapter VI. To illustrate the application of these criteria, a few examples are given here. Work units that are useful in measuring output of personnel in several different activities of a naval base are transfer orders typed, number of students taught, patients seen, square feet of building swept, pay records handled
and area maintained. Further explanation may aid. The number of transfer orders processed was found to be a good indication of the performance of a group of clerical workers in one activity. The transfer orders themselves did not constitute all the work performed. They merely represented the total work of the group. For instance, processing each transfer order entailed such duties as picking up the man’s pay record, his health record, and check-off sheet. Typing the order was only part of the work, but it was representative of the total number of functions that had to be performed by the groups, so was chosen as a work unit.

THIRD STEP: Development of a Reporting System

The third step in the planning phase is setting up a reporting system for measuring and summarizing actual performance data. A systematic procedure must be devised for collecting data regarding the units of measurement produced. As pointed out above in this section the supervisor in charge of the activity being measured is the logical one to supply the data, but the establishment of the collecting system and periodic coordination of the reporting should be the duties of the coordinative staff.

These first three steps—selection of activities to be controlled, definition of units of measurement, and the collecting system—constitute the plan for measuring actual performance. The resultant reports tell what is going on
in the organization. They do not indicate what should be taking place. That is the standard of performance.

**FOURTH STEP: Selection and Review of Standards**

The fourth step which is essential to controlling anything is the selection and review of standards of performance. The problems involved in establishing standards for a work measurement system will be studied in greater detail later in Chapter VI. The general criteria of a good standard are the same as those for a good unit of measurement. In fact, a standard is expressed in terms of units of measurement. It is the model unit of measurement by which performance may be evaluated. Above all it must be representative of what is being measured.

**FIFTH STEP: Comparison of Actual to Standard**

The fifth step in organizing a system of control is the analysis and interpretation of the difference between actual and standard performance. This is a job for the coordinative staff, or someone in the organization who has the qualifications to perform these duties. It is at this point in the system that statistical methods of analysis have a part to play. This analysis involves not only the understanding of whether there is a significant difference; but also the understanding of what is the relationship between cause and effect.

This step will be discussed in detail in relation to work measurement in the following chapter. Suffice to
point out here that it is an essential part of any control system. Another basic element of the comparison step is timeliness. Trouble must be located before it becomes serious. Otherwise it loses its usefulness in controlling a procedure or process.

**SIXTH STEP: Continuous Review**

The sixth step of any system of control is the review and decision on action to be taken as a result of the analysis and interpretation of data disclosed by the control system. As pointed out early in the chapter, experience shows that this function is best performed by the echelon of line executives who are charged with the responsibility and who have the authority to make decisions and to take action in matters concerning what is being controlled.

The sixth step is concerned with the plan of what should be done in light of the analysis of the comparison of actual to standard performance. While the final decision must be made by the line executives concerned; yet here is an excellent opportunity to apply the principles of participation and pooled judgment. One of the favorable factors that bore heavily upon the fine cooperation in the

---

10 Whether the review will be conducted on a continuous basis or periodically is determined by the use to be made of the data. In operative control of operative process review is continuous, but for administrative control, the review is usually periodically; weekly, monthly, quarterly, yearly, etc.
Navy Project received in the field is attributable to the extent to which the local personnel at naval bases were given a chance to participate in the program. Participation in and of itself was found to be a favorable force in motivating naval personnel. Also it has a definite bearing upon the last step of a control system, namely, getting action.

SEVENTH STEP: Follow-up Action

The seventh and last universal step in any control system is the follow-up action to comply with the decision of what plan to follow in view of the analysis of the data from the control system. Getting action is exercising executive leadership, and it is a most complicated and complex thing.

This subject will be discussed in detail in Chapter VII. Two principles are involved. First is the application of the principle of exception which is to the effect that only exceptional cases should receive intensive executive attention. The more self-coordination is exercised at lower echelons, the more time top management will have to devote to broad problems of creative planning and policy formation. The less time top management will have to devote to daily "fire fighting." This process involves delegation and exercise of initiative by "delegates," resulting in voluntary cross coordination with a minimum of formal staff coordination by higher echelons. The second principle is
that of participation. As already noted, the greater the participation on the part of all executives concerned, from top to bottom, the greater the understanding, acceptance, and feeling of belonging to the management team.

The above discussion is not meant to be a thorough analysis of the seven steps in the development and operation of a control system. It is a quick, overall view of the steps in the comparison and corrective action control process.

IV. EXAMPLES OF CONTROL SYSTEMS ILLUSTRATE THE UNIVERSALITY OF THE CONTROL PROCESS

The seven basic steps are found in every control system—as Holden says, "whatever the type or whatever the subject." Figure 12 is designed to illustrate the fact that the seven steps in a control system are applicable in such widely separated areas of management as sales, production, and finance. A specific hypothetical case-illustration will be presented for five different systems. The discussion here is endeavoring to give an overall, thumb-nail sketch, as it were, of each of these systems. Of these five systems, those which are closely related to administrative work measurement will be discussed in detail in later chapters. These chapters will deal with the relation of budgetary control, statistical quality control, and motion and time study to administrative work measurement. The examples of sales control and cost accounting are
examples of operative controls. They are included to illustrate the universality of the seven steps.

FIGURE 12
EXAMPLES OF COMPARISON AND CORRECTIVE ACTION CONTROL SYSTEMS

<table>
<thead>
<tr>
<th>STEPS IN SYSTEM</th>
<th>SALES DEPARTMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Activities to be Controlled.</td>
<td>Salesmen's Effectiveness</td>
</tr>
<tr>
<td>(2) Units of Measure.</td>
<td>Dollars of Sales</td>
</tr>
<tr>
<td>(3) Reporting System.</td>
<td>Based on Sales Slips</td>
</tr>
<tr>
<td>(4) Standards</td>
<td>Quotas</td>
</tr>
<tr>
<td>(5) Analysis and Interpretation</td>
<td>Variances, over and under quota</td>
</tr>
<tr>
<td>of Actual to Standard.</td>
<td></td>
</tr>
<tr>
<td>(6) Continuous Review and Decision on Plans</td>
<td>Plan for Incentives,</td>
</tr>
<tr>
<td>(7) Follow-up Accountability and Preventive Correction</td>
<td>Territorial changes.</td>
</tr>
<tr>
<td></td>
<td>Execution of Plans.</td>
</tr>
<tr>
<td></td>
<td>For example, redivision of territories;</td>
</tr>
<tr>
<td></td>
<td>bonuses, and other salary incentives.</td>
</tr>
</tbody>
</table>
FIGURE 12 (Cont'd.)
EXAMPLES OF COMPARISON AND CORRECTIVE ACTION CONTROL SYSTEMS

<table>
<thead>
<tr>
<th>STEPS</th>
<th>PRODUCTION DEPARTMENT (WORK MEASUREMENT)</th>
<th>COST ACCOUNTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>Manpower requirements to meet work load.</td>
<td>Cost by units of production. Examples: Direct labor per unit, materials, and overhead or indirect costs.</td>
</tr>
<tr>
<td>(2)</td>
<td>Work units, for example, orders typed, students taught, square feet swept, patients.</td>
<td>Dollars or cents per unit.</td>
</tr>
<tr>
<td>(3)</td>
<td>Work measurement reports, giving work units completed and man-hours expended.</td>
<td>Cost Accounting reporting system.</td>
</tr>
<tr>
<td>(5)</td>
<td>Variances from standard; index of productive efficiency; analysis of performance of sub-function.</td>
<td>Variances, over and under standard.</td>
</tr>
<tr>
<td>(6)</td>
<td>Decision of areas needing management improvements. Establishment of accountability and plan for corrective action; forecasting work load and manpower needs.</td>
<td>Work simplification; reduction of costs, analysis of procedures and policies. Also reevaluation of standards.</td>
</tr>
<tr>
<td>(7)</td>
<td>Execution of plans for management improvements. Examples: reallocation of work load; changes in organizational structure relationships and procedures; programs of training and indoctrination, and work simplification.</td>
<td>Execution of plan.</td>
</tr>
</tbody>
</table>
EXAMPLES OF COMPARISON AND CORRECTIVE ACTION OF CONTROL SYSTEMS

<table>
<thead>
<tr>
<th>STEPS IN SYSTEM</th>
<th>BUDGETARY CONTROL (BUDGET OF PRODUCTION OPERATIONS)</th>
<th>STATISTICAL QUALITY CONTROL</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>1. Determination of work load or product mix and production programs. 2. Production of goods or services at lowest cost consistent with quality requirement.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Processes and procedures so as to assure quality of product or service.</td>
<td></td>
</tr>
<tr>
<td>(2)</td>
<td>Cost, broken down by departments, sections, and units on basis of labor, materials, and indirect costs such as labor, supervision, supplies, and capital equipment costs—on basis of month, year, quarter, etc.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Physical characteristics in such terms as feet, cubic area, voltage, etc.</td>
<td></td>
</tr>
<tr>
<td>(3)</td>
<td>Profit and loss (debit and credit) accounting system.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inspection by sampling technique. Tests, guaging, examinations.</td>
<td></td>
</tr>
<tr>
<td>(4)</td>
<td>Budgetary estimates and forecasts.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Specifications and actual samples.</td>
<td></td>
</tr>
<tr>
<td>(5)</td>
<td>Variances over and under budget. Analysis of costs.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Variances from standard in terms of defects, due to deviations of the process from standard operation specifications.</td>
<td></td>
</tr>
<tr>
<td>(6)</td>
<td>Application of work simplification, organizational analysis and analysis of procedures and policies applied to units being controlled, departments, sections, and units. Reevaluate budget.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Analysis of areas in procedures &amp; processes which cause deviation. Plan for correction of process to conform with standards. Rejection of sub-standard production or repair to standard. Plans for preventive correction.</td>
<td></td>
</tr>
<tr>
<td>(7)</td>
<td>Execution of plan, action through changes in organization, procedures, policies, programs and routine operations.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Execution of plans. Follow-up with accountable executive.</td>
<td></td>
</tr>
</tbody>
</table>
Control of Salesmen

The first example is outside the area of production management, but still illustrates the universality of the seven steps in the control process. It illustrates a system which a sales department could employ in measuring the effectiveness of their salesmen.

The first step of the system is to decide the activities to be controlled. The main consideration in this case is what objectives the company wishes to accomplish from the activities of the salesman. If the activities of the salesman are those of a missionary salesman, who makes no sales at all, then of course dollar sales could not be used as a measure. Most salesmen are called upon to do both missionary work and write sales. Thus, in the long run, dollar volume is the determining criteria of a salesman's success.

In this case dollar volume would be a representative unit of measurement of the salesman's effectiveness. The orders would form the basis of the reporting system. Standards would be the sales quotas. Quotas are based upon such factors as the sales potential of the territory, the state of development, and acceptance of the product, and the experience of the salesman.

The fifth step of analysis and interpretation of actual to standard would be evidenced in the variances over and under quotas. The sixth step is continuous review and decisions on plans to improve sales. Such plans take the form
of sales promotional programs, sales bonuses, product changes, changes in size and appearance of the container, territorial changes and the like.

In the sixth step (continuous review) accountability for the results of the activities is established. In the seventh step disciplinary action is taken. It should be positive as well as negative, praise as well as blame. Action should also be taken, of course, to correct any malpractices. It is important that the system be geared to supply information in time for preventive measures to be taken. In sales control action takes such forms as re-division of territories, bonuses and other salary incentives.

**Work Measurement as a Production Control**

The second example is that of a production department. Administrative work measurement is the control illustrated. As noted above, there are other controls that are used by the production department to measure quantity, quality, expenses, and time involved in the production process. Among the more common are cost accounting, budgeting, inventory control, production control of schedules, and quality control. Work measurement is used here to illustrate the seven steps in the control process, and at the same time to present a concise illustration of a statistical work measurement system.
Reference is made to the basic definition of administrative work measurement. It is a management tool which shows you facts about work turned out and the manpower it took to turn out that work. In many instances, work measurement is simply a method of bringing together, in a new way, facts that are already being collected. It is a tool which helps disclose weaknesses and irregularities. It may be thought of as a barometer that helps give a fix on management effectiveness. Such a control assists in establishing accountability for consistent, continuous management improvement.

Again, the differences must be made clear between work measurement based upon standards derived by statistical analysis of performance records and work measurement based upon standards derived from data collected by direct observation of employee performance, usually through the application of time and motion studies. The latter lends itself to a form of operative work measurement which is useful in establishing incentive wage systems. The former finds its greatest use in measuring staff activities where time-and-motion study or some other direct observational method is not applicable. Administrative work measurement facilitates the control of group activities.

Step one of any control system is to determine the objective of the system by deciding what activities are
to be controlled. Work measurement can be used to control a number of activities related to manpower utilization. Manpower requirements are dependent upon the work load, and the manpower it takes to perform the work. It relates the two to give an index of productive efficiency. In this illustration it is assumed that the activities to be controlled are the manpower requirements to meet the current work load.

Step two is determining work units. As pointed out above, this subject will receive detailed analysis in Chapter VI. Suffice here to list typical examples of work units such as orders typed, students trained, square feet maintained, and patients treated.

The third step deals with the reporting system. The basic work measurement reports that come from the activity being measured will indicate work units completed and the manhours expended on the activity. Setting standards is the fourth step. Standards is the subject of the next chapter. Work measurement standards are expressed in terms of manhours per work unit. This standard is called a standard performance-rate. Step five is the analysis and interpretation of actual to standard. In work measurement this step is usually expressed in terms of variance from standard. The overall performance is given in terms of an index of productive efficiency. This index relates total
actual manhours to standard for a given amount of work. Time is the common denominator.

The work of an activity usually consists of more than one function. These divisions are called subfunctions. As noted in Chapter II, a subfunction is simply a group of related processes or divisions of work within a single function. When it is desirable to ascertain why an activity is not up to standard or why it is over standard, then it is necessary to analyze subfunctions to locate the trouble areas. Comparison is also made to other departments as well as to the trend of performance.

The sixth step is periodic review and decision on plans. This step results in establishing accountability, taking corrective action, and setting up procedure to assure preventive correction. This step can also be a means of forecasting manpower requirements for a given work load. The last step in the system calls for execution of the plans made in step six. Examples are re-allocation of work load, changes in organizational structure relationships and procedures, programs of training and indoctrination, and work simplification programs.

Cost Accounting

The third example is cost accounting. This system is not administrative control, but it is an example of operative control that uses the seven basic steps. The objective is to control the cost by units of production.
This data is very important in helping arrive at a minimum price for a product. It also is more directly used by the production department in determining product mix, and in suggesting what products it is profitable to make and which it is not. Cost accounting indicates direct labor cost, materials cost, and indirect costs of supervisory salaries, supplies, and allocation of capital outlay and depreciation on a per-unit basis.

Standard costs are built up establishing the direct labor cost, direct material cost, and overhead cost per unit. The direct labor cost and material costs can be determined with less of a judgment factor than overhead. The direct labor costs for production line items is established from production rates usually set by time and motion studies. The direct materials cost are the actual costs. A more conservative practice is to cost materials at replacement prices rather than actual costs. Overhead costs should be allocated to the products receiving the services, represented by the overhead costs, wherever possible. There usually is a large portion, such as executives' time, which will have to be allocated on some other basis such as ability to pay or volume or dollar sales.

As in other control systems, variances of over and under standard are the indicators of trouble areas. From analysis of these variances and the causes for them, the
executives who have the responsibility and authority to make decisions, decide on plans to correct the condition. Work simplification, reduction of costs, analysis of procedures and policies are the more usual courses of action decided upon. The last step, of course, is execution of the plan.

**Budgetary Control**

Budgetary control is the fourth example. This control is an accounting program that endeavors to control costs by organizational units rather than by product items as in the case of cost accounting. Budgetary control is used to control departments, sections, and organizational units. From the standpoint of the production department, the objectives of the system are to determine the work load of the production program. Further, its aim is to operate at the lowest cost consistent with the predetermined quality of the goods and services being offered.

As in other control systems, the principle of exception is applied in the analysis and interpretation of variances over and under budget. The resultant decision usually calls for action through changes in organizational structure, procedures, policies, programs and routine operations. Chapter VIII will be devoted to a discussion of the relationship of budgetary control to administrative work measurement.

**Statistical Quality Control**
The last example of typical comparison and corrective action control systems in business is statistical quality control. The ideal quality control system is one that has preventive correction built into it to such a degree that the quality of future products is held within upper and lower control limits. This is accomplished through the use of statistical sampling.

Thus by a sampling technique, statistical quality control indicates variances from standard in such a manner as to control the production process and procedure. Analysis of areas in procedures and processes which cause deviation result in plans for correcting them. Of course, the substandard parts are rejected, to be repaired or scrapped.

Chapter IX deals with the relation of statistical quality control to administrative work measurement.

SUMMARY OF THE CHAPTER

The seven basic steps in the development and operation of any comparison and corrective action control system apply universally to all functions of organization—sales, production, finance, and technical and coordinative staff administration, such as personnel, industrial relations, and the coordinative control functions. These steps were developed through the application of the scientific method to the problems of control. Before a control system can be set up thorough analysis of the organization is necessary to determine (a) the objectives of the organization and
(b) analyze the organic functions of the organization to see what work the organization should be performing to accomplish its objectives. Otherwise, it is perfectly possible to establish a control system over a function that never should be performed in the first place.

After an organizational analysis has established what functions should be performed, it is then timely to set up a system of control to compare what is being done with what ought to be happening. The next logical step is to decide what plan of action to take in face of actual conditions compared to established standard conditions. Then, of course, the whole effort of establishing the comparison and corrective action control system is lost if the final phase of follow-up action and the establishment of accountability are not executed effectively. Thus it is that a program of comparison and corrective action can be broken down into three divisions of necessary steps: (1) measurement of actual performance; (2) analysis and interpretation of control data; and (3) regularly scheduled review and follow-up action. These are the major components of a control system necessary to establish accountability and to provide for procedures of preventive correction.

The first, collecting data of actual performance, can best be performed by supervisors on the first echelon of operations. The second step calls for professional aid of
coordinative staff. The third must be performed by the top echelon which has line authority for action.

The three major steps fall logically into the following seven categories:

I. Planning the system, which includes measurement of actual performance:
   1. Selection of activities to be controlled.
   2. Definition of units of measurement.
   3. A reporting system for measuring and summarizing actual performance.

II. Organizing for the introduction of the system, which includes analysis of data:
   5. Analysis and interpretation of the difference between actual and standard performance.

III. Operating the system, which includes review and follow-up action:
   6. Continuous or periodic review and decision on action to be taken as a result of an analysis of data.
   7. Follow-up action to comply with the decision.

The seven basic steps are found in every comparison and corrective action control system—as Holden says, "whatever the type or whatever the subject." Figure 12 illustrates how five vastly different control systems all employ the basic seven steps. The five systems are illustrative of ones found in the sales department, a work measurement system in a production or manufacturing department, a cost accounting system, budgetary control of production operations, and statistical quality control.
These seven steps are the framework of a control system. They present the overall view. The chapters which follow in this section will deal more specifically with the management problems encountered in performance of these seven steps. Particularly our thinking and analysis is directed at the problem of accountability and preventive correction in control, especially in relation to statistical work measurement as an administrative control. The next chapter deals with the important consideration of standards and methods of comparison.
CHAPTER VI
STANDARDS AND METHODS OF COMPARISON

I. INTRODUCTION

Chapter V illustrates the universality of the seven basic developmental steps in any control system and describes them briefly. Without standards, there can be no control. The present chapter is concerned with the proper concept and use of standards in a control system of administrative work measurement.

The relationship of measurement and comparison to standards is analyzed. Practical methods of developing standards are discussed, and methods of comparing actual to standard performance are considered.

II. BASIC CONCEPTS OF STANDARDS

"A standard is a criterion."¹ It is a model of whatever is being measured or compared. It may be expressed in terms of the four basic measures of standards of quality, quantity, expense, and time. The term "model" should not imply perfection. The quality standard of the model may well be known to be far from perfection. The point is the model should reflect the degree of quality prescribed by the organizational plan.

The term "standards" in this present discussion is concerned with the criteria by which administrative work measurement data can reflect the status of performance of the manpower being measured. There is a cause and effect relationship involved in measuring manpower performance, or any other type of performance, i.e., mechanical, electrical, and the like. This relationship demands the careful distinction between cause and effect—means and results. There can be models of methods of operation (the means) and there can be models of end performance or output (the results). The two are more closely related than may first appear because, as a practical matter, you cannot control "results" in terms of a standard unless you first control "means." And to control the "means" you must have some standards by which to go. This does not imply that standards of results are not necessary. They are. In the competitive market place the standards of results will be established, even if "result" standards are not established before hand in the company plant. Nevertheless, the limiting factor in the situation is the standard of "means." If the organization is designed to produce "Jeeps," it will never produce "Packards," no matter what standards of results are set.

2 Ibid., p. 137. These authors say, "Standards of performance cannot be maintained unless conditions of work, systems, and personnel are standardized."
Morris L. Cooke defines a standard and explains its relationship to standardization in the following quotation:

A standard under modern scientific management is simply a carefully thought out method of performing a function, or carefully drawn specifications covering an implement or some article of stores or product. The idea of perfection is not involved in standardization. The standard method of doing anything is simply the best method that can be devised at the time the standard is drawn. Standard specifications for materials simply cover all points of possible variation which it is possible to cover at the time the specifications are drawn. Improvements in standards are wanted and adopted wherever they are found. There is absolutely nothing in standardization to preclude innovation. But to protect standards from changes that are not in the direction of improvement, certain safeguards are erected. These safeguards protect standards from change for the sake of change. All that is demanded under modern scientific management is that a proposed change in a standard must be scrutinized as carefully as the standard was scrutinized prior to its adoption, and that this work be done by experts as competent to do it as were those who originally framed the standard. Standards adopted and protected in this way produce the best that is known at any one time. Standardization practiced in this way is a constant invitation to experimentation and improvement. 3

Measurement and Standardization

Standards of "means" become specifications of methods and procedures followed by the organization in working toward its objectives. A standard of "results" is the model of the finished product or service rendered.

Control of an organization is predicated upon establishing the one best way, and then seeing to it that the

---

organizational activity is kept within normal tolerances of the one best way. The one best way is prescribed by the standards of "means," and control within tolerances is measured in terms of standards of "results."

The one best way may include phases of planning and organizing that relate to preparation time and time of manufacturing operations, as well as prescribing methods of operation. Church refers to this practice as "design." He points out that it is a bill of particulars specifying the manner and method of performing operative work. He was careful to note that he was speaking only of "manufacturing," but the principles could just as well be applied to administrative work. He said:

Design provides a string of particulars, of specifications and standards, and hands them all over to Operation to carry out...

Dutton points out that coordinated effort and results are based upon standardization. He gives as an example the modern assembled product, such as a watch. He goes on to say that standardization is an advantage also in performing

4 Wylie and Brecht, op. cit., p. 95. They say: "Establishment of a standard methods, to be used by all workers for each specific step in the routine, makes available to each worker the one best method."

5 A. Hamilton Church, The Science and Practice of Management, pp. 48-49.
administrative work, such as planning manufacturing
schedules and programs. 6

Standardization is really the application of the
standards of means. Dutton defines it as follows:

Standardization is the setting up, by authority or
common consent, of a quantity, quality, pattern of
method, as a unit of measurement or an example for
imitation. 7

As pointed out above, standardization is the establish­
ment of the "one best way" as standard procedure for an
organization. The refinement of the measurement is
dependent upon the degree of standardization. If the unit
of measurement is uncertain and of an unstandardized variety,
then the results of the measurement will be also. Measure­
ment and standardization are closely related. Dutton says
on this point:

One major object of measurement is predication, and
both measurement and predication are immensely
simplified if known and fixed quantities can be
substituted for variable ones in the equation or
expression of cause-and-effect relation.

Measurement itself is dependent on a degree of
standardization...you have—probably experienced

6 Henry P. Dutton; Principles of Organization, p. 94. He
says: "The same advantages of coordination applies to
standardized performance as a basis of planning. If the
exact time needed to complete an operation is known, a
machine schedule can be laid out with reasonable assurance
that it can be followed. A financial budget relies like­
wise on the accuracy of the estimates of cost and sales,
the control of the conditions, upon which it is based.

7 Ibid., p. 93.
the uncertainty, inconvenience and impracticability of unstandardized units of measure.  

Dutton, writing in 1931, was apparently of the opinion that standards for office work would of necessity have to be of a very subjective nature. He believed that they could not be related to units of measurement anymore exact, or but little better than opinions based upon custom. He says on the subject:

Not all standards permit of such precise specification as those for the materials. A standard of conduct for an office worker, for example, is a complex balance of rights and obligations, which is subject to a constant slow change as circumstances change and points of view and customs are modified. Here the criterion is custom and the generally accepted view, and conduct must be weighed by relatively complex considerations.  

However, Leffingwell and Robinson, writing twenty years later, disagree. They say:

Without standardization, satisfactory planning and control is difficult if not impossible; with standardization, the office manager will know how much work each worker can do, and he will know how much work is to be done.

Finally, there is but one way in which he can control scientifically, and that is by standardization.  

Standardization Depends Upon a Unit of Measurement

Dutton says, "Measurement may be defined as a quantitative comparison of objects or things in terms of

---

8 Ibid.
9 Ibid., p. 102.
10 Leffingwell & Robinson, op. cit., pp. 50-52.
some likeness." Specifically, in connection with administrative work measurement such a "likeness" is the "unit of measurement." Thus the standard is expressed in terms of the unit of measurement.\textsuperscript{12}

The importance of selecting workable units of measurement was outlined in Chapter V above. Five criteria are set forth as being basic. They are:

1. Is it countable?
2. Is it representative of the work to be accomplished?
3. Is the quality of the work unit consistent?
4. Is the terminology consistent and familiar? (This is Dutton's point on acceptance and common use for those concerned.)
5. Does the work unit measure what you want to control? (The work unit preferably should be an end product of the function or functions you wish to control.)\textsuperscript{13}

\textsuperscript{11}Dutton, \textit{op. cit.}, p. 63.

\textsuperscript{12}Wylie & Brecht, \textit{op. cit.}, p. 108. They say: "Control plans dealing with quality and quantity are of value in raising the efficiency of individuals and groups of operators. Their use presupposes the measurability of the work and the selection of adequate production units."

\textsuperscript{13}See Footnote 6, Chapter V. Reference there is made to the Final Report, "Local Command Work Measurement Manual," \textit{op. cit.}, pp. 16-20 and to Ralph C. Davis, \textit{op. cit.}, p. 24.

Dutton, \textit{op. cit.}, p. 68, says:

The chief requirements of a good unit of measurement are that it shall vary in some definite ratio with the quality to be measured, and that it shall be a known quantity, which can be duplicated precisely, as often as the measure is to be used. Two more qualities are convenient but not essential: that the unit shall not be too large or small for convenient application to the objects commonly measured; and that a single unit shall be agreed upon and used by all members of a group having the interest in common.
The importance of adequate units of measurement cannot be overemphasized. They are the basis of the whole system of comparison and control. In the final analysis the units of work measurement selected should reflect manpower performance. They should be representative of the primary work performed by the group. The units selected must answer in the affirmative the following question: Do the work units give a true indication of the manpower input in the resultant output of products or services?

III. TYPES AND DEVELOPMENT OF STANDARDS

Standards are expressed in units of measurement; but the totals of these units can represent three different types of standards, each having a different basic origin or derivation. They are: (1) those based on past performance, (2) engineered standards based upon the best practical commercial procedures available, and (3) comparative standards which compare a group with outside or other groups within the company; in other words, inter-departmental and intra-departmental
standards. 14

**Past Performance Standards**

Past performance standards are the most easily developed and least scientific and effective. For obvious reasons, past performance standards leave a great deal of doubt whether performance in the past has been what it should have been. The most that can be said for such standards is that they are a vast improvement over no standards or rules of thumb. They do provide a method of comparing the present with the past performance to note whether the trend is for the better or worse.

Notwithstanding the shortcomings of past performance standards, they are usually the **beginnings** of any kind of

---

14 Wylie & Brecht, *op. cit.*, p. 465. These authors give the origin of standards as (1) one's own past experience and (2) experience of others. The second category includes both comparative standards and engineered standards, based upon analysis of the best practical methods available. They say: "A standard may be set up on the basis of internal past experience, or it may be developed externally as the result of the analysis and comparison of the experience of others. Standards are subject to revision. They must be cautiously used."

Also see Elmore, Petersen and E. Grosvenor Flowman, *Business Organization & Management*, pp. 365-366. They say: "The yardstick method is also a common technique for appraisal of operating problems. In every phase of business operation there are yardsticks, varying in validity, from scientifically proved principles and theories to pure rules of thumb derived from experience."
standards at all. There were a good many different types of work included in the Navy project studies. Nevertheless, in practically all instances the standards established initially were set by the application of judgment to past performance records. The details of establishment of these standards will be discussed shortly, and it will be seen that they were devised to encourage improved performance; nevertheless they were based upon past performance. There were several reasons for this policy. One was that there was no better method available at the time. A second reason was that past performance as a basis for standards was understood and received better acceptance and use than more advanced methods. A third reason was that it is not possible in many cases to use observational methods for setting standards on staff operations; for example, interviewing.

The pioneering of the Navy project in the establishment of such administrative work measurement standards is not entirely without endorsement by others working in the field. Wylie and Brecht concur in the following statement bearing directly on the question of using past performance as a basis for standards:

Records of past performance offer opportunities to office managers who are not skilled in scientific analysis to build output standards that will be fair and reasonable, provided the records are studied and the facts disclosed therein are properly aligned in the study. It is not always necessary to employ time and motion studies. If they are employed
improperly, the results will probably be more injurious and disappointing than if no study were made at all.\textsuperscript{15}

In Chapter II the present state of development of administrative work measurement was analyzed. It was pointed out that it is present practice of some outstanding corporations to base their standards of office work on past performance. Further, the point was stressed that the mere fact a work measurement system is in operation resulted in increased performance, often as much as a 20 percent increase in output per hour of manpower. J.C. Staehle made a similar statement in a paper before the Chicago chapter of the National Office Management Association. He also indicates that an important by-product of establishing a work measurement system is management improvement. He says:

\textit{By establishing units of measurement and computing the output of employees on an hourly basis, production has been and should be increased anywhere from 10 to 30 percent, conservatively without any incentive other than the desire that everyone has--to make a good showing. Unless units for measurement are set up, progress cannot be noted. It is impossible without this measuring stick to determine the advantages of hiring a better type of employee, purchasing better equipment, improving the layout, or any other improvement. There is a definite guage for measuring the amount of work turned out per employee as reflected in unit cost. The reverse of this is also true, for unless there is measurement the effect of added work cannot be judged. To arrive at a unit of}

\textsuperscript{15} Wylie and Brecht, \textit{op. cit.}, pp. 269-270.
measurement, it is necessary to make an analysis which should lead to improvements affecting costs and quality of work. 16

**Engineered Standards**

The term "engineered standards" infers a state of refinement and development far beyond the past performance standards. How true this is depends upon the state of development in the field to which engineered standards are being applied, because engineered standards simply mean conformity to the best commercial practices available. Usually engineered standards are more rational than past performance standards, however, and are therefore superior.

It should be noted that engineered standards do not mean mere "conformity." They are criteria that represent the best current practice. They are rational because they are the result of the application of an objective analytical technique to observed data obtained directly by investigation.

**Comparative Standards**

Comparative standards are standards derived from comparing one group with another or a whole group of others. It is the standard by which the businessman is apt to be most impressed, because of its close connection with competitive standings and practical situation in the marketplace. By past performance standards a firm may be making

---

great progress, but his consuming public is not at all interested in that fact. In the marketplace it is comparative standards which sell or fail to sell the firm's product or service. In case of a monopolistic position as a public utility company, the comparative standard usually is not with other utilities, but is with alternative uses for the consumer's dollar and substitute products, such as coal, gas, or oil heat for the home.

Also comparative standards can grow out of the relationship of departments to each other, over a period of time. The common denominator is time. The position of each department can be expressed in a ratio of actual man-hours expended on a given quantity of work divided into the standard man-hours for that amount of output or work units. The result is a percentage which is the index of productive efficiency. The trend of each department to other departments can then be observed. If all departments show one general trend save one or two departments, these non-conformers should be called for an accounting. One advantage of such a system is that the work in the several departments does not have to be comparable, since time and not the work unit is the common denominator. Also it is the trend which is the significant factor. Departments are not being compared directly. For example, it is not a matter of comparing eggs and milk; but rather it is a comparison of the time spent on eggs
and milk today, as against the time so used in the past.

The Evolutionary Development of Standards

The standard is the backbone of the control system. The end product or service of the organization can be no better than the standards that it establishes for itself, both standards of "means" and standards of "results."

Ralph C. Davis in his book on top management makes this point very well. He points out that engineers in the field of industrial research have classified standards among three types—"ideal, engineering, and working standards."

The ideal standards "represent the ultimate in the development of the product or process insofar as the engineer is able to envision it with some degree of accuracy."..."The engineering standard represents the best practice that is commercially practicable in the present state of the particular manufacturing art."..."The working standard is the engineering standard and modified by 'tolerance.'"17

Standards are the devices for establishing criteria by which the performance of an organization can be measured. They are in terms which express how well the objectives of an organization are being met, in regard to the quality, quantity, costs of the goods and services being offered to the consuming public. Ideal standards

"depend on analyses of ultimate business objectives... Engineering and working standards are related to immediate business objectives." Analyzed in light of the objectives of an organization, standards should be established which furnish the degree of refinement and quality, consistent with objectives of the organization. In other words, it would be unscientific and uneconomic for one of the three low-priced automobile manufacturers to establish the standards of production comparable to the high-priced cars such as Lincoln and Cadillac.

Davis further makes the point that the degree of refinement and accuracy demanded of an organization's standards is determined by the stage of industrial development in which that organization finds itself. The reader will remember that there are three such stages: the pioneering stage, stage of exploitation, and the stage of stabilization. And for many organizations there has been the fourth stage of deterioration.

In the pioneering stage there is little demand for high quality, quantity, low costs or fast production. Consequently, the standards are likely to be relatively low. As Davis puts it, "they are likely to be codifications of criteria which executives and key employees have been carrying around in their heads for years, plus such standards as may be developed through analyses of past performance records. Furthermore, they are 'drifting
standards.' Progress has been made by trial and error in the development of managerial and operative functions as well as in the product. In consequence, experience standards drift toward higher levels of economy and effectiveness."\textsuperscript{18} As the organization progresses through more advanced stages of industrial development, the need for rational standards becomes more pronounced. Research resulting in more rational standards, begins with basic market and product research. They answer in a very refined manner such questions as the following: Who are our customers? Where are they? What do they want? How can we give it to them? Davis summarizes the stages of development of standards into the following seven:

1. Recognition of a need for better standards.
2. The development of experience standards.
3. The development of rational standards with the development of technical staff functions.
4. Organization for standards work.
5. Control of standards development.

\textsuperscript{18} Ibid., p. 38. Church expresses the same idea. See Church, op. cit., pp. 303-304. He says: "For the most part we shall have to rely on carefully made records....This is a case of applying experience to form standards."
7. Provision for periodic review of standards. 19

IV. METHODS OF ESTABLISHING STANDARDS

An important part of the Navy project, which constituted the primary research of this study, is the "Local Command Work Measurement Manual." The manual went through five revisions in the course of the year. It was developed for use by the local administrative officer at the typical Navy shore station. The procedures suggested are based on research in the field; and after each revision the manual was taken to the field and tried out. The detailed steps in establishing an administrative work measurement system are given in the manual. Those readers interested in a detailed study are urged to consult it.

