

STRUCTURE OF WORKER FUNCTIONS*

Data	People	Things
0 Synthesizing	0 Mentoring	0 Setting-Up
1 Coordinating	1 Negotiating	1 Precision Working
2 Analyzing	2 Instructing	2 Operating-Controlling
3 Compiling	3 Supervising	3 Driving-Operating
4 Computing	4 Diverting	4 Manipulating
5 Copying	5 Persuading	5 Tending
6 Comparing	6 Speaking-Signaling	6 Feeding-Offbearing
	7 Serving	7 Handling
	8 Taking Instructions-Helping	

Note: The hyphenated factors Speaking-Signaling, Taking Instructions-Helping, Setting-Up, Operating-Controlling, Driving-Operating, and Feeding-Offbearing are single functions.

*The Department of Labor's definitions for these Workers Functions are given in appendix B.

Work Fields

Work Fields are organizations of specific methods either (1) characteristics of machines, tools, equipment, or work aids, and directed at common technological objectives, or (2) characteristics of the techniques designed to fulfill socio-economic purposes. There are 99 Work Fields which have been organized for purposes of classifying all the jobs. . . . The Work Fields have been organized into groupings (which are) more or less similar technologically or socioeconomically in overall objectives, that is, the getting of materials and making of products, the processing of information, and the providing of services. . . .

Machines, Tools, Equipment, and Work Aids

These are the examples of the instruments and devices which are used to carry out the specific methods. . . . (Precise definitions are given for each of the separate parts of this category.)

Materials, Products, Subject Matter, and Services

These include: (a) Basic materials being processed, such as fabric, metal, or wood; (b) final products being made, such as automobiles and baskets; (c) knowledge being dealt with or applied, such as insurance or physics; (d) types of services, such as barbering or dental services. . . .

Worker Traits

The requirements made on the worker are expressed by Worker Traits factors. These are reflected in the following components. (1) Training Time, (2) Aptitudes, (3) Temperaments, (4) Interests, and (5) Physical Demands. This body of job information provides a sharper focus on the type of work involved and the traits demands made on the individual worker concerned, and is extremely helpful in counseling, job development, training, and other activities directed toward full manpower utilization. Following are the definitions of the Worker Trait Components:

Training Time is a combination of General Educational Development and Specific Vocational Preparation required for a worker to acquire the knowledge and abilities necessary for average satisfactory performance in a specific job.

General Educational Development: This embraces those aspects of education (formal and informal) which contribute to the worker's: a) reasoning development and ability to follow instructions and b) acquisition of "tool" knowledge such as language and mathematical skills.

Specific Vocational Preparation: This is the amount of learning time specifically directed at a definite vocational goal. This training may be acquired in a school, work, military, institutional, or vocational environment.

Aptitudes. Aptitudes are the specific capacities or abilities required of an individual in order to facilitate the learning of some task or job duty. Following are the aptitudes used: (1) Intelligence, (2) Verbal, (3) Numerical, (4) Spatial, (5) Form Perception, (6) Clerical Perception, (7) Motor Coordination, (8) Finger Dexterity, (9) Manual Dexterity, (10) Eye-Hand-Foot Coordination, (11) Color Discrimination.

Temperaments. Since "temperament" has a wide range of meaning, this range has been limited to: "Those personality qualities which remain fairly constant and reveal a person's intrinsic nature." For the purpose of collecting job data, these traits are evaluated in terms of job situations that require the worker to possess certain temperament qualities or to be able to adjust to tests that require them. This consists of adjustment to situations involving:

(1) Variety of duties often characterized by frequent change.

(2) Repetitive or short cycle operations carried out according to set procedures or sequences.

(3) Doing things only under specific instructions, allowing little or no room for independent action or judgment in working out job problems.*

(4) Direction, control, and planning of an entire activity or activity of others.

(5) Dealing with people in actual job duties beyond giving and receiving instructions.

(6) Working alone and apart in physical isolation from others, although activity may be integrated with that of others.*

(7) Situations involving influencing people in their opinions, attitudes, or judgments about ideas or things.

*Temperaments 3 and 6 have been found to have limited utility and have been deleted from the *Handbook for Analyzing Jobs*.

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Job Analysis for Human Resource Management: A Review of Selected Research and Development

MANPOWER RESEARCH MONOGRAPH NO. 36

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Manpower Administration

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Human Resource Management:
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U.S. DEPARTMENT OF LABOR
Peter J. Brennan, Secretary

Manpower Administration
William H. Kolberg
Assistant Secretary for Manpower



1974

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I. INTRODUCTION

A considerable expenditure of funds has been made over the last several years by the Federal Government and others to research, develop, and apply techniques of job content determination and analysis for the purpose of hiring, training, and upgrading the disadvantaged. The Manpower Administration of the U.S. Department of Labor has been a leader in this effort, but significant projects have also been funded by other Federal agencies, particularly the Department of Health, Education, and Welfare, as well as by other governmental and private groups. Many, perhaps most, of these projects have been undertaken in isolation from one another. A body of knowledge and experience now exists which needs to be critically reviewed so that the most appropriate and cost-effective use can be made of it. Without such a review, the most useful aspects of this experience might fail to receive the dissemination and close attention among practitioners and researchers which they deserve; and as a result, earlier mistakes might be repeated.

The purposes of this monograph are to summarize the various job analysis techniques that have been developed, to discuss their applications to selected human resource management activities, and to suggest priorities for further research and developmental work. The primary focus is on projects funded by the Department of Labor's Manpower Administration through its Office of Manpower Research and Development. Selected projects sponsored by other organizations are discussed when doing so serves to supplement or clarify the treatment of the basic issues in job analysis. But this report does not claim to represent a comprehensive discussion of all the significant research and development work

in the field. For example, many projects employing the Upjohn Institute's Functional Job Analysis (FJA) procedures were funded by the Department of Health, Education, and Welfare and are not included here. The basic components of FJA are described in this report, however. The primary intended audience consists of those practitioners in manpower programs or personnel offices who may find job analysis useful in their efforts to develop new career opportunities and facilitate more efficient manpower utilization. Researchers should also find the document helpful, as will Federal and State officials charged with responsibility for recommending, approving, overseeing, or evaluating local projects employing job analysis procedures.

The approach taken here is largely descriptive and comparative. The different techniques are displayed as on a smorgasbord, and the reader is encouraged to select for further study those which seem best suited to his or her specific needs. An attempt was made to make the descriptions detailed enough to do justice to each method under review and to give the reader a basis for determining whether further inquiry is warranted. However, this monograph is not a how-to-do-it manual. Persons considering using any of the analysis techniques discussed here should contact the researchers directly. These techniques are still evolving and often even the most recent published documents contain methodological aspects which are outdated. A list of researchers' mailing addresses is included in appendix C.

Interspersed throughout the text are comments intended to illuminate similarities and differences among the various methods of analysis, suggest appropriate uses for them, and identify their relative

strengths and weaknesses. No attempt was made, however, to evaluate these methods in any systematic or scientifically rigorous way. Such an attempt would have been beyond the resources of this study. The determination as to which techniques are most appropriate for each occupation, in various organizational settings and for each application, represents a logical next step in the development of job analysis as a human resource management tool.

What Is Job Analysis?

Job analysis may be defined as any process of collecting, ordering, and evaluating work- or worker-related information. It is not an end in itself but rather a means to any of several ends. The purposes for which an analysis is conducted largely determine the types of information gathered and the ways in which that information is arranged. Thus, a study whose objective is to develop jobs for the physically handicapped may use different scales, highlighting different aspects of the task data, from one which is intended to assist in establishing a position classification system. The information may reflect job content, expressed in terms of specific work activities and procedures, or it may consist of the worker characteristics (skills, knowledge, aptitudes, tolerances, etc.) required for adequate job performance. In some instances, both job-oriented and worker-oriented information may be useful.

An analysis may have either a narrow or a broad focus. In the first instance, for example, a study may be conducted of single job classifications, or a small group of related classifications, within a specific organizational setting such as a factory or an office. The results of such a study would be designed for implementation solely within the organization in which the analysis was conducted. A project with a broader focus may involve the analysis of entire occupations, such as nurses or engineers, or functional areas, such as law enforcement. The study would be conducted in one or more representative organizations for the purpose of developing model staffing patterns, qualifications requirements, training programs, etc. These models could then be adapted for use in any organization which employs workers in one or more of the occupations analyzed or performs a function which has been studied.

Applications of Job Analysis Data

The projects under consideration in this report have addressed themselves to several applications of job analysis. A large part of the author's concern is with the kinds of information which the project staffs have sought to gather to accomplish their objectives and the methodological tools which they have developed, adapted, or borrowed in order to obtain that information. The following are brief discussions of some of the uses to which job analysis data can be put.

Job restructuring—A review and analysis of job content data can illuminate situations in which employees with given levels of expertise are performing work significantly above or below those levels or have been given duties which are essentially unrelated to the primary content of their jobs. These situations, which often develop gradually and in response to conditions which no longer exist, can result in highly inefficient use of manpower. Job restructuring is also an effective procedure for eliminating dead end jobs which inhibit employee development, weaken employee morale, and contribute to high turnover rates. The task statements can identify individual worker activities that can be transferred from one job to another. In addition, when the statements are rated on the appropriate scales, managers have valuable information concerning the complexity of each task and its appropriateness for reallocation to another job.

Training program development—Too often, the content of agency training programs is based on intuitive perceptions, or misperceptions, of the skills and knowledges required for adequate performance in a given job. With the rapidly changing nature of many jobs, however, it is no longer possible to assume that employees have the same training needs they have always had. The task statements can identify specific skill and knowledge requirements for each job and aid the trainer in developing behavioral objectives for his trainees.

Qualifications standards development—Since many administrators lack an adequate understanding of the precise nature of the work performed in their organizations, they frequently rely on artificial, and largely irrelevant, criteria when preparing entry and promotional requirements. These require-

ments often screen out applicants who would be capable of doing the job and allow inappropriate candidates to slip by. Properly identified and analyzed task data will give administrators a better idea of precisely what kinds of work experience and educational backgrounds should be required for both entry into the organization and promotion within it.

Test development—Written tests have come under increasingly heavy criticism as being discriminatory and failing to predict employee performance accurately. In recent decisions, the courts have ruled that a written test which cannot be proved to be job related and which has a discriminatory impact is in violation of the law. In any event, an employer's interests are best served by selection procedures which identify those applicants most capable of doing the job, not simply those most adept at taking tests. Since the task data accurately reflect the work currently being performed in an organization, or the skills and knowledge required to perform the work, tests or other selection procedures based on these data can readily be shown to be job related.

Performance evaluation—The evaluation of employee performance can and should be used for a great many personnel management purposes. Regular evaluations can identify exemplary work to be rewarded in the performer and encouraged in other employees. They can also identify substandard performance which may necessitate special training or counseling. Evaluation is thus a primary tool for insuring that management decisions and policies are properly implemented throughout the organization. Employee performance evaluation also plays a central role in the selection process. Without an accurate way of identifying the superior, the adequate, and the inadequate worker, it is impossible to tell whether an organization's entry examinations are in fact selecting the best candidates. If the examinations are valid, they should correlate positively with subsequent performance evaluation; i.e., unless those individuals with high initial test scores receive high performance ratings, the tests cannot be said to be valid predictors of success on the job.

For all its importance to managers, performance evaluation is often conducted in a highly perfunctory manner with results of dubious usefulness. The major problem, again, is the lack of job-related criteria. In many cases, performance standards are excessively vague and refer to personal characteristics felt to be in some way desirable. Such quali-

ties as "initiative" and "reliability" may or may not be interpreted in the same way by different supervisors and, more important, may or may not be important to adequate job performance. Accurate job content identification and analysis, on the other hand, can provide the groundwork for job-related and results-oriented evaluation criteria.

Preparation of accurate job descriptions—Since the responsibilities and activities of most organizations change over time, even job descriptions which were once accurate can easily become obsolete and thus useless to managers. Data from a job analysis, on the other hand, are based on recent observations of, and interviews with, employees as they perform on their jobs. Accurate job descriptions can help guarantee that employees, supervisors, and managers share a common understanding of the duties and responsibilities of each job.

Employee counseling—When agency personnel officials have detailed information concerning the basic content, qualifications requirements, and skill requirements of every job in the organization, they are able to give comprehensive career counseling to agency employees. Both entry-level and senior employees can benefit from information concerning the career alternatives open to them within the agency.

Identification of safety hazards—The Occupational Safety and Health Act reflects a growing national concern for eliminating hazardous working conditions. Job analysis can be used to identify current and potential dangers in job situations.

Other uses—Job analysis data can also be used in a number of additional areas. Among them are wage and salary administration, job development for the disadvantaged or the physically handicapped, affirmative action program planning and implementation, manpower planning, and establishment of management information systems.

It should be emphasized that the basic data from a job analysis will not automatically result in job restructuring, training program development, or the other applications discussed above. Often, the skills of other persons—curriculum specialists or psychometricians, for example—are required. At the very least, the data must be reviewed by agency administrators or their staffs, using commonsense and an understanding of special agency needs, constraints, or priorities.

Also, the data will not remain accurate and useful for an indefinite period. As agency goals, objectives, and priorities are altered, as internal reorganizations are accomplished, as technologies requiring new skills and work procedures are developed, the basic task structure of the organization will change. Thus the task data must be reviewed and revised periodically to insure against basing crucial personnel decisions on obsolete information.

Structure of This Report

The remainder of this introduction is designed to aid the reader who lacks the time to read the entire report and wants to locate sections of particular interest.

Chapter II introduces the major job analysis methodologies, beginning with the approach developed and used by the employment service of the U.S. Department of Labor. Also included are The W. E. Upjohn Institute's Functional Job Analysis, the procedure developed by Eleanor Gilpatrick and her colleagues at the Health Services Mobility Study, and the Position Analysis Questionnaire developed by Ernest McCormick and others at Purdue University's Occupational Research Center.

Chapter III summarizes several individual projects employing job analysis for human resource management purposes. Each is discussed in terms of its goals and objectives, its major methodological characteristics, and its significant results. Chapter IV deals with four applications of job analysis data—job restructuring, education and training, qualifications examining, and performance evaluation. The findings and procedures of many of the research efforts described in the two preceding chapters are reviewed.

Chapter V covers some of the critical, nontechnical aspects of a job analysis, such as staffing the

study and obtaining support for it. Also included are the results of a poll conducted by the Manpower Management Institute of graduates of its job analysis training sessions. These results provide insights into some of the problems faced by practitioners attempting to conduct analyses. Chapter VI discusses some of the major issues in job analysis and presents recommendations for future priorities in research and development.

Appendixes A and B discuss in some detail certain technical aspects of job analysis—various formats for writing task descriptions and scales for use in analyzing the data. They should be reviewed by the reader who is seriously contemplating a job analysis in his or her organization. Appendix C contains mailing addresses of the researchers whose work was discussed in the report. Appendix D consists of a list, prepared by Ann Hok of The W. E. Upjohn Institute for Employment Research, giving bibliographic information on projects using Functional Job Analysis. The report concludes with a bibliography.

The decision to place the discussions of task identification, description, and analysis in appendixes was made primarily to streamline the main body of the report, removing from it the more technical aspects of job analysis. It was felt that the reader looking for a general introduction to the field would be most interested in overviews of the principal methodologies, summaries of significant projects, and discussions of the ways in which job analysis data have been used to improve personnel management and career development.

On the other hand, the reader faced with making some hard decisions on the most appropriate analytical procedures for his or her particular needs is advised to read the technical appendixes carefully. Job analysis is a unitary process. It is impossible to make valid judgments on the value of a study's final product without understanding the ways in which the basic data were described and the dimensions on which they were evaluated.

II. MAJOR JOB ANALYSIS METHODOLOGIES

This chapter contains descriptions of four approaches to job analysis. The Department of Labor methodology is discussed first because of its widespread use and because an understanding of its concepts should be useful in learning the principles of the other techniques.

The Department of Labor Methodology (26, 50, 52)*

The most extensively researched and widely used job analysis methodology in the United States is that developed by the U.S. Department of Labor. It is used for various purposes and to varying degrees in each of the State employment services and by several manpower programs funded by the Labor Department. Many State employment security agencies give training in the methodology to governmental and private sector personnel. Most of the research and development projects discussed in this report used either the Labor Department methodology or a variation on it.

The definitive history of the development of this methodology has yet to be written. However, a Labor Department document prepared in 1970, "Job Analysis in the United States Training and Employment Service," traces the evolution of the methodology, provides some rationale for the shape it took over the years, and describes each of its compon-

ents. The following paragraphs are excerpted from that document (26).

In the United States Training and Employment Service,** job analysis is defined as the activity involved with determining what the worker does in relation to Data, People, and Things: the methodologies and techniques employed; the materials, products, subject matter, and services involved; machines, tools, equipment, and work aids used; and the traits required of the worker for satisfactory performance.

With the passage of the Wagner-Peyser Act in June 1933, there came into being an Employment Service requiring the registration of individuals in the working population according to their occupational characteristics on a scale unprecedented in the history of the country and probably in the history of the world. The Act provided for the development of the present nationwide public employment service through the creation of the United States Employment Service and the establishment of the temporary National Re-employment Service.

From a broad point of view, the responsibilities imposed upon the public employment system by the Wagner-Peyser Act have as their objective: (1) The facilitation of the movement of unemployed persons into profitable employment. (2) the provision of occupational guidance to individuals seeking a vocational field and to employers having special recruitment problems, and (3) reduction of the waste of trial and error recruitment through taking into account, first, the worker qualifications that are necessary to successful job performance and, second, recruiting relationships between occupations.¹

¹ William H. Stead and W. Earl Masincup, "The Occupational Research Program of the United States Employment Service," *Public Administration*, 1942.

