

SUMMARY OF
INITIAL STUDY TO GATHER INFORMATION
AND DEVELOP GUIDELINES FOR
REVIEWING WORK MEASUREMENT SYSTEMS

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INTRODUCTION

Work measurement systems--one basis for measuring productivity--are management systems designed to compare production with standards of performance to determine how efficiently the work was produced. The ultimate function of any work measurement system is to provide a tool by which management can better use its resources.

Government officials have expressed an interest in increasing productivity in the Federal Government. As a result, the General Accounting Office, the Office of Management and Budget, and the Civil Service Commission established a multi-phased joint project to review this subject. Under phase I, information was gathered concerning the extent that work measurement systems are being used.

As a part of phase II, the Norfolk Regional Office was designated to study the effectiveness and reliability of systems in several Federal agencies. The major thrust of this work was to gather information and develop guidelines for other agencies' use in evaluating systems. We chose two installations within separate agencies to do this work.

This document summarizes our initial approach for studying work measurement systems. For each agency, we have summarized a description on the operation of the system, the approaches and methods used in studying the system, and our observations on the system's effectiveness and reliability.

OVERVIEW OF THE STUDY

A work measurement system involves five essential elements to ensure its effective application:

- Methods analysis directed toward the improvement of procedures and systems.
- Selection of appropriate measurement techniques.
- Development of standards to assure correct applicability.
- Accumulation and display of data on actual performance and its relationship to standard performance.
- Analysis and evaluation of performance or productivity, and initiation of necessary corrective action.

Understandably, both between and within Federal agencies, these elements can vary in composition and extent of use depending on the operation for which the system is designed. Therefore, our first approach was to select an appropriate system for review. During phase I, questionnaires were sent to agencies and departments, and briefings were given in order for us to gain more information on these systems. As a result of this preliminary information, one agency's system was chosen for the study because it was a progressive, innovative system. We then chose a representative installation for the study.

The system at this installation integrated several subsystems into one broad system. The subsystems related to the following subjects:

- Standards,
- Cost accounting,
- Management information,
- Performance evaluation,
- Management review, and
- Budgeting.

Throughout our study of this system, the agency provided extensive assistance and guidance. Our approaches and methods for reviewing this system included general orientation on the system, tracing a selected transaction through the system while developing guidelines for the review, and tracing two more transactions through the system while refining the preliminary guidelines. After the initial orientation, our work was geared toward the validity of data within the system, and whether the output data was used. These two factors--validity of data and use of data--in our opinion represent essential elements to the success of any system.

Based on our initial work, we observed that work measurement techniques were used and that the agency was placing emphasis on setting engineered standards, output data was generally valid and useful to higher levels; however, at the installation level, the accuracy of input data was not assured, and output data was not used effectively.

We chose the second agency and installation to further test the effectiveness and reliability of work measurement systems, while at the

same time, further refining the guidelines for reviewing systems. At this installation, there were two separate work measurement systems; one (standards program) was efficiency oriented, and the other (resources management program) was cost oriented. Our approaches and methods for review of these systems involved following the guidelines developed from the first installation. These guidelines primarily provided for evaluating the validity and use of data. Our tests showed that our initial guidelines were generally reliable for reviewing systems, and only minor revisions in the guidelines were required.

At this installation, the standards program seemed to be de-emphasized to the extent that there was an air of distrust in the standards, the input data, and the reports. We observed similar matters in the resources management program and, also, most supervisory personnel were not effectively using the reports.

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If the work at these installations should be representative, it seems that the Government is not getting maximum benefits from work measurement systems.

FIRST AGENCY

WHAT THE SYSTEM INVOLVED

The parent agency to this installation is responsible for buying, stocking, and issuing supplies and materials. To work efficiently, the installation must have the necessary stocks and transmit them quickly to using organizations. At the same time, the installation must have an appropriate number of personnel to perform the work.