In this chapter the methods of calculating standards set forth in the manual will be outlined and analyzed in light of the basic concepts and principles discussed above. 20

19 Ralph C. Davis, op. cit., p. 39. This author also quotes Alfred's Law of Standardization: "Every standard should be subject to revision from time to time in order that it shall continue to reflect the available and applicable knowledge of the art." The Laws of Management, p. 111.

20 See Final Report, The Ohio State University Research Foundation Contract NONr 495(05), June 1953. Attachment II of the Final Report is a reproduction of "Local Command Work Measurement Manual." Copies of the Final Report are available for loan from The Ohio State University, College of Commerce Library.
Temporary Standards

The basic philosophy was to begin with "temporary" standards, based on past performance, and then by an evolutionary process of improvement proceed to more rational standards of the engineered and comparison types. This policy has the advantage of gaining the benefit which comes from the mere fact that work is being measured. It enables an analysis of trend. Also it maintains interest in the program. As a practical matter executives find it difficult to wax enthusiastic about a system that must wait six months or more before any tangible results can begin to be noticed.

Setting "temporary standards" is simply a matter of accepting the past performance rate as a "temporary standard," or exercising judgment in throwing out data which is considered non-typical, and then accepting the remaining past performance data as a "temporary standard." Such a system is admittedly a crude method, but as a starting point it has the advantage of acceptance and experience bears out that it does have beneficial results, as noted above.

Method of Setting Temporary Standards--The Transfer Division, A Case Study

The Transfer Division of a Personnel Department is used as an example. This office is found in every Naval training center, receiving station, or any other naval shore
station receiving and dispatching large numbers of personnel.
The primary duties of the Transfer Division are concerned
with transferring personnel. A logical division of sub-
functions is on the basis of the types of transfers in-
volved. Thus the "Ship's Company Transfers" are concerned
with the duties of transferring personnel attached to the
station. This involves the paper work of a check-off
list, changing a man's berthing arrangements, collecting
his personal health and pay records, writing the transfer
orders, and the like. These duties are measured by using
each Ship's Company Transfer Order as one work unit. Other
work units are Service School Transfer Orders, Recruit
Transfer Orders, Training Orders, Draft Escort Orders,
Discipline Orders, Shore Patrol Orders, and Hospital
Transfer Orders. Each of these represents duties similar
to those mentioned in connection with Ship's Company
Transfers.

Table 1 on page 211 is a reproduction of the work
sheet used during the pilot studies in determining
temporary standards for the Transfer Division at one of
the naval stations. This work sheet is for collection
of raw work measurement data for a period of one month,
four weeks in this case. Manhours expended and work units
completed are recorded weekly. Then, by adding horizontally
in the case of each subfunction, total manhours expended
for the month are calculated. The same calculation is
performed for work units for each subfunction. For example, under subfunction "Ship's Company Transfers" by adding horizontally, a total of 552 manhours is obtained; for work units, the four week total, added in the same manner is 298. From Table 1, the work sheet, monthly totals for each subfunction are posted to Table 2, for the purpose of calculating performance rates and setting temporary standards on each subfunction. For example, in Table 2 (subfunction--Ship's Company Transfers) the first month's total manhours of 552 is divided by 298 work units to calculate the performance rate, which is 1.85 manhours per work unit. A similar calculation yields 0.96 for the subfunction Service School Transfers. Other subfunction performance rates appear in Column 3 of Table 2.

The first figures in Column 4, Table 2, which are indicated by asterisks, are the temporary standards for the subfunctions performed by the Transfer Division. These temporary standards of subfunction performance rates are determined on the basis of judgment. The decision is whether or not past performance rates are adequate standards. If it is decided past performance is an adequate standard, then the past performance rate is accepted as a temporary standard. In this case, it is the first month performance rate.

If it is decided past performance rates are not good standards, a rate that the executives concerned agree is
more representative of standard performance is accepted. For example, in Column 4 of Table 2, all performance rates with a single asterisk (*) use the first month performance rate as the temporary standard. The double asterisk (**) on the temporary standard (1.30**) for the subfunction of Discipline indicates that it is agreed to be a better temporary standard than the first month's performance rate.

This case study of the Transfer Division is given to illustrate the procedure of setting temporary standards.21

Scientific Method Applied to Management Problems

An important phase of the program was an application of the scientific method to the management problems involved in the organizational situation. Before a work measurement system can be installed, basic analysis should be made of the organizational structure and managerial policies and procedures. It will be remembered that before ever introducing work measurement, the Navy project first conducted a problems and attitude survey to discover the nature and area of the management problems.

A program of management improvement was then suggested in an effort to bring about improvements in these areas.

21 This example is found in the Final Report, "Local Command Work Measurement Manual," op. cit., pp. 11-27 to 11-32. Tables 1 and 2 are reproduced from this example and appear on page 11-28 and pages 11-30 and 11-31 respectively.
<table>
<thead>
<tr>
<th>Subfunction</th>
<th>Description of Work Units</th>
<th>First Week</th>
<th>Second Week</th>
<th>Third Week</th>
<th>Fourth Week</th>
<th>Monthly Summary*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>a.</td>
<td>b.</td>
<td>a.</td>
<td>b.</td>
<td>a.</td>
</tr>
<tr>
<td>Ship's Co. Transfers</td>
<td>Ship's Co. T.O.</td>
<td>128</td>
<td>68</td>
<td>145</td>
<td>81</td>
<td>99</td>
</tr>
<tr>
<td>Service Sch. Transfers</td>
<td>Service S. T.O.</td>
<td>140</td>
<td>148</td>
<td>120</td>
<td>130</td>
<td>197</td>
</tr>
<tr>
<td>Recruit Transfers</td>
<td>Recruit T.O.</td>
<td>162</td>
<td>1058</td>
<td>197</td>
<td>1235</td>
<td>190</td>
</tr>
<tr>
<td>Two Weeks Reserve</td>
<td>Transfer Orders</td>
<td>56</td>
<td>57</td>
<td>46</td>
<td>49</td>
<td>71</td>
</tr>
<tr>
<td>Draft Escort</td>
<td>Draft E. Orders</td>
<td>30</td>
<td>25</td>
<td>31</td>
<td>29</td>
<td>35</td>
</tr>
<tr>
<td>Discipline</td>
<td>Disc. O.</td>
<td>30</td>
<td>19</td>
<td>34</td>
<td>31</td>
<td>35</td>
</tr>
<tr>
<td>Shore Patrol</td>
<td>Shore P. T.O.</td>
<td>40</td>
<td>74</td>
<td>40</td>
<td>72</td>
<td>40</td>
</tr>
<tr>
<td>Hospital</td>
<td>Hospital T.O.</td>
<td>34</td>
<td>81</td>
<td>38</td>
<td>85</td>
<td>38</td>
</tr>
<tr>
<td>Total Measured Operative Time</td>
<td></td>
<td>620</td>
<td>651</td>
<td>705</td>
<td>679</td>
<td>2655</td>
</tr>
</tbody>
</table>

| a. Manhours Expended   | T.O. Transfer Orders     |
| b. Work Units Completed| * Four week month assumed in order to simplify. |

<table>
<thead>
<tr>
<th>Subfunction</th>
<th>Description of Work Units</th>
<th>Manhours Expended</th>
<th>Work Units Completed</th>
<th>Performance Rate (Manhours Per Work Unit)</th>
<th>Temporary Standards</th>
<th>Standard Manhours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ship's Co. Transfers</td>
<td>Ship's Co. Transfer Orders</td>
<td>552</td>
<td>298</td>
<td>1.85</td>
<td>1.85* x 298</td>
<td>552.00</td>
</tr>
<tr>
<td>Service School Transfers</td>
<td>Service School Transfer Orders</td>
<td>557</td>
<td>582</td>
<td>0.96</td>
<td>0.96* x 582</td>
<td>557.00</td>
</tr>
<tr>
<td>Recruit Transfers</td>
<td>Recruit Transfer Orders</td>
<td>694</td>
<td>4385</td>
<td>0.16</td>
<td>0.16* x 4385</td>
<td>694.00</td>
</tr>
<tr>
<td>Two Weeks Reserve</td>
<td>Transfer Orders</td>
<td>293</td>
<td>314</td>
<td>0.93</td>
<td>0.93* x 314</td>
<td>293.00</td>
</tr>
<tr>
<td>Draft Escort</td>
<td>Draft E. Orders</td>
<td>126</td>
<td>110</td>
<td>1.15</td>
<td>1.15* x 110</td>
<td>126.00</td>
</tr>
<tr>
<td>Discipline</td>
<td>Disc. Orders</td>
<td>129</td>
<td>91</td>
<td>1.41</td>
<td>1.30** x 91</td>
<td>118.30</td>
</tr>
<tr>
<td>Shore Patrol</td>
<td>S.P. Trans. Orders</td>
<td>160</td>
<td>297</td>
<td>0.54</td>
<td>0.54* x 297</td>
<td>160.00</td>
</tr>
<tr>
<td>Hospital</td>
<td>Hosp. T. Orders</td>
<td>114</td>
<td>343</td>
<td>0.42</td>
<td>0.42* x 343</td>
<td>144.00</td>
</tr>
<tr>
<td>Measured Operative Time</td>
<td></td>
<td>2655</td>
<td></td>
<td></td>
<td></td>
<td>2644.30</td>
</tr>
</tbody>
</table>

* Performance rates of First Month deemed representative.

** Agreed to as being more representative than the monthly performance rates.
TABLE 2
(Continued)

TRANSFER DIVISION, PERSONNEL DEPT.
WORK MEASUREMENT PERFORMANCE DATA
First Month Summary

<table>
<thead>
<tr>
<th>Available Time:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Operative (measured)</td>
<td>2655</td>
</tr>
<tr>
<td>Operative (unmeasured)</td>
<td>0</td>
</tr>
<tr>
<td>Managerial (unmeasured)</td>
<td>640</td>
</tr>
<tr>
<td><strong>Total Available</strong></td>
<td><strong>3295</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unavailable Time:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Leave</td>
<td>320</td>
</tr>
<tr>
<td>Sick List</td>
<td>225</td>
</tr>
<tr>
<td><strong>Total Unavailable</strong></td>
<td><strong>545</strong></td>
</tr>
<tr>
<td><strong>Total Time</strong></td>
<td><strong>3840</strong></td>
</tr>
</tbody>
</table>

- Military Duties: 295 hours
- Normal Work Week: 40 hours
- No. of Supervisors: 4 men
- No. of Operative Personnel: 20 men
- **Total Personnel**: 24 men

Index of Productive Efficiency = \(\frac{2644}{2655}\) = 99.59%

Source: Final Report, The Ohio State University Research Foundation Project N995(05), pp. II-30 to II-31.
An important part of the improvement program was the administrative work measurement system. This was to be the barometer of improvement and the indicator of any new problems or areas needing attention. For the barometer to be affective standards must be established. This in time leads to standardization, to as great a degree as is practicable.

Of course, the program was not complete until the last step of a control system was added, namely, continuous review (comparison) and a system for follow-up corrective action.

Such an overall program of management improvement can be summarized in the following steps:

1. Organizational structure and managerial procedure survey.

2. Program for improvement, aimed at problems and areas needing correction. Such a program can take several directions:
   
   (a) A program of developmental projects adapted to management needs and problems, e.g., organizational analysis and revised organization structure and relationships. (Organization charts); job and position descriptions; work simplification of procedures and operations; and the like.

   (b) Install work measurement and other control systems.

   (c) Training programs on specific needs.

3. Programs of continuous review and follow-up action.

   (a) Definite procedures and means of communications whereby work measurement and other control reports can be analyzed in light of objectives of the organization.
Facilities for assuring participation and understanding on the part of all echelons of management.22

Factors and Forces Involved in Setting Permanent Standards

When incorporated in an overall management problem as described above, administrative work measurement becomes more than merely a device for reporting and communicating to higher authority the status of manpower performance.

22 This overall program coincided closely with Dutton's steps in standardization. Dutton, op. cit., p. 96. He says: "The steps in the developing a standard are the same in principle as those involved in the scientific method....They are as follows:

1. Research and Experiment - The adoption of a standard should be preceded by a period of experimentation, to find the best method... As the major problems are worked out, refinements tend to become less and less radical until a point is reached at which one type is generally accepted and may safely be adopted as a standard... it is properly a staff rather than a line operative function.

2. Adoption of Standard....The selection of the standard type will follow the usual rules for the comparison and testing of hypotheses.

3. A record of the standard adopted...

4. Control of Conditions. - The fourth step in standardization is the control of the auxiliary conditions and supplying the necessary facilities for carrying out the standard. (For example an adequate supply of the correct color paint to assure uniform products.)

5. Teaching the Standard Method...

6. Check-up of Performance....Performance must be inspected, and checked with the standards or models.
It becomes the stimulator of improvements in organizational structure, improvements in procedures, and a morale motivator. In short, administrative work measurement helps: (1) the supervisor control the people under him, and (2) aids him in demonstrating to higher authority the effectiveness of the use of manpower assigned to him.

As a result of the initial management survey and improvements effectiveness of the organization should increase, regardless of whether work measurement is installed or not. Further, if administrative work measurement is installed, and functions properly, the improvements after the initial survey and resultant changes will be gradual and cumulative. This is true, because it is the function of administrative work measurement to indicate areas needing improvement and to maintain a continuous check on operations involving manpower. Administrative work measurement leads to management improvement and cost reduction studies that support requests for facilities and personnel.

Consequently, the present performance will be better than yesterday's--this month better than last. As Dutton points out (See footnote 21 above) as the major problems are worked out, the refinements tend to become less and less radical, and thus the improvement less and less measurable as the process approaches the "one best way."

This phenomenon has an important bearing on
permanent standards.

If standards are accepted as "permanent" too early in the stage of development, before the organization has reached a practical condition of the one best way, there such standards will tend to tie the organization to mediocrity of performance. There will be little motivation in such standards. They will tend to make the organization "look good" manpower-performance-wise, but will not increase effectiveness of manpower utilization.

A number of factors should be considered in setting "permanent" standards. The most important are:

1. By "permanent standards," it is not meant to imply finality. Standards are permanent only so long as the conditions they help measure remain the same in their major aspects. This policy recognizes constant change, and necessity of periodic review of "permanent standards."

2. An evaluation of what is a fair day's work.

3. An evaluation of what standard will motivate the group to more effective performance.

Criteria for Permanent Standards

An analysis and consideration of the factors involved in controlling manpower utilization, as outlined above, lead to the following statement of the criteria of adequate permanent standards for a system of administrative work measurement.

1. The standard must be within limits of subjective judgment of a fair day's work. It must be possible for employees to reach standard without undue effort or worry and they must be able to maintain this pace over a long period.
2. The standard must offer some potential incentive for improvement.

3. The standard must not be a standard of mediocre past performance. This defeats the purpose of work measurement. It must be a stimulator of effectiveness, which will result in improved group performance.

Four Illustrations of Permanent Standards

Wylie and Brecht make the point that there are almost as many ways of arriving at a "standard of output" as there are engineers. Three simple statistical methods developed on the Navy project, and the general method involving time and motion studies will be discussed here.

All three methods suggested by the Navy project were designed to conform with the three criteria of permanent standards mentioned above. The first criteria is concerned with keeping standards within "a fair day's work," to make sure the standard is obtainable and reasonable. In all three methods the standard is established at a level of performance better than the worst past performance and somewhere between the median and best performance. Further, no "permanent standard" is established until the system has operated on "temporary standards" for a period of time sufficient to study the trend of past performance and analyze the circumstances surrounding usually good and also the unusually poor performances. It is estimated that in

23 See Wylie and Brecht, op. cit., p. 269.
the case of most staff operations such a period will be in the neighborhood of six months.

The second criterion states that the standard must offer some incentive for improvement. Standards set by any of the three methods meet this requirement. The effectiveness of the incentive, however, is often beyond the power of the standard. The standard set by one of the three systems affords a reasonable base for comparison with actual performance. As has been pointed out, this fact alone has a stimulating effect. The Navy was urged to give greater recognition to the good and bad performers; but, of course, this is a matter that the standard by itself can only influence by its facilitative powers to compare. It is interesting to note that the Navy does have an item on the "Officers Fitness Report" dealing with cost-consciousness.

The third criterion is that the standard must be sufficiently difficult for attainment to provide a motivating force to improve performance of the group. All three standards set by simple statistical methods meet this requirement. Each method has the affect of setting standard at a point about halfway above the median and the best performance. Setting the standard at the median would in effect be setting it at less than current performance, and so encourage poor or mediocre performance. As was discussed, this is true due to the fact that during the initial stage of the installation of a work measurement
system improvements will result in a gradual and cumulative improved performance rate. Therefore, the median would be an extremely weak standard.

The differences in the three methods of setting standards are basically ones of method of calculation and collecting data.\textsuperscript{24}

1. \textbf{Standard set at Half the Difference Above the Median}

The first method is suggested for use by supervisors who do not have a working knowledge of such statistical techniques as the standard deviation. The first method employs arithmetic to set the standard at a point halfway between the median and the best performance figure in an array of performance rates for the last six months.

An example of this method of setting a standard is again found in the Transfer Division. A performance standard in terms of manhours per work unit is established for each subfunction. The performance rates for the past six months are shown in Table 3 on page 223. For example, the first month performance rate is 1.85 manhours per Ship's Company Transfer order. The following consecutive months'
performance rates for this subfunction are 1.75, 1.88, 1.81, 1.81, and 1.93. These six months' data are sufficient to indicate a trend and to show that the temporary standard of 1.85 is not adequate to meet the requirements of the criteria of a sound standard. (Of course, the larger the numerical value of the performance rate, the lower the efficiency; e.g., 1.93 manhours per work unit is more time than 1.81 manhours).

In order to establish a more realistic, permanent performance standard, the following procedure is conducted for each subfunction:

(1) Performance rates for the past six months are put in an array from the lowest to the highest. This step is illustrated in the upper part of Table 4 on page 224.

(2) The midpoint between the median and the best month's performance is calculated. Taking Ship's Company Transfers in Table 4, the median (middle value) for the six months is 1.83. The best performance rate is 1.75. The difference yields 0.04, adding 0.04 to 1.75 yields 1.79 which is the new permanent performance rate for the Ship's Company Transfer subfunction.

When using this method, one caution must be taken. If the best performance rate (in this case 1.75) was the result of circumstances not likely to be repeated and thus yields a figure way out of line with other performance rates, then it should be discarded and a more reasonable value used, for example, the next best performance rate.

It must be remembered that this is a somewhat rough method for selecting performance standards. The ease with
which it can be understood and computed recommends it for
gen­eral use, but it is important good common sense be
exercised in checking on its reasonableness.

Using the standard performance rates shown in row five
of Table 4 standard manhours have been computed for the
permanent standards for the Transfer Division. The per­
formance standards used in this table can be used until
further data suggests that the standards be changed.

2. Standard Set at One Standard Deviation Below
the Arithmetic Mean

A statistically more refined method of calculating a
standard than the one illustrated above is the second
method. It involves setting the standard at one standard
deviation below the arithmetic mean. Using the performance
rates summarized in the upper part of Table 4 on page 224,
this technique is illustrated in Table 5 on page 225. For
example, the arithmetic mean of the array of performance
rates for the Ship's Company Transfer subfunction is 1.84.
The standard deviation is 0.06, which establishes the
permanent standard of performance at 1.78. Using the first
method, the standard was set at 1.79 manhours. Thus it
can be seen the results of the two systems are remarkably
close.

3. Statistical Determination of Manhours Expended
and Performance Standards for Subfunctions.

The two methods described above both have the serious
disadvantage of a cumbersome procedure of recording the
<table>
<thead>
<tr>
<th>Subfunction</th>
<th>Description of Work Units</th>
<th>First Month</th>
<th>Second Month</th>
<th>Third Month</th>
<th>Fourth Month</th>
<th>Fifth Month</th>
<th>Sixth Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ship's Co.</td>
<td>Ship's Co. Transfer Orders</td>
<td>1.85</td>
<td>1.75</td>
<td>1.88</td>
<td>1.81</td>
<td>1.81</td>
<td>1.93</td>
</tr>
<tr>
<td>Service School</td>
<td>Service School Transfer Orders</td>
<td>.96</td>
<td>.97</td>
<td>.97</td>
<td>.92</td>
<td>.99</td>
<td>.99</td>
</tr>
<tr>
<td>Two Weeks Reserve</td>
<td>Transfer Orders</td>
<td>.93</td>
<td>.97</td>
<td>.94</td>
<td>.95</td>
<td>.97</td>
<td>.91</td>
</tr>
<tr>
<td>Draft Escort</td>
<td>Draft E. Orders</td>
<td>1.15</td>
<td>1.19</td>
<td>1.18</td>
<td>1.27</td>
<td>1.16</td>
<td>1.12</td>
</tr>
<tr>
<td>Discipline</td>
<td>Disc. Orders</td>
<td>1.41</td>
<td>1.39</td>
<td>1.40</td>
<td>1.32</td>
<td>1.39</td>
<td>1.38</td>
</tr>
<tr>
<td>Shore Patrol</td>
<td>S.P. Trans. Orders</td>
<td>.54</td>
<td>.50</td>
<td>.58</td>
<td>.49</td>
<td>.51</td>
<td>.57</td>
</tr>
<tr>
<td>Hospital</td>
<td>Hosp. Trans. Orders</td>
<td>.42</td>
<td>.45</td>
<td>.44</td>
<td>.41</td>
<td>.40</td>
<td>.40</td>
</tr>
</tbody>
</table>

Source: Final Report, The Ohio State University Research Foundation Project No. 195(05), p. II-45.
TABLE 4
TRANSFER DIVISION, PERSONNEL DEPT.
WORK MEASUREMENT PERFORMANCE DATA
ARRAY OF MONTHLY PERFORMANCE RATES AND DERIVED STANDARD RATES

<table>
<thead>
<tr>
<th>SUBFUNCTION</th>
<th>Row Ship's Co. Transfers</th>
<th>Service School Transfers</th>
<th>Recruit Transfers</th>
<th>Two Week Reserve</th>
<th>Draft Escort</th>
<th>Discipline</th>
<th>Shore Patrol</th>
<th>Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.75</td>
<td>0.92</td>
<td>0.13</td>
<td>0.91</td>
<td>1.12</td>
<td>1.32</td>
<td>0.49</td>
<td>0.40</td>
<td></td>
</tr>
<tr>
<td>1.81</td>
<td>0.96</td>
<td>0.14</td>
<td>0.93</td>
<td>1.15</td>
<td>1.38</td>
<td>0.50</td>
<td>0.40</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1.88</td>
<td>0.16</td>
<td>0.97</td>
<td>1.19</td>
<td>1.40</td>
<td>0.57</td>
<td>0.44</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1.93</td>
<td>0.17</td>
<td>0.97</td>
<td>1.27</td>
<td>1.41</td>
<td>0.58</td>
<td>0.45</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Row No.</th>
<th>Ship's Co. Transfers</th>
<th>Service School Transfers</th>
<th>Recruit Transfers</th>
<th>Two Week Reserve</th>
<th>Draft Escort</th>
<th>Discipline</th>
<th>Shore Patrol</th>
<th>Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.83</td>
<td>0.97</td>
<td>0.11</td>
<td>0.94</td>
<td>1.17</td>
<td>1.39</td>
<td>0.52</td>
<td>0.41</td>
</tr>
<tr>
<td>2</td>
<td>1.75</td>
<td>0.92</td>
<td>0.13</td>
<td>0.91</td>
<td>1.12</td>
<td>1.32</td>
<td>0.49</td>
<td>0.40</td>
</tr>
<tr>
<td>3</td>
<td>0.08</td>
<td>0.05</td>
<td>0.01</td>
<td>0.03</td>
<td>0.05</td>
<td>0.07</td>
<td>0.03</td>
<td>0.01</td>
</tr>
<tr>
<td>4</td>
<td>0.04</td>
<td>0.03</td>
<td>--</td>
<td>0.02</td>
<td>0.03</td>
<td>0.04</td>
<td>0.02</td>
<td>--</td>
</tr>
<tr>
<td>5</td>
<td>1.79</td>
<td>0.95</td>
<td>0.13</td>
<td>0.93</td>
<td>1.15</td>
<td>1.36</td>
<td>0.51</td>
<td>0.40</td>
</tr>
</tbody>
</table>

LEGEND:
1. Row 1 - Median
2. Row 2 - Best Performance Rate
3. Row 3 - Difference of Rows 1 and 2
4. Row 4 - Half of Above Difference
5. Row 5 - Best Performance Rate Plus Half of Difference = Standard Rate.

Source: Final Report, The Ohio State University Research Foundation Project N0nr 495(05), p. 77-46.
Standard Performance Rates can be set one standard deviation below the arithmetic mean. This will yield comparable results to the method utilized in the above example in Appendix A. For example, when the standard deviation is computed by using the formula for ungrouped data, standard deviation $\sigma = \sqrt{\frac{\sum d^2}{N}}$, the following results are obtained.

<table>
<thead>
<tr>
<th>Subfunction</th>
<th>Arithmetic Mean of Performance Rates</th>
<th>Standard Deviation</th>
<th>Standard Rates*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ship's Co. Transfers</td>
<td>1.84</td>
<td>0.06</td>
<td>1.78</td>
</tr>
<tr>
<td>Service School Transfers</td>
<td>.97</td>
<td>0.02</td>
<td>.95</td>
</tr>
<tr>
<td>Recruit Transfers</td>
<td>.15</td>
<td>0.01</td>
<td>.14</td>
</tr>
<tr>
<td>Two Weeks Reserve</td>
<td>.95</td>
<td>0.02</td>
<td>.93</td>
</tr>
<tr>
<td>Draft Escort</td>
<td>1.18</td>
<td>0.05</td>
<td>1.13</td>
</tr>
<tr>
<td>Discipline</td>
<td>1.38</td>
<td>0.03</td>
<td>1.35</td>
</tr>
<tr>
<td>Shore Patrol</td>
<td>.53</td>
<td>0.03</td>
<td>.50</td>
</tr>
<tr>
<td>Hospital</td>
<td>.42</td>
<td>0.02</td>
<td>.40</td>
</tr>
</tbody>
</table>

* Column 2 - 3 = 4

Source: Final Report, The Ohio State University Research Foundation Project NONr 495(05) p. II-49.
manhours expended on each subfunction. This data can be collected in three ways: (1) estimated; (2) actually timed by the supervisor or some clerk; or (3) timed by the people whose work is being measured. None of these possibilities is entirely satisfactory. The first is wrought with dangers which can strip a system of its integrity. The argument is that the basic data is a guess, and the system can be no better than its basic data. The second is the best of the three, but leaves much to be desired. It tends to make a clerk out of the supervisor, if he is used. Use of a clerk, working part time on collection of timecards is the most practical of the three possibilities. The third possibility places the worker in a position to juggle the figures among subfunctions, and should be avoided.

The need to calculate time spent on subfunctions without actual timing led to the development of the third method. It is a refinement of the other two. Since it adds another concept, it is advisable not to use the third method until one of the other methods described above has been understood and accepted. In other words, the third method is a refinement which should be developed slowly.

The method is designed to provide a system of allocating time which personnel spend on different subfunctions without keeping actual time spent on each subfunction. From these data, then, performance standards
can be set by application of method one or two outlined above. 25

Nature of the System

Certain conditions of production lend themselves to the application of this third method. The most important is that the work which is measured must be representative and repetitive. It need not be carried on continuously at a uniform rate, but should occur a number of times within the normal reporting period. Also the system lends itself to determining performance rate standards applied chiefly to office production in staff departments. The system is based on an inventory control of forms, orders, or other types of paper work, which are "evidences" of work being performed. Clock time is then allocated in proportion to the volume of the different forms handled. 26

Therefore,

25 See the Final Report, op. cit., Attachment IV, pp. IV-1 to IV-6.

26 The basis for the method of statistical determination of manhours expended and performance standards for sub-functions may be summarized in the following terms:

(1) It is based upon the concept of "work float" and "float time."

(2) Production reporting merely requires a count of—
   (a) Work received during the period,
   (b) Unfinished work in process at the end of the period, and
   (c) The bank of work at the end of the period.

(3) The unit of float time in process is the basis of prorating clock time.

The method of calculating float time is illustrated in Tables 6, 7 and 8.
the method has greatest advantages in situations where the principal duties of the office can be measured in terms of a few forms, letters, orders, or the like of which there is large volume. For example, mail order houses, insurance companies, or manufacturing concerns which have large order departments and correspondence departments.

Not all of the Work Need be Measured

The performance rate standards set by all three methods being described are relative, rather than absolute. They are relative inasmuch as they represent the relative amount of total clock time spent on each subfunction in a given period--hour, day, week, etc. Such a standard includes personal time and waiting time as well as the actual time spent working on the work unit. Absolute standards are set by time and motion studies and measure the absolute amount of time spent on each operation or subfunction. Since administrative work measurement is interested primarily in group accomplishment, it is not necessary to have specific standards for each and every subfunction or operation of an activity or office in the department. It is merely necessary that countable work units be selected for the principal subfunctions of the department that lead directly to an accomplishment of its service objectives.

Support subfunctions (duties or activities) within the department, or assigned duties not related directly to its
principal service objectives, should not be included in the performance rate standards. They should be related to the principal departmental functions by standard ratios. If these ratios can be established by work measurement, so much the better. It should be noted, however, that such support or collateral activities of the department must be included in any estimates of manpower requirements and determination of tables of organization for the department. An example is found in the suggested form of work measurement reports. There, managerial time of supervisors is listed as "unmeasured" work, and the number of supervisors is noted.27

**Basic Data Needed for the Determination of Performance Standards**

Little basic data are needed to set such office production standards by use of this third method. No extensive detailed reporting of production is required. Neither the employee nor his supervisor is required to keep a record of time spent on various assigned projects. Neither of them is required to estimate the distribution of time over the various activities that have been carried on. The only data needed for each work unit can be obtained by simple

---

27 See Final Report, Attachment II, "Local Command Work Measurement Manual," op. cit., p. II-47. The illustration mentioned is given in Table IV on that page and is reproduced as Table 2 in this chapter.
count and a cumulative record of work completed during the period. These data are:

1. Work load on hand at the beginning of the period. (This is the same as (3) below. It is obtained by simple count at the end of the preceding period.)

2. New work received during the period. (This is obtained in the case of clerical work by simple count and tally when the work is received.)

3. Unfinished bank of work at the end of the period. (See (1) above.)

4. Work completed during the period. (Simple count and tally as completed.)

A daily production report should be obtained if at all possible. The work should be reported in a form that will facilitate consolidation into a weekly report; the weekly report into a monthly report, etc.

Tables 6, 7, and 8 on pages 231 to 234 illustrate the third method of setting standards. In cases of large volume of paper work this method greatly simplifies and reduces the time and effort that go into the operation of the collecting and recording of work measurement data. Once performance rate standards have been established, the only data necessary to collect are the three columns shown in Table 8, which would be readily available from the inventory control records of forms and time cards of employees.

4. Standards set by Time and Motion Studies

The purpose for which the standard is to be used determines whether one of the statistical methods or time
## TABLE 6

**BRANCH "Y", STAFF DEPARTMENT "X"**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Collected Data</th>
<th>Computed Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12)</td>
<td></td>
</tr>
<tr>
<td>Activity A</td>
<td>50 10 12 46 48 31.0 0.675</td>
<td>2 14 32 0.696 0.021</td>
</tr>
<tr>
<td>Activity B</td>
<td>20 315 14 317 321 17.0 0.054</td>
<td>4 18 19 0.060 0.006</td>
</tr>
<tr>
<td>Activity C</td>
<td>26 251 37 237 240 31.5 0.133</td>
<td>3 40 33 0.139 0.006</td>
</tr>
<tr>
<td>Activity D</td>
<td>27 140 12 152 155 19.5 0.128</td>
<td>3 15 21 0.138 0.010</td>
</tr>
<tr>
<td>Activity E</td>
<td>5 8 7 4 6 6 1.500</td>
<td>2 9 7 1.749 0.249</td>
</tr>
<tr>
<td>Activity F</td>
<td>7 29 4 31 32 5.5 0.177</td>
<td>1 5 6 0.193 0.006</td>
</tr>
<tr>
<td>Activity G**</td>
<td>8 82 4 86 86 6.0 0.070</td>
<td>0 4 6 0.070 0.003</td>
</tr>
<tr>
<td>Activity H</td>
<td>5 40 6 38 39 5.5 0.145</td>
<td>1 7 6 0.158 0.013</td>
</tr>
</tbody>
</table>

* Figures in parentheses represent the data indicated by corresponding numbers of the definitions of the basic computations listed on page 232. (See Attachment IV of the Final Report.)

** It is evident that the time required to process one piece of Work Unit G through the Branch is very little. The actual average work load of Unit G, during the week, could be picked up from the daily work reports of individuals in the Branch. An average of the unit process time, for a work-in-process float between zero and one work unit has been used, nevertheless, because exact accuracy in determining the weekly work-in-process float time is not necessary.
Definitions of Basic Computations in Table 6. Figures in front of the Definitions Correspond to Numbers in Parentheses in Table 6.

1. Work on hand at beginning of period.
2. New work received during period.
3. Unfinished work at end of period.
4. Work completed during period.
5. Work put into production = \( \frac{(work \ at \ beginning) + (New \ work) - (unfinished \ work \ at \ end. \)}{(work \ at \ beginning) + (unfinished \ work \ at \ end} \)
6. Average bank ahead = \( \frac{2 \ Average \ bank \ ahead}{Work \ completed \ during \ the \ period} \)
7. Waiting time in bank per unit = \( \frac{Average \ bank \ ahead}{Work \ completed \ during \ the \ period} \)
8. Work in production = \( (work \ put \ into \ production) - (work \ completed) = 0 \)
9. Total work load at end = \( (work \ on \ hand \ at \ beginning + new \ work \ received) - (work \ completed \ during \ period) \)
10. Average total work load = \( \frac{(work \ on \ hand \ at \ beginning) + (total \ work \ at \ end)}{2} \)
11. Total float time per unit = \( \frac{average \ total \ work \ load}{work \ completed \ during \ period} \)
12. Total process float time per unit = \( (total \ float \ time \ per \ unit) - (waiting \ time \ in \ bank \ per \ unit) \).

Source: Final Report, The Ohio State University Research Foundation Project NO.nr 495(05), p. IV-4.
<table>
<thead>
<tr>
<th>Activity</th>
<th>Work Units Completed</th>
<th>Process Float Times, Wks.</th>
<th>Weighted Production</th>
<th>Prorated Time</th>
<th>Manhours Per Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>46</td>
<td>0.021</td>
<td>0.966</td>
<td>0.125</td>
<td>90.000</td>
</tr>
<tr>
<td>B</td>
<td>317</td>
<td>0.006</td>
<td>1.905</td>
<td>0.247</td>
<td>177.840</td>
</tr>
<tr>
<td>C</td>
<td>237</td>
<td>0.006</td>
<td>1.422</td>
<td>0.18</td>
<td>133.200</td>
</tr>
<tr>
<td>D</td>
<td>152</td>
<td>0.010</td>
<td>1.520</td>
<td>0.197</td>
<td>141.840</td>
</tr>
<tr>
<td>E</td>
<td>4</td>
<td>0.210</td>
<td>0.996</td>
<td>0.125</td>
<td>90.000</td>
</tr>
<tr>
<td>F</td>
<td>31</td>
<td>0.006</td>
<td>0.186</td>
<td>0.024</td>
<td>17.280</td>
</tr>
<tr>
<td>G</td>
<td>86</td>
<td>0.003</td>
<td>0.258</td>
<td>0.033</td>
<td>23.760</td>
</tr>
<tr>
<td>H</td>
<td>338</td>
<td>0.013</td>
<td>0.494</td>
<td>0.064</td>
<td>46.080</td>
</tr>
<tr>
<td>Totals</td>
<td></td>
<td></td>
<td></td>
<td>7.747</td>
<td>1,000</td>
</tr>
</tbody>
</table>

Source: Final Report, The Ohio State University Research Foundation Project N0nr 495(05), p. IV-5.
<table>
<thead>
<tr>
<th>Week</th>
<th>Waiting Time in Bank</th>
<th>Total Float Time/Unit</th>
<th>Process Float Time/Unit</th>
<th>Selected Standard Time/Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.054</td>
<td>0.059</td>
<td>0.005</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.054</td>
<td>0.060</td>
<td>0.006</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0.058</td>
<td>0.065</td>
<td>0.007</td>
<td></td>
</tr>
<tr>
<td>Av.</td>
<td>0.0553</td>
<td>0.0613</td>
<td>0.0060</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0.056</td>
<td>0.061</td>
<td>0.005</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>0.061</td>
<td>0.067</td>
<td>0.006</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>0.053</td>
<td>0.058</td>
<td>0.005</td>
<td></td>
</tr>
<tr>
<td>Av.</td>
<td>0.0557</td>
<td>0.0620</td>
<td>0.0053</td>
<td></td>
</tr>
</tbody>
</table>

Selected Average Process Float Time 0.005

Source: Final Report, The Ohio State University Research Foundation Project No. 495(05), p. IV-6.
and motion study should be employed. This point was illustrated in Chapter II with examples of present practices in industry. Concerns using work measurement to indicate the effectiveness of the group employ simple statistical methods. Concerns which use work measurement as a basis for establishing piece rates and other similar incentive wages, based on the individual operation, look to time and motion studies for their standards.