It soon became apparent that, in order for such a nationwide employment service to carry out these missions, there was a specific and urgent need for a comprehensive body of occupational information which could be used as basic reference and operational data. To answer this need, the Occupational Research Program of the U.S. Employment Service was initiated. A group of individuals with wide experience in personnel and occupational research work in industrial, governmental, and educational institutions were

*The numbers in parentheses refer to items in the bibliography.

**Now the U.S. Employment Service.

invited to act in an advisory capacity to this new program. This group was designated as the Technical Board for the Occupational Research Program of the United States Employment Service. From their experiences in the field of occupational analysis and the development of selection techniques, the members of the Board felt that two broad principles should govern the planning of such a project.

1. The Program should provide for an initial period of very extensive gathering and processing of data to provide an overall picture of the occupations that exist in the American economy together with a standardized concept of the nature of each occupation.

2. All data should be gathered from original sources through the observation of workers in the working environment in order to reflect occupational facts as they exist rather than to build up an academic statement of an ideal occupational structure.

In the initial stages of the Program, techniques were developed for identifying and describing occupational analysis information significant in bringing together a person and a job. These techniques evolved into a "job analysis methodology," which was presented in a series of instructional manuals for internal use over approximately a 10 year period. Finally, in 1944 a basic *Training and Reference Manual for Job Analysis* was published. From that date, this manual and its revision in 1965 have served as a basic guide for the collection and recording of source data fundamental to the development of occupational analysis information and the tools based upon it.*

The job analysis techniques developed during this period reflected the job market situation of the times, that of a surplus of qualified workers and a shortage of jobs. Consequently, the data collected emphasized the tasks (the what, how, and why of the job) and placed little emphasis on the characteristics required of the worker. On the standard Job Analysis Schedule, the form for recording the data, and three items—experience, training, and performance requirements (responsibilities, job knowledge, mental application, and dexterity and accuracy)—referred to the qualifications a worker must bring to the job.

By the 1940's the economy, including the job market, had radically changed, rather than the surplus of qualified workers of the Depression years, there now was a scarcity of workers, and a surplus of jobs needing to be filled, which demanded a change in hiring practices. The urgency was for recruiting for defense jobs. Highly selective recruitment on the basis of experience had passed out of the picture. Acceptance of inexperienced workers with potential for the jobs became a common practice. In order to utilize every available manpower source, it became increasingly important for recruitment and placement personnel to be provided with estimates of the characteristics or traits which the applicant should possess in order to learn to perform the job. With the not fully qualified (entry) worker becoming important as a manpower resource, the necessity arose for a system of evaluating jobs and workers' potential on the basis of traits requirements.

The first attempt to meet this need was the expansion of the Job Analysis Schedule to include two attachments: (1) A form for recording the Physical Demands of jobs and (2) a Worker Characteristics Form for recording the "personal traits" required of the worker. Each job analyzed was analyzed in terms of significant items on these two attachments, as well as those on the schedule itself.

*This manual was superseded by the *Handbook for Analyzing Jobs*, published in 1972. (52)

The next attempt to provide Worker Traits information appeared in Part IV of the *Dictionary of Occupational Titles*, 1944. This document was entitled "Entry Occupational Classification" and was developed for use in counseling and placing entry workers. Part IV defined entry workers as "individuals who must find employment on some basis other than prior work experience or fully qualifying training." More specifically, they are those individuals who are not fully qualified to compete with experienced applicants for referral to specific occupations; and those who are fully qualified in a specific occupation but who must or wish to enter some field of work in which they do not have competency.

This document contained groups of jobs which had been analyzed and were described in terms of "personal traits," examples of which were, Ability to relate abstract ideas, ability to plan, memory for detail, facility with language, dexterity and muscular control; persuasiveness; liking for people, etc. The information in Part IV proved so useful that in 1949 a project was initiated for the development of a new classification system for jobs that would reflect all significant facts about a job, particularly the two basics—what the worker does and the requirements made on him. One of the first steps was to categorize, define, and standardize traits required of the worker, and to provide manualized techniques and instructions for determining Work Performed and Worker Traits requirements. This activity became known as the Functional Occupational Classification Project. A later stage of the Project included the application of concepts and procedures in the manuals to the analysis of a selective sample of 4,000 jobs. Some of the resulting data were released in our publication, *Estimates of Worker Traits Requirements for 1,000 Jobs as Defined in the Dictionary of Occupational Titles*, 1956. This work was helpful in the research and development of the occupational classification structure for the third edition of the *Dictionary of Occupational Titles*.

The Functional Occupational Classification Project also provided the data upon which to base a new methodology for job analysis. For the past 10 years this methodology has been used experimentally in the Occupational Analysis Field Centers and Occupational Analysis Special Projects that are located in various parts of the country and function under the direction of State Employment Security agencies with technical direction from the Division of Occupational Analysis and Career Information in the Manpower Administration. One of the basic missions of these Centers and Special Projects is to collect current job analysis data for all jobs in the economy, and the application of this "new" methodology in this activity has provided for structuring the collection of the data as well as expanding the information on all facets of a job's makeup. At present there are five categories of information that must be obtained in order to meet the requirements for a complete analysis of a job. (1) Worker Functions, (2) Work Fields, (3) Machines, Tools, Equipment, and Work Aids, (4) Materials, Products, Subject Matter, and Services, and (5) Worker Traits.

Worker Functions

All jobs involve a relationship to Data, People, and Things in some degree. These relationships are expressed by 24 Worker Functions and a combination of the highest functions which the worker performs in relation to Data, People, and Things expresses the total level of complexity of the job.

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(4) Direction, control, and planning of an entire activity or activity of others.

(5) Dealing with people in actual job duties beyond giving and receiving instructions.

(6) Working alone and apart in physical isolation from others, although activity may be integrated with that of others.*

(7) Situations involving influencing people in their opinions, attitudes, or judgments about ideas or things.

*Temperaments 3 and 6 have been found to have limited utility and have been deleted from the *Handbook for Analyzing Jobs*.

(8) Performing adequately under stress when confronted with the critical or unexpected or taking risks.

(9) Evaluation (of information, generalizations, value or decisions) against sensory and/or judgmental criteria.

(0) The evaluation (of information, generalizations, standards, or decisions) against measurable and/or verifiable criteria.

(X) Interpretation of feelings, ideas, or facts in terms of personal viewpoint.

(Y) Precise attainment of set limits, tolerances, or standards.

Interests. The factors of this component are concerned with situations involving a preference for activities dealing with, concerned with, involving, or of:

- 1(a) Dealing with things and objects vs. 1(b) People and the communication of ideas
- 2(a) Business contacts with people vs. 2(b) Scientific and technical nature
- 3(a) Routine, concrete, organized nature vs. 3(b) Abstract and creative nature
- 4(a) Working for people for their presumed good as in the social welfare sense or for dealing with people and language in social situations vs. 4(b) Nonsocial in nature and are carried on in relation to processes, machines, and techniques
- 5(a) Prestige or esteem of others vs. 5(b) Tangible, productive satisfaction

Physical Demands. Physical Demands analysis is concerned with the physical requirements made on a worker by the job, rather than the physical capacities which the worker may possess. These physical demands are made up of (1) the Physical Activities which the job requires and (2) the Environmental Conditions under which the job is performed. They consist of the following six Physical Activities factors and the seven Environmental Conditions factors:

Physical Activities Factors

- (1) Strength
 - (a) Lifting, Carrying, Pushing, and/or Pulling
 - (b) Sedentary, Light, Medium, Heavy, Very Heavy
- (2) Climbing and/or Balancing
- (3) Steeping, Kneeling, Crouching, and/or Crawling
- (4) Reaching, Handling, Fingering, and/or Feeling
- (5) Talking and/or Hearing
- (6) Seeing

Environmental Conditions Factors

- (1) Work Location
- (2) Extreme Cold With or Without Temperature Changes
- (3) Extreme Heat With or Without Temperature Changes
- (4) Wet and/or Humid
- (5) Noise and/or Vibration
- (6) Hazards
- (7) Atmospheric Conditions

The Labor Department publication, *Handbook for Analyzing Jobs* (52), contains the most comprehensive and current description of the Department's approach to job analysis. It is an essential document for anyone using this methodology.

Functional Job Analysis (11, 55)

Functional Job Analysis (FJA) is a technique developed by Dr. Sidney Fine of The W. E. Upjohn Institute for Employment Research. Key aspects of FJA, such as the Worker Functions and General Educational Development scales, are derived from the Department of Labor method, but there have also been significant changes and additions. They include the integration of job analysis with systems analysis, the modification of the Worker Functions scales, and the addition of new scales.

According to FJA, "the systems approach begins by examining the purpose or goal of the agency in which the jobs occur." (55, p. 9) Once the goals are known, the analyst determines what must be done to achieve them. This process includes setting specific objectives (defined as "a restatement of a purpose or a goal in relation to the realities of a specific local situation, taking into consideration the constraints of time, money, manpower geography, and consumer response"); identifying subsystems ("a general grouping of procedures or technologies required to implement a specific objective"); and identifying the specific tasks which need to be done to accomplish the objective of each subsystem.

FJA is concerned with identifying both the way in which work is currently performed in an organization and the tasks which serve to advance the organization's objectives, regardless of whether they are currently being performed in the organization. Thus, a data base is established which not only reflects present realities but may also indicate new tasks.

In Functional Job Analysis, the Department of Labor's Worker Functions scales have been modified somewhat. The Department's People scale has been expanded to include functions which are descriptive of work performed in the rapidly expanding human services fields. The Data scale has also been expanded slightly, and certain levels in all three scales include more than one function each. Finally, the numerical coding system used for the Worker Functions scales has been reversed so that level 1 represents the least complex relationship. This coding system is now in agreement with the General Educational Development system. The FJA Worker

Functions scales are discussed further in appendix B of this report.

Functional Job Analysis uses a Scale of Worker Instructions that indicates the level of discretion a worker has in the performance of a task. It is an eight-level scale and covers situations ranging from those in which "inputs, outputs, tools, equipment, and procedures are all specified" to those in which "information and/or direction comes to the worker in terms of needs (tactical, organizational, strategic, financial)." The Scale of Worker Instructions is highly correlated with FJA's Data (Worker Functions) and reasoning (General Educational Development) scales; hence tasks rated high on one are also given high ratings on the others.

Functional Job Analysis uses the Worker Functions scales to determine not only the level of complexity of a task but also its orientation to data, people, and things. Orientation is expressed in percentages and provides a means of measuring the worker's relative involvement, when performing a given task, in each of the three worker functions. Thus, a task which involves analyzing (Data level 4), negotiating (People level 6), and handling (Things level 1) might have the following orientation: Data, 40 percent; People, 55 percent; and Things, 5 percent. Since, according to FJA, every task calls for the worker to function in relation to data, people, and things, the minimum orientation for each primitive factor is 5 percent. Thus, for example, no task can be oriented completely to data and people, to the exclusion of things.

Functional Job Analysis is described in several publications of The W. E. Upjohn Institute for Employment Research. The most recent and comprehensive of these is *An Introduction to Functional Job Analysis: A Scaling of Selected Tasks from the Social Welfare Field* by Sidney A. Fine and Wretha W. Wiley (11).

Health Services Mobility Study (20, 23)

Since its inception in 1967, the Health Services Mobility Study (HSMS) has addressed itself to the related problems of health manpower shortages, scarce educational resources, lack of career mobility for health workers, and redundancy in credentialing

requirements. Under the direction of Dr. Eleanor Gilpatrick, the study set as its long-range objective the solution of these problems through the design of job ladders which would build systematically on learnable, related skills and knowledges. Other objectives are to plan educational ladders paralleling the job ladders and design performance evaluation instruments. Since implementation of these ladders and use of the instruments are of primary importance to the project staff, the work of the HSMS has been conducted within operating health care delivery institutions, and the full cooperation of practitioners has been sought.

Phase I of the study consisted of a literature review, a study of the occupational structure of the New York City Municipal Hospital System, a survey of the attitudes of Licensed Practical Nurses in the municipal system toward upgrading training, and initial work on a task analysis methodology. Phase II included further development of the methodology, along with field testing and revising it. Methodological research and development continued through phase II. In addition, a pilot study of the entire HSMS procedure was conducted at the Dr. Martin Luther King, Jr., Health Center in New York. The pilot study covered 12 job titles, ranging from professional positions such as Radiologist and Obstetrician-Gynecologist to EKG Technician and Dark Room Aide.

According to the HSMS analysis of personnel patterns in the health industry, the most serious of manpower shortages exist near the top of the various occupational ladders, in the jobs requiring high skill and knowledge levels, while the preponderance of employees occupy lower level positions. Unfortunately, a variety of factors effectively bar these employees from advancing to fill the upper level vacancies. Among them are:

—Credentialing requirements calling for formal, accredited training which may—or may not—be job related. These requirements usually give no credit for previous experience or training in lower level health care positions or in related health specialties.

A heritage of educational and training opportunities, generated in part by the excessive demands caused by the aforementioned narrow and exclusionary credentialing requirements.

—Preconceived notions about "appropriate" jobs for women, with the result that they are

typically confined to certain occupational areas such as nursing and food service work.

Early in the project, the HSMS staff conducted a literature review of job analysis methodologies. Since they concluded that no existing procedure was capable of producing the basic data required for accomplishing project objectives, they began work on developing a new technique.

The HSMS methodology was designed to identify the skill and knowledge requirements for a large number of health jobs so that similarities in these requirements could be used to construct job ladders which minimized reliance on education and training. Such training as was required, as well as performance standards, would also be based on the skill and knowledge data.

After devising their own, very precise definition for a task (which is discussed in greater detail in appendix A of this report), the HSMS staff identified 16 learnable skills, which can be grouped into 6 major categories—manual, interpersonal, language, decisionmaking, general intellectual, and responsibility. Scales reflecting different levels of proficiency were developed for each of these skills. Each task is rated on each scale as well as on an additional scale for task frequency.

Another part of the HSMS methodology is the Knowledge Classification System and Knowledge Scale. While all types of information can be considered knowledge, the HSMS system is confined to those subject matter categories having several levels of complexity, requiring a learning effort beyond everyday experience and the usual maturation process, and having direct applicability to competent task performance. The Knowledge Scale is similar in concept to the skill scales. Once it is determined that a given task requires knowledge in a particular subject area, the appropriate level is determined by using two criteria: breadth of knowledge and depth of understanding.

The HSMS data collection process began with the analysts becoming oriented to the organizational unit and functional area being studied. Information about the nature and purpose of the study was disseminated to all concerned persons, including workers, supervisors, managers, and union officials. Tasks were identified primarily through interviews with the performer, although supplementary data were obtained through observation. Analysts worked in teams of at least two each, and all team mem-

bers had to agree on the contents and dimensions of each task. The task data were reviewed by the project director for completeness, clarity of language, and conformity to HSMS definitions and by functional area resource people for technical accuracy. The teams also determined the skill and knowledge level of each task and submitted their ratings to the project director, and in most cases resource people, for review.

The task identification and analysis process resulted in a very large number of individual pieces of information. A computer-based, advanced form of factor analysis was used to structure this information in such a way as to further the study's objectives. Tasks were grouped into families on the basis of similarities in their skill and knowledge requirements. These task families became the basis for individual jobs, which were then arranged into job ladders. Again, skill and knowledge requirements were used to construct the job ladders. As individuals progress up a ladder, they refine and increase their current skills and knowledge and acquire new ones, largely through work experience supplemented by education and training.

Current HSMS activities include translating the basic task data into curriculum objectives and performance standards.

The Health Services Mobility Study has produced a voluminous amount of written material relating to its techniques, instruments, objectives, and findings. As can be seen from this brief description, the methodology is a rigorous one, requiring staff skills and financial resources beyond the reach of most organizations. It should be noted that the purpose of the study is to develop *model* job and curriculum ladders and performance evaluation instruments which can be implemented, with certain adaptations, in individual health care organizations. Dr. Gilpatrick and her colleagues did not set out to design a methodology capable of being used, in its entirety, by local personnel management or manpower development specialists. Nevertheless, individual aspects of the methodology—the task definition or the skill scales, for example—may be susceptible to local adaptation and application.

The most recent HSMS publication, *The Design of Curriculum Guidelines for Educational Ladders Using Task Data* (23), contains both a description of the curriculum design procedure and a summary of the entire methodology.

Position Analysis Questionnaire (28, 29, 31)

The Position Analysis Questionnaire (PAQ) has been developed over the past several years by Dr. Ernest J. McCormick and his colleagues at Purdue University's Occupational Research Center.

PAQ draws the distinction between job-oriented and worker-oriented job elements. The former are "descriptions of job content that have a dominant association with, and typically characterize, the 'technological' aspects of jobs and commonly reflect what is achieved by the worker. On the other hand, worker-oriented elements are those that tend more to characterize the generalized human behaviors involved." PAQ deals with worker-oriented elements, "since they offer some possibility of serving as bridges or common denominators between and among jobs of very different technologies."

The PAQ consists of 189 "job elements." These elements are not tasks, since they do not refer to specific worker activities in a given technological context. They represent, instead, "generalized human behaviors involved in work." The following list includes the major divisions and subdivisions of the PAQ with the number of elements in each given in parentheses. A representative job element is given after each subdivision.

Information Input (35)

Sources of job information (20): Use of written materials.

Discrimination and perceptual activities (15): Estimating speed of moving objects.

Mediation Processes (14)

Decisionmaking and reasoning (2): Reasoning in problem solving.

Information processing (6): Encoding/decoding.

Use of stored information (6): Using mathematics.

Work Output (50)

Use of physical devices (29): Use of keyboard devices.

Integrative manual activities (8): Handling objects/materials.

General body activities (7): Climbing.

Manipulation/coordination activities (6):
Hand-arm manipulation.