To achieve these functions in the most efficient and effective manner, the installation establishes standards to do the work, accumulates data on time spent and work produced, compares the work produced with the standards, and analyzes production through a series of reports. These matters are integrated into a broad work management system which incorporates the following subsystems.

- A Standards subsystem provides for a systematic procedure of using industrial management techniques similar to comparable private industries. It provides for developing performance standards to determine the number of personnel needed and to evaluate productivity. Most standards developed are based on engineered techniques, such as, time-and-motion studies.
- A Cost Accounting subsystem collects man-hours and other cost data by functional area, such as, storage activities.
- A Management Information subsystem features a computerized central data bank at headquarters to provide all levels of management with a wide range of information on operations. This bank accumulates and stores manpower, cost, and performance data which are the basic ingredients for performance appraisals. The subsystem is designed to collect the information from all installations, bring it into the headquarters

level, and exhibit it to both the installations and the headquarters. Management reports are printed mechanically for program directors and staff elements with feedback information provided to the installations so that common reports are used to evaluate efficiency and effectiveness of mission accomplishments.

- The Performance Evaluation Reporting subsystem is a computerized analytical reporting procedure. It uses information from the central data bank at agency headquarters to determine how resources are used, and acts as a barometer of changing relationships between workload and resources. It is designed to show how resources were applied; to measure performance by comparing actual to standard production; and to provide cost information by various categories such as unit cost, personnel cost, and total cost.
- The Management Review subsystem provides for recurring performance briefings to top management and is built on the premise that top management must know on a timely basis how the organization is doing. Data is usually presented on (1) current trends in workload and performance efficiency, (2) status in meeting key program objectives, (3) qualitative indicators of mission performance, and (4) status of progress in special interest areas.
- A Programming and Budget subsystem uses workload-based performance budgeting techniques. Workloads are quantified in terms of manpower and funds required by applying performance standards and pricing factors. It functions to justify requests for resources and to allocate resources to current operations.

Standards used

Four types of standards are used in this system: detailed standards, intermediate standards, summary standards, and budget standards. Detailed performance standards are developed at the work center level for individual tasks. These detailed standards are combined for the various management levels and become intermediate standards.

Summary standards cover a program function or element such as "requisitions processed manually." By the establishment of summary standards, detailed performance standards are integrated into the headquarters resource management process. Development of these standards incorporates data on units produced, man-hours spent, earned hours (production X detailed standards), and other data relating to past performance. Using this information the installation projects what its performance will be and submits a recommended standard to headquarters. The recommended standard is evaluated at headquarters level by the applicable program manager and the controller. The approved standard then becomes the summary standard. The summary standard is to be used at headquarters for performance evaluation, staff actions by the program manager, and for determining and allocating resources. At the installation, the summary standard is for use in program development, and manpower management and distribution.

Budget standards are also developed at headquarters level. These standards are developed using gross indicators (such as tons shipped) for each cost account. In addition, one gross indicator is also developed for the installation. A standard is then developed by relating all earned hours for the installation to the gross indicator.

Reports

The primary work measurement report is a weekly and monthly production effectiveness report which is summarized for the various levels of management (work center, division, directorate, and installation head). The major portion of this report at the work center level identifies the function, the actual hours expended, the detailed standards by code and work unit, the work units accomplished, the standard time for each work unit, and the standard hours earned for the work units accomplished at the standard time per unit. By comparing actual hours expended to standard hours, performance effectiveness is determined. This report serves as a primary management tool at the work center level and provides the basis for performance data summarization.

Summary data is provided on a weekly basis to the next higher level of management at the installation--the division level. The details which were essential for work center management are omitted. The division level report provides management information needed on a recurring basis--actual hours, standard hours, resultant effectiveness, and a comparison of actual manpower to standard manpower equivalents (manpower that should have been required based on the standards) for each work center in the division.