Time and motion studies set absolute times for the performance of individual operations. A timing device (stop watch, or movies of the operation) is used by an observer to time the performance of a "normal" worker. The number of samples taken to arrive at a standard is determined by the generally recognized principles of statistical sampling. This process will be discussed at length in Chapter X, "The Relationship of Motion and Time Study to Administrative Work Measurement."

The unit of measurement used by motion and time study is typically expressed in very small units of time, often thousandths of a minute. The investigational methods are observational, and the work measured is expressed in absolute times. On the other hand, statistical work measurement is concerned more with measuring progress of groups. Thus the measurement is less refined, often expressed in hours per work unit. It becomes a measure of executive leadership. The investigational methods
used are statistical, and the performance rate standards established are relative.

V. METHODS OF COMPARISON OF ACTUAL TO STANDARD

The purpose of establishing standards, of course, is to compare them to actual performance to judge effectiveness. The comparison function indicates whether the organization is performing according to plans, and if not, it should indicate where the trouble is before it becomes serious. This is the job of the coordinative staff, or someone in the organization with similar qualifications and capabilities. The comparative analysis involves not only the understanding of whether there is a significant difference; but also the understanding of what is the relationship between cause and effect.

The job of comparison entails sifting the maze of work measurement data and then presenting only the pertinent facts to the proper line executives along with an analysis of the causes for existing conditions. Three techniques aid in expediting the comparison function:

1. Use of statistical short cuts, such as sampling.
2. Concentration on trouble areas and critical bottlenecks.
3. Use of summary reports.

Statistical Short Cuts

After an administrative work measurement system has been in operation for a time, upper and lower limits of
normal operation can be established. Then not all the raw work measurement data of time spent on each of a large number of work units needs to be compared and analyzed. A sampling of the raw data may be used. Those subfunctions performing in accordance with the norm may be so reported. Any subfunction showing deviation from normal should receive critical analysis. All the raw work measurement data on such a subfunction should be re-analyzed. This technique is in general use in quality control. Only a small percentage of items in a batch are inspected. If they pass the normal test, the whole batch is approved. If, however, a significant number of the sample are found below standard, then each item in the batch is inspected.

Likewise, if performance indicates a process is in "adjustment," the sampling technique may be substituted for continuous collection of raw data on time spent on each subfunction. Such a practice, however, has the inherent danger erroneously of implying to employees that work measurement is not as important as it once was. Proper explanation of the process should dispell that idea.

Concentrate on Trouble Areas

Pilot studies should be conducted by the coordinative staff to determine whether or not there may be a small percentage of the number of items to be controlled which will involve a high percentage of the factors which are most important. This last is based upon the theory that
a small percentage of the total units to be controlled usually contain most of the critical problems or difficulties demanding attention. This theory is the basis of the sampling technique used in statistical quality control and is revealed in every type of business problem. Sales organizations often find that a large percentage of their business is from a small percentage of customers.

If a thorough analysis is conducted of a management problem, there is always a small number of items that are the key items. Control them and the whole process is controlled. In its analysis the coordinative staff should be on the lookout for such bottlenecks and trouble areas.

Use of Summary Reports

All three of these techniques to aid in expediting the comparison function are an application of the principle of exception. The higher supervisory and executive levels do not have the time to analyze all the detail, so summary reports are practically mandatory.²⁸ More detailed reports can go to the lower level supervisors who are concerned

²⁸ This conclusion was verified by experience on the Navy project, and by interviews with Commanding Officers at stations studied. This fact is also supported by the authorities cited in Chapter IV under the discussion of the coordinative staff, namely, by James D. Mooney, footnote 7; Urwick and Dale, footnote 8; and Joynt, Gen. Somervell, and George Walker, footnote 10.
with the detailed operations of the office or department.

**Report Forms and Graphs**

Report forms and graphic illustrations of performance must be tailor-made to fit each particular administrative work measurement system. Such reports must be designed to highlight the important factors. The important factors, of course, are those which it is desirable to control. In many cases the primary objective of the administrative work measurement system is to increase the effectiveness of manpower utilization. Here the report forms and graphs developed during the Navy project provide a possible beginning for designing records. The monthly summary report form usually used for an office or division is illustrated in Table 2 on page 212.

It will be noticed that the form is arranged to give emphasis to manhours expended, since this factor is most important to executives receiving the report. Column (1) indicates actual manhours expended on each subfunction, and Column (5) shows what time should have been spent on the number of work units involved, which is the "Standard Manhours." The total of Column (1) is the measured operative time for the period, and the total of Column (5) is the number of hours that would have been expended if the work were performed at the standard rate. In the example in Table 2, measured operative time is 2655 manhours
and standard for this work is 2644.30 manhours.

A breakdown of the total clock time for operative and managerial work is given on the second page of Table 2. This time is related to the number of supervisors and operative personnel in the office or division. Such simple statistics are helpful in accounting for manning tables of organization.

A useful ratio is the index of productivity efficiency. It is the total standard manhours divided by total measured operative time. In the example in Table 2 it is 2644 divided by 2655, which is 99.59%.

This simple work measurement report (Table 2) facilitates the comparison function in a number of ways. First, it indicates how the performance of each sub-function compares to standard. Monthly reports become more valuable as time passes, because they then can be compared to note the trend in performance of individual subfunctions. Such analysis leads to attention to subfunctions or areas of subfunctions needing improvement.

As already noted, an accounting for the total clock time of supervisors and operative workers aids in substantiating manning tables of organization.

The index of productive efficiency answers the need for an overall measure. It is comparable with other months, regardless of changes in proportions among the work performed by different subfunctions, because the common
denominator is time. Likewise, the office or division may be compared with other groups within and outside the organization, again due to the common denominator of time. It is an index of manpower utilization or productive efficiency. By watching this percentage over a period of time the trend of the overall efficiency of the group is determined, and likewise this trend can be compared to the trend of the indices of other groups. The comparison is between how one group is meeting its standard with how other groups are doing in meeting theirs.

Any reaction to the rates of improvement between groups should be based on a thorough analysis of how their standards were set. The index should serve only as a warning signal. It is necessary to analyze individual subfunctions to pinpoint trouble areas.

Figures 13 and 14 on pages 242 to 244 illustrate methods of portraying data on performance rates, manhours expended, work units completed, and the index of productive efficiency. For group comparisons the data for the groups can be superimposed on one chart. As a means of dramatizing and giving a quick summary of the data, the use of charts and graphs should be encouraged.

V. SUMMARY OF THE CHAPTER

A standard is a criterion or a model. It may be a model of the method of operations and procedures--a bill
Figure 13

Analysis of Recruit Transfer Orders
Work Measurement Performance Data

A. MANHOURS EXPENDED

Source: Final Report, The Ohio State University Research
Foundation Project NOnr 495(05), pp. II-35 and
II-36.
Analysis of Recruit Transfer Orders
Work Measurement Performance Data

B. WORK UNITS COMPLETED

C. PERFORMANCE RATES

* Performance Rate of 0.13 is the Performance Standard, thus it is 100% for comparative purposes. (See the Final Report, op. cit., Table III on page II-46, Appendix A for explanation of establishment of standards)

**0.13 divided by 0.14 equals 93%.
Figure 14

Transfer Division, Personnel Dept.
Work Measurement Performance Data
Index of Productive Efficiency

Source: Final Report, The Ohio State University Research Foundation Project NONr 495(05), p. II-38.
of specifications, or it may be a model of the finished product or service. In either case the standard may be expressed in terms of quality, quantity, expense, and time.

**Standardization and Measurement**

Control of an organization is predicated upon standardization—the establishment of the "one best way." This is the ideal; the actual practice is performance that tends to conform to the ideal. The standard and standardization depend upon finding an acceptable unit of measurement. Five basic criteria of an adequate unit of measurement are:

1. Is it countable?
2. Is it representative of the work to be accomplished?
3. Is the quality of the work unit consistent?
4. Is the terminology consistent and enjoy general acceptance?
5. Does the work unit measure what is being controlled? Does it reflect the in-put relative to out-put or finished product?

**Nature of Standards**

There are three basic types of standards: (1) past performance standards, (2) engineered standards, and (3) comparative standards. Past performance standards are the most easily developed and the least scientific and effective control. Nevertheless, they provide a logical and effective starting point for installation of an administrative work measurement system.
The other two standards are more rational and depend upon evolutionary development in the art of the industry concerned. The engineered standard is based upon the best practical commercial procedures available. The comparative standard compares an office or division with other activities within the concern and also with outside groups. The common denominator is time.

Standards can be determined by the objectives of an organization. "Ideal" standards depend on analyses of ultimate business objectives. "Engineering" and "working" standards (which correspond with comparative standards) are related to immediate business objectives. The degree of refinement and accuracy demanded of an organization's standards is determined by the stage of industrial development in which the concern finds itself. As progress is made, standards drift to a higher level of performance.

Methods of Establishing Standards

An administrative work measurement system may be installed with the application of "temporary" standards based on past performance. Any installation of work measurement should be an integral part of an overall program of management improvement based upon the application of the scientific method to business problems. Such an overall program entails an analysis and survey of the business problems and trouble areas in the organizational situation. The second step is a program of developmental projects, based on the needs of the
organization. Such projects include training, organi-
zational analysis, work simplification, and installation
of control systems such as work measurement. The third
step is a continuous review and follow-up program.

As the major problems are worked out, the refinements
tend to become less and less radical, and thus the improve-
ment less and less measurable as the process approaches the
"one best way." This phenomenon has an important bearing
on setting permanent standards. It calls for an analysis
of a number of factors in the organizational situation.

Most important of these are:

1. Periodic review of permanent standards to
evaluate whether they reflect present conditions.

2. An evaluation of a fair day's work.

3. An evaluation of what standard will motivate
the group to more effective performance.

Criteria of Permanent Standards

An analysis and evaluation of the above factors lead
to the general statement of criteria for effective
permanent standards. They are summarized as follows:

1. The standard must be within the limits of a
fair day's work. The average employee must
be able to reach and sustain standard pro-
duction over a long period.

2. The standard must offer some potential incentive
for improvement.

3. The standard must be set high enough to stimulate
production. It must not be a standard of
mediocre past performance.
Four Illustrations of Permanent Standards

Three simple statistical methods developed on the Navy project, and the general method involving time and motion studies are discussed. All three of the methods suggested by the Navy project were designed to conform to the above criteria of permanent standards.

1. **Standard set at Half the Difference Above the Median**

   The first method employs simple arithmetic in calculating the standard at a point half way between the median and the best performance figure in an array of performance rates for the last six months.

2. **Standard set at one Standard Deviation Below the Arithmetic Mean**

   The second method is more refined statistically than the first. The first step is the same as in the first method. An array of performance rates for the last six months are arranged from the lowest to the highest. Then the standard is set at one standard deviation below the arithmetic mean.

3. **Statistical Determination of Manhours Expended and Performance Standards for Subfunctions**

   The two methods listed above both employ the cumbersome method of recording actual time spent on each subfunction. This takes an undue amount of supervisory time, or necessitates the time of a clerk. The third method is really a refinement of the other two. It is designed to
provide a system of allocating time which personnel spend on different subfunctions without keeping the actual time. It is based on an inventory control of forms, which are "evidences" of the work being performed. Clock time is then allocated in proportion to the volume of the different forms handled. This method has the greatest advantage in situations where the principal duties of the office can be measured in terms of a few forms, of which there is a large volume of each form.

4. Standards set by Time and Motion Studies

Concerns which base piece rates and other wage incentives on the individual operation usually employ time and motion studies to establish standards. Such studies set absolute times for performing individual operations. A timing device, a stop watch or some form of timed movies, is used by an observer to time the performance of a "normal" worker. The number of samples taken to arrive at a standard is determined by the generally recognized principles of statistical sampling.

The unit of measure used by motion and time study is expressed typically in very small units of time, often thousandths of a minute. The investigational methods are observational, and the work measured is expressed in absolute times. On the other hand, statistical work measurement is concerned more with measuring progress of groups. Thus, the measurement is less refined, often
expressed in hours per work unit. The investigational methods are statistical and the performance rate standards established are relative. Thus administrative work measurement becomes a measure of executive leadership.

**Methods of Comparison of Actual to Standard**

The comparison function is the proper duty of the coordinative staff and entails sifting the maze of work measurement data. Only the pertinent facts go to the proper line executives along with an analysis of the causes for existing conditions. (This is completed staff work.) The data must be timely in order that action may be taken before trouble becomes serious. Three techniques will aid: (a) use of statistical short cuts, such as sampling, (b) concentration on trouble areas and bottlenecks; and (c) use of summary reports.

Report forms should be designed to highlight the important factors. In the control of manpower utilization, examples of such factors are trends in performance of sub-functions, an index of productive efficiency (an index of overall effectiveness of the group), and a breakdown accounting for all the clock-time of both operative and supervisory personnel. Understanding, acceptance, and usefulness of these data are facilitated by employing graphs and charts.

**The Place of Standards in Administrative Work Measurement**

Thus it should be concluded that standards are the
measuring stick of the system. They make possible the comparison of actual performance to the model of the plan. Comparison reports should be designed in accordance with the principle of exception to highlight important trouble areas or unusually good performance, indicated by analysis of actual to standard.

Such leads to questions of "why" and "what to do about it." These subjects are discussed in Chapter VII, "Continuous Review and Action Depend Upon Automatic Control."
I. INTRODUCTION

Chapter VI discusses some of the important problems involved in performing the first five steps of a system of administrative work measurement. It deals specifically with the problems of finding acceptable units of measurement, and the necessity of establishing adequate standards. Application of the principle of exception in comparing actual performance to standard is stressed. In this way, the important trouble areas and problems are called to attention.

This present chapter is concerned with means and methods of effectively carrying out the sixth and seventh steps of an administrative work measurement system, namely, continuous review and follow-up action.

In the narrower sense the follow-up action is control. At least without it there can be no control. This chapter will analyze the complexity of motivating employees to act in a manner that will result in operations which are in accord with organizational plans and policies. Supervised coordination and self-coordination will be discussed. How these methods of handling people can be utilized in a system of follow-up that is automatic will be a subject of primary concern.
II. NATURE OF RESPONSIBILITY AND AUTHORITY OVER CORRECTIVE ACTION

As discussed in Chapter IV the concurrent control functions of direction, supervision, and corrective action are line responsibilities. Corrective action is concerned with the removal of interferences with planned execution and the restoration of effective, coordinated action. It is the final step of any control system. The line executives take the completed staff analysis of actual performance compared to standard and make decisions regarding the proper follow-up action to return the process or organizational activity to normal operations. In the case of administrative work measurement, comparison results in establishment of executive accountability rather than operative accountability.

The coordinative staff may facilitate, but it does not have the responsibility for or authority to perform the function of corrective action. The line organization cannot delegate its authority for carrying out corrective action, except in minor matters that do not involve line policy decisions. To discharge effectively its responsibilities for corrective action, the line executives must fulfill three conditions:

1. Corrective action must be taken within the appropriate and reasonable time limit.

2. Individual accountability must be established.
3. Executives must assure themselves that all important cases receive proper attention.

**Corrective Action must be Timely**

The importance of timeliness was stressed in the last chapter in connection with the analysis of data. It was suggested that only the exceptional cases be called to the proper executive's attention. The same principle applies to the matter of continuous review and follow-up corrective action. Trouble must be located before it becomes serious. Likewise, corrective action must be taken in time to avert a serious condition. A better term for timely corrective action is preventive correction. It is comparable to preventive medicine.

Fayol laid great emphasis upon the importance of timeliness. In his *General and Industrial Management* he points out the control that is not acted upon within due time is a futile sort of activity indeed. His words are:

> For control to be effective it must be done within reasonable time and be followed up by sanctions. It is quite obvious that if the conclusions derived from checking activities, however efficient, come to hand too late to be of possible usefulness, then control will have been a futile activity.  

Necessity for Establishment of Individual Accountability

The control function of comparison determines the degree of agreement between actual and planned results.

---

1 Henri Fayol (Translated by Constance Storrs), *General and Industrial Management*, p. 108.
It compares actual performance to standard. Comparison shows what is taking place in light of what ought to take place. Comparison is the basis for continuous review of performance. It relates performance to the responsible executive, thus establishing accountability.

Davis points out that accountability is an individual matter, not a group problem. He further explains that comparison measures degree of "accomplishment of assigned objectives in terms of quantity, quality, time or expense." Of course, from the standpoint of administrative work measurement, individual executives are responsible for the performance of groups under their control; so the work measurement data on group performance can well be the basis for establishing accountability of individual executives, especially in regard to manpower utilization.

Newman in his book on Administrative Action stresses the importance of establishing individual accountability, and in the same quotation he emphasizes the next point to be discussed, namely, the importance of an executive assuring himself he gives adequate attention to the exceptional cases. Newman says:

(1) If the control is to have an effective influence on performance, the administrator should make sure that the goals are properly identified with individual responsibility. (2) Also, the administrator will

find it impossible to review all aspects of performance, and consequently must select certain points that will give him an adequate indication of what is going on with only a limited expenditure of his time.\(^3\)

**Proper Attention to All Cases**

The executive's outstanding problem is how he will allocate his time among his duties, many of which are concerned with the accomplishment of proper preventive, corrective action. This is an important problem, and it will constitute the subject matter of the rest of this chapter. To assure proper attention to all cases, the executive must apply the principle of exception by conserving his time for the exceptional cases. Second, he must tackle in a practical way the knotty problem of how to motivate people to act in the manner it has been decided they should act to reach the organizational objectives. Last, it must not be left to chance alone that important cases reach the proper executive. There is a need for an automatic feature to the work measurement system to assure the pin-pointing of the important cases.

**III. THE COMPLEX PROBLEM OF EXECUTIVE LEADERSHIP**

Administrative work measurement is the tool which facilitates control. It is an advancement in scientific management which offers a refined method of measuring

manpower performance. The usefulness, and therefore the success of administrative work measurement, depends upon what action is taken as a result of the work measurement data made available to line executives.

Management is the function of executive leadership. The executive is expected to inspire his group to want to achieve the objectives of the organization. More than that, he is expected to facilitate the smooth operation of the group effort and exercise his authority of command in the process. Davis describes executive leadership in the following terms:

He is expected to motivate, coordinate, and direct the organization, or some element of it, in the achievement of the particular objectives. Such accomplishment implies effective group action based on a sound plan.4

It must be fairly clear that executive leadership is vitally concerned with motivating people to act in a certain way. It is a very complex thing, this problem of motivating people in the industrial situation. The complexity of business leadership grows out of the fact that the executive is performing his functions in a complex and mobile, dynamic situation upon which many pressures are operating simultaneously. Within the organization there are pressures from the owners, workers, other executives, and the limiting physical factors of the state of the

4 Davis, op. cit., p. 129.
equipment and plant available. From without there are the social pressures of the community, the pressures of the customers in the market place, and the market situation of supplies and raw materials. The executive's function is to keep the whole situation in "balanced adjustment, in light of the organizational objectives.

To keep the organization in balanced adjustment, the executive must exercise leadership of various kinds. Davis classifies the kinds of business leadership into five categories:

1. The basis of executive motivation is the first. The basis of executive motivation is found in the objectives of the organization. It implies a strong sense of responsibility on the part of the executive.

2. The second is made up of the different degrees of leadership demanded by the state of the economy. It is related to the stages of industrial development. In the pioneer stage the quality of the leadership demanded is less than in the stage of exploitation and the stage of stabilization. Volume of business increases as the evolution takes place, and requirements of the executive are raised until they reach the status of the professional executive.

3. The third is a consideration of the basis of executive influence. Davis summarizes them as having to do with (a) organizational position, (b) ideas, (c) executive
ability, (d) prestige, and (e) personality.

4. The fourth point deals with the character of the use of authority. There is negative leadership, based on fear and threats, on one hand, and on the other there is positive leadership which relies on hope. Davis says:

It offers the individual or group an opportunity to increase the amount of the personal values they may receive above what is normally to be expected. It relates the increase in the personal values enjoyed to a corresponding increase in the primary service values contributed.5

5. The fifth consideration is the degree of directness of leadership influence. It has to do with face-to-face leadership of the supervisor, and indirect leadership which is "delegated" leadership.6

Under negative motivation people will do what they are told, and nothing more. Negative motivation can be effective and in emergency conditions, perhaps justifiable. In the long run, however, progress of large organizations must depend upon positive leadership.

People must be motivated to do more than the bare minimum. Progress in control reaches its apex when employees exercise self-supervision. Davis uses the terms "self-coordination" and "executive coordination." He says:

5 Ibid., p. 143.

6 Ibid., pp. 137-146. These five kinds of leadership are discussed in the section noted.
Self-coordination is the voluntary act of relating one's action to those of other individuals and groups in the organization. It may take place at any organization level, either managerial or operative. It should be encouraged to the maximum practicable extent. Executive coordination is the formal relation of action with respect to time and order of performance. It is accomplished chiefly through the formulation and release of orders, instructions, and directions. It may be accomplished personally by the responsible executive, or for him by his staff. Self-coordination is most effective in small groups where close personal contacts are possible. Its effectiveness as a principle means of coordination decreases rapidly with organizational growth. It becomes necessary to supplement or replace it more and more by formal coordination. Self-coordination remains, however, an important force in the operations of groups that compose the organization.7

Analysis of Method of Executive Motivation Through Work Measurement

Throughout the year on the project one of the basic problems and considerations dealt with getting action. First, the problem was expressed in some such terms as "How to get the story across." Then, after it was felt some progress was made on this problem, the question became "how do you motivate naval officers to get them to use work measurement." All our efforts were directed at motivating naval officers to exercise self-supervision to the end that naval shore stations will be managed more effectively. The conclusions to the Final Report of the project were concerned with outlining the general conditions and suggesting what is necessary to bring about these conditions which will

7 Ibid., pp. 405-406.
accomplish this objective, namely, motivating naval officers to act in a manner that will improve management of naval shore stations. The first conclusion is that some method of accountability is a necessity to motivate action, and that work measurement is such a stimulator as far as manpower utilization is concerned. The second conclusion is that understanding of the control system is a prerequisite to its acceptance and use. Some specific factors necessary to understanding include a manual on basic terms and concepts of the control system, use of group participation, and use of visual aids. Acceptance in turn, is contingent upon a number of factors: (1) attitude toward importance of management problems at naval stations; (2) fear or anxiety of what disciplinary action might result; (3) degree of confidence in standards; (4) time to prove the system; and (5) degree of confidence in leadership.

An analysis of the above conclusions will indicate that they are aimed at discovering how to stimulate self-coordination. As Davis points out, the seriousness of this problem increases with the size of the organization. How do you get people to act—to exercise self-coordination

8 Final Report, The Ohio State University Research Foundation Project 495(05), pp. 23-25.
to be interested in doing a better job of managing the organization? This is the heart of any control problem. It is a commonly accepted fact that action should follow to correct any trouble areas uncovered by a control system, but how to get such action is not so apparent.

**Effectiveness of Directive Alone**

The U. S. Navy has had a work measurement system in operation since 1946. It has been used successfully to substantiate budgetary requests to the Congress. It has formerly operated only in four areas of common service functions: supply, fiscal, industrial relations, and public works, at all large shore stations. The project was asked to investigate the effectiveness of the system at two naval shore stations. Particular attention was directed to what improvements in management might have resulted from installation of the system, due to action of local personnel. In brief, the project report indicates that the system is successful for overall budgetary purposes at the bureau level in Washington, but as far as the local command is concerned, it is just another report. There is no great indication of improvement in the management of the naval stations resulting from its use.9 This early system

---

9 See Section II, Research Progress Report No. 4 to BuPers ONR Contract with the Ohio State University, NOnr 495(05) 6 March 1953, pp. 1-4.
was installed by directive primarily and the people who made the reports in the field were not at all sure of its purposes nor even procedures to be followed.

On June 12, 1953, members of the project made an oral final report to the sponsors of the project, officers and civilian specialists in the Research Division (now called Personnel Analysis Division) of the Bureau of Naval Personnel. In the discussion period of the meeting the observation was made by members of the Navy group that one of the more important contributions of the project was the development of an approach to work measurement that has potentialities of stimulating local officers to do a better job of managing shore stations. This approach is based largely upon the principle of participation.

**Exercise and Development of the Skill of Executive Leadership**

Analysis of executive leadership is a first step in the development and exercise of the skill of the function. Such analysis to be successful must include a factor that is often overlooked. The leader must be aware of his own involvement in the situation, emotionally, socially, and intellectually.

The writer trusts he will not be violating professional practices of researchers if he disclosed without their names some of the attitudes and feelings of officers that were discovered in the primary research. The attitude on
the part of a good many naval officers, which may be quite justifiable under conditions of actual combat, was that leadership is primarily of a negative type. Orders and commands are not to be questioned, but carried out to the letter. On the part of others there seemed to be a recognition that this sort of negative leadership does not work so well anymore, at least not at a shore station. Incidentally, the lack of motivation to improve, in many cases, might be attributable to exercise of negative leadership. Nevertheless, a prevalent attitude was that if negative leadership does not work, then try manipulating people into doing what you want done. This was thought by many officers to be practically the only means of handling "civilians." One top ranking officer expressed the process as one of "engineering the bastards" into doing what should be done.

Two more examples are in order. A commanding officer, for whom the writer personally--and others on the project he feels sure--came to have a high regard, was asked if he had group meetings in which officers under him could participate. He said he did regularly, and expressed the feeling that everyone spoke freely his views. When the officers concerned, however, were questioned about the meetings, there was disagreement about how freely they participated. They did not feel the participation was as free as the commanding officer thought.
These comments are not meant to be criticism of naval officers. They are given as illustrations of misunderstandings of the exercise of the skills of executive leadership, with the thought in mind that there may be an application in them for the business executive.

What is the point of these incidents? What bearing do they have upon development and exercise of executive leadership? Exercising executive leadership is a complex thing. Words are used to define it; and because a simple term is identified with a concept, it is assumed that now the concept is specific and easily understood. But is this in accordance with experience? During the primary research the Navy commissioned the researchers to study the techniques of scientific personnel and industrial management practices of business, and tell them what they are, so the Navy might pass the word to all officers in executive positions and so improve the management of shore stations. Look what happened! Someone on the project dropped the suggestion, albeit, subtly, that, at least at shore stations, the principle of participation should be applied. "Fine," replied the Navy, "we'll engineer the bastards," "Fine," replied the Navy, "I have group meetings regularly, and everyone expresses himself freely."

In these cases the executives concerned were not aware of their own involvement in the situation. They saw things as they are, plus what they are. The discussion logically
leads to the question: What can be done to help executives to have a better concept of their own involvement? Basically, it is a problem of communication, with all that concept implies. Reference has been made in previous chapters to the literature on communications. Roethlisberger has done a great deal of study on the process of communication within the administrative setting. His recent article summarizes possible approach of what can be done by executives to facilitate the understanding of their own involvement and methods of improving communication. Although the quote is rather lengthy, it is worthy of serious consideration:

Am I indulging in wishful thinking when I believe that there are some simple skills of communication that can be taught, learned, and practiced which might help to diminish misunderstanding? To me it is this possibility which the recent findings of general semantics and human relations are suggesting. They suggest that although man is determined by the complex relationships of which he is a part, nevertheless he is also in some small part a determiner of these relationships. Once he learns what he cannot do, he is ready to learn what little he can do. And what a tremendous difference to himself and to others the little that he can do—listening with understanding, for example—can make!

Once he can accept his limitations and the limitations of others, he can begin to learn to behave more skillfully with regard to the milieu in which he finds himself. He can begin to learn that misunderstanding can be diminished—not banished—by the slow, patient, laborious practice of a skill.

But we can expect too much from this possibility, so let me conclude by sounding two notes of caution:

(1) Although these skills of communication of which I am speaking deal in part with words, they are not
in themselves words, nor is the territory to which they apply made up of words. It follows, then, that no verbal statement about these skills, however accurate, can act as a substitute for them. They are not truly articulate and never can be. Although transmissible to other persons, they are but slowly so and, even then, only with practice.

(2) Let us remember that these interpersonal proceedings between Hart and Bing, or A and B whoever they may be, are extremely complex. So far as I know, there exists no single body of concepts which as yet describes systematically and completely all the important processes that our separate theories have said are taking place and how they relate to each other. Let us therefore accept gracefully and not contentiously that these interpersonal proceedings, unlike the atom, have not been as yet "cracked" by social science. Only then can we as students of human behavior live up to our responsibility for making our knowledge fruitful in practice.  

Barnard also has written at length on the subject of the skills of executive leadership. On the technique of listening to employees and trying to understand their points of view, considered in light of the executive's own involvement, Barnard relates a conversation with Dr. Elton Mayo. Mayo makes the point that it is as important to "listen" to what is not being said, as it is to what is said. Understanding develops from such a process, when the executive can analyze "why" the employee is acting as he is. Barnard says:

It is important for you to know that men often cannot talk about what they most want even when

---

they are conscious of it. They could not say either to me or even to each other, "I am starving to be recognized as a man, as a citizen, as a part of the community." To do so would itself destroy self-respect and would be futile as well. In this case, as in countless others, men talk and fight about what they do not want, because they must talk about something, and they even convince themselves that they believe what they say. Dr. Elton Mayo said to me once, as perhaps he has said to you, "I do not longer ask what men mean by what they say." I ask "why do they say it?" And many, if not all, men of affairs do this intuitively as to those matters in which they are most skillful, although they frequently, if not usually, take statements literally in matters in which they are not skillful, or in which their emotions are overly powerful.11

To the writer's way of thinking there is a very significant lesson in the above experience. The Navy has all kinds of well-written literature on leadership, from the standpoint of analyzing what is a good example of a leader; but there it has a dearth of material which could help the officer understand his own emotional involvement in the work situation.

IV. PROPER PLACE OF EMPLOYEE PARTICIPATION AND FACE-TO-FACE COMMUNICATIONS IN PREVENTIVE CORRECTION ACTION

It has been pointed out that one of the important conclusions of the primary research has to do with the principle of participation. Civilian specialists and Naval personnel concerned with the project concluded that one of the more important contributions of the project was

11 Chester I. Barnard, *Organization and Management*, p. 71
the development of an approach to work measurement that has the potentialities of stimulating local officers to do a more successful job of managing shore stations. In the section above emphasis has been placed upon the mental attitudes and skills of dealing with people. In particular emphasis is placed upon the importance of executives at all levels recognizing their own personal involvement, socially, emotionally, and intellectually. Without the proper atmosphere and basic understanding participation is impossible. In this section we are discussing three important considerations: (1) the extent to which it is advisable for employees to participate in management; (2) the fact that an executive's beliefs and personal actions greatly influence responses of employees; and (3) the potential benefits of proper employee participation.

Proper Extent of Employee Participation

An understanding of the proper extent of employee participation is based upon an insight into the place of control in organization and management. The basic principles of the relationship are the subject of Chapter III. The basis for employee participation is found in the realization that executives must function in a democracy. This does not mean to imply that the enterprise should be run for the sole benefit of employees. It does imply that because of the cultural, political, and economic situation in which executives must manage a business, employee
participation in America is vital to success.

In introducing his book, The Art of Administration, Tead explains the setting in which a business must be run. Tead's point that the executive must perform his "art" in a democratic setting is an important one. He says:

By way of projecting how the thesis will unfold, let it be recalled that an art requires a medium for its expression. And in the case of administration the medium seems to be threefold. Its full expression takes place in and through organization, human beings, and a certain kind of wide social and cultural setting, which for us in America is a democratic society.12

Tead goes on to point out the importance of participation, but its practical limitations are recognized. In the administrative planning and organizing there is great benefit to be derived from pooled judgment of participating employees. Nevertheless, when it comes to the execution of plans and programs, responsibility and authority cannot be abdicated. The final decision on administrative plans and policies remains the prerogative of top executives, and the supervision of operative work remains the prerogative of operative management. Tead expresses the degree of participation practical in this quotation:

The truth is that the determination of purpose, policy and broad method is a process which usually

---

12 Ordway Tead, The Art of Administration, p. 5.
it would be wise to share in order to secure the benefit of a pooling of ideas. But the process of directing and overseeing the execution of policy as agreed upon is wisely unified and delegated to single individuals in a line of clearly established authority.13

Importance of Beliefs and Actions of Top Executives

The experience during the primary research confirmed the importance of the attitude and actions of the commanding officer. Subordinates took their cue from the chief executive. When he showed a real interest in administrative work measurement, subordinates were eager to cooperate; and conversely without wholehearted endorsement, wholehearted participation in any program cannot be expected. This sort of endorsement by actions is not usually thought of as a part of participation, but it is an important factor in the quality of participation and motivation of other employees. In a sense, it is participation by the chief executive, and there are many authorities who consider executive actions as a prime motivator of other employees' reactions and participation in company activities.

Two authorities who place strong emphasis upon face-to-face relations and communications are Colonel Urwick and Ernest Dale. They make the point that it is the executive's action which is the pervasive, motivating force in the organization. They say:

13 Ibid., p. 90.
The main duty of any executive is to lead his unit. Leadership involves four main functions: (1. Representing—industrial and public relations, 2. Initiating—planning, 3. Interpreting—getting changes "accepted," and 4. Administering, which consists of controlling, forecasting, planning, organizing, directing, and coordinating).

Putting aside the question of representation, which includes both public and employee relations, neither of which any responsible executive can wholly delegate, administration includes organization and coordination and both leadership and administration depend upon effective communication. It cannot function unless there is a smooth, orderly, and constant flow of communication, which is received, understood, and accepted by those concerned. And that depends primarily on constant contact and the most intimate human relations between the leader and those immediately responsible to him. Because, and this is the crux of the matter, it is the leader's example—not what he says and writes, but what he is and does—that spreads outwards and downwards to the furthest corner of the organization.

On this point of the importance of the kind of "executive living" that motivates employees in the way management desires, Chester I. Barnard states what should be a simple truth, but one which is oft-times overlooked:

The respect of an organization or of a management can be acquired only as is that of the individual—not by what he says today or said yesterday, but by both word and deed through a succession of many days.

At the top management level of the organizational hierarchy, exercise of executive leadership becomes a

---


15 Chester I. Barnard, op. cit., p. 12.
skill of a very high order. This is true because top management is primarily concerned with administrative management of group programs and plans, and at this level the leader's influence is more far-reaching. Also top executives must exercise "delegated" leadership. It would be a great aid to employee relations, if the president could talk face-to-face with every employee and call him by name. But the plain fact is that in corporations of ten, twenty, thirty, and more thousands of employees it is out of the question. It is not out of the question, however, for the chief executive to practice daily face-to-face communications with his immediate subordinates, and so start a favorable chain reaction of attitudes and feelings that reaches down the line to the very last worker.