Interpersonal Activities (36)

Communications (10): Instructing.

Interpersonal relationships (3): Serving/catering.

Personal contact (15): Personal contact with public customers.

Supervision and coordination (8): Level of supervision received.

Work Situation and Job Context (18)

Physical working conditions (12): Low temperature.

Psychological and sociological aspects (6): Civic obligations.

Miscellaneous Aspects (36)

Work schedule, method of pay, and apparel (21): Irregular hours.

Job demands (12): Specified (controlled) work pace.

Responsibility (3): Responsibility for safety of others.

Each job element is rated on an appropriate scale such as "importance," "extent of use," or "time." Some elements are to be rated on their own unique scales. Several are to be rated only with regard to whether they are applicable to a given job.

Another aspect of the PAQ is a list of 76 attributes or human traits which may be required in a given work setting. Some of these attributes may be aptitudes, while others may be situational in the sense that they require the worker to adapt to a specific situation. The attribute list contains several items obviously adapted from certain Department of Labor Worker Traits (specifically Aptitudes, Temperaments, and Interests), while others are similar to certain components of J. P. Guilford's Structure of Intellect described in *The Nature of Human Intelligence* (17). The attributes were rated in terms of their relevance to each job element to arrive at attribute profiles for each element.

Extensive statistical research with the PAQ has resulted in the identification of 32 basic job dimensions. These are groups of job elements which tend to cluster together in specific jobs. This and other research related to the PAQ, along with computer programs, has been made available to interested organizations. The principal uses of the data are in the areas of test validation, developing job families or progressions, and wage and salary classification.

III. SELECTED JOB ANALYSIS PROJECTS

This section contains several brief discussions of selected projects employing job analysis procedures. Included are those projects funded by the Labor Department's Manpower Administration through its Office of Manpower Research and Development for which job analysis methodological information was available, plus certain research efforts funded by other sources to use job analysis for human resource management purposes. The projects are discussed in terms of their general methodological approach, their objectives, and the organizational context in which they were carried out.

Alpha: A Case Study in Upgrading (16)

Two major objectives of this project were to demonstrate the needs and problems of upgrading programs in industry and to generate information and questions about the variables and conditions requiring identification before more generic upgrading programs could be developed for a wide range of industries.

Site of the demonstration model was a small plant, the Alpha Plastics Printing Company, Inc.,* which manufactures printed plastic materials and employs 150 blue-collar workers on three shifts for

*Pseudonym.

5½ days a week. The research team determined that no systematic upgrading program existed and that the company was experiencing problems in recruiting high-level workers (printers), in retaining entry-level workers, and in maintaining the productivity level and quality of workmanship.

Frequent visits and observations together with interviews of the staff and employees initiated the data-gathering activity. A job analysis identified the duties and skill requirements for the company's positions and yielded the data required to redesign the job structure. Another methodological aspect of the study was the development of a typology for determining the *conditions* and *climate* conducive to successful upgrading.

The Alpha demonstration model provided for the training of 58 entry-level employees over a period of 9 months. Subsequently, 19 percent of the newly hired employees were moved up to higher skilled jobs, as printers. In addition, eight middle level senior employees were promoted to printer or laminating machine operator. Overall, the program resulted in the qualification of 14 new printers, 4 more than the company goal. It should be noted that the project was focused primarily on improving the company's job structure and product rather than on contributing to the skill-level advancement of individual employees.

The New Careers Systems Institute, which conducted the Alpha study, is currently applying job analysis techniques for upgrading purposes in a variety of other industrial settings. At this writing, published material on this work is not yet available.

Psychological Assessment of Patrolman Qualifications in Relation to Field Performance (3)

This 16-month study, conducted in the Chicago Police Department, was directed at predicting police patrolman performance. Two main goals were identified by the project sponsor and study team:

—The development of effective procedures and the establishment of general standards for patrolman selection.

—The identification of distinctive "patrolman types," defined on the basis of field performance, which would not be adequately described by the concept of "average" patrolman.

An occupational analysis was conducted to obtain information on the behavioral requirements of the field patrolman's job. This information was used to help choose psychological tests for inclusion in a test battery for selecting entry-level patrolmen. Since the researchers were interested in psychological tests, and thus the job's behavioral characteristics, they did not attempt to gather comprehensive job content information or to identify skill or knowledge requirements.

Data gathering was accomplished through a general orientation to Police Department organization, procedures, and facilities followed by onsite observations of patrolmen at work. Staff members rode with police officers in a cross section of Chicago's neighborhoods at all hours of the day. The result of this process was a list of 20 behavioral requirements for patrolmen.

The test battery was compiled from existing sources and administered to two groups of patrolmen. It was validated by comparing the patrolmen's test scores with their ratings on two subjective measures and several objective ones. The subjective measures were the Chicago Police Department's own semiannual performance rating and the University of Chicago Industrial Relations Center's paired-comparison appraisal technique. The objective measures included departmental awards, citizen complaints, departmental disciplinary actions, and number of arrests made. The subjective meas-

ures were given greater weight than the objective ones. Individual tests whose results conflicted sharply and consistently with the validation measures were removed from the battery.

Among the project accomplishments listed in the report are:

—An improved method for screening patrolmen.

—An improved method for making internal assignments.

—Capability for meeting the Federal Government's test validation requirements.

—Establishment of a close working relationship at all occupational levels between an education center and a big city police department interested in research.

Career Opportunities Research and Development (56, 57, 58)

In 1968, the Chicago YMCA applied the systems approach to job analysis to develop and test model core curriculums in the human services for 2-year community colleges. These curriculums were based on job-related career ladder models, also developed by the study. A cooperative research program with human service agencies and community colleges was thus required. In addition to developing the models, the researchers were asked to document the problems and processes involved in the development phase and to evaluate the research and resulting models.

Sixteen human service agencies and four community colleges agreed to cooperate in the project. Phase I of the work included the data gathering, analysis, task grouping, and model development. Phases II and III were dedicated to the continuing evaluation and maintenance of the models and to the consideration of broadening the career ladders and core curriculum below and above the associate of arts degree level.

Over 200 interviews with, and extended observations of, cooperating agency workers were conducted

by staff of the community colleges. The study team adapted the Department of Labor scales to fit the human services fields. Modifications in the Worker Functions, General Educational Development, Job Environment, and Interest scales were determined to be necessary, but no changes were made on the Aptitudes scales. These modifications are discussed in appendix B.

Over 2,000 tasks were identified as a result of the interviews and observations. After analyzing and restructuring the task clusters, the staff developed model career ladders for each of the following service areas:

community organization	case work
health services	child care
group work	mental health
social service administration	

Phase II activities included an effort to broaden the career ladder models by "standardizing six levels of occupational status in terms of educational achievement and/or life/work competency." Each of the six occupational categories (Professional, Technologist I and II, Technician I and II, and Trainee) is described in terms of its primary functional relationships to data, people, and things; educational requirements; and minimum salary. A suggested curriculum for the AA degree was designed for each of the six occupational levels.

Another aspect of the phase II work included a pilot project in a high school, at three community colleges which award the AA degree, and at a senior college. One of the goals of the testing was to design curriculums for secondary schools and study beyond the AA degree.

Farm Job Ladder (39)

The Farm Job Ladder Demonstration Project is concerned with certain manpower utilization problems arising from the dynamic state of California agriculture. As the unionization of farmworkers progresses, labor costs rise. This is making increased mechanization economically more beneficial to farmers. Trained equipment operators, rather than unskilled migrant workers, are now the farmer's greatest manpower need. Such people are, however, in short supply, owing at least partially to the traditionally seasonal nature of farm employment.

Most farmers have few year-round employees, preferring to hire large numbers of migrant workers for the peak labor periods such as harvesting time. Thus, individual local labor markets typically do not have large numbers of either skilled equipment operators or geographically stable workers available for training.

A second pressing farm manpower need is for supervisors, and managers to run the increasingly large and more highly mechanized farms. The Farm Job Ladder Demonstration Project, then, set out to develop year-round positions and career ladders in both these shortage categories, with the workers drawn, in all probability, from the migrant labor stream.

The work performed during phase I, which began in May 1971, included:

—Task analyses on four medium-sized California farms (the Department of Labor methodology was used).

—Development of career ladders for farmworkers, including detailed, task-based job descriptions.

—Development of training sequence outlines for each job.

—Recommendations for supervisory training programs.

—Development of a practical, farm-related management training outline.

—Development of a farm machine maintenance training curriculum.

Phase II of the project has been underway since November 1972 and consists of implementation, on a larger sample of California farms, of the new job structures and manpower management practices developed in phase I.

Manpower Utilization and Cost Analysis Study of the Fremont (Calif.) Police Department (40)

The organization under study was a law enforcement agency in a fast-growing community of about 120,000 people located in the southern part of the

San Francisco Bay area. The study's objectives included the development of job restructuring alternatives, recommendations for the redesign of in-service training and job-related college curriculums, and the development of employee performance evaluation criteria.

The project staff consisted of a coordinator who worked half time on the study and had a manpower program administration and job analysis background, full-time assistant coordinator with manpower program and public personnel experience, and two occupational analysts, both of whom were sworn police officers.

The basic methodology used in the study was the Department of Labor's job analysis technique. The project's senior staff trained the two occupational analyst/police officers in this technique. Over 1,600 tasks were identified, in both sworn and non-sworn positions, and assigned ratings on the Labor Department's Worker Functions, General Educational Development, and Specific Vocational Preparation scales. Task identification was accomplished primarily through interviews with the performers. Special logistical problems were encountered in gathering material for the multifaceted, highly decentralized position of patrol officer. The personal experiences of the two occupational analysts were used extensively in preparing task statements for this position. Several other patrol officers were then asked to review the task data and make any appropriate comments, additions, or deletions. Validation of all the task data was conducted through followup interviews with employees and supervisors.

Certain problem areas in police manpower utilization provided a focus for the project staff in preparing its recommendations. For example, several studies show that patrol officers spend up to 80 percent of their time responding to calls for services which are either not related to criminal activities or are crime-related but nonhazardous. Most police training, however, places heavy emphasis on the crime-fighting aspects of the job and pays little attention to handling the sensitive human relations problems which patrol officers encounter daily. The heavy burden of routine calls for service also prevents patrol officers from devoting sufficient time to such activities as crime prevention, counseling and referral, and followup investigation.

Employee performance and morale also suffer from these misperceptions of the police role. Selection procedures and performance evaluation standards generally reflect the hazardous duties involved

in police work. Many patrol officers are disillusioned to discover that the job is not as they thought it would be. This problem is aggravated by the flat organizational pyramid, resulting in few promotional opportunities, common to most police departments.

Among the study's products was a job restructuring alternative with complete job descriptions, including a four-level paraprofessional career ladder and a three-level police officer career ladder. Supervisory, managerial, administrative, and clerical positions were also covered in the restructuring alternative. Finally, the task data were also used to develop job-related training outlines and performance evaluation criteria.

Job Task and Requirements Analysis (25)

Job Task and Requirements Analysis (JTRA) is a term used by the Humanic Designs Corporation (HDC) to describe that organization's approach to job analysis. Among the industries in which HDC has worked are automobile manufacturing, food processing, and banking. In addition, its staff recently developed career ladders in three public hospitals under contract with a national public employees' union.

Job Task and Requirements Analysis is described in the HDC publication, *Increasing Employee Mobility Opportunities: An Employer's Handbook for System Design* (25). This document, the result of 3 years of research and development efforts, outlines HDC's generalized procedures for analyzing upward mobility systems, identifying problem areas, and designing appropriate solutions.

Job Task and Requirements Analysis includes the following steps:

- Making preliminary lists of duties and identifying distinct jobs.
- Designing an observation schedule.
- Collecting narrative data.
- Transforming narrative data into task descriptions.
- Determining knowledge and skill dimensions.
- Scaling the dimensions.
- Rating the tasks.

The sheer number of organizations in which HDC has worked over the past few years suggests that its primary emphasis has been on developmental activities and on determining which procedures are most effective in specific situations, rather than on basic research. This impression is strengthened by the tone of the discussion of JTRA in HDC's handbook. Very little, if anything, about JTRA is new. HDC's comments focus instead on the proper application of existing tools and procedures, such as those of the Labor Department and the Health Services Mobility Study.

While HDC found certain of the Labor Department's Worker Traits measurements, specifically Interests, Temperaments, and Physical Demands, possibly useful for initial selection of employees, it considers them "not, on the whole, relevant to the design of an upward mobility system." It also has reservations about the Worker Functions concept "In our view, the 'People, Data, Things' ratings do not contain sufficient information, even when augmented by the other dimensions described, to design a structure based on relevant similarities between jobs," it says. But it concedes that "formal comparisons have not been made and at present it must remain a matter of opinion which option to use." Of the Labor Department scales, only General Educational Development is felt to have definite value in upward mobility design.

HDC finds the Health Services Mobility Study approach, with its emphasis on identifying unidimensional skill and knowledge requirements, more germane for career development purposes. The proper use of this information will vary, however, depending on whether the objective is design of an upward mobility system, which "deals with the movement of people through all or major segments of the jobs and positions within an organization," or simply upgrading, defined as "facilitating the movement of employees one step upward rather than into broad channels of career progression." Upgrading calls for only the identification of required skills and knowledge, information which can readily be extrapolated from adequately written task descriptions. Designing an upward mobility system, however, requires the scaling of skills and knowledge—that is, precisely delineating the amount of a given skill or knowledge required in a task so that the task can be placed properly in a multilevel job ladder. HDC discusses alternative methods of scaling skills and knowledge.

Job Analysis (42)

In June 1967, researchers at the California State Colleges in Long Beach and Los Angeles set out to "discover, test, evaluate, report, and recommend current or proposed practice that can promise more effective and less costly ways to analyze jobs and to make resulting job information readily available and useful." In addition, the project team would "determine whether current and valid job analysis source data can be obtained at less cost and in less time than is common in the observation-interview technique in use by the U.S. Employment Service and its affiliated State agencies."

Initial study activities focused on the "current and proposed changes in the historical model of the job analysis process," as reported in the literature. Following the literature review, the team surveyed the current public and private use of job analysis to gather information on various practices and to elicit user opinions, criticisms, and suggestions. From the review of the data, the researchers incorporated changes in the classic model, tested the modifications and thus produced a revised procedure for collecting, organizing, storing, and retrieving job information.

The survey of traditional and current approaches to job analysis uncovered several areas in which improvement was needed. They include:

1. The subjectivity of the data (resulting from different choices of words by different analysts or different choices by the same analyst over time).
2. Inadequate reliability and validity of input data.
3. Inadequate ways of quantifying the data (for use in demonstrating data validity and reliability, facilitating comparison among jobs, and recording, analyzing, and retrieving data through electronic data processing equipment).
4. Outdated job data.
5. Need for a job analysis system to have the capability of selective retrieval of data so that enough information for each application can be obtained without irrelevant data also being retrieved.
6. Traditional analysis is time consuming and requires personnel with scarce skills. A simplified procedure, capable of implementation by people with only moderate training in analysis, is needed.

Four experimental models of the Job Information Matrix System (JIMS) were developed. JIMS involves the preparation of standardized task descriptions (on the assumption that certain tasks are common to many of the jobs in a given occupational family), using precisely defined words (more words for each level than are found in the Department of Labor Worker Functions scales). It is expected that this procedure will yield job information which is more objective, valid, and reliable.

JIMS uses a checklist format, designed for use by either experienced or inexperienced analysts and even capable of self-administration by the task performer or supervisor. The matrix-modular format of JIMS, with checklists which are readily coded and are written in standardized terms, permits computer storage and retrieval. This suitability for electronic data processing makes JIMS a more flexible procedure than traditional analysis, since selective retrieval of information for specific purposes is possible.

Since JIMS was field tested in only one occupational category, metal machinery, the researchers recommend experimentation in other areas. Before the system can be extended, checklists for each occupation will have to be developed. In addition, the process of identifying and defining key action verbs to be used in assigning worker functions will have to be continued, especially with the Things scale.

The development of a checklist format capable of administration by analysts with only minimal training is an important aspect of this research. Also, the development of the standardized action verb vocabulary should be helpful in bringing about uniformity and precision in worker functions rating.

Job matching and job evaluation (for classification and pay) and preparation of job descriptions are the applications which seem to be emphasized most in this study, although the need for systematic flexibility to insure usable data for other purposes such as restructuring and training, is fully recognized.

Restructuring Paramedical Occupations (15)

This was a 2½-year study to develop and test techniques for easing the shortage of skilled para-

medical personnel in health services and to provide more job opportunities with upward mobility potential for disadvantaged persons. This work was a follow up to a pilot study (by the same research team) entitled *Hiring Standards for Paramedical Manpower*, 1968 (24).

Specific basic objectives of the 31-month project included the following:

- To review and analyze the hiring requirements for paramedical personnel and their functions in the hospital. (The terms "function" and "task" are used interchangeably throughout the study.)
- To determine a set of recommended improvements in the utilization of manpower in the hospital.
- To evaluate efforts to implement recommendations and to measure the effects of implementation on the quantity and quality of medical services.

Cambridge Hospital, city hospital of Cambridge, Mass., accepted the study proposal through the leadership of the City Commissioner of Health and Hospital. The hospital has been and continues to be in a state of transition due to a number of significant changes initiated since 1963. Occupations targeted for study were: Registered Nurse, Licensed Practical Nurse, Nurse Aide, Orderly, Ward Secretary, Surgical Technician, Psychiatric Attendant, X-Ray Technician, EKG Technician, Inhalation Therapy Technician, Neighborhood Health Worker, Laboratory Technician, and administrative and supervisory personnel.