Summarized division level data is provided monthly to the directorate level. Summarized information is also provided the head of the installation relative to the directorates. This report provides performance data to assist in installation-level decisions and actions.

Effectiveness reports become meaningful only when analyzed and, where applicable, action is undertaken to resolve apparent deficiencies or problems. The above reports are oriented toward management-by-exception practices. When data regarding a specific area indicates a problem, action should be taken to determine the cause.

HOW THE SYSTEM
WAS STUDIED

Major phases of our work included general orientation on the system, and tracing selected subaccounts throughout the system while developing our guidelines. The bulk of our work involved tracing the first sub-account to develop the preliminary guidelines. It became apparent that review of two factors--validity of data and use of data--would provide a basis for assessing the system in general, and provide a technique for identifying improvements needed.

In beginning our work, headquarters representatives presented briefings, including slide presentations, on the agency's system. We soon realized that (1) the system was much more complex than we had anticipated and (2) the agency's terminology was not as familiar to us as we had expected. To assist in overcoming these problems, agency officials provided 3 days of intensive training on the system and its terminology. This training covered subjects that are normally presented to the agency's analysts during a 5-week training session.

After our orientation of the agency system, we were briefed by the installation on their operations and involvement with the agency's

work measurement system.

Recognizing the complexity of the system, we decided to select one subaccount and work as a team to trace it from the work center level through its use at the headquarters level. This standardized approach would provide a better understanding to all staff members of the work to be accomplished and serve to establish a single frame of reference. The most important aspect of selecting the initial subaccount was to ensure that it was representative of the system. Accordingly, we selected one of the more established accounts in the system. This subaccount covered functions relating to certain materials and supplies that had to be processed manually. To determine this subaccount's appropriateness, we analyzed the number of personnel assigned under this subaccount, the types of standards used, the number of detailed standards used, and the number of personnel covered by each standard.

After selecting the subaccount, we charted the overall data flow from the work centers to the highest management level where the data was used. This included identifying the forms of system input, tracing the data through the manipulation stages, and identifying the forms and uses of the various outputs. This process provided additional information concerning the system's operation. After becoming familiar with the overall flow, we contacted the analysts responsible for the standards in the area of our initial subaccount for assistance in flow chart-

ing in detail the work relating to that subaccount.

After tracing the initial subaccount, we developed preliminary guidelines for reviewing the system--primarily in connection with validity and use of data. We then selected two other subaccounts relating to different work functions and traced them through the system following the preliminary guidelines. The work for all three subaccounts was very similar. Therefore, the following sections combine all three subaccounts in describing how the system was studied.

Validity of data

In order for a system to function effectively, accurate data must be put into the system and produced by the system. In reviewing this area, our first concern was to satisfy ourselves that the standards for measuring performance were valid. We then could determine if the input data was reasonably accurate and the output data provided a valid basis for management decisions.

Standards

Independent verification of the validity of standards would have been time-consuming and would have required expertise in industrial engineering. Therefore, our approach for verifying standards included identifying the types of standards in use, assessing the qualifications of those engaged in setting the standards, and assessing the methods and procedures used to establish the standards.

We first identified the organizational element responsible for establishing the standards and its position in the organizational structure. Preferably, the group responsible for setting standards should be independent of any organizational element to which the standards apply. If this condition did not exist, we would have to satisfy ourselves that there were adequate controls to ensure the group's independence.

We then reviewed the criteria used in determining the number of analysts required to adequately maintain the system. We asked how the criteria were developed and compared them to those of other agencies and independent firms. After satisfying ourselves as to the adequacy of the criteria, we compared the number of analysts established by the agency's criteria to the number on board. This information would be valuable if the results of further inquiries indicated that the reliability of the standards was questionable.

We also determined how the standards group was organized. In our opinion, a team approach is superior to an individual approach because of the exchange of ideas, less chance of influence by the individuals being measured, and the opportunity for more effective on-the-job training of analysts. We also scanned analysts' workload schedules and interviewed officials to determine how staff assignments were made.