In their article on the use of the General Staff, referenced above, Urwick and Dale make the point that the chief executive needs to free himself from paper work that can be delegated to a staff, and concentrate more on matters which he cannot delegate. One of the best methods of doing this is through face-to-face daily contacts. Roethlisberger says the same for the business situation: namely, there is no substitute for face-to-face communications:

It is in these face-to-face relationships at work—whether they be between superior and subordinate, trainer and trainee, staff and line, or counselor
and counselee—that the important communications take place. None of the formal tools of communications—suggestion systems, bulletin boards, organization charts and manuals, courses designed to give information, magazines, contests, speeches or letters—can supplant or change the character of these daily interactions. The meaningful communications occur in these microscopic processes of daily intercourse. It is through these face-to-face relationships that people at work learn what is expected of them and where they really stand. If in these daily face-to-face relationships people feel insecure, dependent or frustrated, no organizational manual can tell them where they belong.16

Importance of Democratic Participation to Motivation

The proposition setting forth the importance of employee participation in matters that concern them and the company runs something like this: In the democratic society which is the natural environment of the American industrial enterprise, participation is vital for three basic reasons—(1) Participation motivates employees to a high level of cooperation and coordination not attained otherwise. (2) Participation in and of itself affords intangible compensation for employees which are necessary to their well-being and their resultant effectiveness in the organization. (3) Participation increases understanding, which is the basis of acceptance and application of company plans and policies.

Participation is the involvement of the individual employee in matters that are of common interest to him

and to the firm. Barnard emphasizes the importance of
the individual. What is being advocated is not a policy
of softness, paternalism, or giving in to the whims of
employees. What is being advocated is a recognition of
the individual as an individual, and the fact that his
interests are involved. Further, that the individual has
responsibilities to the firm as well as the corporation
to him. Barnard says:

In a world that increasingly stresses organization,
schemes, policies, mass methods, it is good and
practical to have persistently in mind that the
key to dynamic effort in all industry is the
individual and his willingness to develop in it.17

Business decisions, in the final form, must be
expressed in words. Taken out of context and stripped
of the background thinking, even a small part of it,
directives and orders lose much of their original force
and meaning. This fact alone is a strong argument for
participation. Add to it the benefit of pooled judgments
and participation becomes even more attractive. Corporations
hire foremen and supervisors and pay them. As a result of
their activities these individuals amass a great deal of
first-hand, practical information. The question is if the
firm has paid for it, why not use it? It has been this
sort of thinking that has promoted the movement for the
installation of supervisory training courses.

17 Ibid., p. 8.
Tead insists coordination is best assumed when supervisory employees are allowed to participate in policy formation. He says:

Coordination is best assured where representatives of functional groups which are directly affected by or are involved in carrying out new policies are parties to the decision-reaching process.

Decisions can be no better than the understanding out of which they arise; wise authority is thus assured by and exercised after shared deliberation.18

Tead goes on to explain that participation is mutually beneficial to employee and management, because it results in more effective coordination and resultant successful operations for the firm. Further, for the employee it provides intangible compensations, which of itself boost morale so to make the whole program of participation well worthwhile. Tead says:

The administrative drive toward a dynamic coordination will, in short, bring home to executives what the price of functional unity is. For as this effort gets under way, it will render articulate as is possible in no other way those sentiments of the participants which reveal how their satisfactions in and through collaboration on production can be strengthened. This valuable result is not a by-product. It constitutes, along with the need for smooth technical proficiency, the psychologically intrinsic motivation for and justification of the entire coordinative program.19

18 Tead, op. cit., p. 183.
19 Tead, op. cit., p. 194.
The discussion in this chapter has thus far indicated the complexity of executive leadership; analyzed some of the major skills involved; and consideration has been given particularly to the place of face-to-face communications and employee participation as a means of executive leadership. These are practical and important matters, but it remains to be discussed how the executive can build into a system of administrative work measurement the feature of automatic control. How, in other words, can the executive assure himself that the important cases are coming to his attention automatically? An important factor in motivation is the knowledge that the top executive wants results and knows what results are being accomplished. Administrative work measurement aids this motivation.

V. AUTOMATIC CONTROL FEATURE IN ADMINISTRATIVE WORK MEASUREMENT SYSTEM

Complete knowledge and faculty to use all the skills of executive leadership available will be useless, unless the executive has some means of knowing (a) that problems exist and (b) which are the most important ones. In regard to manpower utilization, it is possible to build such automatic control into an administrative work measurement system.

The solution to this problem is found in two directions: (1) encouragement for executives on lower echelons to analyze
the data on their operations for themselves and take needed action or ask for help, and (2) building into the system a device for automatically calling attention to the exceptional cases which deviate too far from set standards. The first is encouragement of self-coordination; the second is a refinement of supervisory coordination. Both are needed for effective control.

It is practically impossible to have a hundred percent control. For one thing it places too great a burden upon the executives and for another, one hundred percent control would undoubtedly boost costs so high, as to price the product out of the market. The question becomes how to get the most control for your money. This problem involves determining what is the amount of control the organization must have in order to meet its objectives. Once this is decided the system must be designed to meet this criteria.

It must not be left to chance for important exceptions to be brought to the attention of the proper executives, it must be built into the system. This calls for the application of three principles: (1) control must have as its objective controlling the process or operational procedure, as well as establishment of accountability; (2) the control system itself must be set up as a continuous routine procedure; and (3) the principle of exception must be utilized in building the automatic feature into the control system.
What the control system is really concerned with is controlling the process or procedure in the organization to make sure that once it is properly set up it does not deviate or vary too much from required standards. It is to confuse cause and effect to think that control is primarily interested in measuring the final product and then establishing accountability for it. Establishment of accountability is necessary to successful control, certainly, but more is needed if the resultant data are not to be of after-the-fact variety. This concept of control of the process or procedure rather than control of the final product alone is fundamental to building automatic control in the system.

The second principle in building automatic control into the system is that the procedure for the system itself should be set up as a regular routine procedure. Figure 15, "Automatic Control of Activities" illustrates the point. The activities to be controlled are reported in a continuous routine matter. The reports should be designed to convey information about the process or procedure being controlled. The supervisor concerned collects the data. He should exercise self-coordination at this point in the control procedure. The reports automatically go to the coordinative staff or some other agent performing these staff duties. Here the function of steps four and five (the analysis and interpretation of actual with standard)
FIGURE 15
AUTOMATIC CONTROL OF ACTIVITIES

Activities to be Controlled--
Process or Procedure--
(Operative or Administrative work)

(1) Analysis and Interpretation of actual to standard
(2) Exceptional cases automatically ear-marked for executive consideration.
(1) and (2) performed by coordinative control staff.

Follow-up Action
(1) Determination of plan for improvement
(2) Execution of plan.
(3) Accountability and preventive correction through automatic control.
(1), (2) and (3) performed by Line Executives concerned.

Reports on actual performance (also exercises self-coordination) by supervisors of activities being controlled.
are performed. This staff automatically and periodically reports to the executives concerned, submitting their analysis of the data for executive decision. If the organization is operating within the limits agreed upon, this fact is simply noted and no further action taken. Emphasis is placed upon the deviation from standard performance, both good and bad. These exceptional cases are the ones that should have the executive's attention.

The principle of exception may be placed in operation by establishing upper control limits and lower control limits. Only those instances falling outside those areas are given consideration.

It becomes the functions of the executives concerned to determine a plan for improvement and to set the machinery into operation necessary to bring about these changes in the process or procedure being controlled. Thus the system automatically controls processes and procedures of the organization to the end that accountability is established and preventive correction becomes continuous.

VI. SUMMARY OF THE CHAPTER

Continuous review and follow-up, preventive and corrective action are the last and "pay-off" steps of a system of administrative work measurement. Without continuous review and follow-up action the control process is meaningless. Corrective action is a line responsibility which cannot be delegated to a staff organization. It is
the process of executive decision, usually on the basis of a completed staff analysis showing the trouble areas as indicated by deviations of actual to standard performance. To discharge successfully the responsibilities for corrective action, three conditions must prevail:

(a) Corrective action must be taken within the appropriate and reasonable time limit.
(b) Individual accountability must be established.
(c) Executives must assure themselves that all important cases receive proper attention.

Successful management resulting in the accomplishment of this last condition is contingent upon: (1) proper motivation of personnel and (2) a system which assures discovery of all important cases calling for executive attention.

Administrative work measurement facilitates control of manpower utilization by supplying performance data. Management is the function of executive leadership, and the executive can use work measurement data in controlling group actions, designed for the accomplishment of a sound organizational plan. This executive leadership is concerned with motivating people to act in a manner beneficial to accomplishment of the plan.

Conclusions in the Final Report of the Navy Project outline conditions deemed necessary for motivation, resulting in better management relative to manpower. They coincide closely to the three conditions listed above.
They are: (1) establishment of individual accountability; (2) an understanding of work measurement as a control system, and (3) acceptance and use of the system, which, in turn, is dependent upon (a) attitude toward management problems (b) fear or anxiety of what disciplinary action might result, (c) degree of confidence in standards, (d) time to prove the system, and (e) degree of confidence in leadership.

Analysis of specific examples confirm opinions of authorities who hold successful skill in executive leadership depend upon: (1) realization on the part of the executive of his own involvement in the situation, emotionally, socially, and intellectually; (2) proper use of face-to-face communications; (especially actions of the executive) and (3) proper use of employee participation.

Employee participation, however, does not mean executive abdication of responsibility and authority. As Tead points out..."the determination of purpose, policy and broad method...usually it would be wise to share. But the process of directing and overseeing the execution of policy as agreed upon is wisely unified and delegated to single individuals in a line of clearly established authority." At the top of the management level of the organizational hierarchy, exercise of executive leadership becomes a skill of a very high order. At that level leadership is concerned primarily with administrative management
of group programs, and much executive leadership is "delegated" leadership. The successful chief executive, through working with his immediate subordinates is able to begin a chain reaction of attitude and feelings that reaches down the line to the very last worker.

Complete knowledge and faculty to use all the skills of executive leadership available will be useless without a system of automatically calling the important problems and trouble areas to the attention of the executive. Continuous review of work measurement data, and a system instituting follow-up action, as outlined in this chapter, assure the establishment of accountability and a program of preventive correction on a continuous basis.
CHAPTER VIII
RELATIONSHIP OF BUDGETARY CONTROL TO ADMINISTRATIVE WORK MEASUREMENT

I. INTRODUCTION

Budgetary control is control of income and expenses, on the basis of organizational units. There is usually a budget for each of the major divisions of the organization, for example, the sales department, the production or manufacturing department, and the general administrative department. The master budget of the company is a composite of all departmental budgets.

Administrative work measurement's relationship to budgetary control is found in the fact that it can provide data vital to estimating both direct labor costs and indirect labor costs. Also, administrative work measurement is a measure of quantity and time, while budgetary control is a measure of expenses. Both controls aid in keeping the organization in balanced adjustment.

It is important to note the difference between budgetary control and budget standards. Budgetary control is the function which compares expense relative to quantity, quality, and time on the basis of organizational units. The budget standard is the model of the expense plan of the organization. For example, a certain department
produces a certain quantity and quality of product during the month at so much cost or expense. Budgetary control is the work of comparing actual expense figures with the standard budget for that given quantity and quality of a month's production.

Likewise, this distinction needs to be made in the case of administrative work measurement. The system of administrative work measurement compares actual quantitative output to the work measurement standard for that quantity.

This chapter consists of a brief description of budgetary control. It is chiefly concerned with an explanation of how administrative work measurement data can be used to improve the basic data that goes into a labor budget and also its use in estimating or calculating indirect labor costs.

II. ANALYSIS OF BUDGETARY CONTROL

Budgetary control is an accounting and statistical control method which is used to form plans and check financial operational performance on an organizational basis. In its pamphlet entitled, "Budgeting Manufacturing Operations," the Metropolitan Life Insurance Company gives the following definition:

A budget system has been defined as a systematic method of gathering information from the past and present, of formulating plans for the future on this basis and of reporting subsequently how these plans have been carried out. The application
and use of this method of planning and recording give what is called "budgetary control."\(^1\)

Budgetary control is concerned primarily with the performance of the comparison function, which facilitates the coordination of effort among the units of an organization, to the end that the objectives of the organization may be carried out in the most economical manner. It is concerned with the future plans and operations of the organization in terms of revenues and expenses. McKinsey points out that planning in any particular business may be classified into three broad groups:

1. That which deals with the operations of the separate departments, such as production, sales and finance. Such planning has been described loosely in the past, as "industrial engineering."\(^1\)

2. That which deals with the coordination of the operations of the several departments to the end that a well-formulated program may be made, for the business as a whole. Such planning may well be termed "budgetary control."\(^2\)

3. That which deals with the determination of future conditions as reflected in the business cycle and the shaping of the plans of the business to meet these conditions. Such planning is known as "forecasting" or "business predicting."\(^2\)

McKinsey recognizes that these three classifications are overlapping. They are overlapping in the sense that

---

1 "Budgeting Manufacturing Operations," Metropolitan Life Insurance Company, p. 3.

2 James O. McKinsey, Budgetary Control, p. 3.
planning for the operations of a separate department is dependent upon forecasting, just as much as forecasting is a part of the budgetary control of the whole business. Nevertheless, McKinsey's classification of the three uses is helpful in indicating the scope of budgetary control. Thus it becomes apparent budgetary control provides (1) control of expenses of the individual department or division, (2) control of expenses of the entire organization, and (3) a method of forecasting revenue and expenditures.

**Essential Features of Budgetary Control.**

The essential features of a budgetary control system consist of estimates of the expenditures and receipts by departments or some other organizational grouping. From this data a financial program is set up. At regular intervals, actual performance is checked with the budget. The budget is then revised in light of any changing conditions.

The essential features of budgetary control have been summarized as follows:

1. The statement of the plans of all the departments of the business for a certain period of time in the form of estimates.

2. The coordination of these estimates into a well-balanced program for the business as a whole.

3. The preparation of reports showing a comparison between the actual and the estimated performance and the revision of the original plans when these
reports show that such a revision is necessary. 3

Thus it is that the budget is the financial interpretation of the objectives of a department. Budgetary control is more. It is the planning of the budgets and the use of these budgets as a method of coordinating overall management of an organization. In this manner budgetary control establishes accountability in financial terms.

Budgetary Control is the tool of management used to plan, carry out and control the operation of a business. It establishes predetermined objectives and provides the bases for measuring performance against these objectives. It enables business to determine the need for modification of its plans as the need arises without waiting until financial statements are prepared at the end of the year, when it is too late to take advantage of the knowledge to alter the company's position for the year in question.

Viewed in this light, it embraces all other management control plans and bears the same relation to them which a master budget bears to the various individual budgets. 4

The writer disagrees with Rowland and Harr that budgetary control "embraces all other management control plans." It is true that most control plans can be related to the financial budget, but to do so in any way short of a summary report is to complicate matters. For example, statistical quality control reports are usually in terms

of so many units over or under the acceptable standards. To translate these units into dollar values and include a total of several different types of units in the budget for the production department could result in confusion. The units would have lost their identity and the purpose of the control to show where the trouble is would be lost. This is not to lose sight of the effectiveness of translating losses due to substandard production into dollar values. This practice is common and when related to the departmental budget, it is effective. Nevertheless, it seems an over-simplification to insist that all control plans can be "embraced" or included in budgetary control.

How Budgetary Control Operates

How budgetary control fits into the seven steps of any control system was discussed in Chapter V under examples of control systems. The example of budgetary control given in that illustration was the budget for a production department. Figure 12 indicates that budgetary control establishes accountability for the performance of a department or subdivision thereof on a financial basis. Also a system of routine reports provides for automatic control. Usual procedure is for weekly, monthly, and quarterly actual operations reports to be compared with the budget. If there is significant variances, the responsible executive is asked to account for the differences and corrective action is planned and executed.
Need for Overall Budgetary Control

In order for budgetary control to be effective it must include all the departments and their operations. Otherwise coordination of effort and organization balance are left to chance. McKinsey gives an example of what may happen if overall budgetary control is not established. His example deals with the firm which has a good sales program, carefully budgeted, but no production budget. He says, "They are easily impressed with the value of a sales campaign which will result in a large increase in volume of sales, but they may fail to realize the importance of working out methods by which to coordinate the sales campaign with the production program so that the goods will be sold ready for delivery at the proper time." 5

The writer was in the office of the Vice-President in charge of advertising of a large pharmaceutical manufacturer when such a problem arose. The export division was just about ready to release an extensive advertising campaign on a certain drug. The dispatching of the orders to execute the program, however, had to be delayed so an adequate shipment of the drug could reach the foreign market in time to supply the estimated demand.

Overall budgetary control calls for a master budget made up of all the departmental budgets, which usually

include budgets for the sales department, finance department and the production or manufacturing department. The master budget of manufacturing operations present three principal problems:

1. Determination of the amount of each product to be fabricated during the budget period and the size of the most economical manufacturing lot.

2. Establishment of a production schedule to assure the prompt delivery of these products in accordance with the sales requirements.

3. Production of these goods at the lowest cost consistent with the required quality.6

The first problem depends upon the sales forecast for determination of the amount of goods to be produced. The sales forecast is usually a combination of two types of data:

(a) estimates of salesmen in the field or estimates directly from customers, and

(b) overall estimates of the potential sales for the industry based upon records of past consumption and forecast of general business conditions and buying power of the territories concerned.

The Metropolitan Life Insurance Company lists four classes of information affecting sales forecasts:

6 Metropolitan Life Insurance Co., op. cit., p. 5. These last two steps are really production planning and control. Budgetary control depends on prior sales, production, and financial planning.
(1) statistics of past sales, (2) general business conditions, (3) conditions within the particular industry, and (4) plans and policies of the company. 7

The last two problems, setting up a production schedule and keeping costs low, depend upon the budget of the manufacturing department for their solution. The manufacturing budget involves two factors:

1. The development of a production program in terms of units to be produced. (This is provided for in a production schedule).

2. An estimate of the costs that will be incurred in the completion of this program. (This is provided for in budgets for labor, materials, manufacturing overhead, and plant and equipment). 8

III. RELATION OF BUDGETARY CONTROL TO WORK MEASUREMENT

Work measurement can provide a very effective technique for supplying data for the labor budget. The labor budget is concerned with the direct labor that goes into producing goods and services. In cost accounting indirect labor is generally included as a manufacturing expense. Indirect labor is the supervisory and executive labor costs and also staff operative labor costs which are not part of the direct labor costs of a unit of production, but which must be allocated to unit costs indirectly. In essence,

7 Ibid.
8 Metropolitan Life Insurance Co., op. cit., p. 6.
indirect labor costs are all the labor costs which are not classified as direct labor costs.

If indirect labor is not included in the master manufacturing budget as a manufacturing expense, then it must be included in the labor budget. In either event, work measurement can be used to supply information about the manhours expended in performance of either primary operative work or staff operative work. Further, work measurement data can be collected on the basis of units of the organization, which coincide with the organizational divisions of the master budget. Thus the labor budget for X department can derive its estimate of manhours expended from the work measurement report of that department.

The budget of the production division of a manufacturing business includes the individual budgets of each line and staff department. The distribution of this expense against the product is a cost problem, but in the case of the staff department a ratio must be established between the work load of the staff to the work load of the line that is applicable to the forecast of future work loads of the line. The point is that administrative work measurement provides a more scientific estimate of how many staff hours it takes to complete a certain quantity of staff work, which is forecast for the future.

Work measurement reports indicate the manhours expended during a particular period, that were applied on a certain
amount of output. Such a work measurement report can be expanded into a forecast simply by using the sales forecast of the units to be produced as the work load and multiplying that figure by the work measurement performance rate of manhours per work unit. The details of setting work measurement standards and making forecasts have been discussed in previous chapters. The work measurement forecast is expressed in terms of manhours to be expended for each subfunction. Apply the average cost per manhour to these manhour forecasts and the result is a labor budget for the period.

V. DETERMINING LABOR REQUIREMENTS FROM WORK MEASUREMENT DATA

Estimating the labor requirements is one of the important steps in any labor budget, for the budget will be no better than the estimate of labor required. The estimate may come from several sources: (1) the cost accounting department, (2) the personnel department, or (3) the line supervisor of the people performing the work. An estimate that is to be at all realistic must have a close connection with the actual production records of the department doing the work.

Use of Cost Accounting

The standard labor costs established by the cost accounting system can be used as a basis of estimates of labor requirements. It should be noted, however, the
cost accounting standards must be based upon the standard time it takes to produce a unit of production. If a work measurement system is in operation, it will provide this information. In the case of primary operative work, time and motion study should be used, where applicable. In staff jobs where time and motion study are not easily applied, administrative work measurement can provide the data on manhours expended.

The Policyholders Service Bureau of the Metropolitan Life Insurance Company made a survey of the budgetary control systems in use in ten or so companies representative of all types of industry. They found many companies consider it impractical to put all the direct labor operations on an incentive basis, day or hourly rates being considered expedient or necessary on a portion of the work. In such cases cost accounting figures are not available. The bureau found:

The preparation of labor estimates under these conditions is generally undertaken by the foremen or factory managers. These executives are given a schedule of the work to be performed in their departments and, based on past operating information, they estimate the amount of each class of labor that will be necessary for the completion of the production program.9

Data from a system of administrative work measurement could supply the information needed on production time of

a certain number of units. Estimates of number of hours of labor needed to perform a given amount of work would no longer need be a guess. Administrative work measurement establishes standards of performance rates. The methods for determining standards is the subject of Chapter VI. The use of such methods of establishing performance rate standards is a vast improvement over the opinion of the supervisor or foreman.

**Use of the Coordinative Staff**

McKinsey does not see the personnel department as the logical organizational agent to collect data for the purpose of establishing the estimate of labor requirements. He says:

If the personnel department collects the data necessary to make this estimate, it will usually lead to a duplication of data, since the same information will be collected and recorded by both the production and personnel departments.10

This writer sees the problem of coordination of efforts, not so much one of limiting the duties and areas of responsibilities of the organizational units, but more a problem of affording all units with a means of communications. The question is not so much shall the personnel department, the cost accounting department, or the line supervisor establish the labor requirements. The problem is how can the data best be collected, how analyzed and

interpreted, how best evaluated, and then plans formed, and how best to obtain the desired action. As pointed out in Chapter VII, this is a problem of executive leadership. If the organization is too large for the chief executive to coordinate these activities, then the logical alternative is use of a coordinative staff. The larger the organization, the more functions this staff will perform.

Application of Work Measurement Standard Performance Rates

In the final analysis the estimate of labor requirements rests upon the quantity to be produced and the labor it takes to produce each unit of goods. McKinsey refers to such ratios as standard labor rates, "standard time limits for the performance of tasks." In work measurement one of the useful tools is the standard performance rate, which is the standard manhours consumed to produce one work unit. Standard performance rates are comparable to standard labor rates, which are set usually by time and motion study applied to primary operative work. McKinsey has this to say about standard labor rates:

Some of the most valuable work of industrial engineers has been in the establishment of standards by which to judge labor. The first work performed by the exponents of "scientific management" was the establishment of standard time limits for the performance of tasks. These rates were first established in connection with factory labor and were used to speed up production. There seems to be no good reason why such standard rates with proper modifications might not be applied to all departments of a business and used very
extensively in the enforcement of administrative control. It is interesting to note that a large manufacturing firm in the East is now scheduling very definitely its salesmen and making a careful study of how each employs his time with the intention of developing standards by which to judge salesmen’s activities.

Standard labor rates serve three useful purposes:

1. They can be used in the estimating of costs in the establishment of prices on special orders and contracts.

2. They serve as a means of judging the efficiency of workmen. If the rates are fair and equitable, a workman’s efficiency can be judged by his ability to reach the standard. In many cases his wages are based on the standard, so that he has an incentive to reach or exceed the standard if possible.

3. They give important service in estimating labor requirements and in formulating a labor program.11

Standard performance rates can be established on work that does not lend itself to time and motion study. What McKinsey has to say about standard labor rates is applicable also to standard performance rates. Since standard performance rates indicate the manhours per work unit completed, application of the wage or salary rate will yield the labor cost per work unit. Along with McKinsey’s second point, the actual performance rate can be compared to the standard performance rate. One important difference needs to be noted, however. The work measurement report is a measure of group activity, not

performance of individuals. Thus, if a supervisor has twenty stenographers on a job, the administrative work measurement report will show if the group performance is up to standard, but it will not show individual differences. If the group performance is substandard, however, an actual work count can be applied to locate the substandard stenographers.

On the third point of estimating labor requirements, work measurement is a long step forward in providing a scientific method for estimating indirect labor needs more closely. Too, administrative work measurement can be used as a method of translating data on performance from time and motion study of individual primary operative workers into cumulative data on group output for manhours expended. Such data is more easily translated into dollar values for budgetary purposes, and they facilitate exercise of pooled judgment by executives and coordination of effort by an administrative control staff.

VI. SUMMARY OF THE CHAPTER

Budgetary control facilitates control of the activities of the organization to the end that the total effort is coordinated in such fashion so as to result in optimum attainment of the objectives of the organization from the standpoint of expenses. Budget estimates, expressed in dollar values, are the primary techniques of budgetary
control. This control conforms to the seven basic steps of any control system, as outlined in Chapter V. Basically, it is a process of (1) comparing actual performance to estimates or standards, (2) analysis and interpretation of results, and (3) deciding on plans of corrective action.

Budgetary control is comparison by organizational units, and to be effective must include all organizational components—divisions, sections, and units. Budgetary control of the manufacturing division includes: (1) production schedules, and (2) budgets of (a) materials, (b) labor, and (c) overhead. Work measurement's relation to budgetary control is found in the fact that it can provide vital data to the estimating of both direct labor and indirect labor costs.

Labor cost estimates may be made by anyone of a number of organizational units, the cost accounting department, personnel department or first line supervisors. The writer sees work load estimates as an important part of the entire control program of an organization, and, therefore, recommends the exercise of the pooled judgment of the top executives in estimating labor costs, coordinating their efforts through use of the coordinative staff. In smaller organizations the functions of the coordinative staff should be performed by the chief executive or his assistant.
Work measurement standard performance rates can be established on work which does not lend itself to time and motion study. Time and motion study have their greatest application to line operative functions, under conditions of standardized, repetitive operations of large volumes. In cases where time and motion data are available on individual projects or job orders, these data may be used in cumulative total form. As such they become work measurement data on group activities. Budgets are composed of dollar values of group activities over a period of time. Thus work measurement facilitates budgetary control by the presentation of data on individual projects or job orders on a cumulative group basis.
CHAPTER IX

RELATION OF STATISTICAL QUALITY CONTROL TO WORK MEASUREMENT

I. INTRODUCTION

Statistical quality control facilitates the management function of constraining and regulating the procedures and processes of production operations to the end that the quality of the goods produced is in accordance with the objectives of the organization. Statistical quality control is concerned chiefly with the comparison phase of control. It is based upon sampling techniques, used to control the production process as well as to perform the inspection function.

Kennedy defines statistical quality control in this manner:

Science begins with measurements. One function of Quality Control is recognizing, measuring, calculating, and evaluating variation...We think of control as power or authority to direct or restrain, or as a mechanism for regulating, but in the phrase, "Quality Control by statistical methods," it is used in the sense of a standard of comparison. Think of the word control less as you would in the "control tower" at an air field and more as you would in the "control number" of an ampule of anti-toxin. In the latter phrase, the word "control" establishes for the biologist that the contents are of a certain standard.

In manufacturing, statistical quality control is associated with inspection. The actual physical measurements are secured from an inspection and then the degree and extent of digression among them,
as compared with a standard, are determined by Quality Control methods. Because with Quality Control the significance or harm of the variations can be predicted, and because Quality Control frequently discloses causes and conditions, it is found to exert a powerful and positive influence over the control of quality.¹

The need for quality control is basic to our present mass production processes. The basis for assembly-line mass production is the ability to make another item just like the last one. Since no two things can be made exactly alike, the problem becomes one of determining how much product variation can be allowed, and then to employ methods which will insure that it is not exceeded.

Such methods entail setting up standards. As pointed out in Chapter VI of this paper, standards are of three basic varieties, (1) past experience standards, (2) engineered standards, or (3) comparison standards. Regardless of their origin, quality standards must be tight enough for interchangeability and loose enough for economic manufacture. In two areas of the inspection function, development has been successful in keeping pace with demands of industry. One is in the development of high-precision measuring instruments, and the other is statistical quality control systems.

¹ Clifford W. Kennedy, Quality Control Methods, pp. 4-6.
Relation of Work Measurement to Statistical Quality Control

Work measurement relates the work turned out to the amount of manpower it took to do the work. Statistical quality control tells whether the work is up to standards of quality required in order to meet the objectives of the organization. Work measurement as an administrative control is control of group activities. The group activities can be either those of the line organization or the staff organization. The group activities of the line organizational units are the cumulation of work of the primary operative workers, in other words, the products produced. Such products can be measured by a number of tools like gauges, testing machines such as test tensile strengths, and electronic high-precision gauges.

Statistical quality control can be related to work measurement reports of line activities by comparing the excellence of the quality of the product being produced at different levels of performance rates. Performance rate has been defined as the number of manhours per work unit. As the rate of production increases (indicated by

---

2 This definition is the reverse of the commonly accepted definition of a "production rate," which is in terms of quantity per hour or the quantity per manhour in terms of capacity. Emphasis here is upon manhours expended, not machine capacity as is often the case in manufacturing processes.
a lowering of the performance rate) after a certain point, quality of the output can be expected to fall as the optimum rate of production is passed. By observing at what point quality falls below acceptable standards as the performance rate improves, it is possible to establish an optimum performance rate for an activity. Without such a control of quality, it is entirely possible to push the rate of output too high for economical operations.

Work measurement reports of staff work are the cumulations of the operative work of the staff organizational unit. Examples of this work are secretarial work; letters typed, phone calls made, etc. Some of this type of work does not lend itself so readily to statistical quality control, because determination of the quality of such staff work is more subjective than in the case of products produced by primary operative employees. Also while staff work is becoming increasingly more important volume-wise in large organizations, still the instances where staff work is repetitive are not nearly as frequent as the repetitive work found in a mass production factory.

Nevertheless, there are a good many clerical operations that are highly repetitive and demand the quality of output be maintained at a high level. Examples of these operations are order receiving and processing, invoice preparation, billing and posting accounts receivable, and other
accounting processes. As in the case of work measurement, statistical quality control began to be applied to clerical operations at the close of World War II. The companies which are using it are applying the technique to highly repetitive clerical operations. The General Electric Supply Corporation has prepared a pamphlet on the subject for private distribution. The following quotation from a testimonial letter from their Newark Office indicates the typical clerical operation to which statistical quality control can be applied successfully:

> From our limited experience, we have concluded that Quality Control is not wisely applied to every office procedure. Its greatest value appears to be on routine tasks, repetitive in nature, with daily volume running well in excess of 100 documents, line items, postings, etc., preferably in the vicinity of 400 to 600. One other point we emphasize is that the application is best suited to operations where quality of work should be consistently maintained at a high level.³

Statistical quality control data of clerical staff work can be related to administrative work measurement data in exactly the same manner as described above in the case of manufacturing operations. The relationship is established by comparing the excellence of the quality of the product being produced by the group at different levels of performance rates. In other words, the administrative

---

work measurement performance rates are recorded on the same chart with percentages of units of acceptable quality in a batch, which are supplied by statistical quality control data on staff operative work. By observing at what point quality falls below acceptable standards as the performance rate improves, it is possible to establish an optimum performance rate for an activity. This type of control amounts to deciding what quality of clerical work is desirable from the group, and then making sure that increased rate of output does not result in lower quality work.

Examples of the application of statistical quality control to administrative work will be explained in a later section after a discussion of the development and basic principles of the system.

II. DEVELOPMENT OF STATISTICAL QUALITY CONTROL

Statistical quality control began as late as the 1920's. It was made possible by the development of an exact theory of sampling. Dr. Walter A. Shewhart of the Bell Telephone Laboratories is the father of statistical quality control. He first sketched a modern control chart

---

4 For a more comprehensive account of this background material see Acheson J. Duncan, Quality Control and Industrial Statistics, pp. 1-9; and Joseph M. Juran, Management of Inspection and Quality Control, pp. ix-xiv.
on a memorandum prepared in 1924. The control chart was improved during the intervening years, and in 1931, Dr. Shewhart published a book on statistical quality control.5

Initially American industry was not enthusiastic about statistical quality control. The need was not great enough yet in the thirties. World War II provided the need for such control. The armed services were the first to use scientifically designed sampling procedures for inspection purposes. General Leslie E. Simons' book, An Engineer's Manual of Statistical Methods, appeared in 1941. In order to lower rejection of their deliveries, industrial suppliers to the armed forces were forced indirectly to adopt quality control methods similar to the armed services.

In addition to using statistical quality control, the armed services initiated an educational program through the American Standards Association to promote use of statistical quality control. The printed materials prepared in connection with the program gave concise statements of American control-chart practice. During the years of World War II over eight hundred organizations sent representatives to the courses.6

As a result of the training programs and research sponsored by the Armed Forces during the war, quality

6 Acheson J. Duncan, op. cit., p. 3.
control societies began to be formed. One of the first was begun in Buffalo in July, 1944. It is the Society of Quality Control Engineers, and in cooperation with the University of Buffalo, they publish the *Industrial Quality Control*. Soon interest was great enough to support a national organization, known as the American Society of Quality Control. The organization was founded February 16, 1946. By 1951 it had a membership of nearly four thousand in forty-six localities in every section of the country. The national organization has assumed the duties of publishing the *Industrial Quality Control*, and is the leading promotor of the use of statistical quality control in this country.

The development of statistical quality control is in its infancy. Great improvements are forecast by statistical quality control advocates. For instance, *The Wall Street Journal* quoted Professor Joseph M. Juran of the New York University to the effect that "each year the production of goods not up to specifications costs $500 to $1,000 per productive worker. Half of that loss could be saved by quality control." Professor Juran was reported to estimate that a "potential saving by industry of between two billion and three billion a year can be made through the reduction of rejected goods, reworking and inspection costs, and out-and-out waste." 7

7 Acheson J. Duncan, *op. cit.*, p. 7
III. CHART CONTROL AS A QUALITY INDICATOR

The successful application of statistical methods based upon the laws of chance and central tendencies finds its validity in the idea that control of the process results in control of the end product.

Juran expresses the principle thus:

where the homogeneity is derived from common origin rather than from mixture, measurement of a sample of product can still reflect accurately the nature of the creating reservoir. The inspected pieces, reflecting the nature of the process which produced them, will also reflect the nature of the uninspected pieces produced by the same process. This principle is the root of acceptance sampling. Furthermore, the inspected pieces will also reflect the nature of the unmanufactured pieces. This principle is the root of control sampling.

Juran footnotes the above quotation with this statement: "The two italicized statements epitomize the principle of using inspection data to obtain knowledge of the process. Nothing else in this book equals this principle in importance."

Dr. Walter A. Shewhart developed the chart control and he indicates that its purpose is three-fold: (1) to establish a standard for an operational process, (2) for use in helping meet the standard, and (3) to serve in the

---

8 Joseph M. Juran, Management of Inspection and Quality Control, p. 78.

9 Ibid.
comparison of actual performance to standard. The theory is that there are two different forces at work in a process which cause variations in quality—chance variations and assignable causes. Chance variations are not due to any one or individual number of causes but are the results of all the factors in the process. The only way to change or eliminate chance variation would be to change the process basically. Chance variation is inherent in the process and as long as the process is operating within the limits prescribed by the objectives of the organization, the process can be said to be "under control."