After reviewing several job analysis procedures, the research team developed a methodology which they felt would be feasible in the milieu of a hospital and would furnish reliable information. They recognized that "using observation as the principal method of task identification in the hospital atmosphere, where privacy is one essential of quality patient care, would be difficult if not impossible." Therefore, use of observation was limited to validating information. For this purpose, observations were made of half those performers who responded to the "confirmation" interviews (conducted to determine if the function attributed to a specific job represented 95 percent of the person's activity during the workweek).

An extensive interview schedule initiated the phase I data-gathering activity. Supervisors and performers (87.7 percent) were interviewed and then

consulted again if the subsequent cross-checking validation process warranted it. An additional study effort resulted in a set of more complete definitions of tasks identified in the pilot study. The level of task complexity was determined by having the researchers, hospital supervisory personnel, and nursing and medical consultants from other medical centers rank the tasks in order of difficulty. Such criteria as practical experience, educational exposure, and general responsibilities were used. A panel of practitioners also contributed to the ranking effort.

Next, interview formats for each department (not for each job or job title) were prepared. Data were obtained through interviews. No questionnaires were used. Interviewers elicited a variety of data relating to education, training, experience, career expectations, and salaries for each incumbent as well as the percentage of time spent performing each task. The research assistant and an outside graduate registered nurse then observed the work of about half the sample for validation purposes.

Phase II activities began with the organization and tabulation of the data. The data were arranged to display such items as percentage of workers at each occupational level performing each task, percentage of time spent on each task, overlaps in tasks performed by workers at various occupational levels, and personal characteristics, opinions, and aspirations of those interviewed. With this data base, the researchers consulted with independent experts in health manpower and prepared their recommendations. Phase II concluded with a followup at the hospital to observe the effects of change as a result of the implementation of study recommendations.

The report of the study is a two-volume set. Appendixes in volume II include the definitions of tasks for 9 selected occupations and a set of 70 tables which reflect the analysis of the functions performed by the paramedical personnel during the period of the interviews. An extension of the project work completed at Cambridge Hospital is attempting to determine whether the same techniques could be used in other types of hospitals in the Boston area. This work is ongoing.

Task Analysis by Selected Criteria (4)

Task Analysis by Selected Criteria is an approach which combines much of the Department of Labor

methodology with additional scales measuring other task dimensions. It was used to develop career opportunities for Biomedical Equipment Technicians (BMET's).

No single location or client for the study existed. The task data were gathered from individuals in a variety of organizations employing BMET's. The study's major product consists of 230 BMET tasks and their relationships to each of the selected criteria. These criteria include the Labor Department scales plus the following:

- Type of equipment used (six options).
- Task frequency (from 1 indicating daily to 5, almost never).
- Importance (a three-level "consequences of failure to perform" scale).
- Difficulty of learning (from 1 indicating very easy to 3, very difficult).
- Time required to perform the task (four options ranging from under 1 hour to 40 hours).
- Types of learning and learned performance (based on the work of Robert Gagne and discussed in chapter IV of this monograph).
- Training time (similar in concept to the Department of Labor's specific vocational preparation but more precise over a compressed range—level 1 is "less than 1 hour," level 9 is "more than 2 years").
- Skill complexity (based on the total of the three Worker Functions ratings—an imprecise and questionable use of Worker Functions data; see appendix B of this report).
- Projected changes for tasks and equipment (six levels from "obsolescence" to "in the R and D stage").

Twelve panels, each consisting of three experts in the field, were used to rate the tasks. Each panel was responsible for a different criterion, i.e., one panel rated all the tasks for Worker Functions, another rated them all for projected changes, etc.

Task Analysis of Library Jobs in the State of Illinois (41)

A task analysis of library jobs in the State of Illinois was conducted in 1970, for the twofold pur-

pose of seeking the most effective way to use professional personnel and examining the library tasks currently being performed by professionals to suggest ways for delegating work to support personnel. The project, sponsored by the Illinois Library Association, emphasized the requirements placed on the worker. The research team and an eight-member Ad Hoc Committee on Manpower Training and Utilization, appointed by the Illinois Library Association to assume an advisory role, set the following specific study objectives:

- To conduct a thorough library survey of studies, data reports, and programs in task analysis.
- To apply the task analysis technique to a number of libraries in Illinois.
- To provide data for job restructuring, job definition, and curriculum development.

Initially, the Ad Hoc Committee selected 18 libraries in the State to be studied. The sample included every major type of library. Elementary, junior high, senior high, college, and university libraries, public libraries, and special and other libraries. In addition to the visit, interviews planned for each of the 18 libraries, a survey was mailed early in the study to all 50 State libraries and other library settings to identify any relevant task analysis studies. The response indicated that no task analysis studies were in progress.

Over 100 employees were interviewed during the visits to the 18 libraries. Job responsibilities of the employees interviewed ranged from the duties of custodians to those of library directors. Data collected from the library interviews were analyzed to identify tasks, to write task statements, and to complete the 15-scale rating of tasks. The methodology used for task analysis was basically the Department of Labor procedure with some modifications. The study team described each task identified with a written task statement.

Tasks were then measured for 9 areas (15 scales) of interest:

- Performance Standards (4 scales).
- Task Environment (1 scale).
- Worker Functions (3 scales).
- General Educational Development (3 scales).
- Worker Instructions (1 scale).
- Training Time (1 scale).

- Time to Complete the Task (1 scale).
- Extraordinary Physical Demands (1 scale).
- Knowledge/Skills/Abilities.

This nine-point analysis was reviewed by the Advisory Committee to insure that the methodology would (1) cover analysis requirements of library jobs, (2) be applicable to all library jobs, and (3) provide for agreement among the analysts' independent activity.

A validity check was conducted for the 1,615 tasks that had been identified. Each task statement was reviewed to confirm that it described a task. Tasks were grouped into 35 functional areas for the purpose of uncovering duplications and inconsistencies. The more general functional areas included administering, selections and acquisitions, cataloging and processing, registration and circulating, reference services, patron service, collection maintenance, facility maintenance, and miscellaneous.

The study team hopes that this data collection and analysis effort will contribute to the restructuring and redefining of library jobs. Such studies are also helpful in planning curriculums for postsecondary training programs. The team concludes that further assistance should be directed to library administrators in developing new job descriptions and in arranging their agencies' staffing patterns.

Upward Mobility Through Job Restructuring—U.S. Civil Service Commission (12, 13)

A team from the U.S. Civil Service Commission's Bureau of Policies and Standards, Office of Special Projects, began a study in June 1970 for the purpose of "conducting, in three selected agencies, experimental demonstration projects to test the feasibility of using job restructuring techniques to enable employees in lower grades to progress to higher grade jobs not customarily filled by promotion from the lower levels." It was agreed that information gathered during the study would be compiled in the form of guides, for use by the Federal Government, on the advisability and methods of effecting an upward mo-

bility program. The continuing effort to respond to a need for providing advancement opportunities for low-grade workers with limited education and training prompted the projects.

Two agencies of the Department of Health, Education, and Welfare (HEW)—the Social and Rehabilitation Service and the Audit Agency—and the District of Columbia Government's Department of General Services accepted the demonstration project proposal. With strong support from the top management, "Project Bridge" was initiated at the Social and Rehabilitation Service for 35 employees in dead end jobs. The program of work experience and training was designed to qualify these employees for eight occupations, which previously had been filled from the Federal Service Entrance Examination (FSEE) register. The FSEE* is the Federal Government's primary vehicle for filling entry-level professional positions and, historically, has tended to favor recent college graduates over experienced clerical employees. Provision was made for additional employees to start the program as others moved up.

In view of the December 1970 HEW employee demonstration protesting the lack of career opportunities for minorities, and the fact that many of the arrested employees were Comptroller's Office staff members, a formal request was submitted asking the project team to include the Office of the Comptroller in the study. The Audit Agency, one of two major divisions within the Comptroller's Office, was selected because of its large number of professionals and absence of technician positions. A distinction was made between fiscal and management audits. This allowed people without accounting backgrounds to move into newly created Management Technician positions. Management Technicians assist in nonfiscal audits and are receiving experience which will prepare them for Management Analyst positions.

The audit function is a necessary component of operations throughout Government. Hence the significance of this demonstration effort lies in its potential for wide application in this traditionally conservative area.

Two organizations within the District of Columbia Government's Office of General Services, the Division of Printing and Reproduction and the Bureau of Building Management, were chosen for the study because of the interest in applying job restructuring to a blue-collar worker setting. The project team decided it was impractical, however, to develop a career ladder by job restructuring for the Division of Print-

ing and Reproduction, but they recommended a job analysis effort to identify training needs, which would lead to a workable upward mobility program.

The project team decided that job restructuring for the Bureau of Building Management would not contribute to what had already been done by the agency. Since it has a high ratio of low-skill custodial jobs to high-skill work and little turnover at the higher skill levels, promotion opportunities are limited. The team felt that it would be unfair to raise hopes for advancement with little chance of their being realized. Recommendations included reorganizing to add more work activities under the Bureau or viewing the entire Department as a unit to allow for greater intradepartmental movement.

The Department of Labor's *Handbook for Analyzing Jobs* and the Johns Hopkins Institute's *Introduction to Functional Job Analysis* are referred to in the report as sources of task analysis technique information. In the training program developed by the study team, four task analysis measures are included for the data-gathering activity:

1. The Worker Functions scales.
2. The General Educational Development scales.
3. The Specific Vocational Preparation scale.
4. The Worker Instructions scale.

Project team members concluded that job restructuring is applicable to solving the upward mobility problem, strong support from management is essential and counseling and career guidance should be part of the program.

Study products include a set of examples of the program elements required to achieve upward mobility through work and training and a 3- to 4-day training package for developing an upward mobility program. The package consists of modules for job and task analysis, job design, job element approach to qualification requirements, and training plans, to be used as time allows. It was designed to be appropriate for local or State officials as well as Federal Government managers.

Vocational Education in Michigan (43)

This was a study to determine the extent to which selected vocational training in three Michigan com-

*Now replaced by Professional and Administrative Career Examination (PACE)

munities was meeting local employers' perceived skill requirements. Major objectives of the research were.

—To compare entry-level skill requirements in a sample of 10 occupations with presumably related vocational curriculums and programs in the three communities.

—To use the results of these comparisons to bring about needed improvements in vocational education programs in the three communities.

—To develop a methodology which could be used in school systems to reduce discrepancies between employer-desired skills and curriculum-produced skills.

Four committees were established to serve as resource, liaison, and review groups during the study work period. They included the Research Steering Committee, representing the funding agencies and other interested groups, and three Community Advisory Committees, each consisting of representatives from appropriate industry, education, and other local organizations. The Community Advisory Committees would assume an important role in initiating the implementation of the team's recommendations.

Selection of the 10 occupations was based on two main considerations: (1) Association with economic growth in Michigan's industries and (2) availability of vocational preparation in the high schools or through other local vocational programs. In addition, an effort was made to select those occupations which were considered to have significant possibility for change in job content and curriculum requirements. The set of 10 occupations selected would reflect the following characteristics:

—Appropriate balance of white- and blue-collar jobs.

—Appropriate balance of jobs traditionally held by men and by women.

—Relevance to the State of Michigan in terms of vocational education needs.

—Distribution along the skill ladder.

—Distribution among vocational and educational categories (that is, trade and industrial, health, sales and distribution, and office).

—Likely future change in content requirements in the occupation.

Categories of occupations requiring postsecondary

or college education were excluded, as were those showing a decline in employment opportunity such as agricultural occupations, private household workers, and nonfarm laborers. Ten occupations were tentatively reviewed by the Research Steering Committee. A few changes in the original set of occupations resulted in the following list: Retail Sales Person, Clerk-Typist/Clerk-Stenographer, Licensed Practical Nurse, Dental Assistant, Automobile Engine Mechanic, Construction Electrician, Numerically Controlled Machine Tool Operator, Construction Carpenter, Chef/Cook, and Bookkeeper.

The communities chosen for the study—Detroit, Grand Rapids, and Mt. Pleasant—represented large, medium-sized, and small cities.

The project staff compiled task checklists for each entry-level occupation, using available literature and consulting with subject matter experts. The researchers added any anticipated task arising from technological and procedural changes in the content of the 10 occupations. Job tasks were then organized according to job task classes on interview guide task listings. The following questions were used to elicit the five types of information expected from the interviews:

—Is the task one that entry-level persons should be able to perform on the employment start date?

—For those tasks considered required or preferred, what proportion of entry-level personnel have been able to perform them?

—How important is the job task performance for hiring and promotion?

—With what frequency is the job task performed by entry-level persons?

—What level of performance proficiency is desired?

Additional questions were asked to determine the importance of such factors as appearance, attitude, interpersonal relations, and skills. After review, testing, and revision, the interview guides were submitted for Department of Labor approval.

As soon as approval was received, the research team proceeded with interviewing owners, managers, personnel directors, or supervisors in several establishments using the occupations being studied. Each person interviewed had an opportunity to add to the task listing, but the interviews yielded very few additional tasks. The interviews continued until a wide

variety of types and sizes of establishments were contacted and it was evident that little or no new information was being collected. Data collected during the interviewing phase were summarized, tabulated, and published in the team's Interim Report. Tasks labeled as required or of great importance by 80 percent of the employers were designated as "most important."

The research team next directed its attention to the existing curriculums for the 10 occupations. No curriculums were found for the Dental Assistant, Construction Electrician, Licensed Practical Nurse, or Numerica' Controlled Machine Tool Operator occupations. The curriculums for the other occupations were usually in the form of course outlines. This situation proved to be a problem because the methodology relied on the existence of curriculums. Additional information about the student experience and course content was gathered from discussions with vocational supervisors and teachers.

A comparison of the critical task lists by occupation with the review of existing curriculums and student/educator responses revealed several situations in which a curriculum was not designed to produce skills considered important by employers. For each, the team developed a set of recommendations intended to reduce the discrepancy between the skills desired by employers and those produced by vocational programs. The set of recommendations covered the following topics:

- Establishment of a Training Advisory Committee.
- Curriculum development and updating.
- Staff requirements.
- Facilities, materials, and equipment requirements.
- On-the-job training.
- Student selection.
- Student education.
- Placement of graduates.

Implementation of the study's recommendations varied among the three communities. The smallest community, Mt. Pleasant, accepted both the recommendations and, more significantly, the job analysis process, while the largest city, Detroit, essentially rejected both. The study resulted in some changes in Grand Rapids. The team concluded that success depended primarily on the interest and cooperation exhibited from the beginning by individuals at the decisionmaking levels. Because of the apparent similarity of entry-level skill requirements among employers in the same occupational area, researchers recommend that nationwide job task analyses in selected occupations be conducted or supported by a Federal agency such as the Department of Labor.

IV. APPLICATIONS OF THE TASK DATA

As the Introduction to this monograph indicates, job analysis is a means to several human resource management ends. Four of these ends are discussed in this chapter on applications of job content information. Two of the applications—job restructuring and development of education and training programs—are included because substantial amounts of research have been directed toward them. The importance of a third application, qualifications examining, is achieving greater recognition as the courts and the Equal Employment Opportunity Commission require that selection procedures be job related. Finally, performance evaluation is included because of its importance to such areas as education and training, test validation for employee selection and promotion, productivity measurement, and overall program evaluation. Unfortunately, relatively little research has been done in this field although some promising starts have been made.

Job Restructuring

The Department of Labor Job Analysis Methodology

The Manpower Administration's publication, *A Handbook for Job Restructuring* (51), offers a concise description of the Department of Labor approach in this area. According to the Labor Department, the most important task dimensions for restructuring purposes are those relating to Worker Functions (Data, People, and Things), General Educational Development, and Aptitudes. In special

circumstances, however, other factors take on added significance. For example, in certain industrial situations, or if job development for the physically handicapped is one of the reasons for restructuring, it will be necessary to use the Physical Demands and Environmental Conditions scales. Similarly, if the mentally retarded or the emotionally disturbed are potential beneficiaries of the restructuring effort, then tasks should be rated on the Temperaments scale. However, no scale should be used if it does not discriminate among tasks in such a way as to provide meaningful bases for job restructuring decisions.

Once tasks have been identified and rated on the appropriate scales, patterns begin to emerge which provide the analyst with insights into restructuring possibilities. Ratings on a combination of scales, rather than on a single one, typically form the basis for these insights. For example, in many administrative and technical jobs, there is a correlation among the Data (Worker Functions) and Reasoning (General Educational Development) scales and certain Aptitudes such as Intelligence, Verbal and Numerical. Some tasks will tend to be rated highly on all or most of these factors, while others will receive generally lower ratings. Thus, certain natural divisions become apparent, and the identification of lower level, supportive jobs is facilitated.

The restructuring process is by no means automatic, however, and is not dependent solely on task ratings. In addition, the Department of Labor emphasizes the interrelationships among jobs within the organization. In order to understand fully the nature of these interrelationships and the ways in which they can affect restructuring possibilities, the

analyst must consider such factors as work flow, plant or office layout, relevant technology, hierarchical relationships, and the establishment's overall organization and purpose. Finally, other considerations, such as the desirability of retaining certain less complex tasks in higher level jobs while allowing supportive employees to gain experience in performing more demanding work, are also important.

The Department of Labor approach to upward mobility includes both career ladder and career lattice development. A career ladder consists of a series of jobs at progressively higher levels within the same occupational category. This is vertical mobility. Movement along a career lattice can take place vertically and in two other ways. A worker may, on the basis of relevant training and experience in one job, be promoted to a higher level job in another occupational category. This is diagonal mobility. Or, a worker who is faced with a dead end in one category may take a lateral transfer to another category where the upward mobility possibilities are better. This is horizontal mobility.

The Department of Labor approach uses the Occupational Classification Code from the *Dictionary of Occupational Titles* to identify jobs which are in the same or related occupational categories. Pertinent criteria for career ladder and lattice development include ratings on the General Educational Development, Aptitudes, and, sometimes, Physical Demands scales. Also, information on similarities or relationships among technologies, which can be obtained from the task descriptions and the Occupational Classification Code, is important. Finally, the organization's recruitment, transfer, and promotion policies and any union requirements are important considerations.