Since the validity of the entire system depends on the accuracy of standards established, competent people should be setting the standards.

We obtained information concerning the qualifications required for analyst positions, the type of training provided before analysts are allowed to set standards, and the type and frequency of training provided to increase the analysts' proficiency and awareness of innovations in work measurement. We obtained opinions of analysts as to whether the criteria and practices for hiring analysts are adequate. We also questioned the analysts as to whether the internal training they receive is sufficient for the tasks they perform.

Our next effort was based on the criterion that standards should be established on the basis of the most efficient and economical method for performing a task. Using this criterion, we determined whether method studies were required and if so, whether the recommendations resulting from the studies were implemented. Method studies should precede the establishment of standards for identifying the best method and eliminating nonessential and duplicate operations.

By examining instructions for the standards program, we identified the requirements regarding periodic reevaluation of established standards. We discussed the adequacy of the established time intervals between reviews with analysts. We were also alert for any evidence that the agency had de-emphasized standards development, such as by excessively reducing the work measurement staff once initial standards were established.

Our final work in this area included testing a representative number of standards within the selected work centers to determine whether pro-

cedures for the reevaluation of the standards were being followed. We also traced the history of standard changes, the reasons for such changes, and determined whether adequate procedures were followed in the use of certain work measurement techniques.

After reviewing the organization and qualifications of the analysts and the documentation for the standards selected, we analyzed the overall results to determine whether an expert in industrial engineering should be consulted to perform a more detailed assessment of the procedures being followed. We made a determination that since there was an independent organization for setting standards, analysts were adequately trained, and the review of the standards' documentation revealed no apparent problems, additional work would not be necessary in this area.

Input

We found that in most instances input data was being reported manually by the same individuals who performed the work. Input counted independently, such as by automated count, usually contains fewer errors than manual input. Where the count is manual, particularly by the individuals whose performance is measured, an absence of any procedures to verify the input, at least on a test basis, would tend to render the input suspect. Realizing the difficulty and time involved in verifying each individual's work count over an extended period of time, we concentrated on assessing the adequacy of internal controls for ensuring accurate input to the degree of tolerance acceptable by management. We evaluated the procedures for recording and reporting work accomplished and direct and indirect hours expended.

Based on our results, we made selective tests to determine the validity of input data. These tests were made to determine whether all work completed and man-hours expended were counted. In testing for accuracy of work-count data, we identified locations where the output from one work unit would represent the input to the next. This provided a ready means for externally checking the output count of the first unit.

For testing the validity of the man-hours reported, we compared time and attendance records for a selected period to the total hours reported through the work measurement system.

Employees who manually count their work units may have a tendency to overstate the count if they believe the system is used to check their individual output. Therefore, it is extremely important that employees be familiar with the purposes of the work measurement system. As a test, we interviewed several employees to determine if they knew the purposes of the system.

Output

Input data are usually summarized and merged to produce information in report form for use by management. To satisfy ourselves that the output data properly reflected the aggregate of pertinent input, we familiarized ourselves with the data manipulation process, particularly the

controls established for maintaining data accuracy. We obtained the necessary information by examining flow charts and logic diagrams and through discussions with operating personnel. These sources provided a broad picture of the operation and defined what the system did to the source data.

We next determined whether the system had adequate controls to ensure accurate data manipulation. We observed actual operations to obtain a better understanding of the system. We evaluated the handling of errors disclosed by internal controls to assure that erroneous data were corrected and re-entered into the system in a timely manner.

Use of output data

A work measurement system can have accurate standards and valid input and output data but serve no real purpose unless the output is effectively used. In evaluating the use of output data, we determined what information management receives, how management uses it, whether the information is sufficient, and whether any action was taken. We began our review at the lowest management level and traced the use of data through the headquarters level.