Duncan explains it thus:

They are under control in the sense that, if chance causes are alone at work, then the amount and character of the variation may be predicted for large numbers, and it is not possible to trace the variation of a specific instance to a particular cause. On the other hand, if the variations in the data do not conform to a pattern that might reasonably be produced by chance causes, then it is concluded that one or more assignable causes are at work. In this case the conditions producing the variation are said to be "out of control."

Once the upper and the lower control limits have been established on a highly repetitive production operation, the control chart is ready to indicate when assignable


11 Acheson J. Duncan, op. cit., p. 244.
causes of variance are present in the process. If the process does not undergo any change, the statistical chance that a single plot point will land outside an upper or lower control limit is only three in a thousand. Under these conditions the process is said to be normal, and the values of averages and ranges would continue to fall inside their respective control limits under normal conditions. When a plot point falls outside U.C.L. or L.C.L. then some factor is changing the process. This is the automatic signal to look for the assigned cause. It is an obvious but important conclusion that it is only when remedial steps are taken that quality control becomes a reality.

**Application of the Control Chart**

An illustration may be helpful in clarifying the use of control charts. Figure 16 gives an example of a control chart, showing performance in production of a machined part. Between the hours of midnight and ten in the morning the process produced items whose measurements fell within the upper and lower control limits, although the process did show rather large deviations toward the upper and lower limits. At ten, eleven, and twelve a.m. the process was above the upper control limits, although still within the upper limits of the blueprint specifications.

This control chart indicates that something is going wrong with the process, and immediate steps should be
-314-

Figure 16
Example of a Quality Control Chart
(A machined part process)

Size of Machined Part in Inches

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.253</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.252</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.251</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.250</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.249</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.248</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.247</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Deviations of Sample From Standard

<table>
<thead>
<tr>
<th>Hours</th>
<th>12 p.m.</th>
<th>8 a.m.</th>
<th>12 a.m.</th>
</tr>
</thead>
</table>

Legend:
Spec. - Specification
U.C.L. - Upper Control Limit
L.C.L. - Lower Control Limit
X - Engineering Dimension
R - Range of Sample

taken to correct it. What actually would be done is to inspect the lathe or other tool set-up to see the process is set up correctly. Thus, statistical quality control acts as a preventive correction, better still if the control chart is kept at the work place, it can be a means of self-coordination on the part of the operator.

In the same manner the $\bar{R}$ chart can be an indication of trouble. The control chart has the features of timeliness and automatic control, and it is proving its worth in day-to-day repetitive operations. Robert M. Currie of Ford Motor Company has this to say about control charts:

The benefits are varied. Among the more important are improved end-product quality, reduced scrap loss, reduced rework costs, increased productivity, purposeful machinery maintenance, and increased customer satisfaction. But of possible equal importance is the restoration to the worker of personal pride of performance, a most elusive factor which has been all but lost in modern mass production. Through Chart Control the operator is realizing his desire to be more completely identified with what is a major step forward in the area of human relations from which real benefits will ultimately derive.12

The Limitations of Control Charts

There are certain limitations to the application of the control chart, as is to be expected. They have to do with (1) the size of the operation, (2) the nature of the end product, and (3) the attitude of employees toward statistical quality control.

Dr. Shewhart, the originator of the control chart, points out the limitations of (1) the time needed to establish a system and (2) the necessity that the process be a repetitive one involving the mass production of a large number of units.

This potential state of economic control can be approached only as a statistical limit even after the assignable causes of variability have been detected and removed. Control of this kind can not be reached in a day. It can not be reached in the production of a product in which only a few pieces are manufactured. It can, however, be approached scientifically in a continuing mass production.13

IV. DEVELOPMENT AND APPLICATION OF STATISTICAL QUALITY CONTROL TO STAFF OPERATIVE WORK

The statistical methods which are applicable to the inspection data of manufacturing processes are also applicable to office management and other forms of staff operative work. The cumulative totals of the staff operative work can be used in administrative control of group effort of staff organizations.

"Quality Control in the Office" was the subject of a series of papers and panel discussions presented at the Office Management Conference of the American Management Association held in New York City, October 16-17, 1952. The panel chairman was Simon Collier, Director of Quality

13 Walter A. Shewhart, op. cit., p. 46.
Control, Johns-Manville Corporation. He opened his
remarks with reference to the work in statistical control
developed by Dr. Shewhart; and he concluded with this
statement:

Whatever the reasons for our failure, we in office
management have the same problems as the production
man, and the same basic principles that have proved
themselves on the production line can be used to
obtain better results in the office.14

The three other speakers on the panel were Dale
Lobsinger, Superintendent, Quality Control, Transportation
Services, United Air Lines; Paul Holly, Manager, Clerical
Operations, Aldens, Inc., (A mailorder house); and Fred
E. Shelton, Jr., Office Manager, The Standard Register
Company, a manufacturer of business machines. All three
firms are using statistical quality control as an ad­
ministrative control over group efforts of staff organ­
izations. They are also applying the system to some line
operative work, to which statistical control has not been
applied heretofore.

Use of Statistical Quality Control at United Air Lines

United Air Lines applies the system to two service
problems and a problem of auditing certain accounting
records. They apply statistical quality control in

14 "Quality Control in the Office," Raising the Sights
of Management, Office Mgt. Series No. 132, American
Management Association, 1952, p. 41.
ordering and supplying food. The bill for that food is $4 million a year for approximately 3½ million meals. They also use statistical quality control extensively in freight weighing operations and baggage handling. Finally, they use the system in reservation work to check the accuracy of their ticket issuance. This airline is enthusiastic about the results of the application of statistical quality control to clerical operations. Mr. Lobsinger stresses the importance of correcting defects in the procedure which are disclosed by the system. He concludes:

Think about that in connection with any clerical activity. If we can find out what is wrong and learn the nature of the errors, their extent, and the people who have been producing them, we—as managers and supervisors—will know how to correct the situation and set our course in the right direction. 15

Use of Statistical Quality Control at Aldens

In 1946 Aldens adopted a method of "quality control through statistical analysis" to their five major sections, which are the mail opening section, the order reading section, the index section, the entry section, and the distribution section.

The importance of follow-up improvement is emphasized. Mr. Holly says on the subject:

At the end of each month, the charts are collected and a critique is held. Here problems are openly

15 Dale Lobsinger, ibid., p. 43.
discussed. Methods of solving definite problems are arrived at, and the results of previously applied methods are reviewed. Here, also, it is discovered that, although the errors may be local, the causes of errors and the method of correcting them can be generalized. We recognize the fact that quality control is merely a thermometer which takes the temperature. We must prescribe the necessary remedy. 16

Use of Statistical Quality Control at Standard Register Company

The Standard Register Company began exploring the possibilities of adopting statistical quality control to the office operations early in 1948. Since that time they have conducted an experimental program in one of their office departments. They have installed active programs in many office departments, and plan to extend the system to other office departments.

In their accounts receivable department they had the problem of saving time without sacrificing quality. All invoices previously were verified by means of a 100 percent inspection. By the use of sampling plans and control chart techniques, they were able to reduce the time spent in verifying these invoices by 47 percent and, at the same time, even with a reduced operating budget maintain the desired quality level.

In their customer records department, the problem was one of improving quality. By the use of sampling plans

16 Paul Holly, op. cit., p. 45.
and control chart techniques, the quality level of the prime operation of this department was raised from 86.2 to 95.9 percent. This 11.2 percent increase in efficiency was effected in a period of two or three weeks.

Mr. Shelton explained how their quality control is related to quantity output. At any given time a supervisor can look at the quality control chart and inform himself of the percentage of the present work load (output) that is meeting quality specifications. As pointed out previously in connection with quality control of manufacturing processes, the supervisor has a positive check on the effect of increased production rate (as evidenced in increased output) on the percent of acceptable units of production, quality-wise.

The prime benefits that have been experienced from the installation of statistical quality control at the Standard Register Company are summed up by Mr. Shelton in the following quotation:

1. It provides a continuous record of quality in a manner that enables management to determine at a glance the quality level of work of any given operation and department.

2. It establishes conditions for savings in time spent in inspecting and double-checking.

3. It improves quality of work without increasing costs.

4. It has a beneficial psychological effect on personnel because of the visible control chart.
5. It indicates specific types of and reasons for errors more quickly.

6. It gives supervisors confidence in the quality of the work of their personnel.

7. It motivates immediate investigation of poor work.

Finally, in addition to these prime benefits, there are the added benefits of savings due to possible changes made in methods and systems as the result of the investigation of "out-of-control" points on the control chart.17

Use of Statistical Quality Control at Prudential

Another corporation which is making extensive use of both administrative work measurement and statistical quality control of office work is the Prudential Insurance Company of America. With the bookkeeping and correspondence job that accompanies servicing two million policyholders, such operations offer excellent opportunities of applying the systems to office operations which are standardized, repetitive and demand a high degree of accuracy.

Bennet B. Murdock, Senior Method Analyst for the Company, and his staff have made extensive studies of the application of statistical quality control. He states that their experience, in several types of clerical work indicates that an average unit of work costs one dollar

17 Fred E. Shelton, op. cit., p. 53.
to complete, and further it costs seventy-five cents to check each work unit. His point is "unless the cost of a checking operation is less than that of the errors it prevents, it is economically unsound." 18

The results of research on one clerical operation indicate that checking a sample of 30 percent of the output resulted in reducing the error in the finished produce, from 3 percent error under 100 percent checking, to less than 2 percent under the sampling plan. Mr. Murdock attributes the improved performance "largely to the sincere efforts of supervision and management to make the program a success." It seems to the writer that this is another example of improvement resulting simply from the installation of a system that gives operatives and management some kind of measuring stick by which to judge effectiveness. In this case there is not even any evidence of any effort to improve or change the process. The improvement must be attributed to the fact that operatives and executives began to focus attention on the effectiveness of the operation, and that statistical quality control afforded a timely measuring stick. Improvement can also be attributed

18 Bennet B. Murdock, "Improving Clerical Accuracy Through Effective Use of Quality Control Techniques," Prudential Insurance Company of America (For private distribution only), 1953, p. 2.
to the greater interest in the work, and improved morale of operative personnel.

**Importance of Top Management Backing and Acceptance by Operatives**

Out of their broad experience with statistical quality control at Prudential, Mr. Murdock discusses some conclusions which are well worth consideration. His first conclusion has to do with the importance of "selling" the program to top management and then to the executives and the operative workers who will have to use the system. This conclusion confirms the importance of top management backing and acceptance at lower echelons found in the case of work measurement pilot studies conducted during the primary research of the Navy project. Mr. Murdock expresses the thought in the following words:

Some extremely important steps should be taken before a Quality Improvement Program is put into effect. It should be sold to the clerical staff, to the Section Head and to management. These people should thoroughly understand the basic aims of the program and participate in it to the fullest possible extent. Only with complete cooperation throughout can the program fully realize its potential.\(^{19}\)

\(^{19}\) *Ibid.*, p. 10. This point is emphasized in the following paragraph, which is part of the reply to the writer's inquiry addressed to one of the larger rubber tire manufacturers regarding their use of statistical quality control:

"We have been studying Statistical Controls for about a year and have concluded that applications exist in the organization. The main difficulty we find is in selling the program. Department Managers and employees do not readily subscribe to a departure from the traditional concept of error control--100% verification."
Without top management backing, subordinate executives give but a token support to the program. Furthermore, even with top backing, success of any such program as statistical quality control depends upon the use to which first line supervisors and operatives apply it. If the report is not understood and accepted, it is not likely to be little more than another report.

The Concept of Drifting Standards

Prudential uses the concept of drifting standards in their statistical quality control program much in the same manner the Navy project applied the concept to work measurement systems. In both cases, the system is devised to indicate areas needing improvement. Followed by an improvement program, there then is set a new standard, which reflects the better performance due to improved processes and procedures. In the vernacular of golfing, a few sand traps are removed, and a new par for the course is set, which is lower than the old par.

This phenomenon of improved performance due to improved working conditions reaches the point of diminishing returns after a time. The length of the time is the unknown quantity. Murdock explains Prudential's experience thus:

Incidentally the position where the accuracy levels off may be considered as the goal of our program. It puts us in the peculiar position at the beginning of a program of trying to attain an indefinite objective and of not being sure we have reached it
until we have gotten there and have been there for a while.20

The initial stage of the program, then, is a period of improvement. It gives the operative workers and the supervisors a chance to improve the process to the degree of performance desired and practical. After the initial period, the system then becomes one of controlling the process within the upper and lower acceptable standards. Murdock says on the point:

From these remarks you will note that the program itself may determine the ultimate standards. This, I think, is unique in Quality Control. It is, therefore, possible to split our programs into two parts. The early stages may be looked upon as a period of Quality Improvement; the later stages as Quality Control.21

Statistical Quality Control as a "Group" Control

The operative form of quality control is the performance of the inspection function. In such a case, the quality of a given quantity or batch of work is checked to see that it meets quality standards. The administrative form of quality control is so-called statistical quality control. In this latter case, emphasis is placed not upon inspection of the batch, but upon the level of quality maintained by an individual or a group and the trend of any quality deviation of the process.

20 Ibid., p. 8.

21 Ibid., p. 11.
In the manufacturing process, the speed and efficiency of the machine are often limiting factors. In clerical processes, the machine is still a limiting factor, but the staff operative workers themselves also are an important element, quality-wise. Therefore, the control program is one of controlling the group, which, of course, is administrative control. Murdock explains their use of statistical quality control in the following quotation:

A strict control would require the keeping of a "control chart" for each clerk with appropriate measures taken in the case of any clerk whose accuracy was below the acceptable minimum. This would be proper if we were dealing with machines. In dealing with people, with their psychological and emotional reactions, it might be unwise to have such controls. In any event, we seldom use them except in an Acceptance Sampling Program. What we want is a method to improve the work of a group of people doing the work without any direct or indirect threat to the security of these people.22

V. SUMMARY OF THE CHAPTER

The development of statistical quality control was begun in the 1920's with the work of Dr. Walter A. Shewhart and others in the Bell System. The most common application of statistical control has taken the form of chart control. Using mathematical formulae developed for sampling techniques, upper and lower control limits are established for a process. The closer control charts are to the work place, the better; for properly understood they stimulate

22 Ibid.
self-coordination and quality-mindedness throughout the organization. As soon as the sampling results are plotted on the chart and a deviation beyond the upper or lower control limits is evidenced, action is taken to find the cause in the process. This gives statistical quality control timeliness and the feature of being automatic.

Statistical quality control is limited in application to a process that produces a large mass production volume. As in most control systems, standards cannot be set on past performance until the system has been in operation long enough to assure the process itself is ready for "normal" operations. There are some products that call for a hundred percent inspection, and, of course, statistical control cannot be substituted. Last, but perhaps most important, the human factor must be considered, and every effort used to promote "quality-mindedness." Application of principles of participation, establishment of accountability, and top level backing of the program are all efforts that will help stimulate self-coordination at all echelons of the organization.

Statistical quality control facilitates the management function of constraining and regulating a process to the end that the quality of goods produced and services rendered is in accordance with the objectives of the organization. It is based upon sampling techniques.
Administrative work measurement relates the quantity of work turned out to manhours expended on those work units. Administrative work measurement is group control of the quantity factor of the end product of a group. Work measurement data can be cumulative totals of time of production and output of line operative workers. However, administrative work measurement, based on performance records in terms of representative work units, is more applicable to the work of staff organizations. Administrative work measurement data on staff groups indicates the status of quantity performance of the group. Statistical quality control of staff organizations indicates quality performance of the same group. Without one type of these control data the other is practically useless. As a matter of fact, if work measurement is applied to situations where quality control is non-existant, quality is assumed to be constant.

As pointed out above in this chapter, the trend of quality can be charted along with the trend of quantity output. The former is indicated by statistical quality control data. The latter is indicated by administrative work measurement data. By observing at what point quality falls below acceptable standards as the work measurement performance rate improves, it is possible to establish an optimum performance rate for an activity. Without such a
comparison of control data, it is entirely possible to push the rate of output too high for economic operations.

Thus administrative work measurement relates the work the group turned out to the amount of manpower it took to do the work. Statistical quality control tells whether the work of the group is within the upper and lower standards of quality required in order to meet the objectives of the organization. It tells whether or not the process is operating within the tolerances of quality demanded.
CHAPTER X
RELATIONSHIP OF MOTION AND TIME STUDY TO ADMINISTRATIVE WORK MEASUREMENT

I. INTRODUCTION

An explanation of the relationship between motion and time study and administrative work measurement should aid in establishing the basic differences in the two. Primarily these differences are concerned with the investigational methods used, the nature of the data resulting from the two, and the purposes to which each is most applicable.

It should be noted that the data are in the form of production records, expressed in terms of representative work units. It is not necessary to record and measure all the work completed by a particular organizational group. In fact, not all the work is so recorded. Time study develops a work measurement standard initially by the application of certain statistical methods to observed data. Performance analysis develops a work measurement standard by the application of certain statistical methods to production records. In the case of routine staff operations, these production records are expressed in terms of representative work units. What is measured is the
effectiveness of group leadership, to the extent that the quantity of group results is a criterion.

It should be emphasized at the beginning that motion and time study and administrative work measurement are not homogeneous management tools. Time and motion study methods are techniques used to measure the time of performance of an operation, or an element thereof. Motion studies are used to improve production methods. Furthermore, the operations to which time and motion are most often applied are line operative projects, found in the production of material goods in manufacturing plants. Administrative work measurement, on the other hand, is a system of reporting data regarding manpower utilization, and the report is always on a group basis. The report reflects the manpower performance of the group—not the individual. Time and motion studies always start with measuring performance of individuals. Note that the data from time and motion studies can be the basis of standards of performance, and these standards can be used in an administrative work measurement report. In such a case, total manhours actually expended by the group in producing their output for a given period (day, week, month, etc.) is compared to the standard manhours for producing that volume of output. The standard time, in this case, is derived from time and motion studies. Time and motion studies are not usually used in this fashion although they are in some concerns. Wherever practicable
administrative performance standards should be based upon operative performance standards. They are usually used to set piece rates or some other wage incentives and in improving methods of production.

On the other hand, administrative work measurement is usually based upon a statistical analysis of performance results, not performance standards set by time and motion studies. Such a system is applicable particularly to measurement of group performance of staff operative workers. It measures group progress of programs. The uses of administrative work measurement have been summarized into the following eight:

1. To control staff operative work.
2. To bring management problems into focus.
3. To determine manpower requirements.
4. To indicate the trend of group performance.
5. To establish accountability for performance.
6. To improve communications.
7. To show departments or areas of possible improvement.
8. To check the results of action taken.

Administrative Work Measurement Leads to Use of Work Simplification Techniques

It is important to note that whether the standards used are based upon time and motion studies or statistical analysis of past performance data, the administrative work
measurement report leads to the use of various work simplification techniques. Administrative work measurement is the barometer which tells the management how the organization is utilizing its manpower. The executive can tell by analyzing reports of departmental units which is effective and which is not. Administrative work measurement indicates where the management problems are, but it does not solve them. Such action calls for application of the management principles and techniques of corrective action. The steps in an overall program of management improvement are summarized in Chapter VI, and Chapter VII of this paper deals at length with follow-up action that should result from analysis of work measurement reports.

Possible programs for management improvement include training programs, programs of developmental projects, and installation of control systems to check results. All these programs lead to the application of some type of work simplification techniques. It will be remembered that the first step in a management improvement program is an analysis of the organizational structure, and procedures survey. Such a program leads naturally to the publication of an organizational manual, dealing with the formal relationships as shown on the organization chart. Such a manual also usually prescribes standard procedures for carrying
out the primary duties of the corporation. This step alone is valuable in eliminating useless work and simplifying procedures.

Job and position descriptions are other forms of work simplification techniques. They uncover wasteful duplication and unnecessary activities. Likewise, the use of flow charts is helpful in analysis of processes and leads to work simplification.

The proper introduction and use of these work simplification techniques are good subjects for supervisory training programs. It gives added meaning to training programs when the subject matter is related to the on-the-job problems. Thus it is that administrative work measurement indicates the problems, and follow-up action leads to use of the different types of work simplification techniques available to help solve the problem.

Differences in Investigational Methods

Another important difference between administrative work measurement and time and motion studies is the purpose for which they are used. If the data is to be used to establish basic times for piece rates or some other wage incentives on individual operations, then time and motion studies are usually employed. If, on the other hand, the purpose is to measure group performance in terms of hours per work unit, then administrative work measurement
standard performance rates, based upon statistical analysis of past performance, is the logical technique to employ. Obviously, if standards have already been set by time and motion studies it would not be advisable to develop independent standards based on production records, but instead to use time and motion standards as a basis.

Time and motion studies set absolute times for performing individual operations, and the investigational method is by observation of the "normal" worker. Standard performance rates, set by statistical analysis of past performance data, are relative standards. The investigational methods are not by observation, but by the application of statistical techniques. Such administrative work measurement standards are relative in the sense that they apply to the present state of development in the industry as reflected in the currently accepted "one best way." As improvements are made in the processes and organizational procedures, the "one best way" is improved, and the standards improve accordingly.

It is the purpose of this chapter to illustrate the basic differences listed above by a rather thorough analysis of time and motion study. The basic concepts and techniques of time and motion study will be given in brief summary form. Some of the more important arguments in favor and against time and motion study will be discussed. The conditions in an administrative work measurement system
which lend themselves to use of standards set by time and motion study will be compared to those which logically suggest the use of standards set by statistical analysis of past performance.

II. THE ORIGIN AND NATURE OF TIME AND MOTION STUDIES

Motion and time study are concerned with finding the most economical and efficient manner of performing manual work. Time study was originated by F. W. Taylor, while motion study was developed by the Gilbreths. Time study was used originally primarily for rate setting. Motion study has developed into a technique for improving methods. Originally motion and time study were not applied to clerical and other staff work, but only to repetitive manufacturing processes. For the most part the workers were primary line operatives. Time study was not applied to secondary or staff operations within the production division.

Shumard defines time study in the following terms:

A science covering the true measurement of time, as applied to industry, in which proper machine performance, methods, human endeavor, and conditions surrounding them are studied for the purpose of analysis and standardization.1

This definition includes much that the other authorities consider to be motion study. Apparently

1 F. W. Shumard, A Primer of Time and Motion Study, p. 3.
Shumard does not differentiate between motion study and time study.

Chane defines motion study as follows:

A scientific analysis of the material, equipment, and methods used in performing an operation or a series of operations in order to eliminate needless and ineffective effort, with the ultimate goal of finding a better way of accomplishing a task.

This author goes on in his discussion to limit time study to setting rates. He says:

Time study is the technique used in determining the standard time required to complete the task.

Barnes points out that it is common practice today to use motion study and time study together, since the two supplement each other. Motion study usually precedes setting standards by time study. Barnes classifies the analysis and evaluation resulting from motion and time study into four uses. His definition follows:

Motion and time study is the analysis of the methods, of the materials, and of the tools and equipment used, or to be used, in the performance of a piece of work—an analysis carried on with the purpose of (1) finding the most economical way of doing this work; (2) standardizing the methods, materials, tools and equipment; (3) accurately determining the time required by a qualified person working at a normal pace to do the task; and (4) assisting in training the worker in the new method.

The One Best Way

The first purpose of motion and time study assumes

3 Ralph M. Barnes, Motion and Time Study, p. 1.
that for each operational situation there is one best way or method of performing the work. Chane states that categorically, "Therefore, the engineer must use the one best way of finding the one best method in order to make his maximum contribution."\footnote{George W. Chane, op. cit., p. 2.} Barnes spells out the concept a little further. He points out that "the best way," or "optimum manner," or "method of maximum efficiency" should be qualified to include "all factors considered." He gives an example of a motor driven pencil sharpener as being the best device for a large office; but the hand-operated one may be the most economical for the small office. He adds:

\begin{quote}
Therefore, what may be the best way in one case may not be the best in another case. It should also be added that the best method for one operator may not be the best method for another operator.\footnote{Ralph M. Barnes, op. cit., p. 2. This point will have particular significance when Abruzzi's views on "the one best way" are discussed in a later section of this chapter.}
\end{quote}

**Process Analysis Techniques**

There are a number of techniques that the industrial engineer can use to improve the methods and procedures for performing work. They deal with an analysis and evaluation of methods, materials, tools, and equipment, and working conditions. Process analysis is conducted through use of such tools as the process chart, flow diagram, and gang
process chart. The process chart uses symbols, along with process descriptions of each step, to indicate the order in which steps in the process are performed. The flow chart shows the flow of the work through an office or factory in diagram form. The gang process chart is an aid to studying the activities of a group of workers. It is a composite of individual process charts arranged to permit thorough analysis.  

A program for improving methods of a series of operations in a process should include analysis of the individual operation also. Such an analysis may be in terms of degrees of refinement ranging all the way from a simple description of the steps performed to a micromotion study of the job. An operator's chart describes what movements are made. For example: "left hand, reaches for washer in bin." Micromotion, on the other hand, indicates time in two thousandths of a minute. Operation analysis usually includes (1) motion study, (2) a cursory analysis of the operation, and (3)—these two followed by a detailed

---

6 The purpose of discussing the techniques used in connection with motion and time study is to describe briefly the processes that they may later be compared to those used in connection with administrative work measurement. Fuller explanation of techniques used with motion and time study can be found in any one of a number of good texts on the subject, such as Ralph M. Barnes, Motion and Time Study, 3rd edition, N. Y.: John Wiley and Sons, Inc., 1949.
study of the operation by elements or by therbligs, which involves micromotion study. The investigational method used in analysis of the operation is observational in each of the above cases.

III. MOTION AND TIME STUDY TECHNIQUES

In order to convey the general impression of the manner in which motion and time study are conducted, it may prove beneficial to explain briefly some of the more important techniques. They include a discussion of the stop-watch procedures and motion picture techniques.

According to the American Society of Mechanical Engineers, Frederick W. Taylor first used time study in the machine shop of the Midvale Steel Company in 1881.

Methods of Operating Stop-watches

There are two basic methods of recording time from a stop-watch, (1) continuous timing and (2) repetitive or snap-back timing. In the continuous method the observer starts the watch at the beginning of the first element and lets it run during the whole period of the study. The time study man notes the time at the end of each element and records it.

In the snap-back method the hands of the watch are returned to zero at the end of each element. There is an

---

alternative snap-back arrangement that uses two stop-watches. When the observer pushes the lever, one watch stops and the other starts, thus recording delays as well as operations. It is not the purpose of this discussion to decide which is the better but only to describe briefly both systems.

**Motion Study and Use of the Chronocyclegraph and Micromotion Study**

The names of Frank B. Gilbreth and his wife, Lillian M. Gilbreth are closely associated with motion study. The work he did in improving efficiency in the laying brick is well known. The Gilbreths are also well known for their work in the study of fatigue, monotony, transfer of skill, and work for the handicapped, as well as the development of such techniques as the process chart, micromotion study, and the chronocyclegraph.

The Gilbreths originated the term micromotion. The technique was first made public at a meeting of the American Society of Mechanical Engineers in 1912. In a micromotion study, a motion picture is taken of the operation. In the picture is also a timing clock. By this means the fundamental element or subdivisions of an operation may be studied. The Gilbreths made little use

---

of the stop-watch, preferring the more exact method of motion pictures.

Frank Gilbreth developed seventeen elementary subdivisions of a cycle of motions, which he thought were common to all kinds of manual work. He coined the word "therblig" to describe any one of these seventeen motions. Incidentally, "therblig" is Gilbreth spelled backwards.9

Gilbreth also developed the chronocyclegraph. It is a device for the study of motions. A photographic record can be made of the movements of a worker by recording the path of motion in three dimensions by attaching a small electric light bulb to the finger, hand, arm, etc. A stereoscopic camera is used for this purpose.

IV. SETTING TIME STANDARDS AND RATES

The time standard for the performance of a job is the heart of motion and time study. The best method having been established, the stop-watch or some similar timing device is used to determine the standard time to perform the operation. On the basis of these data the day-to-day performance of repetitive workers can be compared to the standard. The standard is used as a basis for establishing the piece rate, and wages will be reflected in actual

performance compared to standard. Thus, the standard can be used as a basis for anyone of a number of incentive wage payment plans.

The determination of a standard usually entails the use of the stop-watch. The operation is divided into elements. Barnes goes on to explain the procedure as follows:

A selected or representative time value is found for each of these elements, and the time values are added together to get the total selected time for performing the operation. The speed exhibited by the operator during the time study is rated or evaluated by the time-study observer, and the selected time is adjusted by this rating factor so that a qualified operator, working at a normal pace, can easily do the work in the specified time. To this normal time are added allowances for personal time, fatigue, and delay, the result being the standard time for the task.10

As noted in the "Introduction" to this chapter, standards set by time and motion studies employ "observational" methods of investigation, and the standards set are in absolute times for performance of the elements of the operation. The fact that another man (the time-study expert) observes the performance of the first man (the operative worker) and then makes a subjective

10. Ralph M. Barnes, op. cit., p. 3. It should be noted that "synthetic" standards have been used in office work. These are standards that are estimated by means of mathematical tables or formulae which have been derived from recorded time-study observations.
evaluation rating the worker percentage-wise to the "normal" worker has been the alleged basis of many labor disputes. Many firms have been able to explain time and motion studies to the satisfaction of the workers, however. As a matter of fact, it is not uncommon for unions to have their own time-study men working side by side with company time-study men.

**Uses of Motion and Time Study**

Motion and time study have broad and far-reaching applications in the field of industrial management. Up to the present writing, motion and time study has been applied primarily to factory situations involving highly repetitive work. Primarily the application has been toward analysis of direct labor costs.

Barnes points out, however, that motion and time study is applicable to many other areas of work besides direct labor in a repetitive production situation. He claims:

> Although motion and time study is most commonly applied in the factory and the office, the principles are universal and may be equally effective wherever manual work is performed. 11

He goes on to cite examples of motion and time study being used in banks, mail order houses, department stores, supermarkets, and on the farm. It is also being used to

---

simplify the housewife's tasks in the kitchen.

From the standpoint of industrial management, motion and time study of the individual operation has often led to more extensive analysis into production processes, involving the redesign of products and layout of machines. In this sense time and motion studies lead to use of work simplification techniques. As noted in Chapter II of this paper, under the subject of "The Present State of Development of Work Measurement," Leffingwell and Robinson advocate the use of time and motion study to improve the process of office operations, but not for setting standards of performance.12 The examples that Barnes gives of the application of time and motion study to office operations and other staff work deal with a relatively few operations that are highly repetitive. Otherwise the system for accounting for a large number of subfunctions becomes very cumbersome and, consequently, costly.

Phil Carroll devotes a chapter to the subject in his latest book.13 He criticizes the present practice of relating overhead costs proportionately to direct labor or to sales dollars. He maintains:


13 Phil Carroll, How to Chart Time Study Data, Chapter 3, "What About Indirect?" pp. 23-39.
In contradistinction, overhead costs—particularly those of overhead labor are not proportional to output because of the substantial fixed expenses included. This might be described as the cost of the nucleus of the organization. This set-up element is incurred chiefly in indirect labor cost and may approximate 20 per cent of the total cost of business at normal volumes. Such amounts are too large to be overlooked.14

Carroll recommends measurements and job standards for indirect labor work. At the same time he warns: "Therefore, care must be exercised in measuring indirect operations to make certain that standards are established in terms of fair work requirement of the operation itself. At the same time, it is necessary to set up also the means for controlling the repetition of the work."15

Carroll seems to be thinking here of indirect labor jobs which are fairly repetitious. He also is thinking of setting up incentives for individual workers performing staff work, and he points out that much more can be done than has in the past in this field. The writer concurs and where job standards can be set up for work that is even fairly repetitious, such practice could be integrated into a work measurement system that is able to measure even a greater segment of indirect labor.

How work measurement can be applied to indirect labor jobs that do not lend themselves to motion and time study

14 Ibid., p. 31.
15 Ibid., p. 34.
is illustrated in some of the activities which the project measured in its experimental work. Work measurement was applied to a Navy school. The work of the instructors was measured. The functions they perform were analyzed and the time spent on each recorded. Such reports are valuable in justifying the extent of the work load of individual instructors, and they also help to justify the number of instructors in relation to trainees. Nevertheless, strict application of motion and time study could easily cost much more to conduct than its benefits warrant. The problem of incentive in this case involves much more than answering the questions "how long did you teach, and how many?" There are many indirect labor jobs the primary characteristics of which are not their repetitive operations. An example of this is the Masters-at-Arms in the Navy. One hour they may be on guard detail, next an inspection, then a funeral or parade detail, and often just in stand-by status. Work measurement is not so much concerned with setting up a job standard for individual Masters-at-Arms. Work measurement is more interested in controlling the overall activities of the group of Masters-at-Arms. Thus simple statistical standards can be applied in some situations where motion and time study are not too practical.

V. STATISTICAL QUALITY CONTROL METHODS APPLIED TO MOTION AND TIME STUDY DATA

The motion and time study methods described above come
in for critical analysis in Abruzzi's latest book. He particularly questions present motion and time study practices of establishing standards of "normal time" for operations, the establishment of standard allowances for various types of delays, and he questions the validity of standards for groups of motions. Abruzzi terms present procedures "subjective," and recommends his adaptation from statistical methods used for quality control. His methods are based upon the works of Shewhart and others. Abruzzi bases his findings and conclusions primarily on research conducted in several garment plants in New York City. The objectives of the research are set forth in the following terms:

The goal of the research program was to develop estimating procedures that could be verified in terms of the modern theory of experimental inference. These procedures will not make it possible to predict how much time industrial work should require in terms of some hypothetically "normal" worker. In fact, it will be shown later that the amount of time required for any work can have scientific meaning only with respect to a set of predetermined specifications. Under these conditions current rates of production can be compared to the specifications to determine whether they are economically acceptable.17

16 Adam Abruzzi, *Work Measurement, New Principles and Procedures*, p. 19. Abruzzi points out the subjective nature of present motion and time study data throughout the book, but specific reference is made on page 19 regarding this point.

Standard Data Procedures Declared Invalid

Abruzzi goes to great length to illustrate reasons why he feels standard data procedures are invalid. One of the basic reasons, he claims, is that operators can and do regulate their own output. He uses quotations from Golden and Ruttenberg, Presgrave, Whyte, Mathewson, Roethlisberger, Gardner and Mundel to substantiate his claim. 18

Abruzzi also questions the use of the concept of the normal worker as being highly subjective. He questions, too, whether or not individual elements can be added together to arrive at a standard time for an operation. An expression of his views are indicated in the following:

Ryan also comments on Segur's assertion that motion times are constant within reasonable limits. According to Ryan, this is inconsistent with experimental evidence (such as that described in this book) showing that individual workers differ in their production rates. In any event the use of standard data is justifiable only if it can be shown that element times may be added without considering the relationships among movements.

Edwin Ghiselli and Clarence Brown severely criticise the fundamental standard-data assumption that each movement involved in an operation is independent of all the others. Actually, they emphasize, the individual works on the operation as a totality, which implies that each part of the operation affects all the other parts. In support of their views, these writers present the results of a simple and very fast key-tapping experiment; this experiment showed that eliminating two of the movements did not

18 Ibid., pp. 16-17 and 22-23.
reduce the cycle time as much as had been expected.19

"One Best Way" Questioned

Abruzzi criticizes "the one best way" concept on the same basis as he does the standard data concept. He claims:

In both cases, for example, elements and motions are defined descriptively, giving the erroneous impression that they are independent. However, it is clear from the experimental data in this book that such elements and motions are often correlated.20

An Evaluation of Statistical Methods Applied to Motion and Time Data

Abruzzi points out that the difference between his statistical method of determining standards and present-day time study procedure is the application of statistical sampling procedure. While time study procedure ordinarily consists of taking a single limited set of readings on one worker at an arbitrary time, the statistical method makes use of chart control. The use of control charts was described in Chapter IX of this paper under the discussion of statistical quality control.