Farm Job Ladder (39)

The Social Development Corporation's Farm Job Ladder project used the Department of Labor's job analysis approach. Because of the highly unstructured nature of agricultural work—job descriptions, accurate or otherwise, are virtually unheard of—the SDC staff found it necessary to find a framework on which they could arrange the tasks to be identified. They used, six general agricultural functions—ground preparation, cultural practices, harvest, maintenance, planting, and administration. Initially, these functions provided a systematic way of gathering the task data. Later, they enabled

the staff to insure that the various work flows, or sequences, necessitated by technological, climatological, logistical or other considerations were not disrupted by the proposed restructuring alternative.

The staff used selected criteria to assign each task they identified to one of six levels of complexity. The most important of these criteria were the General Educational Development and Specific Vocational Preparation scales. When tools or equipment were involved, the Department of Labor's Things scale was used in assigning task level. (The Things scale, when divided into its two subscales, man, machine and nonman, machine, is the best of the three Worker Functions for determining task complexity.) These levels were then used as the basis for the Farm Career Ladder (see chart 1). The roman numerals under each job title reflect the level of most tasks in that job. But not all tasks in a given job are at the same level. The importance of maintaining work flows prevented a uniform grouping. In addition, assigning higher level tasks to a job facilitates mobility. Employees at level III, for example, will be able to perform level IV tasks as a means of preparing themselves for advancement. Job descriptions were prepared for each proposed job, they included descriptions of each task to be performed in that job.

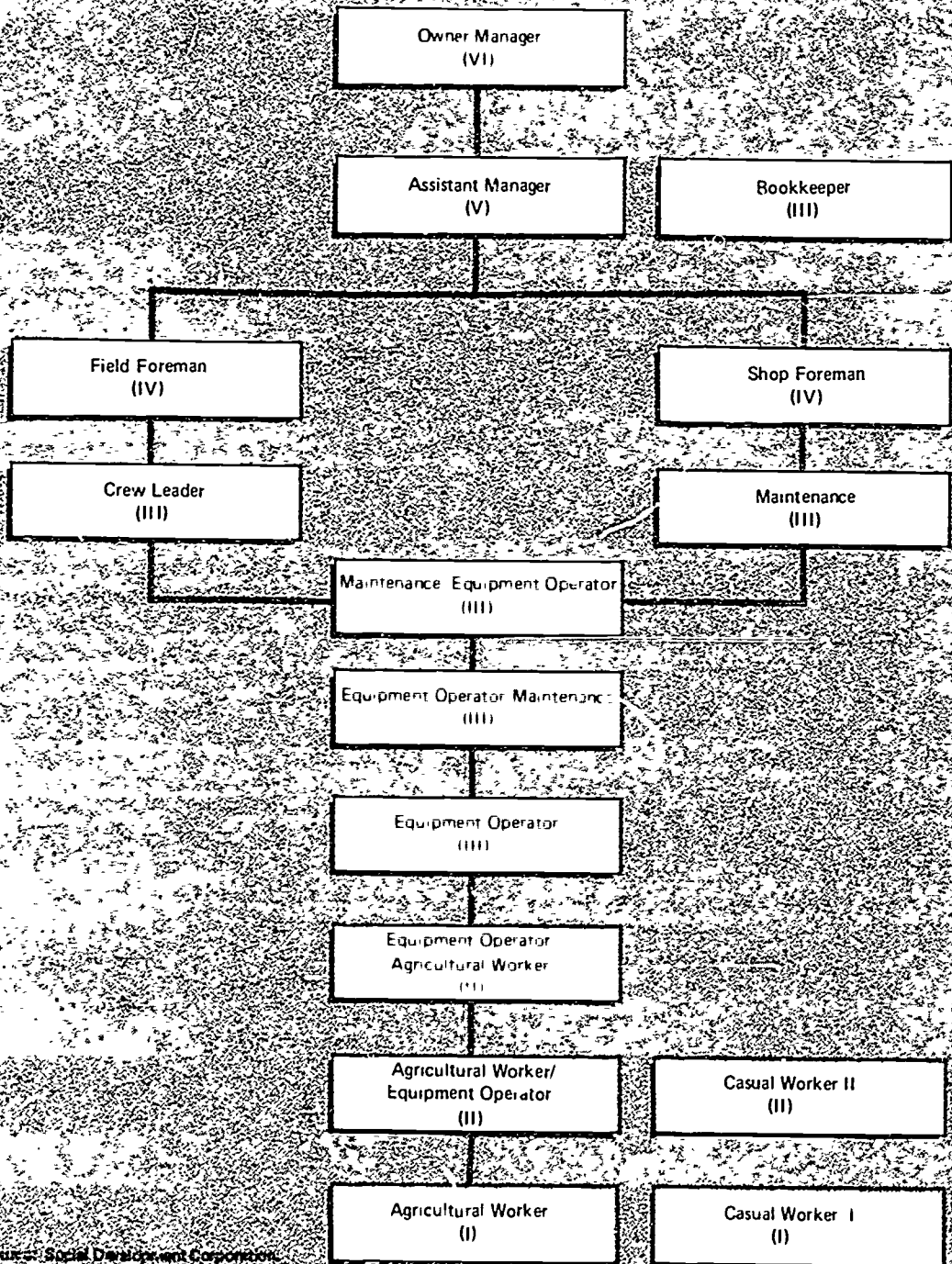
The Farm Job Ladder project is significant because it represents one of the few attempts—perhaps the only one—to structure agricultural work rationally in response to changing social and technological conditions. Increased mechanization on the farm, the problems of migrant workers, and national policy toward revitalizing rural America all demand fresh thinking and new techniques with regard to agricultural manpower utilization. The project staff is currently engaged in working with several farmers to implement the study's findings. This effort should yield a clearer understanding of the study's implications for the entire agriculture industry.

Health Services Mobility Study (20, 23)

Job restructuring in the Health Services Mobility Study (HSMS) is, of course, accomplished by using the task identification procedure and skill and knowledge scales developed for the study.* All the tasks in a given group of job titles being studied form the data base for restructuring. Each task is given a scale

*An overview of the HSMS methodology is given in chapter II. The task identification procedure and the scales are discussed in detail in appendixes A and B.

CHART 1
FARM CAREER LADDER



Source: Social Development Corporation

value on each of the 16 HSMS skills and on an indeterminate number of knowledge categories (one scale value for each knowledge category required in the task). These data are subjected to factor analysis which results in a set of task families. Each task in a given family is related to the other tasks in that family by virtue of identical or similar required skills and knowledge categories. Tasks are assigned to levels within their respective families on the basis of their skill and knowledge scale values. Thus, each level includes tasks which require related skills and knowledge at similar scale values.

With the mass of task data broken up into families on the basis of related skills and knowledge categories and each family subdivided on the basis of skill and knowledge levels, the next step is the creation of idealized jobs and job ladders. According to HSMS, "each job is related to the job above and the job below on the ladder because the jobs require related skills and knowledge. Lower level jobs require lower scale levels and fewer categories; higher level jobs require higher scale levels and more categories."

The HSMS focus on specific skills and knowledge categories is particularly useful in career lattice development. Often, jobs in distinctly separate occupational categories have very similar skill or knowledge requirements. A food service worker, for example, may need the same human interaction and reading skills, at similar levels, as a clerk. (Food service workers may be required to read recipes, food labels, or operating instructions for machines.) Most qualifications requirements, however, consider previous work experience to be job related only if it was in the same occupational area. Thus, the food service worker would not be considered qualified for the clerk's job unless he or she had previous clerical experience or could pass a general intelligence test which might not accurately measure the required skills. By describing jobs in terms of their component skills and knowledge requirements, the HSMS approach thus enables the worker to transfer his or her skills from one occupational category to another.

One possible drawback to the HSMS approach, especially for organizations lacking sophisticated data processing expertise and equipment, is its use of an advanced form of computer-based factor analysis. This procedure is necessitated by the large number of individual pieces of information which must be manipulated. As was noted in chapter II, the HSMS

methodology was developed to support the project's model building activities and was not intended for local application. However, the project staff intends to develop training manuals to assist local practitioners interested in using the HSMS skills and knowledge scales.

Alpha (16)

The Alpha project of the New Careers Systems Institute was located in a plastics printing plant and involved skilled printer and laminating-machine operator jobs, as well as supportive cutter and backtender positions. This project provides an example of a work situation in which the restructuring possibilities are constrained by the technology involved. The printing machines were 100 feet long. The printer and the backtender were stationed at the input end of each machine, while the cutter was stationed at the output end. The cutter was thus in the only logical position to assume initial quality control responsibilities as the printed material came off the machine. The backtender's job, though more difficult than the cutter's, was assigned to new employees because it was located nearer the printer's work station and could thus be more easily supervised by him. The project staff comments that:

the job redesign had to "protect" Alpha's almost automatic very rapid crew-machine production; otherwise, the company would find the costs of training prohibitive. The machines could not be slowed for prolonged periods or left idle to satisfy training needs. The redesign had to blend in with Alpha's routine operating procedures. (16, p. 52)

The project's final report does not indicate that the task data were rated on any scales such as those used by the Labor Department or the Health Services Mobility Study, although the language used to describe various activities suggests that the staff was strongly influenced by the Labor Department Worker Functions. Thus, the restructuring criteria were expressed verbally, as written descriptions of workers' duties, rather than quantitatively, as numerical ratings or scale values.

Among the results of the restructuring effort were:

—An entry-level, combined cutter-backtender position allowing new employees to be exposed to the duties of both jobs. Because of the distance between the two work stations, individual workers would rotate between the jobs rather than perform them simultaneously.

—Assignment of certain press set up and tending duties, formerly performed by the printer

or jointly by him, the cutter, and the backtender, to the more experienced cutters and backtenders.

—Assignment of press control and monitoring duties, requiring some print theory and control procedures knowledge, to a newly created print trainee job. This position was created as an upward mobility opportunity for experienced cutters and backtenders.

—Releasing of the printer from less complex duties, allowing him to devote more time to scheduling, inspecting materials, and exercising final quality control responsibility.

Restructuring Paramedical Occupations (15)

The Northeastern University study, *Restructuring Paramedical Occupations*, found little or no upward mobility available to employees at any level in Cambridge Hospital. Once again, traditional and restrictive credentialing requirements were the major culprit. The study also found considerable overlap, from one level to another, in the performance of specific tasks, especially among Nurse Aides, Licensed Practical Nurses, and Registered Nurses. The researchers recommended the creation of a new occupational ladder to parallel the traditional hierarchy of the hospital. The entry level for this ladder would be the currently existing Nurse Aide job. The remaining three levels would be new jobs—Nursing Assistant, Medical Assistant, and Physician's Assistant. This ladder was designed in such a way that experience and on-the-job training in one job would qualify an incumbent for the next higher level. The credentialing requirements associated with traditional positions such as Licensed Practical Nurse and Registered Nurse would thus be avoided.

As was discussed in chapter III, the basic task data were gathered through interviews with workers and supervisors and arranged, within each hospital department, by level of complexity through consultation with various experts. Interviews based on checklists were used to determine the percentage of workers at each job level performing each task, thus revealing the overlaps mentioned above.

The project staff recommended the restructuring of Registered Nurse and Licensed Practical Nurse jobs to eliminate most of those employees' "easy"

tasks. However, they did not indicate any specific tasks which should be removed from, or added to, these or any other jobs. Instead, these decisions are to be made by the hospital officials using the task statements, ranked in approximate order of difficulty, and the task overlap data compiled by the project. A Job Description Committee, consisting of two Registered Nurses, two Nurse Aides, and one Licensed Practical Nurse from the hospital and the project's research assistant, was formed to translate the task data into actual jobs. The first six job descriptions prepared by this committee, containing specific task statements, are included in the project's final report. Formation of this committee was viewed by the researchers as very encouraging, since it indicated a willingness on the hospital's part to implement the study recommendations.

Education and Training

Health Services Mobility Study (23)

The Health Services Mobility Study (HSMS) methodology includes application of the task data for education and training purposes. The major concern has been the design of curriculum guidelines for educational ladders. These ladders are intended to parallel and support the HSMS job ladders, allowing employees to gain the required skills and knowledge, at the required levels, for performing more responsible work. The study's curriculum design methodology is only now being applied and is thus subject to revision.

Just as the task description is the basic building block for the job ladders, curriculum objectives perform the same function for the educational ladders. They are to be written in behavioral terms: that is, each will state an intended outcome of the training. These intended outcomes will consist of the kind of task performance expected, the conditions under which that performance will take place, and the standards for determining its acceptability.

The curriculum objectives will be written in language incorporating both the HSMS task descriptions and the skill and knowledge data. In fact, the HSMS curriculum objectives are highly dependent on the task data. As was mentioned earlier in this chapter, the task descriptions were subjected to computer-

based analysis and arranged into clusters referred to as factors. Each factor was defined on the basis of its skills and knowledge content. Tasks were further assigned to levels (jobs) within their factors on the basis of their skill and knowledge scale ratings. Curriculum objectives will be written for each skill and knowledge category needed in a job. The objectives will also reflect the nonscalable procedural information found in that job.

It is intended that the curriculum content be set in the context of formal academic disciplines so that the learning which takes place will be transferable to other work situations requiring those disciplines. These situations can exist either in completely different occupational areas or at the next higher level of the same area. Thus the curriculum objectives are to contribute to both career ladder and career lattice development.

The HSMS staff emphasizes the contrast between its approach, which bases curriculum objectives on very complete task descriptions, and approaches that use less detailed task inventories. The Department of Labor's single sentence task statements, for example, do not—and were not intended to—provide enough information by themselves for curriculum development. They need to be interpreted by experts in the occupational area if their skill and knowledge content is to be ascertained. These experts are usually at least one step removed from the task-gathering process and thus may differ among themselves in their interpretations of the task statements. One expert may see a particular skill required at a certain level in a given task. Another may not consider that skill important at all, as he or she interprets the task statement, or may see it at a higher or lower level. The accuracy of the curriculum content is thus questionable.

In the HSMS approach, on the other hand, all the information required for curriculum development, including specific skill and knowledge content, is gathered initially through interview and observation of the task performer. The role of the expert is to confirm the accuracy and completeness of the task description, including proper use of technical terminology and correct scaling of skills and knowledge requirements. Discrepancies can be resolved, if necessary, by returning to the task performer for additional information. By the time curriculum development is to begin, then, the task data have been verified and, to a large extent, quantified to prevent misinterpretation.

Task Analysis by Selected Criteria (4)

Technical Education Research Centers, Inc., (TE-RC) suggests several ways in which its Task Analysis by Selected Criteria approach can be helpful in developing education and training programs. Among the suggested applications are the following:

—Estimating the total time required for training on the basis of the *learning time* information for each task.

—Evaluating existing training materials, or choosing new ones, on the basis of the task statements.

—Maintaining current information on training needs through periodic updating of the task data. Thus, when new equipment is introduced or new procedures are applied, the proper adjustments in the training program can be made.

Two other applications are covered in slightly greater detail. One is determining training priorities through the use of each task's scale values on certain criteria. In most cases, the relevant criteria are *task frequency* and *task importance*. The first step is to reverse the numbering system on the frequency scale so that on it, as on the importance scale, high values indicate high priority.

Frequency (reversed)

1. Almost never
2. Several times a year
3. Several times a month
4. Several times a week
5. Daily

Importance

1. Failure to perform could result in some inconvenience
2. Failure to perform could be costly
3. Failure to perform could lead to damage to life or limb.

Note. It is not clear whether "failure to perform" means simply that or also means "failure to perform properly."

Since the frequency scale has five levels and the importance scale only three, the next step is to equalize the weight of the two scales in determining final priority (provided, of course, that the analyst wants them to have equal weight). This is done by multiplying each task's raw frequency rating by three and its raw importance rating by five. These adjusted ratings are then multiplied by each other to produce a final score for each task. High scores indicate that a task has high priority for training purposes. The following is an example of this process.

Task No.	Frequency		Importance		Priority Rating
	Raw	Adjusted	Raw	Adjusted	
1 -----	5	15	3	15	225
2 -----	5	15	2	10	150
3 -----	1	3	1	5	15

Task 1 is performed daily and failure to perform it could lead to damage to life or limb. Thus it has the highest priority rating. Task 2 is also performed daily, but failure to perform it would result in less drastic consequences and its priority rating is thus lower. Task 3 has the lowest priority because it is almost never performed and has little importance attached to it.

TERC briefly discusses procedures for using other criteria as determinants of priority for training, weighting one scale more heavily than others, and making criterion scales nonlinear. It also notes that specific local situations will contain other elements which will strongly affect the setting of training priorities. Thus the procedure described above is much more likely to suggest priorities than to dictate them.

The other application of its task data which TERC discussed in some depth is based on Robert M. Gagne's work with regard to types of learning. Tables 1 and 2 present much of this material. According to TERC:

The most dependable condition for insurance of learning is prior learning of prerequisite capabilities. This is sometimes called specific readiness or enabling conditions. Research has shown that having learned the prerequisites, nine of ten students are able to solve a problem which they were initially unable to solve. They were able to solve the problem without hesitation and with no practice on the problem itself. Here, "the prerequisite for a type of learning is that which distinguishes one type of learning from another." For example, to solve problems, a trainee must have mastered the prerequisite principles (and so on as indicated on the chart). Thus, practical and desirable outcomes can be gained through proper emphasis on the prerequisite skills and knowledge. Any particular learning is not at all difficult if one is truly prepared for it. (4, p. 143)

The type of "performance established by learning" (stimulus responding, motor chaining, etc.) is identified for each task. Thus the types of "internal (learner) and external conditions" for learning a given task (its "specific readiness or enabling conditions") are suggested.