Installation

Our plan for obtaining information on the use of output data included having all work measurement reports distributed to us, obtaining a list of all work measurement reports received by the department in which we were working, and interviewing various levels of management.

We determined which management level received the reports, whether the reports were timely, and the extent to which the reports were used.

Interviewing individual managers to obtain broad coverage would be extremely time-consuming. We therefore developed a questionnaire to obtain broad coverage within a short time frame. We developed the questionnaire, not only for the purpose of determining use of data, but also to assist in identifying any problems in the system which we had not initially recognized.

In administering the questionnaire, we again coordinated with agency officials. We administered the questionnaire in groups to managers of the same level. For example, our first session was for department heads and the second was for branch chiefs. One problem in this approach was that, by the time the second group participated, the information concerning what was on the questionnaire had filtered down through the various levels.

By reviewing system documentation, we determined the intended purposes of the reports. By comparing the intended purposes with the managers' reported use of the output, we were able to determine if the reports were being used as intended.

The questionnaire responses were used to determine the extent to which reports were being used for planning, budgeting, manpower allocations, operations, and performance appraisals. We also used the questionnaire responses to identify reports not used by managers and the reasons for lack of use.

At the installation level, we also determined if the work measurement system provided management sufficient information to identify productivity increases. We inquired into the extent to which productivity trends were used for the whole installation, as well as for each of its major mission elements. We determined whether a goal had been established for increasing productivity, and obtained and evaluated the procedures for computing changes.

Headquarters

Work measurement data can be very useful at headquarters for evaluating performance and for determining what resources are required. Our work at headquarters in connection with use of data included (1) identifying the organizational components that receive the work measurement reports, (2) obtaining a statement of the mission for each organizational level, (3) identifying the reports received by these levels, (4) inquiring into how each level uses the reports in managing operations, (5) evaluating managers' opinions as to any problems experienced in using the reported data for management decisions, and (6) identifying any staff element or office responsible for consolidating the work measurement system information for presentation to higher management levels.

From information received concerning work measurement systems in general, we knew that the primary use at the headquarters level would be in the budget formulation process. Therefore, we made inquiries into

how the budget was constructed, identified any input information other than that from the work measurement system which was used in the budget formulation process, and inquired into the authority granted to each installation for redistributing authorized manpower once the budget is established.

At this level we also examined the adequacy of headquarters' management of the work measurement system. At headquarters, we identified the reports received on the operation of the work measurement system, and evaluated the procedures management followed in monitoring the system. We considered the headquarters training program for the installation's analysts, the system for reviewing standards established by these analysts, and for testing the validity of data received from field installations.

OBSERVATIONS ON THE SYSTEM

From our initial study, it seemed that standards were valid, output data was generally valid and useful to higher levels; however, at the installation, the accuracy of input data was not assured, and output data was not being used effectively.

Validity of input data

We observed that independent checks were not made to insure valid work counts. The counts were, more often than not, made manually by employees in the work center being measured. Some of these employees did not have a good understanding of the purposes of the work measurement system; therefore, they could be inclined to overstate their work

counts with the belief that the system was designed to check on individual output. We also identified opportunities for establishing an automatic computer count.

The installation did have a limited control procedure which involved having analysts review reports on production and efficiency for reasonableness of data. As a result, the analysts have identified some significant fluctuations which possibly could have been caused by erroneous input data.

Installation use of output data

Through questionnaires and discussions with supervisory personnel, we found very limited use of the work measurement output below division level management. Questionnaire responses disclosed that a majority of supervisory personnel did not even receive the report. The main emphasis by all levels of management was on summary standards and not on detailed standards. Detailed standards were more representative of work performed at the work center levels and should have been used at those levels for performance evaluation, production control, and resource programming and distribution. We found the work measurement system reports to be primarily used by analysts for monitoring the standards program. There appeared to be several contributing reasons as to why work measurement reports were not being fully utilized.