As Shewhart warns, statistical methods are limited in their validity to the application of instances that involve repetitive conditions of great numbers. In order that upper control limits and lower control limits can be set, it is necessary that a condition approaching statistical

19 Ibid., pp. 125-126.
20 Ibid., p. 218.
stability be reached. In the case of time and motion studies such as Abruzzi's, the decision of when a random sample is in the state of statistical stability involves subjective judgment. Abruzzi recognizes this fact; but expresses the belief that a great number of random samples is more reliable than the present motion and time study procedure of only a few samples.

Let us grant, for the moment, Abruzzi's contention that workers control the rate of work. In view of the fact that any number of samples of operative time for any particular job is controlled by the workers themselves, in the same manner as in a motion and time study, it is difficult for this writer to comprehend how the results of such statistics can be much more representative of a "fair day's work" than that set by time and motion procedures. In the final analysis, following Abruzzi's reasoning, it would seem that time and motion procedures depend upon the subjective evaluation of the observer. On the other hand, use of statistical sampling methods described by Abruzzi result in the standards being set by the collective subjective decision and evaluation of the workers themselves. This is based on the idea of Abruzzi's that workers determine their own rate of working.

The data of Abruzzi's methods are based upon actual present and past performance of operative workers. Such methods give no assurance at all that past performance is
the most effective from the standpoint of producing the most with the least effort. Abruzzi states that when performance data fall outside the upper or lower control limit that it is due to assigned causes; and he hints that this information is valuable in leading to causes of ineffective management. Little space is devoted in his book, however, to an explanation of exactly how such data can be used to improve management. If the only purpose of the time and motion study is to be solely the establishment of piece rates on the basis of past performance, then there is much to recommend his system. For methods of improving management, however, much more still needs to be done.  

21 From the writer's analysis of the ideas presented in Dr. Abruzzi's book on Work Measurement, New Principles and Procedures, there are some very important differences between his application of the statistical methods in arriving at standards for operative projects of job orders in a manufacturing plant (the garment industry) and the simple statistical procedures used in the Navy pilot studies in establishing standard performance rates for group control of staff operations. As a matter of fact, the only similarity is in the use of the term "statistical."

The two methods are entirely different. Abruzzi applies Shewhart's principles of statistical quality control to the problem of setting standards for performance of a physical operation. Past performance data is used to set upper and lower control limits, between which any performance will be acceptable. It is important to note that there is nothing in Abruzzi's system, as far as the writer was able to ascertain, which would result in the improvement of past performance. As a matter of fact, Abruzzi did not seem
The engineers and business leaders, who have built large mass production plants upon the application of "the one best way" and other principles, have a great deal of empirical success to recommend continued use of such ideas.

(footnote No. 21 cont'd.) to be interested in improving the process. He is concerned primarily with finding a reasonable way of setting piece rates without using time and motion studies, which he feels are invalid procedures for setting rates.

The simple statistical methods advocated in the primary research of this study are not an application of Dr. Shewhart's principles of statistical quality control. No upper and lower limits are set within which performance is assumed to be normal. Standards are set on past performance data, but two safeguards are built into the system to assure performance is not forever tied to mediocrity. (1) From an array of past performance rates, the arithmetic mean is determined. The standard, however, is not set at this point, which would tie future performance to the past. The standard is set a point between the mean and the best past performance rate. (Two methods are suggested for this calculation. One is to set the standard at half way between the mean and the best performance rate. The other is to set the standard one standard deviation below the arithmetic mean) (2) The administrative work measurement system calls for an analysis of the organizational structure and procedures, before data for establishing standards is collected. This implies that the organizations being measured will start collecting data when they are operating under the "one best way." Further, the system calls for continuous review of work measurement data in an effort to locate problems and institute a continuous management improvement program through the application of principles of sound organization structure, effective procedures, and work simplification techniques. Standards which apply to administrative work measurement are discussed in Chapter VI of this paper. See also the Final Report, op. cit., "Local Command Work Measurement Manual," Appendix A, "Setting Standards Based on Performance Data," pp. 11-42 to 11-49.
If Abruzzi's findings apply universally, then what is to be substituted for the "one best way?" It is entirely possible that the problem here is but one aspect of the larger problem of the place of the individual in a large impersonal industrial society. One methods improvement man laments the fact that the workers can in ten minutes cut the heart out of an improvement idea which it took him all night to figure out. May not the problem, then, be one of determining how to deal with people?

Certainly, the statistical methods of sampling developed by Shewhart and his co-workers primarily at the Bell System present great possibilities of indicating when a system or procedure is in or out of balance. More needs to be done in the direction of perfecting the use of such statistical methods in industrial problems involving all the factors and forces in the situation—the physical factors of plant and equipment, the industrial leadership, the element of labor, and outside social and physical factors. This is not an argument against use of modern statistical sampling methods. It is simply a reminder that, like all methods of control including work measurement, statistical methods solve no management problems by themselves. They can help by pointing out where the difficulties are to be found. More, from an analysis of the work situation, one is forced to agree with Mary Follett, Whyte, Roethlisberger, Elton Mayo and others,
who see the complexity of the factors and pressures, physical and social, within and from without the plant that all play a part. The problem is to maintain proper balance. Under these conditions, perhaps the question becomes "what is the one best way—from the standpoint of psychology, sociology, industrial management, and even philosophy."

There is a need for some such method as statistical sampling control to tell when the whole process is deviating from normal and to indicate where and what the assigned causes are. Until more progress is made in this direction, it would seem to this writer folly to substitute for the concept of the "one best way," granting all Abruzzi's claims of its statistical imperfections, a concept of statistical control, chained to past performance. This last statement is based on the assumption that the "one best way" implies constant search for improvement, and that there is not this innovational drive in any system whose criteria of success is based on past performance alone.

VI. SUMMARY OF THE CHAPTER

Motion and time studies are concerned with finding the most economical and effective manner of performing primary operative work. Such studies are used to set standards on time to perform elements of operations, and so are the basis for wage incentive plans. Motion and
time study has found its greatest acceptance and use in measuring direct labor, although it is applicable to indirect labor to a much larger extent than it is presently being used.

Dr. Abruzzi is recommending that standards be established by applying statistical methods similar to those developed by Shewhart for quality chart control. Stop-watch or motion pictures would be used to record the time of different operatives take to perform operations. By application of the random sampling technique upper and lower control limits would be used to indicate "assigned causes" of deviations of the operation from normal. To the writer this system appears primarily a statistical method for determining time standards for operations on the basis of past performance. It is not clear how such a system would provide for management improvements, and, therefore, it seems inadvisable to abandon the present motion and time study and the concept of the "one best way" until more effective methods for improving operations are determined.

The primary differences between motion and time study and work measurement are ones of degree and purposes. The former is used mostly for measurement of direct labor of repetitive operative work. It is used for setting time standards and wage rates on operative work. Administrative
work measurement can be used to measure indirect labor as well as direct and is applicable to many staff operative jobs which do not lend themselves to measurement by motion and time study. Simple statistical methods are not used to set refined time standards of elements of work, but they are used instead as standards of activity, and provide a basis for management improvements. Whether performance standards are based on time study or on statistical analysis of performance results, administrative work measurement data leads to the use of various types of work simplification techniques.
PART III - ANALYSIS AND EVALUATION OF FIELD SURVEYS AND PILOT STUDIES ON ADMINISTRATIVE WORK MEASUREMENT

CHAPTER XI

ANALYSIS AND EVALUATION OF FIELD SURVEYS ON MANAGEMENT PROBLEMS AND DIFFICULTIES

I. INTRODUCTION

Part II - "Establishment of Accountability and Preventive Correction" is a discussion of the basic principles of management controls. It emphasizes the proper place of administrative work measurement in planning, organizing, and controlling the activities of an enterprise. It also discusses the relationship of administrative work measurement to other controls such as statistical quality control, budgetary control, and operative work measurement based upon time and motion study. Part III is concerned (1) with an analysis of the field surveys on management problems and difficulties and (2) with an analysis of the pilot studies on administrative work measurement conducted at the Naval Training Centers at Great Lakes, Bainbridge, and San Diego. These surveys and pilot studies will be evaluated on the basis of the principles and practices discussed in Part II.
II. PRELIMINARY INTERVIEWS

The first field work on the Navy project was a survey of the management problems and difficulties being experienced by Naval officers at USNTC, Great Lakes and USNTC, Bainbridge. In September, 1952, seventy-five interviews were conducted with a cross-section of Naval personnel at all echelons of these two stations. From the results of the management difficulties survey, a questionnaire was designed. The purpose of the questionnaire was primarily to provide an instrument which would aid in the analysis of management problems and difficulties at Naval shore stations. A test of the survey was conducted at USNTC, Great Lakes during the period 13-20 November 1952. As one of the results of the survey, the questionnaire was further refined and revised. It was given to Naval officers at USNTC, San Diego during the period March 30 to April 15, 1953. The final form of the questionnaire appears as "Command Management Check List (Form II)" and is included in this paper as Appendix A.

Method Applied to Preliminary Interviews

The mission of the Navy project was defined in general terms as being that of suggesting methods and techniques by which Naval officers in executive positions at shore stations could become more effective administrators and consequently effect more efficient management of shore stations. Before specific recommendations could be
offered, it became apparent that an analysis of the specific difficulties and problems at shore stations was necessary. This is a simple application of the scientific method to management problems, the first step of which is the analysis of problems and difficulties.\textsuperscript{1}

The method used during the seventy-five interviews at Great Lakes and Bainbridge was to explain to the people contacted that the researchers were not interested in uncovering problems at their station \textit{per se}, but that the interviewers were interested in those problems which might be representative of management problems at Naval shore stations in general. Interviewees were encouraged to discuss any problems they felt had an important bearing upon the management of the station. Care was taken to point out that the problems gathered would not be associated with the names of individuals.

The people interviewed represented a cross-section of the organization, consisting of those in the top management level of administration, those in middle management, and those who are first line supervisors, as well as a few on the operative or production level.

\textsuperscript{1} Dutton's interpretation of the scientific method is discussed in Chapter VI of this paper. See page 210 and footnote 22. The definition of scientific management as the application of reflective thinking to determine facts and principles in the solution of business problems is discussed in Chapter II, page 15 and footnote 4.
Results of Preliminary Interviews

The suggestions from those in the field, statements of difficulties and management problems, and observations of the interviewers become the subject of "Progress Report Number 2," which was submitted to the sponsors of the Navy project, the Personnel Analysis Division of the Bureau of Naval Personnel, on October 29, 1952. The statements of problems received from the field are listed in Appendix A of "Progress Report Number 2." A summary tabulation of the eleven problem areas disclosed by the management survey at USNTC, Great Lakes and USNTC, Bainbridge is given in Table No. 9.

Evaluation of Preliminary Interviews

The chief value of the preliminary interviews was an indication of the areas of management in which the Navy project could most profitably conduct research. An indirect result benefiting the researchers was a more realistic feeling for the problems that face Naval officers in executive positions at shore stations. Evaluation of the statements of problems and difficulties indicated the desirability of variflying the findings of the interviews with a larger sample of Naval personnel. Also there were raised further questions about the problem areas. What was the degree of seriousness of the problems? What was the urgency? What is the status of understanding of the principles of good management among the Naval personnel
### TABLE 9

**SUMMARY TABULATION OF TYPICAL MANAGEMENT PROBLEMS FOUND AT LARGE NAVAL STATIONS**

<table>
<thead>
<tr>
<th>PROBLEM AREA</th>
<th>NUMBER OF TIMES EXPRESSED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bainbridge</td>
</tr>
<tr>
<td>1. Communications and coordination</td>
<td>17</td>
</tr>
<tr>
<td>2. Turnover and Rotation</td>
<td>6</td>
</tr>
<tr>
<td>3. Paper Work and Red Tape</td>
<td>8</td>
</tr>
<tr>
<td>4. Civilian Employees and WAVES</td>
<td>8</td>
</tr>
<tr>
<td>5. Work Measurement</td>
<td>4</td>
</tr>
<tr>
<td>6. Organizational Structure</td>
<td>10</td>
</tr>
<tr>
<td>7. Handling People</td>
<td>5</td>
</tr>
<tr>
<td>8. Morale Problems</td>
<td>5</td>
</tr>
<tr>
<td>9. Public Relations</td>
<td>8</td>
</tr>
<tr>
<td>10. Extra Military Duties</td>
<td>2</td>
</tr>
<tr>
<td>11. Classification and Promotion</td>
<td>3</td>
</tr>
<tr>
<td>12. &quot;No Problems&quot;</td>
<td>2</td>
</tr>
</tbody>
</table>

*Source: Interviews with seventy-five Naval Officers in executive positions, giving their evaluation of important management problems at Naval Shore Stations. Conducted during September, 1952 at USNTC, Great Lakes, Illinois, and USNTC, Bainbridge, Maryland, as part of The Ohio State University Research Foundation Project NOrn 1195(05).*
concerned? What were the feelings or points of view of the personnel? All these questions had a bearing on what kind of a management improvement program should be undertaken.

The preliminary interviews were a step in the right direction, but the mission of the Navy project needed further clarification. The interviews, therefore, were followed by a more systematic management survey.

III. COMMAND MANAGEMENT SURVEY AT USNTC, GREAT LAKES

A command management survey, consisting of a questionnaire and follow-up interviews, was conducted at USNTC, Great Lakes during the period 13-20 November, 1952. The purposes of this survey were:

1. To get a measure of the degree of understanding of the management areas making up the subject matter of the questionnaire, namely, such areas as work measurement, organizational structure, the group discussion meeting, work simplification, etc.

2. To get a measure of the feeling or point of view toward the management areas making up the subject matter of the questionnaire.

3. To bring the management areas to the attention of Naval personnel in an effort to increase their interest in the importance of good management.

The items in the questionnaire were based on information gathered from previous interviews in the field. The questionnaire was pre-tested with the voluntary assistance of officers of the NROTC of The Ohio State
University and selected officers at the U.S. Naval Air Station, Columbus, Ohio. It is reproduced as Appendix A of this paper. The final revised instrument was then administered to 205 Naval personnel at Great Lakes. Out of the total of 205 questionnaires submitted, 194 were completed. This gave an unusually satisfactory return of 94.6 percent and is indicative of the outstanding cooperation that was given the Ohio State representatives by the Center Commander, his staff, and entire personnel on the station.

After the questionnaire was administered, follow-up interviews were held with selected officers whose answers indicate they might be productive sources of information and reaction. Particular attention was given in the follow-up interviews to the subjects of work measurement and the group discussion meeting.

**Method of Structuring the Survey**

In order to measure differences between echelons of administrators, returns are tabulated on the basis of three classifications: Class A is made up of captains and commanders, Class B includes lieutenant commanders and lieutenants senior grade, while Class C is made up of lieutenants junior grade and all below, including a few enlisted personnel who are first line supervisors.

From the above structuring, the survey resulted in the following totals:
Thirty-five percent of the officers were not then performing administrative duties. They were tabulated separately to detect any particular bias due to isolated problems which might be peculiar to the station at which the survey was being conducted. It should be noted that no serious bias is recognized in the results.

Likewise, it was discovered that there were no significant differences among the answers from officers of the three classifications.

Results of the Management Survey

A detailed tabulation and analysis of the findings of the Great Lakes Command Management Survey are presented in Progress Report No. 3, submitted to the Bureau of Naval Personnel on December 19, 1952. An analysis and evaluation of the results of the survey led the Navy project to make certain conclusions and recommendations.

---

2 Progress Report No. 3, The Ohio State University Research Project No. 495(05), Dec. 19, 1952. (For Navy distribution only; on file in The Bureau of Naval Personnel.) The writer quotes only summary data, thus avoiding criticism of individuals or particular stations.
First, the results of the questionnaires answered by 194 officers, substantially verified the list of problem areas summarized from the preliminary interviews. The management problems fall into the following ten areas:

1. Work Measurement
   (a) Need of local commands for a better understanding of the present Integrated Navy-wide Shore Establishment Work Measurement System. (Sixty-four percent know nothing about it.)
   (b) The place of work measurement in managing a local command.

2. Organizational Structure
   (a) Need to know fundamentals of charting, billet description, and other organizational analysis techniques.
   (b) More important, need for an understanding of the organizational relationships, formal and informal.

3. Communication and coordination of effort manifests itself a problem in several ways.

4. Work simplification techniques are not well known.

5. Improved group conference techniques as an important means of expediting and facilitating communication and coordination of effort.

6. Incentives and motivation present the problem of tying in with immediate objectives of the local command.

7. Proper personnel assignment to increase better manpower utilization.

8. WAVES and civilian employees present special problems.

9. Leadership in command management ashore is different from that called for in billets aboard ship.

10. Training and indoctrination on command management.
Second, the analysis of the data from the survey and information gained by interviews and observations of interviewers led to certain conclusions that were to determine the future course of the Navy project. Major points among the conclusions included the following:

1. The problem of justifying manpower utilization was an urgent one. Higher authority was demanding action on this problem.3

2. It was concluded that accountability for manpower utilization must be established, and that work measurement was the logical system to establish this accountability.

In addition to the above conclusions, the Navy project made a number of recommendations. The three major ones are as follows:

1. That a formal training course be established to indoctrinate officers going to shore billets in principles and practices of effective management. The course would have as its ultimate objective improved management of the shore establishment, in the same manner that indoctrination courses, preparatory for sea duty, have as their ultimate objective a more efficient sea-going Navy.

2. That coordinative staff functions be performed by the Management Engineering Departments at large shore stations.

3. A program of management improvement be established. A major part of such a program would be the installation and operation of a work measurement system.

---

3 See Chapter II of this paper, pp. 48-60 for a discussion of the increased emphasis upon efficiency in government, particularly upon effective manpower utilization and work measurement.
Evaluation of the Management Survey

The questionnaire and follow-up interviews proved a successful device in affording an analysis of the status of (1) the management problems at a station, (2) the degree of understanding of some of the management principles and techniques (such as the concept of organization structure and uses of work measurement), and (3) the attitude, feelings, and points of view of people in the field toward these factors. In a sense, however, the survey in and of itself "saved no souls." It did not, of course, solve any problems.

Progress Report No. 3 was taken to the Bureau of Naval Personnel and provided the basis for the conference at which future plans of the Navy project were formulated. The opinion was expressed by some of the sponsoring Navy group in the Bureau that while the survey seemed to be a practical device for calling attention to problems, yet it did not tell the Bureau of Naval Personnel anything they did not already know. Further, what the people in the Bureau seemed to conceive as the situation in the field may be summarized into two conclusions: (1) that the local officers needed to have at their command more techniques of management, and (2) that it was urgent that something be done by way of accounting for manpower utilization. The other branches of the Armed Forces were beginning to install some form of work measurement systems. There was a good
deal of discussion pro and con in the Services--on the informal, grapevine level--and it appeared desirable to investigate the possibilities of work measurement further, especially in view of pressure from the top to do something about accounting for manpower as part of a management improvement program.

A point in favor of the survey should be noted. While the survey may not have told some officers in the Bureau anything new, it did verify the situation. Further, it was the conclusion of the interviewers from their observations that the survey made a good many officers in the field aware of the manpower utilization problem and other management problems to a greater degree than before and in ways which showed them the seriousness and importance of those problems.

1. Evaluation of Recommendation for a Training Course

The recommendation for the establishment of a course to train officers in the fundamentals of management was based on the conclusion from the survey that there exists a need for such training. The idea was expressed in the following two paragraphs of the "Summary Report" of Progress Report No. 3.4 It was concluded:

That solution or improvement in areas of the problems and difficulties of command management depends on

improved administrative practices and use of proper management techniques by naval officers at the local command, especially in regard to more effective manpower utilization.

That something in addition to traditional manuals and directives is needed in order to "get the story across" on a Navy-wide, continuously sustained basis.

The recommendation was taken under advisement. While there was agreement on the need for such training, the establishment of such a course in the Navy is a long-term problem and process. In view of trend to cut down on training activities which take officers away from their regular duty stations, the adoption of the recommendation did not seem immanent.

2. Evaluation of Recommendation for Use of a Coordinative Staff

A management engineering staff was in operation at USNTC, Great Lakes when the members of the Navy project from The Ohio State University began working with that station. It was the cooperation of the officers and enlisted personnel in the Management Engineering Office which made possible the rapid administration of the survey, and this fine cooperation was extended throughout the entire year of the project. The Management Engineering Staff, however, operated more as a technical staff, advising the commanding officer on particular technical aspects of management, rather than operating as a coordinative staff.
to facilitate the functions of control.  

For example, the Management Engineering Office works on such projects as an organizational manual, a survey of use being made of vehicles, and similar studies. This writer sees such projects as the proper work of that office, but feels that the Management Engineering Office should also perform the staff functions of control, in order to perform its technical functions with greatest effectivity. Also, if the Management Engineering Office at a large Naval station like those at Great Lakes, Bainbridge or San Diego performed the staff functions of control, such activity would be beneficial in relieving commanding officers of a vast amount of detail paper work, which they indicated during the survey is a serious problem to them.

The co-director of the Navy project emphasized that without some kind of reporting system that would facilitate analysis of the activities of the organization, any program of management improvement is a hit-and-miss endeavor. Likewise, without a reporting system that will indicate the

---

5 See Chapter IV of this paper, particularly page 135, Figure 9, "Relation of Top Line and Staff Organizations," where the difference between a technical staff and a coordinative staff is emphasized.

6 See Chapter IV of this paper, pp. 96 to 152. The functions of control are discussed in Section II. See particularly page 104, Figure 1: "The Organic Functions of Control." The staff functions of control are routine planning, scheduling, preparation, dispatching, and comparison.
management problems and difficulties, important areas of management problems may go unnoticed until the situation calls for emergency action. The purpose of the coordinative staff is to gather data, analyze, and report to proper line authority their findings of what is going on in the enterprise, in comparison to what ought to be happening. Then the coordinative staff may perform the functions of a technical staff in recommending corrective and preventive courses of action. Without such analysis, the work of the Management Engineering Office cannot help but be hit and miss.

On the basis of the survey (including interviews, suggestions and observations as well as the results of the questionnaire) the Navy project made the following recommendation in Progress Report No. 3;7

1. Establishment of the Billet of Administrative Coordinator

It is recommended that the Bureau of Naval Personnel study the recommendations set forth in the "Final Report of the Management Committee" at the Annual Naval Training Center Conference, held at the U. S. Naval Training Center, Bainbridge, Maryland, on 13-17 October 1952. The Ohio State group recommends adoption of that committee's

proposal with the possible two following changes or additions:

That the functions of the billet include more than the technical aspects of command management. That the principal duties of this office be those of administrative staff service, whereby this office is the coordinator between the commanding officer and his department or division heads. Such functions involve conferences on plans and policies; setting up systems and procedures; and also handling the details of a system of reports, analyses, and follow-up action. The administrative staff, thus, has two functions: (1) the coordination of thought and (2) the coordination of action. Such functions better enable a center commander to gain the overall picture of what is going on in his organization.

For the reasons outlined above, the writer feels this recommendation has great potential benefit to effective management of Naval shore stations. As pointed out in Chapter IV of this paper, the use of an advisory staff to perform the functions relating to the information details of coordination of overall activities is not foreign to the military. Its use is found in the general staff. Nevertheless, the use of such a coordinative staff at local Naval shore stations is not the usual practice. The traditional organization calls for the Commanding Officer to rely heavily upon his Executive Officer (second in command) to perform the functions which could be performed

---

8 See Chapter IV of this paper, pp. 116-118, especially footnote 8 quoting Lyndall F. Urwick and Ernest Dale, "Profitably Using the General Staff,"
by the coordinative staff plus a good many line duties which cannot be delegated to a staff organization. The writer's personal evaluation on this recommendation is that some progress has been made in introducing the idea of the coordinative staff, but it is generally a new management concept. The writer feels that the usefulness of the coordinative staff needs to be demonstrated at several Naval stations, before its application is to become widespread.

3. Evaluation of Recommendation for a Management Improvement Program

The third major recommendation of Progress Report No. 3 is a program of management improvement that is designed to take care of present management difficulties and also to continue as long as the enterprise exists. Its forward-looking activities are designed to discover problems before they become serious, and provide the machinery for solving such problems. This is an application of the scientific method to management problems. In brief such a program consists of three steps. First is the installation stage and consists of establishing a sound organizational structure in view of the mission and objectives of the enterprise. The first step also includes a survey of management problems and difficulties. The second step consists of establishing a program of developmental projects adapted to the management problems discovered.
Such projects include the application of the various work simplification techniques. The third stage or step consists of a program that is based upon the performance of the control functions of comparison and corrective action. Work measurement has the potentialities of facilitating these functions.

The following steps were recommended in Progress Report No. 3, as those necessary for the establishment of a continuous program of management improvement:

1. Establish the mission and spell out the objectives of each unit of the organization, if this has not been done.

2. Establish the organizational structure.

3. Conduct a command management survey of each unit of the organization to determine any difficulties existing at the station.

4. Set up a program of developmental projects that is adapted to the needs of the station, e.g., such projects would include organizational analysis, making billet descriptions, setting up progress reports and follow-up conferences.

5. Wherever possible, fill billets with officers with administrative background. Attending the Indoctrination and Refresher Course in Command Management should be a prerequisite.

6. The local command should participate in the continuous Conference Training Program. (Seminars).

7. Conferences between representatives of top command of the local station and a particular unit or group.

8. Set up administrative controls to see that
performance is reaching the stations' objectives and missions, and in accordance with approved methods. 9

Such a program has the potentialities of affording local Naval stations with a definite program in which supervisory personnel at all echelons of management may be given an opportunity to participate. As a result of

---

9: See Progress Report No. 3, op. cit., p. 6. See also Chapter VI of this paper, pp. 210-217 for a discussion of the application of the scientific method to the solution of management problems. In their brochure, "Teamwork in Business Management," published in 1954 for private distribution, Booz, Allen, and Hamilton, Management Consultants, Chicago, Illinois, outline their method of approach. The following is found on page 5 of this reference:

"In performing these services for our clients, our work breaks down into these five phases: (1) we obtain and study the facts pertinent to the problem or situation; (2) we analyze these facts; (3) we prepare a program of recommendations for action for the correction or improvement of the weaknesses found; (4) we present and review this program with the management involved; and (5) after the program is accepted, we plan and assist in its installation.

"Subsequently we may audit the operations of the program to see that it is being followed and is meeting the requirements of the business."

It is interesting to note the similarities of the method of approach used by this consulting firm, and the eight steps recommended by the Navy project for the installation of a permanent program of management improvement. The writer feels the Navy program has one important advantage over the consulting approach. The Navy program does not have to wait for a management audit by an outside firm, but instead calls for establishment of administrative controls, which as a part of the permanent system, are designed to call attention to management problems before they become serious.
this recommendation, the sponsors of the Navy project enthusiastically endorsed the plan for the development of a work measurement manual. The manual was to be used at local Naval stations to introduce work measurement. Emphasis was placed upon work measurement because it is a logical beginning for the administrative controls to be used in connection with a program of management improvement. It is applicable especially to the performance of the functions of comparison and corrective action. Work measurement was also considered a timely subject for research in view of the importance attached to the problem of manpower utilization.

IV. SUMMARY OF THE CHAPTER

The first field work on the Navy project consisted of interviewing seventy-five Naval personnel, who represented a cross-section of all echelons at USNTC, Great Lakes and USNTC, Bainbridge. The survey enabled the Navy project to narrow their research to a consideration of the following eleven areas of management problems and difficulties:

1. Communications and coordination.
2. Turnover and rotation.
3. Paper work and red tape.
4. Civilian employees and WAVES.
5. Work measurement.
6. Billet (job) analysis.
7. Handling people.
9. Public relations.
10. Classification and promotion.
11. Morale problems.

The preliminary interviews were followed by a management survey (questionnaire and interviews) covering 194 officers and enlisted personnel in supervisory positions at USNTC, Great Lakes. The questionnaire verified the areas of management problems found in the preliminary interviews. It also gave an indication of the status of understanding of work measurement, the organization structure, and some work simplification techniques.

Data from interviews and analysis of the questionnaire results led to two major conclusions: (1) that the problem of justifying manpower utilization was urgent, and (2) that there was a need for establishing accountability for manpower. Further, it was concluded work measurement was a logical system for establishing accountability of manpower.

There were three primary recommendations: (1) establishment of a training course in management principles and practices for officers assigned to shore billets; (2) use of coordinative staff at large shore stations; and (3) a permanent program of management improvement be established.

The preliminary interviews and the subsequent management survey served their purposes. The recommendations
were based upon the application of the principles of sound management as outlined and discussed in former chapters. The recommendation for a permanent program of management improvement led to the decision to conduct pilot studies on work measurement. These studies are the topics to be discussed in the following chapter.
CHAPTER XII
ANALYSIS AND EVALUATION OF PILOT STUDIES
IN DEVELOPMENT OF AN ADMINISTRATIVE
WORK MEASUREMENT SYSTEM

I. INTRODUCTION

The field surveys of management problems focused attention on the need for establishing a permanent program of management improvement at Naval shore stations. The essentials of such a program are discussed in Chapter XI of this paper. These essentials may be summarized into the following: (1) An initial survey of problems and difficulties, resulting in the establishment of a sound organization structure and proper procedures. (2) The installation of permanent administrative controls, which will result in a periodic review of potential problems and difficulties. (3) The establishment of ways and means of effective corrective action through participation of the executive and supervisory personnel concerned. Such action will include a periodic reappraisal of the organization structure and also lead to the use of various work simplification techniques.

The most urgent problem at the stations studied was the need for some system which would provide adequate means of accountability for manpower utilization. The sponsors
of the Navy project were convinced that accountability of manpower utilization is a problem Navy-wide. For this reason, it was decided that a proper study for the Navy project would be the development of an administrative control that would satisfy the need for accountability of manpower utilization. Such a developmental project was seen as a logical first step in the development of a program of management improvement at Naval shore stations, and a system of work measurement was the answer to the need for a system establishing accountability for manpower.

It is the purpose of this chapter to analyze the developmental efforts of establishing an administrative work measurement system. Further, the chapter will evaluate the effectiveness of such a system in increasing efficiency in management.

II. INTRODUCTION OF WORK MEASUREMENT AT USNTC, GREAT LAKES, ILLINOIS, 9 FEBRUARY 1953 to 28 MAY, 1953

A system of work measurement designed primarily to function as an administrative control was developed in pilot studies at USNTC, Great Lakes and USNTC, San Diego. The earliest developmental work was conducted at Great Lakes. Then the methods and procedures that proved most effective were tried out on a larger scale at USNTC, San Diego. At both stations members of the Navy project conducted follow-up surveys to determine the success of the pilot studies.
Introduction Period USNTC, Great Lakes

The first developmental work on introducing a system of work measurement was conducted at USNTC, Great Lakes during the period 9-19 February 1953. The objectives of the pilot study were outlined as follows:

1. Try-out and evaluation of alternative methods of getting across the basic concepts of work measurement.

2. Evaluation of materials on work measurement.

3. Development of understanding and acceptance of work measurement on the part of local officers.

4. Introduction to local officers of manuals and techniques which will result in management improvements on a "relatively unrefined, common sense basis."

Methods and Procedures

The most important feature of the research design was to use three different methods of introducing work measurement in an effort to determine the best method of presentation. Three test groups were chosen to try each of the three methods, and the cooperation of the Management Engineering Office was solicited in selecting groups that were as nearly alike in regard to attitude, difficulty of applying work measurement to their output, availability, and general intelligence as was possible.

The procedure of introducing work measurement to these groups was as follows:

1. Backing was obtained from higher authority in the form of a memorandum from the Center Commander
requesting cooperation and the submission of progress reports on specified dates.

2. Two group meetings were held with each of nine departments. Both meetings were used to introduce the "Work Measurement Manual" and to discuss work measurement. In the first meeting, the "before" test on knowledge and attitude toward work measurement was given. The second meeting was used additionally for the purposes of introducing other work measurement literature to participating personnel, and having them fill out small group meeting and materials evaluation forms.

3. After the group meetings, the nine groups were treated differentially as follows:

   (a) Three groups were given individual staff assistance with an emphasis on "helping them help themselves" in devising a work measurement system. Those groups were called "C" groups.

   (b) Three groups were given individual staff assistance in which the Ohio State representative took the lead in devising a work measurement system. These groups were called "B" groups.

   (c) Three groups were given no individual staff assistance. They were designated as "D" groups.

4. About one week after the first group meeting, a third meeting was held with each of the nine departments. The purpose of this meeting was to give the "after" test on work measurement and to discuss progress thus far in getting the work measurement systems installed.

5. Members of the Ohio State group kept running logs throughout the course of the pilot study. Emphasis was placed on documenting problems or difficulties encountered, dominant attitudes of participating personnel, and gathering case material for revised editions of the "Work Measurement Manual."

**Follow-up Period, 23-24 March and 25-26 May, 1953**

The people in the nine experimental departments at
Great Lakes were revisited by representatives of the Ohio State group on 23 and 24 March 1953. The purpose of this visit was to observe what had been happening to the work measurement systems which had been started in February; to discover the kinds of difficulties the people were experiencing in installing work measurement; and to get additional reactions of Naval personnel concerning the potentialities of work measurement for them. It was explained to the people at Great Lakes that a "Revised Work Measurement Manual," based on the experience gained during the introduction period and the comments of the people involved in the experimental groups was being written. Copies of this revised second edition of the "Work Measurement Manual" were mailed to Great Lakes 30 March 1953.

A final follow-up visit was made to Great Lakes on 25-28 May 1953. At this time, the third revision of the "Work Measurement Manual" was given to participating personnel as a replacement for the second edition. The new edition was introduced by pointing out significant changes which have been made in various parts of the "manual." The Management Engineering Office was asked to help participating personnel in changing over to the procedures outlined in the latest edition of the "manual."

In addition, an attempt was made to find out what uses the people had been able to make of their work measurement
facts and how they felt about voluntarily continuing work measurement for their own use. These findings are reported later in the section which deals with "Results of the Work Measurement Pilot Studies."

III. PILOT STUDY OF WORK MEASUREMENT AT USNTC, SAN DIEGO, CALIFORNIA

Introduction Period, 25 March to 15 April 1953.

As a result of the field work at Great Lakes, the approach of "helping personnel help themselves" was judged to be the most effective approach. The main objective of the experiment at San Diego was to try out and evaluate further this general approach—on a much larger scale. Further try-out and evaluation of (a) a revised edition of the work measurement manual and (b) a revised "Command Management Check-List (Form II)" were also part of the pilot study. ¹

Methods and Procedures

As at Great Lakes, the Center Commander issued a memorandum outlining the program, listing dates for

¹ See Final Report, The Ohio State University Research Foundation Project NONR 495(05), June, 1953. "Local Command Work Measurement Manual" is Attachment II, pp. II-1 to II-65, and "Command Management Check-List (Form II)" is Attachment III, pp. III-1 to III-4 of the Final Report. The "Command Management Check-List (Form II)" is also reproduced as Appendix A of this paper.
progress reports from participating groups, and soliciting full cooperation. Meetings were held with the Commanding Officers of the Service School Command, the Administrative Command, and the Recruit Training Command and their staffs to explain the program and determine what activities should participate in the study. It was decided it would be advisable for every department of the Administrative Command to participate. A meeting of Administrative Command department heads was conducted to explain the program and compile the list of participating personnel. In all, twenty-three groups participated in the program at San Diego as compared with nine at Great Lakes. This generally resulted in a larger number of persons attending subsequent small group meetings, usually fifteen to twenty, compared to ten or fewer in the Great Lakes meetings. Also, the greater number of persons participating reduced the amount of individual help it was possible to give participants at San Diego.