This information would appear to have definite value in instructional planning—that is, in determining the sequence of training segments so that the trainees always approach new material armed with its "prerequisite capabilities." The talents of someone versed in educational psychology would be needed, however, to apply Gagne's broad conceptual outline to specific local situations.

Functional Job Analysis (11)

The Upjohn Institute's Functional Job Analysis (FJA) approach distinguishes among three types of skills—adaptive, functional, and specific content. They are defined thusly:

Adaptive Skills refer to those competencies that enable an individual to manage the demands for conformity and/or change in relation to the physical, interpersonal, and organizational arrangements and conditions in which a job exists. Included are management of oneself in relation to authority, to impulse control, to moving towards, away from, or against others; to time (e.g., punctuality and self-pacing); to care of property; to dress (e.g., style and grooming). These skills, rooted in temperament, are normally acquired in the early developmental years, primarily in the family situation and among one's peers and reinforced in the school situation.

Functional Skills refer to those competencies that enable an individual to relate to Things, Data, and People (orientation) in some combination according to personal preferences and to some degree of complexity appropriate to abilities (level). They include skills like tending or operating machines, comparing, compiling, or analyzing data; and exchanging information with or consulting and supervising people. These skills are normally acquired in educational, training, and avocational pursuits and are reinforced in specific job situations.

Specific Content Skills refer to those competencies that enable an individual to perform a specific job according to the standards required to satisfy the market. These skills are normally acquired in an advanced technical training school or institute, by extensive on-the-job experience, or on a specific job. They are as numerous as specific products, services, and employers who establish the standards and conditions under which those products and services are produced.

In effect, the degree to which a worker can use his functional skills effectively on a job is dependent on the degree to which his adaptive skills enable him to accept and relate to the specific content skill requirements. (11, pp 79-80)

Adaptive skills, although regarded as crucial to worker satisfaction and growth, do not have a direct relationship to FJA task statements. The functional and specific content skills required for each task, however, are determined as part of FJA's initial data-gathering procedure. FJA task data are intended to provide inputs, not merely into the selection of training materials, instructors, or priorities, but also into specific curriculum content.

The following example is taken from the Social and Rehabilitation Service's *National Task Bank* (49) for workers in the public welfare field, which was prepared by the Upjohn Institute using FJA

Task: Talks with/discusses preferences, feelings, and situation with unwed mother, explaining possible arrangements, in order to provide mother with information necessary to obtain confidential maternity and medical care.

TABLE 1. TYPES OF LEARNING AND LEARNED PERFORMANCE

Performance established by learning	Internal (learner conditions)	External conditions	Definition	Example	Inferred capability
Stimulus responding ----	Certain learned and innate capabilities.	Repeated exposure to response-provoking stimuli; immediate confirmation of active response.	Making a specific response to a specified stimulus.	Trainee repeats new word "torque."	Connection, identification.
Motor chaining ---	Previously learned individual connections.	Presenting a sequence of external cues that call for a sequence of specific responses; repetition to achieve selection of response-produced stimuli.	Exhibiting a chain of motor responses, each of which is linked to each subsequent response.	Using a wrench to remove a sparkplug.	Sequence of motions.
Verbal chaining --	Previously learned individual connections and cues.	Presenting a sequence of external verbal cues, effecting a sequence of verbal responses at the same time.	Exhibiting a chain of verbal responses, each of which is linked to each subsequent word.	Listing, from memory, the steps for starting a diesel engine.	Verbal associations; verbal sequence.
Multiple discriminating ----	Previously learned chains, motor or verbal.	Practice providing contrast of correct and incorrect stimuli.	Making different (chained) responses, to two or more physically different stimuli.	Pointing out and identifying the ball peen hammer, the carpenter's hammer, and the tack hammer.	Discrimination.
Concepts ----	Previously learned multiple discriminations.	Recalling discriminated response chain along with a variety of stimuli differing in appearance, but belonging to a single class; confirmed by successful application.	Assigning objects of different physical appearance to classes of like function.	Sorting out all the resistors from a pile of spare parts.	Classification.
Principles -	Previously learned concepts.	Using external cues, usually verbal, effecting the recall of previously learned concepts in a suitable relationship; confirmed by specific applications of the rule.	Performing an action in conformity with a rule which is composed of two or more concepts.	Adding more flour for high altitude baking.	Principle or rules.
Problem solving	Previously learned rules.	Self-arousal and selection of previously learned rules to effect a novel combination which is self-confirming.	Solving a novel problem by combining rules.	Troubleshooting a radio.	Principles, plus problem-solving ability.

Source: Technical Education Research Centers, Inc.

Functional:

How to convey information to specific audience.
 How to listen, explore, and reflect feelings, give advice/
 counsel to meet needs of others.

Specific Content:

Knowledge of local resources for helping unwed mothers
 with medical needs and maternity care.



TABLE 2. ACTION VERBS RELATED TO SPECIFIC KINDS OF LEARNING

ASSOCIATION						
Stimulus Responding	Motor Chaining	Verbal Chaining	Multiple Discriminating	Concepts	Principles	Problem Solving
associate	activate	cite	choose	allocate	anticipate	accommodate
gave a word for	adjust	copy	compare	arrange	calculate	adapt
grasp	align	enumerate	contrast	assign	calibrate	administer
hold	close	letter	couple	catalog	check	adjust to
identify	copy	list	decide	categorize	compile	analyze
indicate	(dis)assemble	quote	detect	characterize	compute	compose
label	(dis)connect	recite	differentiate	classify	conclude	contrive
lift	draw	record	discern	collect	construct	correlate
locate	duplicate	reiterate	distinguish	file	convert	create
loosen	insert	repeat	divide	grade	coordinate	develop
move	load	reproduce	isolate	group	correct	devise
name	manipulate	(re)state	judge	index	deduce	diagnose
pick up	measure	transcribe	pick	inventory	define	discover
place	open	type	recognize	itemize	demonstrate	find a way
press	operate		select	match	design	invent
pull	remove			mate	determine	realize
push	replace			order	diagram	reason
recognize	stencil			rank	equate	resolve
repeat	trace			rate	estimate	study
reply	tune			reject	evaluate	synthesize
respond	turn off/on			screen	examine	think through
rotate				sort	expect	troubleshoot
say				specify	explain	
set				survey	extrapolate	
slide				tabulate	figure	
signal					foresee	
tighten					generalize	
touch					illustrate	
turn					infer	
twist					interpolate	
					interpret	
					monitor	
					organize	
					plan	
					predict	
					prescribe	
					program	
					project	
					schedule	
					solve	
					translate	
					verify	

Source: Technical Education Research Centers, Inc

Knowledge of agency guidelines for helping unwed mothers.

Knowledge of specific client situation.

Knowledge of needs, problems, and their possible solutions for unwed mothers.

Knowledge of, and how to identify, prenatal and post-natal medical needs.

In this example, and in the great majority of the items in the National Task Bank, the specific content skills are expressed as types of knowledge (of resources, agency procedures, guidelines, personal characteristics of clients, etc.). According to the Health Services Mobility Study, knowledge is learned

through instruction, while skills require practice. It may be that some of the specific content examples for the above task actually involve both skills and knowledge, in the HSMS definitions of those terms. For example, a worker might easily pick up "knowledge of local resources for helping unwed mothers" through classroom instruction or by reading the appropriate manuals. However, the skill in putting that knowledge to work, by analyzing the individual client's particular needs and selecting the most appropriate resource, would be developed only through practice. An effective training program, then, would

have to combine classroom work covering the resources and procedures for using them with supervised on-the-job training in applying that knowledge to the individual client's best advantage.

The functional/specific content dichotomy is useful in distinguishing between those skills having applicability in relatively narrow occupational settings (specific content) and those with broader utility, such as in facilitating career advancement (functional). FJA training content data would be even more useful, however, in planning education and training programs if the distinction between skills and knowledge were also recognized as important.

Job Relevance of Vocational Education Curriculums in Michigan (43)

In this study of vocational education curriculums in three Michigan communities, task data were used to perform a somewhat different purpose from that of other studies discussed in this section. The goal was to increase the job relevance of vocational education by identifying discrepancies between those skills employers look for in entry-level employees and those actually produced by vocational curriculums. The data-gathering and analysis methodology was outlined in chapter III of this report.

As an adjunct to the primary effort, however, the Battelle staff prepared a "concise description of a recommended (more comprehensive) methodology for school systems to use in designing and maintaining vocational education programs to develop student skills which correspond to employer-desired skills." This methodology contains the following seven steps:

1. Decide on curriculum organization and select program offerings, based on an assessment of employment opportunities, student body desires and needs, and resources and constraints.
2. Assess employer and job requirements.
3. Formulate performance objectives for programs and select/develop measures of attainment of objectives.
4. Assess characteristics of target populations.
5. Design programs:
Courses and other instructional units within programs.
Instructional strategies and methods; content; sequencing, and materials, equipment, and media.

6. Implement and conduct programs:
Assess entry-level skills and knowledges.
Assess attainment of objectives.
7. Conduct followup studies:
Job placement.
Graduate job performance.
Employer job requirements.

Battelle's major effort was to devise and test a procedure for implementing step two. Its comments regarding step three are also relevant in a discussion of job analysis.

Like the Health Services Mobility Study, Battelle was strongly influenced by the work of Robert Mager (30) in establishing training program objectives in behavioral terms. The Battelle report puts it succinctly: "Objectives specify what the learner is to be able to do upon completion of instruction." In addition, "objectives specify conditions under which the learner is to display the desired behavior" and "the *level of performance* that will be considered acceptable." Finally, they "must be stated at an appropriate level of specificity to permit measurement of performance."

According to Battelle's report:

Job requirements task analysis information, and skills and knowledge required for performance of these tasks serve as the basis for formulating performance objectives at the program level. Two major outcomes are possible, depending on the terminal objectives of the program. In some cases, the program objectives will literally provide for the teaching of required job tasks. In other instances, program objectives will be stated in terms of skills, knowledge, and other capabilities required for successful task performance. School training, in this latter case, stops short of literally teaching actual job tasks, but instead provides for certain required capabilities, and with the assumption that on-the-job experience will lead to successful task performance. Which of these strategies to employ, or which combination of the two for a given job, depends on the job itself along with time/funds constraints and other factors. Further, regardless of which of the above strategies is used, time/funds constraints may not permit the teaching of all job tasks at the required level of proficiency, or all prerequisite capabilities. Nor might it be desirable to do so, since certain skills and skill components (e.g., those tasks unique to particular organizations) may be more appropriately learned through on-the-job experiences or in company-sponsored training

Thus, selection of particular job tasks, skills, and capabilities must be made along with levels of proficiency the program will seek to teach. Information obtained on the tasks during the task analysis phase (such as importance, frequency, and degree to which a task for a job is common across establishments) is useful in providing guidelines in selecting tasks and associated skills and knowledge to teach. Also, estimates of learning difficulty for the various tasks can provide another criterion for task selection (43, pp. 75-76)

Thus, Battelle recognizes the need for translating task data into curriculum content. Its task dimensions (importance, frequency, etc.), however, appear inadequate to provide more than, as its report says, "guidelines" to this process. This is not to fault the institute, however, because the purpose of its project was simply to identify discrepancies in curriculum content, and it appears to have done so admirably. But the need for better ways to analyze job content data for curriculum development remains. The Health Services Mobility Study approach of identifying specific skill and knowledge content may have relevance, although it is probably too rigorous and time consuming to gain widespread acceptance among school systems. The Functional Job Analysis dichotomy between functional and specific content skills, with proper attention paid to knowledge content, may be more appropriate. Similarly, the Technical Education Research Centers' adaptation of Gagne's types of learning concept should be useful in step five (instructional strategies, etc.) of Battelle's recommended methodology.

As the Battelle staff concludes:

The ease and validity with which the formulation of program objectives can be accomplished are directly dependent upon how well the previous step of assessing job requirements has been accomplished. If a well-defined description of required job tasks and associated skills, knowledge, and proficiency levels is available, then the formulation of program objectives is greatly facilitated. If such information is not available, then formulation of program objectives presents several major problems. In turn, if program objectives cannot be well-formulated, subsequent formulation of subterminal objectives and associated courses and units, and design of the learning environment, suffer proportionately (43, p. 77)

Qualifications Examining

Job analysis as a means of devising job-related qualifications examinations and procedures has not received the attention it deserves. While several of the projects reviewed in this monograph have dealt with job restructuring and/or education and training program development, only two—the Chicago Police Department and the U.S. Civil Service Commission studies—have addressed themselves to the problems of employee selection. There are signs that, at least until recently, personnel practitioners had little more interest in this area than did the researchers. A survey of State and local government personnel practice

conducted in 1971 by the National Civil Service League, showed that test validation was 11th on a list of 15 personnel functions ranked in order of frequency of performance. (36)

The problem is not failure to accept employment examining as a valid personnel function. Well over 90 percent of the 357 respondents to the National Civil Service League's survey, each with at least 500 employees, used some form of examining, including written tests, review of education and experience, oral interviews, and, or performance tests. The civil service reform movement of the late 19th and early 20th centuries, aided by the increasing sophistication of psychological testing and measurement as a science, has made merit as determined through "objective" procedures, the rule in public personnel selection. The private sector has by no means been isolated from these developments.

The problem is that true objectivity is not often easily attained, and the appearance of it is frequently accepted as a substitute. True objectivity requires relatively rigorous efforts to determine actual job requirements and to select examining procedures which measure them accurately in each applicant. Personnel specialists often do not have the time, resources or training for these efforts. A high school education, which is presumably certified to by possession of a diploma, may not actually be required for the performance of an entry-level job, but it does represent a standard which can be demanded evenhandedly of all applicants. A written test may not have any predictive power in selecting applicants capable of performing on the job, but it has an aura of objectivity about it and its numerical results can be used to justify personnel decisions.

There are strong indications that these practices are—and will continue to be—changing. Court decisions, such as *Griggs v. Duke Power*, and the guidelines of the Equal Employment Opportunity Commission, whose coverage has recently been expanded to include State and local governments, are providing employers with the incentives to make the time, find or reallocate the resources, and seek out the training required to make their employee selection procedures truly job related.

The most recent, and specific, word on this subject comes from the Equal Employment Opportunity Coordinating Council, which has representatives from the U.S. Civil Service Commission, the Commission on Civil Rights, the Equal Employment Opportunity Commission, the Department of Justice, and the Department of Labor. The Council's "Uni-

form Guidelines on Employee Selection Procedures" have been published in draft form. They are being circulated for comments by interested parties and are subject to modification. They will become effective when they are published in the *Federal Register* as final. They will apply to private and State and local government employers, labor organizations, and employment agencies. The following excerpt discusses job analysis:

A required element of any validation study is a systematic and comprehensive analysis of the job for which the test is to be used. The analysis must be based upon (1) the duties performed by the incumbents on the job, (2) the level of difficulty at which the duties are performed, (3) the circumstances and conditions under which the duties are performed, and (4) those duties which are critical i.e., those which must be performed competently if the job is to be performed in a satisfactory manner. The job analysis should describe on what bases any working conditions were determined to be critical and on what bases duties were determined to be critical, such as the proportion of time spent on the respective duties, their levels of difficulty, their importance, or their frequency of performance. If a duty which occupies a high proportion of time is not deemed critical, the reasons therefore must be set forth. For those duties which have been determined to be critical pursuant to clause (4) above, the job analysis should set forth which knowledges, skills, abilities, and other worker characteristics are required for successful job performance.

The requirements for a job analysis set forth herein are not intended to specify a particular method of job analysis. Any professionally recognized method of job analysis is acceptable if it is comprehensive and otherwise appropriate for the specific validation strategy used. For example, it is recognized that some methods of job analysis provide direct identification of the knowledges, skills, abilities, and other worker characteristics necessary for successful job performance by an analysis of work process, rather than specific job duties. In any case the factual base, for the determination of the identified knowledges, skills, and abilities, and other worker characteristics must be documented. (7, pp. 7-8)

Vernon Taylor discusses the various types of test validation and their relationship to job analysis in a paper prepared for the Public Personnel Association (now the International Personnel Management Association):

A test has *content validity* if it directly measures the skills and knowledges that are necessary to job performance. The basic prerequisite to this process is a first-hand knowledge of the tasks performed on the job. This information is a first consideration in planning any test, and with it the establishment of content validity in an achievement test can be fairly easy. . . . If (certain) skills and knowledges are an important part of the content of the job and are also included in the test content, the test has content validity. The relationship between job and test content is obvious . . .

Construct validity has been defined as an analysis of the meaning of test scores in terms of explanatory concepts or "constructs." More importantly, construct validity is used to *infer* the degree to which people possess some trait. If we cannot measure an ability directly (as with a work

sample test), we find a way to measure it indirectly. This is done when the test measures aptitudes. . . .

Whereas content validity may be achieved by studying only the tasks performed in an occupation or class, construct validity requires a complete job analysis. After the tasks to be performed are understood, it is necessary to identify the specific skills, knowledges, and abilities necessary to their performance. Only then is it possible to utilize constructs in the planning of an examination.

The desk audit commonly performed by classification technicians is a short-cut approach to job analysis, but it does not produce the depth or detail of information needed for examination planning. Its function is to provide classification and pay information. . . .

A job analysis must produce a list of the aptitudes, skills, knowledges, and other characteristics required to perform the job, which are possessed to a satisfactory degree by some of the prospective applicants, but perhaps not by all. This is known as a list of job requirements or performance requirements. It must include indications of the degree of skill at which each characteristic is needed, and its importance to success in the job. . . .

Construct validity can be demonstrated by showing a complete record of the process that was employed, including a list of the tasks identified in the job analysis, the list of abilities required to perform these tasks, the reasons for not attempting to measure all of the necessary abilities, the nature of the tests used and the evidence that suggested their use, and their reliabilities when used. All of this information should be retained in the agency's files as long as that examination plan is in use. . . .