- A general lack of education by middle and lower management as to how work measurement reports could be used.
- Inability to take timely corrective action based on work measurement data because of lack of authority.
- An overemphasis on summary standards at the installation, evidently because summary standards are emphasized by headquarters.

FOLLOW-ON AGENCY

WHAT THE SYSTEM INVOLVED

At the installation level, we found two separate work measurement systems. One (standards program) was efficiency oriented while the other was cost oriented (resources management program).

Standards program

For the standards program, analysts develop detailed performance standards at the work center levels. The detailed standards are summarized as composite standards which also include fixed allowances for supervision.

The primary work measurement report under the standards program is the weekly and monthly production report. This report is summarized at various management levels from the work center level to the installation level. This report contains information such as earned/authorized man-hours, actual man-hours, work units completed, and production efficiency. A supplemental data report is also prepared which contains earned man-hours, actual man-hours, production effectiveness by cost accounts, and production rates using work counts from the resource management program.

Resources management program

The resources management program is more cost oriented than the standards program. The standards program and the resources management program have different types of work units reported as input. Detail

work units (boxes packed or pallets stacked) are reported in the standards program, whereas gross measures (tons received and tons shipped) are reported in the resources management program. Both programs use the same cost and organization codes and, as previously stated, the earned hours computed for the standards program and work units for the resources management program are used to compute production rates for the supplemental data report. Each month, the work units completed are reported from each department. Actual costs are also accumulated by the accounting department for inclusion in the reports.

The primary work measurement reports generated from the program include an operating budget expense report and a performance statement report.

--The operating budget expense report is prepared in detail by cost center and summarized for the installation. This report is designed primarily for local managers and portrays cumulative man-hours and expenses by cost center and cost account code. Subtotals are shown for each cost center on the detail report and total expenses by cost center are given on the summarized report.

--The performance statement report is also prepared in detail and summary form each month for distribution to the installation and department heads. This report indicates funds budgeted and spent through the end of the month being reported for each cost account.

HOW THE SYSTEM WAS STUDIED

Our secondary objective for work at this installation was to further refine the guidelines developed at the initial installation. For the most part, the guidelines proved to be satisfactory and only minor revisions were necessary. The guidelines, which have been published

(planned to be published about May 15, 1972), adequately describe our methods for study at this installation. Accordingly, our work approaches and methods are not repeated here.

OBSERVATIONS ON THE SYSTEM

At this installation, we found a situation almost in contrast with the first agency studied. The standards program at this installation seemed to be de-emphasized to the extent that there was an air of distrust in the standards, the input data, and the reports. In more detail, we noted that:

- Initial hiring and training procedures for analysts were adequate but there were no programs for updating basic training.
- The majority of the standards in use were set by work sampling. This technique is not as precise as engineered techniques, such as time-and-motion studies.
- Over a period of several years, there has been a decrease in the ratio of engineered to nonengineered standards.
- Of the standards we examined, 57 percent had been established for more than 2 years without a review by the analysts.
- We noted errors in several standards and, in other instances, adequate documentation was not available to support the computation of standards.
- In most cases, the managers at all levels said they made no use of reports.
- No independent group was responsible for monitoring either the input or output of the system. Responsibility for valid data was delegated to the lowest supervisory level.

--There was a lack of understanding by supervisors and employees as to the purposes of the system.

--In most cases, production efficiencies were not monitored; therefore, work centers were not required to answer for poor efficiency.

For the resources management program, independent checks were not made to determine the validity of work counts. The responsibility for valid input was delegated to the department heads. Most of these officials had no system for monitoring input data. The majority of these counts were made manually by employees in the work center being measured. Most of these employees did not have a good understanding of the purpose for the system. We found that the resources management program reports were used primarily by the budgeting section. As we found in the standards program, the attitudes of personnel at all management levels was that of distrust in the accuracy of input and reports. Furthermore, we found that most of the supervisory personnel had no idea as to how to effectively use the reports.