Two introductory meetings were held with each group, followed a week later by another meeting. The "before" test on knowledge and attitude toward work measurement was given during the first meeting. The remainder of the time was devoted to an explanation of work measurement and how to set up a local system. The third meeting was devoted to the "after" test on work measurement, and the administration of the "Command Management Check-List (Form II)"
and the other forms evaluating the meetings and manual. Discussion was conducted on problems or difficulties encountered in establishment of a work measurement system.

Members of the Ohio State group acted in an advisory capacity to individuals setting up their systems. A log of critical incidents and problems was kept throughout the pilot study.

**Follow-up Period, 25-29 May, 1953**

A follow-up visit was made to San Diego the last week in May, at which time the third edition of the "Local Command Work Measurement Manual" was presented to the people who participated in the pilot study. The changes made in the revised manual were explained and their reactions were solicited. In addition, the people who had been installing work measurement were interviewed to get at the problems which they were encountering in setting up their systems and to record their feelings and attitudes toward the continued use of work measurement at the local command level. The results of these interviews are summarized in the section which follows:

**IV. ANALYSIS OF RESULTS OF FIELD SURVEYS**

The analysis of results of field surveys is concerned with (a) the results of the materials and methods developed for the introduction of a system of work measurement, and (b) the analysis is concerned with the results derived from
operation of the system. There are four different sources of results data: (1) the four different evaluation forms, (2) the field logs kept by members of the project, including one-the-spot observations of the installation of work measurement system, (3) personal interviews with personnel who set up their own systems, and (4) the early work measurement reports submitted by participating groups and the action taken as a result of those reports.

The four different forms, which the Navy project developed to aid in analysis of results, include "Work Measurement Information Form," "Materials Evaluation Form," used to poll the people who used the Work Measurement Manual," "Group Meeting Evaluation Form," and the "Command Engineering Check-List."2

Analysis and evaluation of results are based upon pertinent information from all of the sources outlined above. The analysis presented in this section will be by way of a summary and will present only those statistical totals necessary to substantiate the conclusions set forth.

2 The "Command Management Check-List (Form II)" is reproduced herein as Appendix A. The "Work Measurement Information Form" appears as Appendix B. The "Group Meeting Evaluation Form" is Appendix C of this paper, and the "Materials Evaluation Form," used to gain reactions to the work measurement manual is included herein as Appendix D.
The analysis includes both Great Lakes and San Diego pilot studies. Detailed statistics of the results of the introductory pilot studies at Great Lakes are the subject of Progress Report No. 4, submitted by the Navy project to the Bureau of Naval Personnel on 6 March 1953. For example, the latter gives a breakdown by groups of the percentage of correct answers on questions designed to measure degree of factual knowledge about work measurement, both before and after the introductory sessions. The data used herein will be by totals for all the groups and will state simply that the average percent of total possible correct answers before was 23.8\%, while the test given after introductory sessions shows an increase to 71.1\%. The detailed statistics on the pilot studies at San Diego are the subject of Progress Report No. 5, to the Bureau of Naval Personnel dated 25 May 1953.

Analysis of Methods of Approach

The primary objective of the introductory pilot studies at Great Lakes was to determine which of three possibilities was the best method for introducing work measurement to

---

3 Progress Report No. 4, dated 6 March 1953 and Progress Report No. 5, dated 25 March 1953 were submitted by The Ohio State Univ. Research Foundation Project NOnr 495(05) to the sponsors of the project, the Personnel Analysis Division of the Bureau of Naval Personnel, Navy Department, Washington, D. C.
local commands. It may seem to the reader who is a professional educator that it should be obvious which is the best method of approach, namely, the method of giving personal assistance plus the use of a manual. Note, however, that the Navy formerly introduced the Integrated Work Measurement System using mainly a manual and directives. Interviews with personnel who had been the recipients of this method indicated that "indoctrination and explanation of the system to local officers is inadequate." 4

As outlined above three different methods were used in the introductory pilot studies. In Group "C" activities, Navy project personnel "helped them help themselves". Suggestions were made, but conferences and individual interviews were used to encourage the group to arrive at their own decisions in regard to work units, systems of collecting manhours and the like. In Group "B" activities, Navy project personnel acted as consultants by setting up the system for the group. Work units and forms were decided upon by the Navy project personnel. Group "D" activities devised their own systems. The only assistance they received was the manual and introductory

---

4 Progress Report No. 4, Ohio State Univ. Research Foundation Project NOhr 495(05), 6 March 1953, Section II, p. 1. (Report for Navy distribution only.)
group meetings.

The method of "helping them help themselves" (Group "C") proved to be the most successful. This conclusion was substantiated by data from three sources: (1) operational results, (2) results of questionnaire, the Work Measurement Information Form, and (3) observations from log notes of Navy project personnel.

"C" Groups First to Have Systems Into Operation

During the introductory period, 9-19 February 1953, one "B" group requested its classification be changed to a "C" group. This changed the structure of the experiment on methods of approach so that there were four "C" groups, two "B" groups and three "D" groups. All groups reported what progress they had made on their work measurement system as of 1 March 1953. As indicated in Table 10, all four of the "C" groups have installed their systems, whereas groups who had been subjected to other methods of approach had not yet set up their systems.

"C" Groups Favored by Field Personnel

Forty-one people from the twenty-three groups at San Diego were asked upon the first contact with them at Group meetings to rate the five methods of approach to work measurement listed in Table 11. Then, about two weeks later the same group was asked this question again. Group "C" method was the preferred choice in both surveys. See Table 11 on page 393.
TABLE 10

WORK MEASUREMENT PILOT STUDIES --
INSTALLATION PROGRESS OF NINE GROUPS

As of 1 March 1953

I. "C" Groups

--- One group already had its work measurement system in operation, and had submitted the first report.

--- Three groups had selected work units and set up reporting forms. One of these groups was considering ways of using work measurement to forecast personnel needs.

II. "B" Groups

--- The two remaining "B" groups had not yet established their systems.

III. "D" Groups

--- One group had selected work units and was making progress on setting up reporting forms.

--- Two groups had not set up systems.

Source: Progress Report No. 4, The Ohio State University Research Foundation Project No. 495(05), Section III, p. 1, and Appendix F of this reference gives a full report of these findings.

Note: Nine groups were divided into groups "B", "C", and "D", on the basis of method of introducing the work measurement system. Group "B" used the method of small group meetings plus the manual, but no staff aid. Group "C" used staff aid in "helping them help themselves," plus group meetings and the manual. Group "D" used only the manual and were left to establish their system alone.
### TABLE 11

WORK MEASUREMENT PILOT STUDIES --
EFFECTIVENESS RANKING OF
METHODS OF APPROACH

A survey of forty-one Naval personnel in supervisory positions at USNTC, San Diego, California, ranked the methods listed in the following order (from the most to the least effective):

<table>
<thead>
<tr>
<th>Method Description</th>
<th>TOTAL SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group &quot;C&quot; Method</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Group &quot;B&quot; Method</strong></td>
<td></td>
</tr>
<tr>
<td>Work Measurement Manual used in connection with formal course.</td>
<td>140</td>
</tr>
<tr>
<td>Work Measurement Manual used in connection with large formal conference.</td>
<td>164</td>
</tr>
<tr>
<td><strong>Group &quot;D&quot; Method</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Source:** Results of the "Work Measurement Information Forms" submitted to Naval personnel at USNTC, San Diego, March 25, 1953 to April 15, 1953 as part of The Ohio State University Research Foundation Project 495(05).

**Note:** Respondents were asked to "use a scale from one to five, using one to indicate the most effective means and five to indicate the least effective means." Thus the lowest total score indicates most effective means of introducing work measurement.
Benefits of "C" Group Method Summarized

Observations noted in logs of Navy project personnel lead to the conclusion that the Group "C" method of "helping them help themselves" is the most effective. These observations were summarized in Progress Report No. 4 as follows:

1. Affords an opportunity to take group differences into account.

2. Gives supervisors at local level an opportunity to participate in the program--feel they are a part of it.

3. Mistaken ideas can be corrected early. For example, almost every group first felt work measurement had only one purpose--to cut personnel.

4. Group discussion of work measurement leads to management improvement. For example, in setting up a work measurement system, one group began to question whether certain functions should be performed, and if so, what is the best way.

5. Unfavorable attitude can often be changed when specific problems of the group are discussed.  

Group Meetings an Aid to Promoting Understanding

Another result coming from the pilot studies was a series of reactions about the value of the small group meetings in fostering understanding of work measurement.

---

5 See Progress Report No. 4, op. cit., Sec. III, Appendix F, p. 2. The importance of participation is discussed at length in Chapter VII of this paper--"Continuous Review and Follow-up Action Depend upon Automatic Control and Extensive Participation," pp. 268-277.
These reactions were obtained by use of a "Group Meeting Evaluation Form." Most of the people who responded to this form said they were convinced that the small group meeting was a help in bringing about understanding of work measurement.

Manual is an Aid to Understanding

The usefulness of the work measurement manual, prepared by the Navy project personnel, is discussed in Section IV, pages 20 and 21 of the Final Report. The Naval personnel in the field were asked to evaluate the usefulness of the manual. Their endorsement is expressed in the following quotation:

Thirty-six of the personnel cooperating in the work measurement pilot studies at Great Lakes and seventy-seven at San Diego were asked to evaluate the manual, recording their responses on an evaluation form. There is a very close agreement between the results at the two Training Centers. Most of the respondents (89% at Great Lakes and 85.8% at San Diego) said the manual is understandable. Likewise, most gave the manual a vote of confidence as being worth keeping in a work measurement program, 89% at Great Lakes and 78% at San Diego. A high percentage of the respondents at both stations see practical ways of using the information in the manual in helping them

---

6 See Progress Report No. 4, op. cit., Section III, Appendix E, for results of the Group Meeting Evaluation Form at Great Lakes. See Progress Report No. 5, op. cit., pp. 25-34 for the results of the survey on group meetings conducted at San Diego.
in their jobs, 81% at Great Lakes and 78% at San Diego.7

The manual and small group meetings were part of the introductory process for all groups. There was a marked improvement in the knowledge about work measurement indicated by tests given before the introductory meetings and again afterwards. How much of the improvement was gained from the manual and how much from the meetings cannot be ascertained, but this is rather beside the point since the Navy project has demonstrated the superiority of the Group "C" method of introduction, which includes the use of both the manual and the small group meeting.

The instrument used to test the degree of knowledge on work measurement was the "Work Measurement Information Form." The first twelve questions are designed to test the respondents' basic knowledge of work measurement. A large gain in knowledge was indicated in the groups both at Great Lakes and San Diego. The average percent of total possible correct answers showed an improvement from 23.8% to 71.1% at one station and an improvement from 45.7% to

7 See Final Report, Ohio State University Research Foundation Project N0nr 495(05), June, 1953, p. 21. These data are a summary of the results of the "Evaluation of Materials Form," evaluating the manual, given to Naval personnel at Great Lakes and San Diego. For details, see Progress Report No. 4, op. cit., Appendix C and Progress Report No. 5, op. cit., pp. 21-24.
Command Management Check-List Useful as Indication of Problem Areas

The "Command Management Check-list" was developed from the preliminary studies at Great Lakes, which are discussed in the previous chapter. The check-list was revised and used in the San Diego pilot studies to analyze the management problem areas and further test the instrument. The results verify the findings at Great Lakes. Practically the same problems were discovered at both stations.

Reactions were received in follow-up interviews. It was concluded that the check-list may be effective when used as an aid in finding out what supervisors think to be the problems in their organizations. The check-list may also act as a thought stimulator about other problems. Used in this manner the check-list can act as an important first step in a management survey of the organization structure, methods, and procedure. Thus it should aid in uncovering areas where work measurement could be installed profitably.9

8 See Progress Report No. 4, op. cit., Section III, Appendix D, pp. 1-9 for results at Great Lakes. See Progress Report No. 5, op. cit., pp. 6-20 for results at San Diego. The "Work Measurement Information Form" is reproduced as Appendix B of this paper.

9 See Final Report, op. cit., Section IV, pp. 21-22. The "Command Management Check-List" is reproduced as Attachment III of the Final Report. See also Progress Report No. 5, op. cit., pp. 35-50. The development of the check-list is discussed in detail in Chapter XI of this paper and is reproduced herein as Appendix A.
Usefulness of Work Measurement Indicated by Operation of Systems

So far the above analysis of results has been concerned with the effectiveness of the materials and methods developed by the Navy project for the introduction of work measurement. Attention is directed now to the actual results from the operation of the different local systems which make up the pilot studies. The progress of the local systems is summarized in the following quotation from the Final Report:

As of 1 June 1953, the work measurement systems developed by the local activities participating in the pilot studies at Great Lakes have been in operation approximately three and a half months. At San Diego their local systems have been in operation less than two and a half months. Even in this short time, a majority of local officers have apparently discovered sufficient use for their systems to decide to continue them, even if on a voluntary basis. At one of the Training Centers two thirds of the activities participating in the pilot studies decided voluntarily to continue work measurement after the termination of the pilot study. At the other Training Center two of the three commands decided to continue their systems after the pilot study activities were finished. Some commands and departments have already decided to extend work measurement to more of their units, after their systems have been further developed. Policy is to iron out details of reporting data, setting standards, and carrying on a follow-up action, using present pilot-study systems. After their systems have been refined, then it is planned to extend work measurement to additional units.¹⁰

Examples of how work measurement systems, installed during the pilot studies, are being used are discussed in

¹⁰ See Final Report, op. cit., Section III, p. 16.
The examples include such activities as checking on functions performed; the reorganization of certain schools; comparison of activities of different mess halls; equalization of working hours; justification of new equipment; and reductions in personnel allowances.

V. EVALUATION OF THE PILOT STUDIES

The objectives of the pilot studies at USNTC, Great Lakes and the objectives of the follow-up pilot studies at USNTC, San Diego are outlined above. The objectives of the Great Lakes pilot studies may be summarized as (1) the development of an effective method of introduction of work measurement, and (2) development and evaluation of training material. The objectives of the San Diego study were (1) to try out the system developed at Great Lakes on a larger scale, and (2) to test the revised manual and check-list.11

---

11 The objectives of this dissertation are outlined in Chapter I, pp. 1-2. The objectives of the dissertation include not only the development and trial of a work measurement system which will facilitate control of staff work, but also one objective is an explanation of how such a work measurement system can increase effectiveness of an organization. It is the writer's opinion that this last objective is one that could well be the purpose of further work with the Navy. The co-director of the project made this point in the final meeting with the sponsors of the project. The Final Report was being made in oral form. He made the
In Section IV above, the results of written materials and methods developed by the Navy project are analyzed. One of the primary objectives and one of the most important contributions of the Navy project was the development of the method of introducing work measurement. This evaluation is based upon the fact that "C" groups using this method established their systems before the other groups. The people participating in the pilot studies and the Navy project personnel chose the method applied to "C" groups in preference to the other methods.

Likewise, the manual, the method of small group meetings and the check-list are a contribution to proper method of installing work measurement at Naval shore stations. This evaluation is based upon the results outlined in Section IV immediately above.

Thus it may be concluded that the pilot studies were successful in the accomplishment of the objectives outlined above.

(footnote 11 cont'd.) point that in the present Navy project on work measurement the Navy had a foundation but the house still had to be built. If it were not, the Navy would lose much of its investment in the project. The point is that work measurement must be a part of a control system that points out management problems and difficulties. Such problems lead to the application of some form of work simplification. If work measurement is not used in this way, it loses much of its value.
**Evaluation of the Effectiveness of the Work Measurement System**

The evaluation of the pilot studies so far has been concerned alone with the methods and materials of introducing a system of administrative work measurement. It has been concluded that the system can be introduced successfully by application of the methods and materials (manual and checklist) developed by the Navy project. As it were, the bridge can be built. The next question is "Will it perform its intended functions effectively?"

**Reporting Systems and Standards**

The criteria of effective standards is the subject of Chapter VI of this paper. The methods used in the pilot studies were analyzed. It was concluded that upon the basis of the criteria of sound standards established that the methods of setting standards outlined in the manual and used in the pilot studies were in accord with basic principles and sound practices.12

---

12 See Chapter VI of this paper, pp. 217-218. Criteria of sound permanent standards are summarized in the following terms:

(1) The standard must be within the limits of a fair day's work. The average employee must be able to reach and sustain standard production over a long period.
(2) The standard must offer some potential incentive for improvement.
(3) The standard must be set high enough to stimulate production. It must not be a standard of mediocre past performance.
The pilot studies were not in operation for a long enough period to be able to judge the results of the standards set. However, even though no permanent standards had been established, activities operating under temporary standards were able to compare themselves with similar groups; note trends in performance; and locate areas calling for management improvements. Specific examples of these results are discussed on pages 16 to 18 of the Final Report, under the heading, "How Work Measurement is Being Used in the Field."

Evaluating the reporting systems must be based, likewise, on the short time the pilot studies were in operation. Examples of reporting systems are given in the "Local Command Work Measurement Manual." It is the observation of this writer that there is one objection which is usually raised to the installation of a system. That objection is that the system will require a great deal of time to collect the data and make reports. Groups participating in the pilot studies were asked to keep a record of the time spent on the reporting system during the first month. It is significant that the general consensus was that the time involved is negligible.

Time consumed in collecting data is not a problem unless the system attempts to measure work in too much detail. Establishing a system that will adequately
represent the work being done, and still not involve an excessive amount of time for recording data was found to be a problem in some cases. In the thirty-two groups studied (nine at Great Lakes and twenty-three at San Diego) varying individual problems were encountered. The general suggestions in the manual were helpful, but often it was a matter of tailor-making a system to fit special needs.

It is this writer's evaluation that the recording systems recommended were developed as far as possible in the time available, but that important problems still remain to be solved in individual cases. For example, in a Personnel Department at one large Naval station, it became necessary to set up a full-time control desk to keep tally on the different kinds of transfer orders being handled. This slowed the processing of personnel, so it is conceivable a draft of fifty or so men would be delayed by the accounting process.

Another example is found in a Finance Office. A pay record was accepted as a representative work unit, but the fact is it takes two to three times as long to process the pay record of Naval personnel who have many years' service, dependents' allowance, insurance deductions, and the like, compared to the new recruit who gets a crisp twenty-dollar bill and that is all. If different pay records are used as different work units, the system becomes cumbersome.
One solution to the problem is to keep the single work unit, applicable to all pay records, and then explain that the poorer performance rate is due to preparation of pay records of personnel with long service.

These two examples are typical of the many problems which faced the individual groups cooperating in the pilot studies. The Navy project personnel working as they were with twenty-three groups at one station in a two-week period and nine groups at the other station, did not try to operate in a consulting capacity in the sense of solving problems for the individual groups. The Navy project personnel did try to explain the general method of approach to such problems, explain the principles involved, and encourage local groups to find their own solutions.

Work Measurement Must be Tied in With Management of the Entire Station

The point that work measurement is only a facilitative tool, and is useful only when corrective action is taken as a part of a management improvement program was made time and time again throughout the pilot study.13

---

13 See the Final Report, op. cit., Section V, subheading D, "Work Measurement Must be Tied in With Operations and Management of Entire Station," pp. 25 and 26; also see Section VI (4), p. 28 where use of work measurement to facilitate overall control is recommended. Attachment I of the Final Report, op. cit., pp. 1-5 to 1-6 emphasizes the importance of "Continuous Review and Follow-up." Also see
Nevertheless, the writer is of the opinion that generally speaking neither the Naval personnel in the field nor the people in the Bureau gave as much importance and meaning to this fact as the writer believes it warrants. Full understanding of the place of administrative work measurement in the management of an enterprise calls for an understanding of the organic functions of management. This is the reasoning behind the recommendations that resulted from the preliminary management survey. It will be remembered that these recommendations call for (1) a training course in basic principles and practices of management of a shore station; (2) establishment of a coordinative staff at large stations; and (3) a permanent program of management improvement, based on the concept of control as an organic function of management and the application of scientific methods to the solution of business problems.

In retrospect, it seems to the writer that more emphasis should have been placed on the basic concepts of control. The thinking at the time of planning the Navy

project was that the first logical step was to introduce work measurement and give illustrations of its uses, without going into the basic theory of control extensively. The result was that Naval personnel in the field, who by and large have little, if any background in management, failed to see the full potentialities of a system of administrative work measurement. For example, some supervisors see the system only as a means of justifying the number of employees and Naval personnel on the personnel allowance list. They fail to see how the system can show where improvements can be made, and that then the next step is an application of some work simplification techniques.¹⁴

¹⁴ To show how a system of administrative work measurement can increase the effectiveness of management is one of the main burdens of the dissertation. Basic concepts have been discussed in former chapters (especially Chapters III, IV, V, VI, and VII) and conclusions on the subject will be discussed in the following chapter. Nevertheless, it seems appropriate to the writer to summarize here the basic concepts which he feels would have been an aid in furthering the concept of the proper use of work measurement as an administrative control. First, a functional analysis is beneficial in analyzing and explaining the place and uses of administrative work measurement. There are three organic functions of management: planning, organizing, and controlling. There are eight organic functions of control. They are routine planning, scheduling, preparation, dispatching, comparison (which are all staff functions) and three line functions of direction, supervision and corrective action. To control the group activities of an enterprise successfully these functions must be performed. Administrative work measurement facilitates all eight functions of control.
VI. SUMMARY OF THE CHAPTER

The primary research of this dissertation consists of a year's field work at three large Naval shore stations. Surveys of management problems and difficulties were made at USNTC, Great Lakes, and USNTC, Bainbridge, Md. Results indicated need for a means of accountability of manpower utilization. A system of work measurement was deemed the first logical step in setting up a program of management improvement at local Naval stations.

This present chapter is concerned with the work measurement pilot studies conducted at USNTC, Great Lakes, and USNTC, San Diego. The pilot study at Great Lakes developed a method of introducing work measurement at local Naval stations. The method includes (1) giving professional aid in "helping local personnel help themselves" in setting up a work measurement system, (2) use of a manual developed by the Navy project, and (3) small

(footnote 14 cont'd.) but primarily administrative work measurement is concerned with comparison and corrective action. The system of administrative work measurement set up during the pilot studies are systems designed to facilitate the control functions of comparison and corrective action of groups. The data from these systems should result in the application of methods of work simplification that will, in turn, result in improved effectiveness of management of the shore station. The uses of work measurement to facilitate the functions of control are outlined in Figure 3, Chapter IV, p. 108.
group meetings to facilitate local participation.

Results and Findings of the Pilot Studies

Groups using this method of approach were the first to have their work systems in operation. Naval personnel using the system along with groups using other systems, were asked to rate different methods of introducing work measurement and they all rated the method of "helping local personnel help themselves" as most effective. Likewise, Navy project personnel rated the method most effective of the three possibilities. Among the benefits of the method were flexibility of presentation to suit attitudes and capabilities of groups being taught; benefits of participation by local personnel; early correction of mistaken ideas; and possibility of early discovery of management problems, leading to improvements through work simplification.

Reactions of local personnel, obtained by use of the "Group Meeting Evaluation Form," indicated most of the respondents were convinced that the small group meeting was an aid in bringing about understanding of work measurement.

The effectiveness of the work measurement manual developed by the Navy project is indicated in a number of ways. First, before and after tests of knowledge of work measurement showed marked improvements after studying
the manual. The average percent of total possible correct answers indicated an improvement from 23.8% to 71.7% at one station and an improvement from 45.7% to 73.5% at the other station. Further, most of the respondents answering an evaluation form said the manual is understandable, 89% at one station and 85.8% at the other. Eighty-one percent of the respondents at one station and 78 percent at another indicated the manual should be kept in a program of introducing work measurement. Eighty-one percent at one station and 78% at another indicated the manual was helpful to them in setting up their individual systems.

One of the materials developed by the Navy project is the "Command Management Check-list." It is reproduced in Appendix A of this paper. The purpose of the check-list is (1) to discover areas of management problems and (2) to suggest possible areas of problems to people using the form. In the latter role, the form acts as a method of self-analysis. It was concluded that the check-list is affective as an important first step in a management survey of the organization structure, methods, and procedures. It was also found useful when used to aid self-analysis of management problems.

The above results indicate that the methods and material aids (manual, check-list, and small group meetings) are effective in setting up a system. In a sense, the results indicate the Navy project did develop
methods and materials effective for building the system. Equally important are the findings regarding the usefulness of the work measurement system in managing a Naval shore station. Although the pilot studies covered only a period of three and one-half months in operation at one station and two and one-half months at the other station, some encouraging results were reported. First, all groups were able within a reasonable time to set up a system. Second, considerable corrective action resulted from work measurement reports. Examples of action taken include such as checking on functions performed; the reorganization of certain schools; comparison of output at different mess halls; equalization of working hours; justification of new equipment; and reductions in personnel allowance tables.

**Evaluation of the Pilot Studies**

1. From the above results it seems reasonable to conclude that the pilot studies were successful in the objectives of development of a method of approach and introduction in setting up an administrative work measurement system.

2. The methods for setting standards advocated by the Navy project meet the following criteria of sound standards:

(a) The standard must be within the limits of a fair day's work. The average employee must be able to reach and sustain standard production over a long period of time.
(b) The standard must offer some potential incentive for improvement.

(c) The standard must be set high enough to stimulate production. It must not be a standard of mediocre past performance.

The temporary standards, under which pilot studies operated, were effective in enabling groups actually to make several different types of comparisons. They were able to compare themselves to similar groups note trends in performance; and locate areas calling for management improvements. Specific examples are given on pages 16 to 18 of the Final Report.

3. The evaluation of the reporting systems may be summarized as follows: the systems need improving, but present procedures have the advantages of having the backing of those who use them and are reportedly not burdensome from the standpoint of the time involved in collecting data. The present systems were developed as far as possible in the time available, but important detail problems still remain to be solved in some individual cases.

4. The point that work measurement is only a facilitative tool, and is useful only when corrective action is taken as a part of a management improvement program was made time and time again throughout the pilot studies. (See footnote 13 above). Emphasis was placed upon the uses of work measurement without explaining sufficiently, exactly how such uses relate to the management
of the station. Hence, Naval personnel seemed to have a limited understanding of the full potential of administrative work measurement to facilitate the control functions of comparison and corrective action. In retrospect it seems to the writer that more emphasis should have been placed on the basic concepts of control. The point should have been emphasized more clearly that administrative work measurement is concerned with the work of controlling the activities of the group, which is concerned with top level plans for action, and plans for carrying out the plans for action. Administrative work measurement is concerned primarily with performance of the control functions of comparison and corrective action. As such work measurement data outlines the areas of group activity that need improvement. The improvement step is part of corrective action and leads to organizational analysis; and analysis of methods and procedures, which in turn leads to the application of some kind of the various types of work simplification.

The pilot studies gave the Navy the tool of administrative work measurement. Its use by the Navy must be still further advanced to gain full benefits. Proper application of the various types of work simplification is an area in which research should be conducted, if the full potential of work measurement as an administrative
control is to be realized. The story of work measurement leading to work simplification is one important phase of the Navy program of management improvement which needs to be emphasized repeatedly.
PART IV - CONCLUSIONS AND RECOMMENDATIONS

CHAPTER XIII

CONCLUSIONS FROM THE STUDY

I. INTRODUCTION

An analysis and evaluation of the entire study (Primary and secondary research) leads to the conclusion that the important contributions of the dissertation are not to be found mainly in the field of new technical developments applicable to work measurement systems. Rather it is concluded that the most important contribution are in non-technical areas. (They are non-technical in the sense that they do not deal primarily with accounting and statistical schemes.) The chief contributions come in the field of management, concerned with (1) the methods of applying techniques properly and (2) the proper concepts of the principles of management which are concerned with administrative control. In other words, this study concentrates on supplying the executive with the savior faire necessary for him to use work measurement as an administrative control in a manner that will take full advantage of the potentialities of such a system.

The present chapter will discuss first conclusions regarding the status quo of the typical administrative...
situation which leads to the need for improved methods of introducing and operating a work measurement system and which also indicates the need for a better understanding of the place of administrative control in the management of an enterprise. Second, the chapter will discuss conclusions in regard to the basic principles and concepts of administrative work measurement. Third, the chapter will discuss conclusions of the study in regard to the installation of an administrative work measurement system.

II. THE NEED FOR BASIC CONCEPTS OF ADMINISTRATIVE WORK MEASUREMENT

From the primary research (management surveys and pilot studies on work measurement) it is concluded that there is a pattern of limiting factors and forces inherent in the large, present-day organization. These factors and forces, it is concluded, are as follows:

1. Executives do not have a good understanding of the concept of administrative control. They recognize the need to delegate some of their duties, but generally executives do not have an adequate understanding of the use of the coordinative staff to facilitate control of a large enterprise.

2. There is a need for a more comprehensive concept of the organizational structure of an enterprise.

3. Size alone is a limiting factor in the organizational situation.

4. The policy of frequent rotation of executives is a disrupting factor in the management of an enterprise.
5. Outside pressures of public opinion is a limiting factor, both in the military situation and private industry.¹

Limiting Factors and Forces Lead to Management Problems

The management surveys conducted as part of this study disclosed eleven areas of management problems. They are listed in the Final Report as follows:

1. Communications and coordination.
2. Turnover and rotation of executives.
3. Paper work and red tape.
4. Civilian employees and WAVES.
5. Work measurement.
6. Billet (job) analysis.
7. Handling people.
9. Public relations.
10. Classification and promotions.
11. Morale problems.²

In addition to the above findings, interviews with officers in executive positions revealed that they recognize also the need for some kind of help in solving the problems which attend their administrative duties.

¹ See Chapter XII of this paper for analysis and evaluation of these factors. Also see Final Report, The Ohio State University Research Foundation Project No. 495(05), June 1953, Section II, p. 8.
It is the conclusion of this study that the kind of aid needed by executives in administrative positions is to be found in an analysis of the limiting factors and forces.

Some of the limiting factors and forces cannot of themselves be changed. They are inherent in the management of a large enterprise. Examples are (1) large size (2) outside pressures, and (3) policies governing rotation of executives. Other factors such as inadequate concepts of control and organizational structure can be remedied. The sound concepts of control and organizational structure are basic to a program of management improvement. This conclusion is supported both by the primary research and the secondary research.3

On the basis of the primary and secondary research the conclusions of this study in regard to the status of managerial ability at the typical large enterprise are as follows:

1. That there was a need for an effective method of approach or means of introducing administrative work measurement, and

2. That there is a need for executives to have a better understanding of the basic concepts of work measurement as an administrative control.

3 See Chapter XII of this paper, under subheading "Work Measurement Must be Tied in With Management of the Entire Station," and also Chapter III of this paper.
III. CONCLUSIONS REGARDING BASIC PRINCIPLES AND CONCEPTS INVOLVED IN ADMINISTRATIVE WORK MEASUREMENT

As a result of the initial interviews and management surveys one of the early conclusions which was strengthened by the pilot studies that followed, was that effective management is dependent, in the final analysis, upon the right kind of executive leadership. Further, "the right kind" of executive leadership infers understanding of the basic principles of management, which is the basis for a well-defined philosophy of management.4

From a fund of knowledge and experience, and a philosophy of management executives should develop a method of approach and a way of thinking about management problems.

As a result of the experience of the primary and secondary research, certain conclusions have been postulated about what basic principles apply and how they go to make up the proper concept of work measurement as an administrative control. These principles and practices have been discussed in detail in the foregoing

---

4 This was the basic thinking behind the recommendation for a training course for officers in the principles and practices of management. This recommendation was part of the Navy project Progress Report No. 2, dated 19 December 1952. See Chapter XI of this paper. This conclusion was re-affirmed in the evaluations of the pilot studies, wherein the writer concludes "more emphasis should have been placed on the basic concepts of control." See Chapter XII of this paper.
chapters. It is concluded that the following basic concepts of management are necessary background for executives in order to have an adequate understanding of the place of administrative work measurement in the management of an enterprise:

1. **A Clear Understanding of the Proper Relationship of Administrative Work Measurement to Management of the Enterprise.**

   It is concluded that a clear understanding of administrative work measurement depends upon:

   (a) An understanding of the organization and organization structure,
   
   (b) The relation between staff organization and basic management functions, and
   
   (c) The relationship between the basic control function, and the principles governing their performance.

2. **Importance of Difference Between Operative and Administrative Work**

   The second concept that it is concluded is vital deals with operative and administrative work. It is important to note that control is exercised over operative work and also over administrative work. Operative work is concerned with individual projects or job orders, whereas administrative work is group work or programs.

   Operative work measurement is concerned with measurement of projects or operative work. Traditional investigational methods of setting standards are
observational, by use of time and motion studies. The standards set are absolute, and since they are usually directly related to the operator's wages, such a system acts to motivate the individual worker.

Administrative work measurement is concerned with progress of programs. It is an expression of total group accomplishment. The investigational methods are simple statistical analysis based upon past performance, and the standards' (performance rates) are relative. They are relative in the sense that as the methods and procedures of the group are improved, the performance of the group improves and the standards are raised. Thus the standards are "drifting" standards. The results of administrative work measurement are an indication of the performance of the group, and as such is a measurement of leadership. While operative work measurement acts to motivate the operative worker, administrative work measurement acts to motivate the executive. The former leads to corrective action that has to do with the methods, procedures, and attitudes of the operative worker. Administrative work measurement leads to corrective action affecting the methods, procedures, and attitude of the group and lead to organizational analysis, analysis of flow of work, procedures, and the application of various other types of work simplification techniques.
3. Full Potentialities of Uses of Administrative Work Measurement as a Tool of Control

Administrative work measurement acts as a quantity measure in establishing executive accountability for manpower utilization. Thus administrative work measurement has the following primary uses:

1. It leads to management improvements, brought about by the application of work simplification techniques.
2. It leads to cost reduction studies that can be used to support requests for facilities and personnel.
3. It can be used to control staff operations.
Comparisons can be made (a) to past performance, (b) with similar activities, and (c) with established standards.
4. To bring management problems into focus, which leads to the application of work simplification techniques.
5. To determine manpower requirements.
6. To improve communications.
7. To check on corrective action taken.

4. Limitations of Administrative Work Measurement

The inherent limitations of administrative work measurement were found during the primary research to be the following:

1. It measures quantity, relative to time, but not quality of work.
2. It is a weak control of expenses, measuring only the indirect expense of personnel wages and salaries.
3. It does not aid in deciding if the work should be done in the first place—is it a proper function?

4. It can result in manpower utilization at undue costs in quality, time and other expense.

The above factors determine what can be measured by administrative work measurement. The basic limitations listed above may be summarized to state that administrative work measurement can measure quantity, but not the other basic measures of quality and expense. Likewise the factors and forces present in the individual organization may limit the practicableness of using work measurement as a measure of quantity. These limiting factors are:

1. Size of the operation. In an office of three or four clerks work measurement can better be performed by personal observations of the supervisor.

2. Nature of the end-product. From the experience during the pilot studies, it is the writer's opinion that it is not good practice to apply work measurement to such activities as the band, duty officers, the captain's aide, and the like; because as a matter of policy these functions are going to be performed whether or not they show up well on a work measurement report. From the standpoint of the entire enterprise, activities that are not an important portion of the primary work may be disregarded or arbitrarily the number of such
personnel may be a ratio of the number of personnel who perform the primary duties. This is the system recommended to the Navy for accounting for supervisory personnel.

3. Attitude of employees is an important factor in deciding how administrative work measurement is used. The attitude of the employees must be one of understanding and acceptance, before the system can be used successfully. They must be shown that the system is fair.

4. It takes six months or so before an activity can begin to make meaningful comparisons to past performance data and to performance records of other activities. Also it takes six months' experience in order to establish performance standards, which can be considered permanent and used as a basis for decisions in regard to corrective action.