Criterion-related validity is measured by comparing test scores with other scores that provide a direct measure of the abilities in question. In the case of employment tests, the scores are compared with criteria of job success. . . .

The goal of test validation in public personnel work is to determine the effectiveness of tests in identifying those applicants who would be successful if appointed to positions in the classes for which they are tested. The most widely accepted evidence of this effectiveness is an empirically observed relationship between pre-employment test scores and post-employment criteria of job success. When this positive relationship is found, an applicant with a high score is considered more likely to succeed than is an applicant who earned a low test score. Indeed, any applicant may be considered more likely to succeed than is any other applicant with a lower test score. (45, pp. 3-7)

The importance of job analysis in criterion-related validity lies in its use as a way of selecting job-related performance evaluation criteria, a subject which will be discussed in the final part of this section.

Upward Mobility Through Job Restructuring (13)

The U.S. Civil Service Commission project, Upward Mobility Through Job Restructuring, recommended use of the job element examining procedure, a technique developed by Ernest Primoff of the Commission, which has been used for several years in examining for Federal blue-collar jobs. The job element procedure is explained, with abundant ex-

amples, in the Civil Service Commission's publication *Job Qualification System for Trades and Labor Occupations—Handbook X-118C* (48).

A job element is not related in any way to an element of a task as discussed in appendix A. Job elements are those skills, knowledges, and abilities (SKA's) required for successful performance of a given job. The job element technique is meant to serve as an alternative to qualifications standards which require a specified number of years in specified work situations. The examiner using the job element procedure is primarily concerned with whether the applicant possesses the required SKA's, not with how he or she may have acquired them. It may have been on the job, in school, in community or volunteer work, or through general life experiences. The examiner uses the most appropriate examining procedure in determining whether the applicant possesses the key job elements. If, for example, the ability to type at a given speed is required in the job, a performance test would be in order. If skill in performing arithmetic operations under deadline pressures is called for, a timed, paper and pencil test may be appropriate.

The development of a job element examining procedure for a specific position requires a job analysis for the identification of the necessary elements (SKA's). This analysis does not include job content determination in the form of specific task identification. Instead, it involves having supervisors, workers, and other experts determine the elements through group discussions. The Civil Service Commission project staff did use task statements, however, as examples of work situations in which specific job elements might be demonstrated. This procedure was recommended for inservice placement (i.e., promotion from within the organization) in three job series—Budget Technician, Social Science Technician, and Management Auditor Technician. The following are the job elements identified for Budget Technician jobs, GS levels 5 through 8:

- a. Work from complex rules, regulations, and procedures with minimum assistance from supervisor.
- b. Perform accurately work which requires meticulous attention to detail.
- c. Communicate information or ideas (oral or written) by means of letters, memos, summaries, reports, etc.
- d. Work with and abstract quantitative data from a variety of standard forms and other data sources.
- e. Recognize problem areas and inconsistencies in data.

Each of these elements is required at each level in the Budget Technician series. The higher levels, of course, require possession of some or all elements to a greater degree. Thus, the job element examining procedure must determine not only whether the applicant possesses the required skill, knowledge, or ability, but also the extent to which he or she has it. In the examples given above, a review of the work history is one likely examining procedure. The CSC staff lists specific tasks for each element, which, if performed in previous jobs by the applicant, would indicate possession of that element. Listed below are examples of relevant tasks for the first job element—"work from complex rules, regulations, and procedures with minimum assistance from supervisor."

—Applying official and/or legal business terminology and documentary regulations.

—Dispensing information relative to the correct interpretation of rules and regulations governing such matters as insurance, education, employment, and housing.

—Allocating and insuring the proper utilization of personnel, equipment, supplies, services, or facilities for specific purposes according to predetermined schedules, priorities, and procedures.

—Interviewing applicants for employment and processing application forms according to established procedures.

—Scanning documents and deriving pertinent points.

These tasks are listed in order of their relevance to the element in question. An applicant who could demonstrate experience in performing the first task would receive a higher rating on that element than the applicant who had only performed the fourth task.

The CSC staff also provides a recommended supplemental application form and a structured interview guide for eliciting the necessary information from job applicants. Also provided are suggested ways to gather and organize supervisory appraisal data in order to evaluate the quality of each applicant's prior work performance. Final scores are based on the cumulative totals of each rating on each element.

The job element procedure does not eliminate the need for test validation. However, by making use of the whole range of examining tools it reduces the personnel specialist's dependence on written tests. The process of identifying job elements provides a clear understanding of exactly what qualities are being sought in the applicants and thus aids examiners in selecting the most appropriate selection devices. It should be emphasized that, when used properly, written tests can be excellent examining tools. Problems have arisen with them when they have been asked to produce results they were not intended to produce or were interpreted incorrectly.

When a job element examining program is based on a careful and complete job analysis, its validity can easily be documented. There are other beneficial effects to this technique. For example, when jobs are described in terms of their abstract elements, it is possible to find common elements across several occupations and thus increase career lattice opportunities. This theme is found throughout the literature on job analysis—in the Worker Functions concept, for example—as well as in the Health Services Mobility Study and Position Analysis Questionnaire methodologies.

Psychological Assessment of Patrolman Qualifications in Relation to Field Performance (3)

The Industrial Relations Center of the University of Chicago conducted an occupational analysis of the patrol officer's job in the Chicago Police Department. Their purpose was to gain insights into the behavioral aspects of the job in order to facilitate development of a psychological test battery for employment selection purposes. Some of the behavioral requirements they found are listed below:

- Make prompt and effective decisions, sometimes in life and death situations, and be able to size up a situation quickly and take appropriate action.
- Maintain a balanced perspective in the face of constant exposure to the worst side of human nature.
- Tolerate stress in a multitude of forms, such as meeting the violent behavior of a mob, arousing people in a burning building, coping with the pressures of a high-speed chase or a weapon

being fired at the officer, or dealing with a woman bearing a child.

—Exhibit a number of complex psychomotor skills, such as driving a vehicle in normal and emergency situations, firing a weapon accurately under extremely varied conditions, maintaining agility, endurance, and strength, and showing facility in self-defense and apprehension, as in taking a person into custody with a minimum of force.

—Have the facility to act effectively in extremely divergent interpersonal situations. An officer has contact with paracrims, informers and people on the border of criminal behavior besides the dealings with criminals. At the same time, officers must relate to the people on their beat—businessmen, residents, school officials, visitors, etc. Their interpersonal relations must range up and down a continuum defined by friendliness and persuasion on one end and by firmness and force at the other.

The occupational demands placed on field patrol officers are not unique to that job, but they certainly differ in substantial ways from those faced by workers in industrial, commercial, bureaucratic, or even most other service contexts. This fact and the crucial nature of the job make employee selection a far from routine process. Most of the behavioral requirements listed above call for skills which are among the most difficult to predict. Some of the task dimensions discussed elsewhere in this report, such as the U.S. Department of Labor's Temperaments and Interests scales and the Health Services Mobility Study's Interpersonal Skills scales can be used, to a limited extent, to identify these skill requirements in jobs. But considerable doubt remains concerning whether current psychological tests are capable of accurately measuring the extent to which human beings possess these skills. An article by two International Association of Chiefs of Police staff psychologists, Deborah Ann Kent and Terry Eisenberg, Ph. D. (27), makes reference to a followup study in Chicago in which the test battery developed from the occupational analysis is shown to have had very limited validity in predicting successful job performance among new police recruits.

Given the multifaceted nature of the police officer's job and the limitations in psychological testing, the job element approach may be worth further study in this area. Police departments commonly conduct background investigations on their job applicants,

but these usually focus more on matters of moral character than on evidence of interpersonal skills, decisionmaking capability under stress, or broad-minded attitudes.

Although the Chicago study had results which, in the long run, were somewhat disappointing, it served to direct attention to the special problems of examining in those occupational areas where such characteristics as psychological and emotional stability under stress are definitely job related.

Performance Evaluation

Health Services Mobility Study (21)

Performance evaluation, like qualifications examining, has been somewhat neglected as an application for job content data. Yet, the need for job related performance standards is every bit as great as the need for job related employee selection procedures. The Health Services Mobility Study (HSMS) lists the following uses for valid performance evaluation data:

1. To enable an institution to evaluate the quality of its own work, covering individuals within the institution.
2. To compare groups of employees. For example, the success of an educational ladder paralleling a job ladder can be measured by applying performance evaluation instruments to incumbents trained in conventional programs and to newly placed incumbents trained in the new programs. A comparison can then be made between the two groups.
3. To evaluate the adequacy of occupational programs. If curriculum objectives are derived from task activities, the adequacy of individual programs can be ascertained by reference to the performance of the tasks in actual work situations.
4. To determine when students have successfully reached standards of completion of program requirements in laboratory or clinical work independent of time requirements. If performance evaluation were used to determine student readiness to pass from laboratory to clinical or to ascertain when clinical work was successfully completed, there might be greater safety to the patients who are involved in the clinical practice. Performance evaluation would make it possible to save on laboratory and/or clinical training time when not needed by proficient students or to prescribe additional training for students performing below par.
5. To be used alone or in conjunction with proficiency or equivalency examinations to evaluate an individual's readiness to be accepted with advanced standing in existing programs, into job titles or to sit for licensure or certification examinations.
6. To be used to validate test items in proficiency examinations. Currently, incumbents' scores on proficiency test

items are used to validate test items, but the items are not tested for job relevance. Performance evaluation instruments can be used to validate test items, to thus provide for job relevant test items (21, pp 2-32)

These uses are most appropriate in the health field which was the HSMS staff's primary concern. But, with slight modification, they are applicable in other areas as well.

Work on the HSMS performance evaluation instruments is in the preliminary stages. However, the following comments can be made to shed some light on the general nature of their approach.

—Since the HSMS curriculum objectives are to be written in behavioral terms, they will contain standards of acceptable task performance. These same standards will be usable as inputs in the design of performance evaluation instruments.

—Two models (A and B) for performance evaluation were designed. "A" was designed for tasks which have outputs that are easily evaluated and "B" was designed for those whose outputs are not easily evaluated.

—In Model A, criteria for evaluating the outputs of tasks are presented to appropriate raters (who could be supervisors, coworkers, patients, other persons, or a combination of these). The raters are told to rate each task performer's outputs on a scale ranging from "distinctly superior" to "distinctly inferior."

—Model B is used for those tasks which have outputs that are not easily evaluated. Examples of this would be when the output cannot be separated from the procedure, such as in giving reassurance; when the output is intangible, such as in teaching; or when the criteria for outputs resulting largely from intellectual processes are difficult to evaluate objectively, such as in diagnostic tasks. In these cases, the task performer is evaluated with respect to the skills and knowledge inherent in the task rather than with respect to the output. Thus, the raters (who might be the same people used for Model A) evaluate each performer against the skill and knowledge scale values required for each task. For example, if a given task requires Human Interaction skills at scale value 5, the descriptor for that scale value would be used as a criterion. Performers would be rated against that descriptor along a scale ranging from "distinctly superior" to "distinctly inferior."

Functional Job Analysis (II)

According to Fine and Wiley, "theoretically, all tasks performed in an agency should contribute to its objectives; but unless the expected results and their respective performance standards are carefully thought out and specified beforehand, this will remain only a theoretical proposition." In Functional Job Analysis (FJA), performance standards are determined for each task statement and may be either descriptive or numerical. Descriptive standards are nonspecific and subjective and thus open to misinterpretation. Numerical standards are objective and require no interpretation. Thus, they communicate the standards by which the worker's performance will be evaluated more explicitly. However, they can be relied on too heavily to the neglect of qualitative measures. Objectivity is not served when irrelevant or secondary measures are used simply because they can be quantified. The following is an FJA task statement with both descriptive and numerical standards:

Asks client questions, listens to responses, and writes answers on standard intake form, exercising leeway as to sequence of questions, in order to record basic identifying information.

Descriptive Standards

Writes answers legibly.

Listens carefully to client's answers and records responses accurately.

Easily changes sequence of questions to meet unique situations or problems.

Numerical Standards

Asks all required questions of client (form 100 percent complete)

On the average, completes X number of forms per day.

No more than X complaints from clients per month about worker's manner during interview.

FJA performance standards should also reflect each task's orientation measure. In the above example, the primary orientation is toward Data (50 percent) with a substantial involvement with People (40 percent). The Things orientation was minimal (10 percent). Thus the performance standards relate largely to data functioning, with only slightly less emphasis on the worker's involvement with people.

V. NONTECHNICAL ASPECTS OF A JOB ANALYSIS STUDY

A complete job analysis consists of more than simply gathering and rating job content data for application toward one or more specific purposes. There are preliminary activities, involving both planning and politicking, and there are evaluations and updates to be conducted after the basic analysis has been completed. But the whole process should not be thought of as having only three phases—beginning, middle, and end. Some activities occur during two or more phases and one, the periodic updating of job content information, insures that the process never truly ends. This chapter discusses some activities which may be called supportive of or auxiliary to the technical analysis and which are crucial to its success.

Establishing Goals and Objectives

In some cases, a job analysis project's specific goals and objectives will be known from the beginning. Current employment examinations will need to be validated or new ones developed in order to meet Equal Employment Opportunity Commission requirements. Job descriptions or a position classification plan will be outdated and in need of revision. At other times, general goals will be known—reduce turnover or increase upward mobility opportunities—but the specific ways in which they are to be accomplished will not yet be clearly understood. In

these latter instances, job restructuring or new examining procedures may or may not be appropriate means. It will only be after the study has progressed for some time that the specific nature of its products will become apparent. Thus it is not always possible, or desirable, for the planning of a job analysis study to be completely separate from, and prior to, the conduct of the study. The two activities may be carried out concurrently. As new data are generated, certain objectives or products will begin to appear preferable to others. In some cases, a modification of overall goals may be in order if they should appear to be unrealistic in the light of present or anticipated organizational resources.

The fact that goals and objectives may change as a better understanding of the organization and its environment is gained does not, of course, mean that goals should not be established initially but simply suggests that a job analysis study can be a dynamic force, identifying the need for changes in unexpected areas, and that flexibility is in order. (As stated earlier, the purpose for which an analysis is conducted largely determines the types of data which are gathered and the way in which those data are arranged.)

Organizational goals and objectives, as distinguished from those of a job analysis study, are also subject to change. Although the process is often a slow, evolutionary one, in some cases it can take place more quickly. State and local public agencies, in particular, are susceptible to changes in legislative or Federal funding agency priorities and occasionally must alter their own goals accordingly. The likelihood of organizational goals changing substan-

tially may have a bearing on the choice of a job analysis methodology.

For example, in our discussion of Sidney Fine's work for the Upjohn Institute the point was emphasized that his Functional Job Analysis approach is integrally connected with the identification of organizational goals. Tasks are identified in terms of their contribution to the accomplishment of systems objectives. That job content which does not make such a contribution is disregarded as superfluous. It would appear, then, that FJA is most appropriate in those circumstances in which goals and objectives are relatively clear and not likely to change. In other, less stable cases it may be advisable to use an approach which concentrates on establishing a complete inventory of existing job content without regard to current priorities. Again, no case is being made here against the identification of organizational goals before conducting a job analysis, but many agencies must operate in environments which make such identification difficult, if not impossible.

Gaining Support for the Study

A job analysis study could conceivably result simply in a confirmation of the status quo, for example, all employees may already be working at levels consonant with their skills and experience and have adequate access to upward mobility opportunities. It is much more likely, though, that an analysis will reveal the need for change and will suggest directions in which that change might occur.

It has become a cliché to note that many people feel threatened by the possibilities of change. Such feelings do persist, however, and in many cases they are justified. Job analysis, if done properly, can benefit many of an agency's current employees. But it is not likely to be done properly if the project staff ignores these employees and thus fails to benefit from the constructive suggestions they can provide. If current agency employees, from entry-level workers to department heads, are made to feel that changes are being proposed which are indifferent or antithetical to their interests, fear and opposition are inevitable. Employee opposition becomes especially potent of course, when strong unions or professional associations exist within the organization. Similarly, persons with responsibility for the agency's personnel

policies or administration have much to offer a job analysis study, will certainly be affected by its results, and have the capability for facilitating or obstructing its implementation.

Horowitz and Goldstein (24) tell of resistance, on the part of nursing supervisors at Cambridge Hospital, to an upgrading program for nursing assistants. Among the reasons for the supervisors' opposition were the following:

—Although the nursing assistant program was a nursing program, nursing supervisors had not been sufficiently involved in the planning stages.

—Many commitments previously made by the hospital administration were later rescinded. Several of the supervisors believed the financial commitment made to the upgraded employees and the union would not be met and the Nursing Department would unjustly bear the brunt of the blame.

—One nurse resented what she termed "the condescending and condemning attitudes toward nursing personnel and nursing education by the hospital administration." (15, vol. 1, pp. 92-93)

As a result of these and other objections, the City of Cambridge's Commissioner of Health and Hospital reluctantly refused to approve the program, even though it had the support of the employee union.

The importance of involvement and consultation with the employees whose work is being analyzed would seem obvious, but it is too often ignored. This involvement is especially critical because the validity of the data gathered is largely dependent on the cooperation of the workers being interviewed and observed. As the second and third objections cited by the nursing supervisors above would indicate, the job analysis project staff may have to do more than convince employees of the study's inherent value to them. They may have to overcome distrust and bitterness directed against the organization because of real or imagined betrayals in the past.

The Health Manpower Council of California recommends consideration of the probable results of a job analysis even before the study begins as a way of predicting, and preventing, likely objections.