Methods of Introducing a System

One of the primary conclusions of this study is that there is a need for an effective method of approach or means of introducing administrative work measurement. The development of a method of approach or introduction was one of the chief contributions of the pilot studies on administrative work measurement. Chapter XII of this paper is devoted to an explanation, analysis and evaluation of the pilot studies, and it is concluded
that the introductory methods developed by the Navy project are the most effective for the installation of a system that is designed to be a part of a permanent management improvement program. The methods developed can be summarized as follows:

1. Giving professional managerial aid in "helping local personnel help themselves" in establishing the details of an administrative work measurement system.

2. Use of a manual developed by the Navy project.5

3. Use of the small group meetings to facilitate local participation.

Seven Steps in Setting up a System

The functions of comparison and corrective action involve performance of the following: (1) measurement of actual performance, (2) analysis and interpretation of actual performance data compared to standards of performance, and (3) provision for regular review and follow-up action on the basis of the analysis and interpretation of performance. The above procedures are necessary to establish accountability and carry out corrective actions.

The developmental and operational phases of such a system of comparison-and-corrective action are as follows:

5 See the Final Report, The Ohio State University Research Foundation Project N0nr 495(05), Attachment II, pp. II-1 to II-65.
I. Planning the system, which includes measurement of actual performance:
1. Selection of activities to be controlled.
2. Definition of units of measurement.
3. A reporting system for measuring and summarizing actual performance.

II. Organizing for the introduction of the system, which includes analysis of the data:
5. Analysis and interpretation of the difference between actual and standard performance.

III. Operating the system, which includes review and follow-up action:
6. Regularly scheduled review and decision on action to be taken as a result of the analysis of the data.
7. Follow-up action to comply with the decision.

The above seven steps are concluded from the analysis and findings in Chapter V of this paper. Detailed information on each of the seven steps is found in the work measurement manual.

Difficulties Encountered in Development of the System

There were many difficulties and problems encountered during the pilot studies, which provided the experimental situations for development of the administrative work measurement system outlined above. In this sense, the primary research was operational research; since the system was developed in an operational setting. The difficulties encountered may be summarized into the following primary difficulty areas:
1. Attitude of Indifference

While the top echelon officers, especially the Center Commanders, were fully cognizant of the importance of having some kind of a system to account for manpower utilization, this appreciation of the seriousness of the problem was not prevalent to such a marked degree among the "typical" officer in executive capacity at the lower levels of the organization.

2. Lack of Understanding of Potential Uses of Administrative Work Measurement

The second major problem encountered in the installation of the work measurement system was the lack of understanding of "what and how" the system was to be used. While the typical officer would not say so, a good many officers more articulate, expressed the feeling that any such system would be used "against" them, usually it was thought to justify cuts in personnel.

3. Choice of "Proper" and "Adequate" Work Units

In installing a system of administrative work measurement, one of the primary difficulties was gaining agreement upon the selection of work units. The trouble was in two directions: (a) on the number of work units necessary to cover the major work of the organization, and (b) upon the decision of what constitutes an individual work unit.
The tendency was to measure "everything," instead of selecting only those work units which would represent the primary work of the organization. The result was a bulky and cumbersome work measurement report, from which it was difficult to ferret the pertinent information.

Closely related to this difficulty is the one of choosing individual work units. The problem centered around the decision of what the major job or subfunction consisted.

4. Choice of "Fair" Standards

Once work units were agreed upon, the next problem was the selection of standards which were acceptable to all concerned. The tendency was to set standards that were very easy of attainment. Obviously, such standards were ineffective since they did not provide a motive for improved management, but only acted to "make the group look good."

5. Methods of Collecting Data

The methods of recording and reporting the basic data for work measurement reports presented a practical problem. The basic data consisted of (a) manhours spent on each subfunction or operation, and (b) the results or output produced during the period of time spent on the subfunction.

As noted previously unless some statistical method
were devised to gather the data, the result was that the supervisor must spend a sizeable amount of his time on clerical details, or a clerk must be used to collect the data. While the Navy project did make progress on this problem, there is still room for improvement.

The Universal Factors and Their Force and Effect
1. The Importance of Correct Attitude

The first primary problem in installing a work measurement system was the attitude of indifference on the part of the typical officer. Few of the officers on lower echelons were seriously concerned with establishing accountability for the manpower they used. All officers were cooperative with the personnel of the Navy project, because the project had the support of the chief executives; but lower echelon officers did not themselves greatly feel the need for work measurement.

This attitude requires for correction more than communications. It requires the relation of accountability to the possibility of disciplinary action by the superior executive and consequent adverse effect on the subordinate's chances of promotion.

The force of the attitude of indifference is important in determining the acceptance, use, and therefore, the overall success of a system of administrative work measurement. Although it is often assumed that
communication of policies and ideas is extremely poor in the military organization, there was nothing in the primary research that would warrant the conclusion that the military is anymore cumbersome in this regard than any other large organization.

The effect of indifference is predetermined failure of the system. Thus indifference becomes a primary universal factor in setting up a system of administrative work measurement. The need and uses of the system must be thoroughly explained, understood, and accepted by the executives concerned before proper use of the system can be expected.

2. Importance of Understanding Potential Uses of Work Measurement

Lack of understanding of the potential uses of administrative work measurement can be traced back to lack of knowledge in regard to the basic concepts of administrative control. This factor was found to be very prevalent, and the writer believes it to be the most important factor in determining the type and quality of the management of an organization. Without an adequate understanding of the proper place of administrative work measurement as a control in the management of an organization, the work measurement system degenerates into just another report. It ceases to be a positive motivation that is after the fact, for the most part.
Thus the understanding of the potential uses of work measurement is an important factor in the organizational situation, which exercises an important force and has far reaching effects on the management of the organization. As in the case of correct attitude, this factor was prevalent throughout the organizations studied. Many of the officers cooperating on the study were reservists who are executives in commercial and industrial organizations in civil life. There was nothing in the primary research that would suggest this lack of understanding of basic concepts is peculiar to the Navy. Instead, there is every indication that this condition could well be expected to be present in any other large organization. Thus presentation of basic concepts is a problem that executives thinking about installing work measurement should be prepared to handle.

3. Importance of Adequate Work Units

Many of the difficulties of selecting work units grew out of the fear and misunderstanding of the uses intended to be made of work measurement data. The belief was common that work measurement was to be used primarily as a device to justify reductions in personnel. For this reason some executives insisted that every last operation of their group be reflected on the work measurement report. The contention of the personnel of the Navy project was,
that only the primary work need be measured, and the rest of the time could be related by use of ratios.

The problem of choosing work units is a universal factor, in that every organization installing work measurement will encounter it. Work units are basic factors of the system. Well chosen, in the opinion of all concerned and judged also by the criteria of good work units set forth in this paper, work units will be a favorable factor affecting the success of any work measurement system.

4. Importance of Good Standards

The problem of setting standards is tied closely to that of choosing work units. Likewise, it is a problem that is inherent in any administrative work measurement system. Staff work is measurable by administrative work measurement; but since the output of staff work is often intangible, setting standards for it is more difficult than setting standards for operative work, which is usually measured by the application of standards set by time and motion studies.

The methods of setting standards developed by the Navy project may be evaluated adequate, in light of the acceptance they received by personnel in the field. What success the methods enjoyed is due in large measure to the fact that local personnel participated to the extent of actually setting their own standards. Thus
the standards enjoyed acceptance, and a minimum of criticism.

Like the wise choice of work units, the setting of fair standards, accepted as representative of the work and reasonable of attainment, is very important to the success of the system. Standards are an important factor affecting the success of the system.

5. Importance of Efficient Method of Collecting Data

Collecting work measurement data is a universal problem inherent in all systems of work measurement. If it is not solved successfully, the cost of collecting and recording the data may well outweigh the benefits to be gained from the system.

As pointed out above, the Navy project set up its system to include the use of clerks to record time spent on subfunctions and work units completed in a given period. The personnel cooperating in the pilot studies were asked to keep an account of the time involved in this process. With very few exceptions, all agreed the time so consumed was negligible, compared to usefulness of the data obtained.

Nevertheless, collecting data is a universal, inherent problem and should be studied further. The Navy project developed a simple statistical method of setting standards and accounting for time, without
actually keeping time records. This process is based upon the concept of "float time" and is explained in Chapter VI of this paper. This system was not installed in the pilot studies, since it is a refinement calling for understanding and acceptance of still another concept. It was felt at the time that the method of using "float time" should be used only after the local personnel were thoroughly familiar with the simpler methods. The primary advantage of the method employing "float time" is that it does away with the use of clerks to record time spent on subfunctions, and simplifies the record keeping.

V. SUMMARY OF CONCLUSIONS

The chief contributions of the study are (1) the development of proper methods of introducing a system of administrative work measurement, and (2) codification of the basic principles and practices of management which executives must understand in order to take full advantage of the potential uses of administrative work measurement.

Establishment of the Need for Administrative Work Measurement

There is a pattern of limiting factors and forces inherent in the large, present-day organization. Two factors which can be rectified are: (1) that executives do not have a good understanding of the basic concept of administrative control, and (2) neither do they
comprehend fully the proper concept of the organizational structure of an enterprise. These two factors can be summarized as the need for better understanding of basic principles and practices of management.

The management surveys conducted by the Navy project showed also the need for a method of approach or a means of introducing work measurement.

Conclusions Regarding Basic Principles and Practices Applicable to a System of Administrative Work Measurement

It is concluded that the proper executive leadership is dependent upon an understanding, acceptance, and use of the following concepts:

1. A clear understanding of the functional analysis of organization and management, especially in regard to the function of control.

2. Importance of the difference between operative and administrative work.

3. Administrative work measurement acts as a quantity measure in establishing executive accountability for manpower utilization. It has the following primary uses:

   (a) It leads to management improvements, brought about by the application of work simplification techniques.
   (b) It leads to cost reduction studies that can be used to support requests for facilities and personnel.
   (c) It can be used to control staff operations. Comparisons can be made (1) to past performance, (2) to similar activities, and (3) to established standards.
   (d) To bring management problems into focus.
   (e) To determine manpower requirements.
   (f) To improve communications.
   (g) To check on corrective action taken.
4. Limitations of administrative work measurement inherent in the system are as follows:

(a) It measures quantity, but not quality.
(b) It is a weak control of expenses, measuring only indirect expenses of personnel wages and salaries.
(c) It does not aid in deciding what consists of the proper functions of an organization.
(d) It can result in improved manpower utilization at undue costs in quality, time and other expense.

Limiting factors in the measurement of quantity (application of administrative work measurement) of an individual enterprise are as follows:

(a) Size of the operation.
(b) Nature of the end product.
(c) Attitude of employees.
(d) It takes six months or more operation time before meaningful comparisons may be made.

Conclusions Regarding the Installation of an Administrative Work Measurement System

One of the primary conclusions of this study is that the methods for introducing a system of administrative work measurement, developed by the Navy project, are the most effective means. The methods developed for introduction of a system may be summarized as follows:

1. Giving professional aid in "helping local people help themselves" in establishing a system.
2. Use of the work measurement manual developed by the Navy project.
3. Use of the small group meetings to facilitate local participation.

An administrative work measurement system, designed to perform the control functions of comparison and
corrective action, must be able to perform the following adequately:

1. Measure actual performance.
3. Provide for regular review and follow-up action on the basis of the analysis and interpretation of performance.

The developmental and operational phases of such a system are outlined above in the seven basic steps given in Section IV of the chapter.

**Difficulties Encountered in Development of the System**

The difficulties encountered in setting up a system of administrative work measurement during the pilot studies may be summarized as follows:

1. Attitude of indifference on the part of executives on lower echelons.
2. Lack of understanding of the potential uses of administrative work measurement.
3. Choice of "proper" and "adequate" work units.
4. Choice of "fair" standards.
5. Method of collecting data.

**The Effect and Force of These Factors on the Problem of Administrative Control**

It is concluded that all five of the above problems are universal to a large degree. Since they are all basic to a system of administrative work measurement, these factors have an important effect on the success
of the system and exert a force that demands serious attention. All these problems must be recognized and coped with by executives about to install a system of work measurement. They are the foundation blocks of the system. The system can be no more successful than the success experienced in solving these five problems. In case of each of the problems, suggestions from experience of the pilot studies are given for their solution. They are not the final answer, but certainly the suggestions define the problems of installation of a system; indicate the force and effect of these factors on the problems of administrative control; and give suggestions for a logical method of attacking these inherent factors.
CHAPTER XIV
RECOMMENDATIONS

I. INTRODUCTION

This study is an investigation and evaluation of work measurement as a tool of administrative control. The primary research conducted at three large Naval shore stations provided the administrative setting for the investigational research.

The conclusions from the study indicate that (1) executives generally feel the need for some kind of aid with their administrative problems; (2) that before any aid or tool can be used successfully, the executive must have a clearer understanding of the principles and practices of management, especially the proper role of administrative control as an organic function of administrative management; (3) that work measurement has the potentialities of functioning as a proper tool to facilitate administrative control, in regard to establishing accountability on the basis of quantitative measurement of manpower utilization; and (4) that there is a need for a method of approach or means of introducing a system of administrative work measurement, in a way which will result in proper use of the system as an
administrative control, rather than just another report. These conclusions show need of the study for an investigation and evaluation of work measurement as a tool of administrative control.

Further, the conclusions summarize the following investigational results and evaluations, which indicate the study has made progress toward offering practical solutions to these needs:

1. Codification of the basic principles and practices necessary for an adequate understanding of the concept of administrative control in general, and in particular, the application of a system of administrative work measurement as a tool of control.

2. Development of a system of administrative work measurement, and codification of the necessary steps in such a system.

3. Development of a method of approach or means of introducing work measurement, which has been proved successful in the motivation of the proper uses of the system.

The general recommendations are that the investigational results and evaluations of the study be applied to large industrial organizations in much the manner as these methods and techniques were used in the pilot studies conducted for the Navy. It is implied in this general statement, of course, that only the best methods developed during the pilot studies should be used, and where improvements in method and application have been noted, advantage would be made of their use. For
example, more emphasis would be given to the basic principles and practices of management than was the case in the pilot studies. (Actually, a concise codification of the concept of work measurement as an administrative control was not available in written form at the time of the pilot studies.)

II. GENERAL RECOMMENDATIONS

From the investigation, analysis, and evaluation of the findings of the study, recommendations are outlined as a plan of action for industrial organizations and government agencies which find they face the administrative control problems inherent in the typical, large organization. There are three primary recommendations: (1) establishment of a course to train executives in the basic principles and practices of management; (2) the use of the coordinative staff or staff specialist to perform the staff functions of control; and (3) establishment of a permanent program of management improvement, with work measurement as one of the primary tools of administrative control.

1. Course in Management

The basic concepts of management as outlined in the preceding chapters should provide the subject matter for a course in management for executives. Such a course should cover the basic concepts of management, but the
discussion, to be as realistic and interesting as possible should be aimed at the local management problems. Preliminary investigations or a management survey based on some such instrument as the check-list developed by the Navy project will give an indication of the important problems and difficult areas.

Of course, to be effective the course must have the wholehearted support of top management. In fact, top management should take the course first. Then, depending upon the size of the group and personalities involved other courses should be scheduled. The course should be set up on a definite schedule and run in a business-like manner.

Finding the right kind of man to teach the course is important. Some companies are sending promising young, or middle-aged executives to special courses, being conducted at a number of the outstanding colleges of commerce and universities throughout the country. If the executive group is very small, perhaps all can attend such a course in due time. The more frequent plan, however, is to expect executives sent to special courses, to return and conduct a similar course for the rest of the company executives.

2. **Staff Assistance for Better Control**

The use of the coordinative staff is important to bring about the conditions necessary to make delegation
as practical and effective as possible. Through performance of the five staff control functions, the coordinative staff is able to effect the integration of thought and indoctrination of subordinate executives to top management thinking and policies to a high degree. Thus, it is possible to delegate responsibility for execution of specific projects to operative executives, with confidence that the operations will be in accord with top management plans and policies.

It is recommended industrial organizations study their administrative control problems. If conditions are similar to those found in the primary research of the study, then it is recommended that consideration be given to the establishment of a coordinative staff, or if size of the organization does not warrant, then that consideration be given to the creation of a staff position as an aid to the chief executive in carrying out the staff functions of control.

Such coordination calls for setting up conferences on plans and policies; installation of procedures and systems (such as work measurement); and also handling the technical details of operating a system of reports, analysis of results, and advice on follow-up action. The coordinative staff position thus must coordinate the "thinking" and the "actions" of groups making up the organization.
The coordinative staff is able to increase the effectiveness of the organization by relieving the chief executive of a great deal of detail work. Top management determines "what" the organization shall do. The coordinative staff may assist with "how" (systems and procedures) plus a study of "how well" (reports, analyses, and suggestions) plans and objectives are carried out.

3. Program of Management Improvement

The third recommendation for executives faced with problems related to administrative control is the application of the scientific method to the solution of management problems. The basic plan for such a program includes the following steps:

I. Installation stage:

1. Establishment of a sound organizational structure in view of the mission and objectives of the enterprise.

2. (a) Survey of management problems and difficulties.

2. Set up a program of developmental projects that is adapted to the needs of the organization, as indicated by the management survey.

(a) Such a program leads to the application of various work simplification techniques.

II. Permanent program:

1. Establishment of administrative controls, such as budgetary control, quality controls, and work measurement.
(a) Such a program calls for installation of systems to perform or facilitate the comparison and corrective action functions of control.

2. Facilities should be provided for means of communication between top management and lower echelons.

(a) This calls for the coordinative staff or executive administrative assistant coordinating the efforts of the organization.

3. Regular conferences or training programs should constitute part of the positive follow-up action as a result of conferences on results of administrative control systems.

(a) For example, if the work measurement reports from one department show a decline, while other departments are improving, the following action is in order: (1) establish accountability; (2) discuss problem and assign causes; (3) initiate a program of developmental projects to improve the problem; (4) specific work simplification techniques might well be the subject of training programs aimed at solution of the problem; (5) and, as a last resort, relieve the responsible executive of his command, when it has been demonstrated that improvement is practicable, but is not being accomplished.

It is only by integrating the data from the administrative work measurement system with the management of the entire enterprise that full benefit may be derived from the system. Used as a part of a permanent program of management improvement, work measurement can successfully indicate areas needing improvement; establish accountability for manpower utilization, and accomplish the other uses outlined in the previous chapter, such as
leading to the application of work simplification and leading, too, to cost reduction studies that can be used to support requests for facilities and personnel.

4. Adaption of Proven Methods and Training Materials

As a corollary recommendation to the three mentioned above, it is recommended that organizations entering into a program of management improvement avail themselves of the methods and training materials developed by the Navy project for adoption to their own needs. The primary development of the Navy project is the method of approach or means of introducing work measurement and the "Command Management Check-list." The method of approach includes (1) giving professional managerial aid in "helping local personnel help themselves" set up a system, (2) use of the work measurement manual, and (3) use of the small group meeting.

The "Command Management Check-list" should serve as a guide in developing a similar instrument to use in surveying management problems in an organization.

III. RECOMMENDATIONS FOR FURTHER RESEARCH AND DEVELOPMENT

Besides recommendations applicable to executives interested in improving the administrative control of their organizations, the study discloses problems, the solution to which, leaves room for refinements, and also the study throws light on the path ahead to other
and new problems which deserve further research.

1. **Further Research on the System**

It is recommended that further research be conducted to refine the methods for accounting for the time spent on the different subfunctions of the work being measured. For example, there is need for further research in the operational details of the statistical method for determining performance rates and standards. The basic concepts of this system are outlined in the Final Report of the Navy project, but the system was not put into operation in the pilot studies and further field work undoubtedly would be beneficial in refining the system and disclosing the types of staff operations to which it is most applicable.

2. **Development of an Integrated System**

The system of administrative work measurement developed by the Navy project is designed primarily for the individual unit (department, section, or unit). It measures the work of the organizational unit. The system was not developed to the point where heterogeneous groups or departments performing dissimilar work could be compared as closely as desirable.

The *Work Measurement Manual* suggests the use of Index of Productive Efficiency. Thus, the efficiency of one group may be compared to another. Nevertheless, this index is an "overall" indication of the ratio of
actual manhours it takes one group to perform a given amount of work compared to "Standard manhours." The index is very useful in observing the trend of two or more groups, but it must be remembered that under the present system it is possible to have a wide variation in the refinement or difficulty of the standards of departments. Therefore, any reaction to rates of improvement between departments should be based on a thorough analysis of how their standards were set.

The need for further research is in devising a method of gaining agreement on the degree of difficulty to be built into standards set by different departments. A possible solution may be in group meetings of the departments concerned, at which details of the difficulty of standards are explained. This would lead to comparison of standards, and should result in bringing their degree of difficulty closer together. Also, some staff officer should compile the data for future use.

3. **Standardized Forms and Procedures**

In the pilot studies employee participation was encouraged to the greatest extent possible. As a result, unless they copied from each other, each department had a slightly different report form. The manual suggests a standardized monthly form; but it doesn't suggest standardized forms for recording data daily. Such
refinements are relatively easy details to make, but unless they are suggested, the system will not be uniform.

4. Application of Organizational Analysis and Work Simplification Techniques

After work measurement has been introduced as part of a program of management improvement, the next logical development is the application of methods, procedures, and techniques which will correct the problems and trouble areas disclosed by work measurement.

This can be an ambitious problem including training and indoctrination on organizational analysis, job analysis, use of flow charts, and simplified methods and procedures of operation.

5. Establishment of Quality Control

The study recognizes the importance of quality control as an administrative control to be used in connection with work measurement. It does not, however, develop a system of statistical quality control applicable to administrative work. Reference is made to Chapter IX of this paper which discusses statistical quality control.

It is recommended that research be conducted on the development of a system of statistical quality control, based on Dr. Shewhart's concept of the "Control Chart." Such a system would greatly increase the usefulness and refinement of data supplied by a system of administrative
work measurement.

6. Establishment of Budgetary Control

In order to complete the systems by which to measure quantity, quality, expense, in relation to time in regard to administrative work, it is recommended that an area deserving of more research is budgetary control of staff operations. Present practice is often to relate staff costs to direct manufacturing cost or some other direct cost by use of ratios. This is a most unscientific method and does not give adequate control of staff expenses. One obvious reason this is true is that in times when production declines and direct costs therefore become lower, is the very time when more staff services are needed and used.

IV. SUMMARY OF RECOMMENDATIONS

General Recommendations for Application to Industry:

1. That a course in the basic principles and practices of management be established for executives.

2. That a coordinative staff or staff assistant be used to coordinate the "thinking" and "action" of the organization.

3. That a program of management improvement, based upon the application of the scientific method, be instituted.

4. That the methods and training materials developed by the Navy project be adapted to the program instituted
Recommendations for Further Research and Development:

1. That refinements in the administrative work measurement system developed by the Navy project be made, especially in regard to accounting for time expended on different subfunctions.

2. That refinements be made in the present system in regard to standardization of criteria of what is a fair day's work.

3. That forms and procedures of the present system be standardized.

4. That application of organizational analysis, and work simplification techniques be applied to areas where the need is indicated by work measurement reports.

5. That a system of statistical quality control over staff operations be developed.

6. That a system of budgetary control over staff work be developed which will reflect the actual costs and expenses, instead of using a ratio of some remotely related cost, such as manufacturing costs.
BIBLIOGRAPHY

BOOKS


PERIODICALS


Freeman, H. A. "Statistical Quality Control." Mechanical Engineering, (April, 1937.)


PAMPHLETS


The Navy Shore Establishment Work Measurement System Interim Manual, SECNAVINST 5202.1 dtd. 31 July 1952. (Secretary of the Navy Instructions).


MISCELLANEOUS

Booz, Allen, and Hamilton, Work Measurement and Personnel Utilization for the United States Coast Guard: New York: January 24, 1953. (For Coast Guard distribution only).


APPENDICES:

Appendix A
"Command Management Check List (Form II)"

Appendix B
"Work Measurement Information Form"

Appendix C
"Small Group Meeting Evaluation Form"

Appendix D
"Materials Evaluation Form"
APPENDIX A

APPENDIX A (continued)

Instructions: Circle the number or letter which you consider your reaction to each item on the list under the following categories:

1. No problem (Concerning an area which is not a problem to you.)
2. Situational problem (Concerning an area which could be improved in a small, noncritical way to benefit you.)
3. Insignificant problem (Concerning an area which represents an essential function, a which is not preventing you from doing your job while here in the unit.)
4. Fairly Important problem (Concerning an area which requires attention, but which is not critical enough to be classified under the other headings.)
5. Important problem (Concerning an area which represents a critical problem in need of immediate solution.)
6. Not applicable (Concerning an area which is not or would not be applicable to you.)

Example: 1 2 3 5 X Learning the policies of the station.

Tear off this page and refer to the items above as you go through the list of items.
II

X 1 2 3 4 5 Knowledge of what goes on in all offices of a large organization.
X 1 2 3 4 5 How to get officers to understand each other's problems.
X 1 2 3 4 5 Uneven flow of work.
X 1 2 3 4 5 Overstaffed.
X 1 2 3 4 9 Changing essential procedures.
X 1 2 3 4 9 How to write job or billet descriptions.
X 1 2 3 4 9 Spreading your efforts too thinly.
X 1 2 3 4 9 Justifying personnel.
X 1 2 3 4 9 Giving training.
X 1 2 3 4 9 Lack of proper indoctrination in a new shore billet.
X 1 2 3 4 5 Being understood by superiors.
X 1 2 3 4 5 Overlooking the feelings and problems of those on lower levels.
X 1 2 3 4 5 Too much routine paper work.
X 1 2 3 4 5 Finding time for work planning.
X 1 2 3 4 5 Unqualified personnel.
X 1 2 3 4 9 Less control over military personnel on shore stations than at sea.
X 1 2 3 4 9 Getting enlisted personnel to understand importance of their duties.
X 1 2 3 4 9 Trying to satisfy more than one boss.
X 1 2 3 4 9 Lack of teamwork among department heads.
X 1 2 3 4 9 Fluctuating work loads.

III-3
APPENDIX B

Work Measurement Information Form

OHIO STATE UNIVERSITY
RESEARCH FOUNDATION
NAVY PROJECT 495(05)
19 March 1953

WORK MEASUREMENT INFORMATION FORM

PURPOSE:

This form is to be given before and again after using the Work Measurement Manual. Its purpose is not to test you but to check on the effectiveness of the written material. For this reason, please do not guess at the correct answers. If you do not know, simply check the space labeled "do not know."

INSTRUCTIONS:

(1) Indicate your answers in the spaces provided. Some questions call for more than one response.

(2) DO NOT GUESS. If you do not know, simply check the space labeled "do not know."
1. Work measurement may be described best as the management tool which:
   (Check one)
   (a) determines the objectives of your organization.
   (b) solves work-flow problems.
   (c) shows the relationship between work turned out and the manpower required to turn out the work.
   (d) shows you whether your work unit is representative.
   (e) do not know

2. Work measurement is not completely new. All naval shore activities report work measurement data to:
   (Check one)
   (a) the Chief of Naval Personnel.
   (b) the Chief of Naval Operations.
   (c) the appropriate bureau having management or technical control over them.
   (d) the Bureau of Supplies and Accounts.
   (e) Office of Industrial Relations.
   (f) do not know

3. As a first step in laying the groundwork for work measurement, an initial survey of objectives and functions is important because:
   (Check the best answer)
   (a) it gives an overall picture of your organization and the management problems that need attention.
   (b) it gives you something to do while you are trying to decide what work units to select.
   (c) objectives and functions can never be changed.
   (d) work measurement must minutely cover every objective and function.
   (e) it automatically indicates the form to be used in reporting work measurement data.
   (f) do not know
4. Assume you are in charge of an office whose function is to issue war bonds. A record card is made out for each bond issued. A completed record card is the work unit you have chosen for measuring the work. Suppose you have four people working in the office, each putting in an eight-hour day entirely devoted to preparing record cards. A count of the number of record cards accumulated at the end of a particular day is 320.

Figure the performance rate for this day. (Show your computation.)

Performance rate

Do not know

5. Assume you are in charge of the Transfer Division of the Personnel Department. You have ten people writing Recruit Transfer Orders. On February 15, your performance rate was 1.0 and on March 15 your performance rate was 1.5. The performance rate on March 15 shows a:

Check one

(a) more productive use of man-hours.

(b) less productive use of man-hours.

(c) do not know

6. "The number of work units on hand at the end of the reporting period." This statement is a definition of:

Check one

(a) performance rate

(b) variable work units

(c) consolidated workload

(d) weighted work units

(e) backlog

(f) do not know
7. Among other things, a work unit must be:
   (Check one)
   (a) a single unit which measures all the work.
   (b) representative of the work being performed.
   (c) expressed in terms of number of people on board.
   (d) any of the above
   (e) do not know

8. Select the statement below which describes the least likely step you would take in devising a work measurement system in your department.
   (Check one)
   (a) Select a work unit
   (b) Identify possible areas for work measurement
   (c) Detail one person to choose work units and set up a reporting system
   (d) Determine the objectives of your work measurement system
   (e) Provide for continuous review and development of specific management improvements
   (f) Set up a report system
   (g) Do not know

9. "An expression of the man-hours expended divided by the work units completed." This statement is a definition of:
   (Check one)
   (a) subfunction
   (b) consolidated workload
   (c) performance rate
   (d) weighting
   (e) backlog
   (f) do not know
10. Work measurement at the local level has a number of objectives. Check two statements below which are least likely to be objectives of local work measurement.

- (a) justifying personnel allowances
- (b) estimating successfully the number of additional personnel necessary to do the job
- (c) obtaining data to support the annual Navy budget
- (d) checking results of action taken
- (e) analyzing past performance
- (f) comparing the efficiency in manpower utilization at one station with another
- (g) locating areas in need of management improvements
- (h) do not know

11. One characteristic of a good work unit is that it is tangible. From the list below choose three other characteristics of a good work unit.

- (a) readily accessible for counting
- (b) measures input
- (c) has consistent and familiar terminology
- (d) representative of the work being performed
- (e) readily loses its identity
- (f) shows quality of work
- (g) do not know

12. List up to six work units which could be used to measure work in your department.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
13. Indicate your general feeling toward work measurement as it may apply to your department or organizational unit. (check one)

(a) Do not consider work measurement essential in my department's operation.

(b) Undecided as to the merits of using work measurement in my department.

(c) Tend to believe in using work measurement in my department, but have some important reservations.

(d) Wholeheartedly believe in using work measurement in my department.

(e) Feel that work measurement is an absolute essential for good management.

(f) Do not know enough about work measurement to have very much of an attitude about its use in my department.

14. Indicate your general feeling toward the following statement:

"With an understanding and receptive point of view toward management techniques, naval officers can bring about a great deal of management improvement at naval shore stations on a relatively unrefined, commonsense basis." (check one)

(a) strongly disagree

(b) disagree

(c) uncertain

(d) agree

(e) strongly agree

15. Rank the effectiveness of the following means for getting naval personnel to understand, accept and use work measurement.

(Use a scale from 1 to 5, using 1 to indicate the most effective means and 5 to indicate the least effective means.)

Work measurement manual alone, promulgated by a strong directive from higher authority.

Work measurement manual used in connection with small group meetings and resultant individual participation.

Work measurement manual used in connection with small group meetings, staff assistance in "helping the officer to help himself," and resultant individual participation.

Work measurement manual used in connection with formal course.

Work measurement manual used in connection with large formal conference.
APPENDIX C

SMALL GROUP MEETING EVALUATION FORM

Ohio State University
Research Foundation
Navy Project 495 (05)

A. Did the group meetings help you get the meaning of work measurement?

- 2.2% 2.2% 48.9% 35.6% 11.1%
  No help Little Some More than Great help help help help help

N = 90

B. To what extent did these group meetings contribute to your willingness to give work measurement a try-out in your department or division?

- 6.8% 4.5% 31.5% 46.0% 11.2%
  Not at all Undecided Willing to Willing to Completely
  sold on whether I give it a give it a sold on
  trying it should give try but have try. trying it.
  it a try reservations

N = 89

C. On the basis of your experience in these meetings, rate the worth of "the small group meeting" as a means for work measurement indoctrination and training.

- 2.3% 1.1% 42.7% 32.5% 21.4%
  Worth Helps very It helps Helps Absolutely
  nothing little a lot necessary

N = 89

* Not answered on one form.
D. In your opinion what was wrong with the meetings?
(Point out specific things.)

E. What did you like about the meetings?
(Point out specific things)

F. What suggestions do you have for improving these group meetings?
(Make specific recommendations.)

Note: This form was used as part of the pilot studies at USNTC, San Diego, California, 30 March to 15 April 1953. Ninety people evaluated the group meetings, which was a 75 per cent return of the forms distributed. Some forms were not returned, because thirty people did not attend both of the small group meetings.
APPENDIX D

MATERIALS EVALUATION FORM

Ohio State University
Research Foundation
Navy Project 495 (05)

Title of Material __________________________

Date Evaluated __________________________

A. Extent to which MATERIAL is:

(1) UNDERSTANDABLE
(Extent to which you get the meaning of the material)

<table>
<thead>
<tr>
<th>1.3%</th>
<th>5.2%</th>
<th>7.7%</th>
<th>56.0%</th>
<th>29.8%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>6</td>
<td>43</td>
<td>23</td>
</tr>
</tbody>
</table>

Means nothing to me.
Mean very little to me.
Moderately little meaning.
Moderately clear meaning.
Get most or all of the meaning.

(2) USEFUL
(Extent to which you think the material will be of help to you in your job. You can see practical ways to use it.)

<table>
<thead>
<tr>
<th>11.6%</th>
<th>10.4%</th>
<th>52.0%</th>
<th>20.8%</th>
<th>5.2%</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>8</td>
<td>40</td>
<td>16</td>
<td>4</td>
</tr>
</tbody>
</table>

No help
Little help
Some help
More than average help
Great help

B. Over-all Rating of Worth of Material

<table>
<thead>
<tr>
<th>15.6%</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>46.6%</td>
<td>36</td>
</tr>
<tr>
<td>19.4%</td>
<td>15</td>
</tr>
<tr>
<td>11.6%</td>
<td>9</td>
</tr>
<tr>
<td>3.8%</td>
<td>3</td>
</tr>
</tbody>
</table>

Well worth keeping in program.
Worth keeping in program.
Probably worth keeping in program if revised.
Doubt if it should be kept in program.
Should not be kept in program.

C. Comments on Materials
(Suggest anything which would be of help in revising the material.)
### Comments on Materials

(Suggest anything which would be of help in revising the material.)

<table>
<thead>
<tr>
<th>Comment</th>
<th>Number of Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater simplification of content and arrangement of material.</td>
<td>7</td>
</tr>
<tr>
<td>More direct applications of written material to specific departments.</td>
<td>6</td>
</tr>
<tr>
<td>More detailed discussion on types of work units applicable to specific departments.</td>
<td>6</td>
</tr>
<tr>
<td>More definite information and instruction for breakdown of man-hours expended.</td>
<td>5</td>
</tr>
<tr>
<td>Not enough consideration of quality factor.</td>
<td>4</td>
</tr>
<tr>
<td>Attitude: Questioning value of work measurement in certain departments.</td>
<td>5</td>
</tr>
<tr>
<td>Approach: More definite instructions with manual.</td>
<td>2</td>
</tr>
<tr>
<td>No comments.</td>
<td>41</td>
</tr>
</tbody>
</table>

Note: This form was used as part of the pilot studies at USNTC, San Diego, California, 30 March to 15 April 1953. Seventy-seven people evaluated the "Local Command Work Measurement Manual" with this form. This is a 58 per cent return of the forms initially distributed.
I, Richard Thompson Rudduck, was born in South Bend, Indiana, April 30, 1916. I received my secondary school education in the public schools of the City of Mishawaka, Indiana. My undergraduate training was obtained at Wabash College, from which I received the degree of Bachelor of Arts in 1941. I received my degree of Master of Business Administration from the Graduate School of Business Administration, Harvard University in 1948, having concentrated my studies in the fields of Industrial Relations and Marketing.