It is wise to anticipate the probable kinds of changes that may occur as a result of the analyses. The recommended changes will be designed to increase output, alleviate staffing problems, increase worker satisfaction, improve the quality of patient care and either hold the line on, or reduce, overall costs. . . .

These changes all require management support and follow-through. Therefore, it is strongly recommended that

the Technical Consultant in Task Analysis procedures discuss, in advance, the analytical procedures, probable findings, and general kinds of changes that can be anticipated for each department with the department heads and their subordinate supervisors. It is important to hold these discussions in advance of the actual analyses, in order to avoid any future misunderstandings about either the procedures or the use of the task analysis findings. As mentioned earlier, this is a new approach to better utilization, and time is well spent in orienting management personnel to both the requirements and benefits of adequate task analysis. (19, p. 5)

The United States Civil Service Commission Task Force lists several management attitudes, practices, and concerns which may have to be addressed:

1. Lack of Full Management Commitment, or "will."

Commitment is the capstone of any upward mobility effort. If management has the *will* to do or support such a program, then most obstacles can be easily met. A firm word from the top works wonders in getting the wheels greased and working smoothly. On the other hand, if management lacks "will," the tiniest obstacle becomes a major problem. In upward mobility, strong commitment is especially crucial, since this area seems to generate an unwarranted amount of fear and misconception. Reasons for the absence of "will" are numerous and generally fall in the following broad categories:

a. *Indifference:* Management simply may not be interested in or convinced of the effectiveness of job restructuring, or it may not see the need for providing upward mobility opportunities. Some managers may feel that the job restructuring technique is merely a useless gimmick. For any of these reasons, management may not be willing to expend the necessary effort.

b. *Insecurity:* Some managers may see proposals for job restructuring or upward mobility as a threat. It may seem to them that the very existence of such proposals implies that they have not done their job adequately. Or, they may be concerned that they will not be able to cope with any resulting organization change.

c. *Prestige:* Top officials closely associated with a particular group may oppose moving employees up through job restructuring on the grounds that it would dilute the "profession" with employees who did not undergo the same degree of training as they did and that they insist is necessary. Therefore, they oppose job restructuring when it includes career ladders leading directly into the "profession." They also oppose it because it tends to be associated with selection programs which emphasize the actual requirements of the work rather than "profession-determined" qualifications.

d. *Racial bias:* In sectors where most lower level employees are minority group members, racial bias may be the root cause for lack of commitment to upward mobility, especially if managers in these areas equate minority with low-skill levels or ineptness, or both.

Whether or not management is fully committed to the program can be determined early by the treatment accorded the restructuring group. Lack of support may be manifested in various ways. The group has unusual difficulty in getting data such as staffing charts, promotions and accessions lists, or job descriptions and finds it hard to obtain suitable quarters and equipment. It has to cope with foot dragging at various levels. Frequently heard are, "It's being studied,"

"We mustn't proceed too hastily," "There are lots of problems to be worked out first," "It's a great idea but it won't work in *my* shop," or "We tried but the Civil Service Commission won't approve our plan." Without clear support from the top, the effort is probably doomed to failure. The importance of making certain of management commitment before proceeding with an upward mobility project cannot be overemphasized. The removal of obstacles depends upon it.

2. Management Practices Incompatible With Upward Mobility Goal

a. *Outmoded attitudes:* Some managers assume that employees are motivated to work hard and well only by the carrot and stick approach. In other words, employees must be managed by manipulating and controlling them through a system of sanctions and rewards. They fail to see employees as having striving, growth-oriented goals of their own.

b. *Traditionalism and resistance to change:* Some managers feel that "the way it has always been done" is of necessity the best way. This may include the neglect of planning and forecasting, failure to make good utilization of manpower, failure to determine employee skills and potential, failure to set up good training programs and a failure to provide a stimulating work environment. A corollary of this is what is referred to as the firefighting style of management, whereby managers grasp at temporary palliatives to meet each crisis as it comes up. Another common manifestation of this traditionalism is management's overly cautious use of regulations. It tends to find in them barriers to action rather than using the flexibilities in the Federal personnel system which permit them to carry out innovative-type programs. Such limited attitudes, practices, and views of regulations pose particular problems both for job restructuring and for upward mobility. It takes considerable effort to sell their merits to this kind of manager. He is not usually geared to recognize the employee's need for growth on the job, his need for an opportunity to advance to (or at least try his hand at) work with greater responsibilities—the core of job restructuring for upward mobility.

c. *Desire to retain quality employees in place:* It is not hard to understand why a supervisor would be loath to give up a topnotch secretary or clerical worker even though it blocks the employee's development. Not only does the supervisor hesitate to lose an employee, but he is additionally burdened by having to train successors. Whether or not this practice is conducive to efficient management, it is clearly an obstacle to upward mobility.

d. *Empire-building:* This phenomenon, often a major barrier to job restructuring, can be found not only in the ranks of top management but also at the level of the first-line supervisor. Two prominent features of one type of empire-building are unwarranted grade escalation and inefficient work organization. A hallmark of this situation is a structure in which professionals are not being utilized at their full level, in which there are deputies or assistants not required by the work ("layering"), and in which the staff assumes tasks beyond the bounds of the work the unit is supposed to do—often overlapping or duplicating another unit's work. Such a work structure is hard to redesign without hurting someone and the mere suggestion of it often (for obvious reasons) inspires fear and hostility. (13, pp. 23-27)

The experiences of the Alpha project illustrate some of the difficulties encountered in an industrial

setting. These problems are not uncommon in other contexts as well.

Critical to the success of the project was the participation of the first-line supervisory staff and foremen. Except for third shift personnel, they were brought together to go over program details prior to the start of the program.

Most of the details on the development of the program and instructional materials had been developed without their involvement. As a means of involving them, they were solicited for their inputs to the manuals being produced in the printing and laminating-embossing department.

These occasions were intended to serve the purpose of informing and gaining advice as regards the operation of the program and especially to win the full support of the foremen for the project.

As regards the program, they accepted it but did not believe it would really change things. They were never won over to the program. Getting ahead by improving one's skills required more motivation than they saw in these new employees. It was their contention that success was dependent upon the individual. If he wanted to do it, he could.

In part, the attitudes of the foremen were racial. The most adamant were those in print production. All the foremen in this unit were whites who had transferred to New Brunswick when the company shifted its operations from Trenton. The other two foremen, in lamination-embossing, were Black and were highly supportive of the program. They had also transferred in from Trenton.

In part, the negative behavior of the foremen was provoked by trainees "hasseling" them, explaining that they had to get off production because they were scheduled to go to class. Of course, some employees were discipline problems. They excused their work behavior by referring to their "special" program status.

The foremen were also caught in the middle of managerial production demands and low employee morale. The employees felt, correctly, that the company had not met its commitments in paying the increased wages on time. The employee wanted improvements to be made as regards rest periods, lunch and toilet breaks. While there are no direct measures of the impact of these attitudes on foremen, it is logical to assume that they felt some of the brunt of these attitudes and some acting-out of felt grievances.

The first-line supervisor had little to gain from the program. It only increased his problems since he was responsible for the quality and quantity of the goods produced. The program design did not provide any incentive for him in terms of any bonus or other benefits.

Program planning in this area must give serious consideration to incentives for foremen and supervisors who are not direct beneficiaries of upgrade programs (16, pp. 153-154).

The preceding comments deal specifically with managerial and supervisory personnel but they are also applicable to all employees who will be affected by, or are in a position to influence the success of, the study.

In many organizations, unions or employee associations can provide the mechanism for informing the rank and file of the study's purpose and soliciting their support. In the Fremont Police Department study, for example, the Assistant Project Director spoke at a police association meeting near the start

of the project and wrote two articles for the association's newsletter. Employee comments, questions, and suggestions were encouraged. Although some departmental employees were still critical of the study, expressing the belief that the resources devoted to it could have been more profitably employed elsewhere, most were highly cooperative and many made helpful contributions to its final recommendations. This can be at least partially attributed to the project's "open door policy" which kept the study from being perceived as a mysterious and malevolent force.

Relations with personnel officials are particularly important to projects working in public agencies subject to legislatively mandated merit system procedures. Some civil service officials may oppose a job analysis study initially because they believe its results will increase pressure on them to violate the merit principles by which only the most qualified applicants are considered for public employment. It may be necessary to discuss the study's objectives and procedures with them in some detail to assure them that any recommendations of final products will be based on systematically and objectively determined assessments of job content and will thus be in accord with merit principles. Merit system officials are more likely to accept projects conducted by agency personnel staffs than those conducted by "outsiders" who lack technical competence in personnel management and who may not appreciate the value of preserving these principles. Thus it is particularly important for these "outsiders" to develop and convey an understanding of the concerns of the merit system administrator.

The support of top personnel officials is helpful in at least two ways. It provides access to technical expertise in personnel management, a factor which is particularly important when such expertise is not found among the project staff itself. And it helps to refute the claims of antagonistic or reluctant managers that civil service procedures prohibit implementation of the study's recommendations.

Staffing the Project

In most instances, the project staff should consist of individuals with varying skills and experience. As was mentioned above, personnel expertise is helpful because a job analysis study is essentially a

personnel management activity and because the presence of such expertise on the staff enhances the project's standing in the eyes of civil service administrators. The Health Manpower Council of California recommends against excessive reliance on personnel analysts for data gathering, however.

The use of personnel analysts for this activity immediately triggers suspicion and "calculated cooperation" among other workers. No matter what management says, most workers will believe that the personnel analysts are going to apply task analysis information to classification (and, therefore, salary) levels. Workers will naturally respond accordingly. (19, p. 8)

Personnel specialists, then, may be most useful as technical assistants in identifying the kind of data to be gathered and in reviewing those data in order to formulate recommendations.

Thus it is often advisable to assign data gathering responsibilities to persons working in the occupational area being studied. Both the Social Development Corporation projects reviewed here, in law enforcement and agriculture, followed this pattern (39, 40). In both cases, it was decided that worker-analysts could be trained within a short period to a sufficiently high level of competence in task analysis techniques. The worker-analysts brought with them an understanding of the terminology and procedures employed in the occupations being studied and the ability to gain the cooperation of the workers being interviewed.

The Health Manpower Council offers the following qualifications requirements for worker-analysts:

Worker-Analyst Qualifications. Thorough knowledge of the departmental activities, supported by one year of experience in the department; demonstrated professional competence, a personality that is reasonably well liked and respected by the other workers, average intelligence, ability to work independently; and ability to follow instructions exactly. (Task Analysis looks easy because it is not complicated. It is, in fact, a rigorous discipline.)

Not required are Advanced writing skills or previous analytical experience.

Not desirable are Supervisory personnel, except where the supervision has been confined to clerical assistants (19, p. 7)

Task Analysis Survey

While this report was being prepared, the Manpower Management Institute sent questionnaires to graduates of its task analysis training workshops to learn of their experiences in applying the technique and thus aid in planning future workshops. Certain

of the survey's findings are included here. The great majority of the Institute's workshop graduates are from public agencies. However, there is little reason to believe that their experiences differ substantially from those of persons in the private sector.

There were 86 responses out of more than 500 questionnaires sent out. One of the questions was:

"What were your objectives in conducting a task analysis?" (Respondents were asked to choose from among 11 suggested objectives and/or to specify any objectives not listed.)

The results suggest that the respondents appreciate the diverse uses for job analysis data:

- Writing or Revising of Job Descriptions—60
- Determining Qualifications Requirements—49
- Development or Maintenance of a Position Classification System—48
- Career Ladder or Lattice Development—46
- Job Restructuring—46
- Assessment of Training Needs—35
- Performance Evaluation—27
- Training Curriculum Development—21
- Test Development—19
- Test Validation—13
- Employee Career Counseling—13

A similar diversity is revealed in response to a question on the types of jobs which were analyzed:

- Administrative or Managerial—47
- Clerical—43
- Paraprofessional—40
- Professional or Scientific—36
- Technical—35
- Skilled Trades—22
- Semiskilled—22
- Unskilled—21

The survey responses indicate that job analyses have been conducted in most of the functional areas which are performed in the public sector:

- General Administration—36
- Social Services—27
- Education—21
- Planning and Development—19
- Health—18
- Environmental Services—13
- Public Works—13
- Public Safety—11
- Transportation—10
- Library—9
- Recreation—8
- Housing—6

Workshop graduates were asked to name the major obstacles to performing a job analysis in their organizations. Money appears to be the number one problem:

- Funding not available—34
- Lack of top management support—27
- Lack of available manpower and/or time—21
- Civil service or personnel department opposition—16
- First line supervisors opposition—14
- Middle management opposition—13
- Union or employee organization opposition—9

The subject of obtaining funds to support a job analysis study warrants further discussion, not only because it ranked first in the list of obstacles, but also because it is directly related to the second and third barriers. The reluctance of top managers is often based, at least partially, on a simple concern for funding the study. If outside funding should become available, this reluctance may be overcome. Also, "lack of available manpower and/or time" is often another way of saying lack of money to purchase these resources.

Traditionally, the greatest source of outside funding, especially for State and local agencies has been the Federal Government. Certain Federal agencies have particular interests in specific functional areas:

- Department of Health, Education, and Welfare (Education, Health, Libraries, Mental Health, Rehabilitation Services, Social Services).
- Department of Housing and Urban Development (Housing Inspection and Code Enforcement, Planning and Development)

- Department of Justice (Criminal Justice, Drug Abuse Prevention, Juvenile Delinquency)
- Department of Labor (Manpower)
- Department of Transportation (Airports, Highway, Transit)
- Environmental Protection Agency (Environmental Services)

Since job analysis is a personnel function, the Intergovernmental Personnel Program, administered by the U.S. Civil Service Commission, is a possible source for State and local governments. Organizations in the private sector may want to contact the U.S. Department of Commerce or the Small Business Administration. *The Catalog of Federal Domestic Assistance*, published by the U.S. Government Printing Office, identifies specific Federal programs, describes eligibility requirements, and provides guidance in applying for funds. Also, the regional offices of all Federal agencies involved in domestic assistance programs have been clustered in 10 cities, making 1- or 2-day "grantsmanship" visits more feasible.

Private foundations represent another potential source of support for job analysis studies. A standard reference in this area is *The Foundation Directory*, prepared by the Foundation Center and distributed by the Columbia University Press. To the extent that revenue sharing becomes a reality, persons interested in job analysis in the public sector will have to present their arguments for such efforts to State and local officials. Finally, two or more organizations with similar personnel needs may decide to cooperate in either funding the study themselves or seeking outside help. For example, two police departments could pool their resources to conduct an analysis. Many Federal agencies encourage such cooperative ventures.

VI. CONCLUSIONS AND RECOMMENDATIONS

Conclusions

What follows are some thoughts written by one who has recently begun to surface from beneath a paper avalanche of job analysis reports, working papers, task inventories, and assorted human resource management tomes. First, a brief rephrasing of perhaps the four most important points made in this paper:

1. The purpose(s) for which a job analysis is conducted should determine the type of information collected, how it is documented, and the dimensions on which it is rated.

2. Persons interested in applying any of the job analysis methodologies discussed in this report should contact the appropriate researchers directly for complete and current information. (Addresses are found in appendix C.)

3. To be successful, a job analysis project must devote sufficient attention to certain nontechnical matters, including as clear an articulation of organizational and project objectives as possible, acquisition of adequate and appropriate staff capabilities, and development of support from all concerned persons.

4. Although a job analysis study will require an initial expenditure of resources which may seem prohibitive to top managers, it can often be justified as a means of developing more efficient personnel management practices. Creative grantsmanship and cooperative efforts among organizations with similar needs can help solve funding problems.

As was stated earlier, this report does not attempt to make systematic evaluations of the various job

analysis methodologies. However, some general comments can be made with regard to certain techniques and their appropriateness for two of the most common job analysis applications—job restructuring and education and training program development.

When job restructuring is the goal, the Department of Labor approach appears adequate for those situations in which jobs from only one, or a few closely related, occupational categories are being studied. Depending on the types of work with which the analysts are concerned, various adaptations of or additions to the DOL scales may be appropriate. When more ambitious career ladder and lattice development is desired, involving a large, complex organization with a diversity of job classifications or, perhaps, more than one organization, the DOL approach is less satisfactory. The key to horizontal, diagonal, and extensive vertical mobility is commonality in skills and knowledge requirements. The worker functions concept begins to address this issue, but only in the most general way. The Health Services Mobility Study's (HSMS) skills and knowledge taxonomy is much more appropriate for this situation. The HSMS methodology is resource consuming, though, and may thus be unattractive to even large organizations unless there is the possibility of outside funding. The best setting for the use of this approach is probably very similar to that in which it was developed—a research and development effort to gather and analyze data and to develop career models in a given occupational or professional area which can be adopted, with modifications, by local practitioners.

The Upjohn Institute's Functional Job Analysis shares many of the characteristics of the Department of Labor approach from which it is derived. Per-

haps its most important contribution is its systems orientation by which it encourages a critical review of work procedures and forces a specific delineation of organizational goals and objectives. To do this, it requires close support and involvement from all levels of decisionmaking and all relevant types of expertise—a desirable feature in any job analysis.

The Department of Labor task statement, written in terms of "what the worker does" and "what gets done," allows the analyst to document the job content data in a standardized way. It also provides for maintaining a proper perspective on worker-oriented, as well as job-oriented, characteristics of the work situation. It would be strengthened, though, by addition of the Health Services Mobility Study's task definition which insures the proper specificity of the data for job restructuring purposes. (This definition is discussed in appendix A.)

Because of the unfortunate way in which so many education and training programs are developed—through a combination of tradition, plagiarism from other organizations, and haphazard adoption of whatever materials or instructors are available—any process of systematic task identification should be an improvement. But mere task inventories, in which curriculum content must be inferred from task statements which were written to describe the work being performed, not the skills and knowledge required to perform it, are inadequate. (The Department of Labor's *Task Analysis Inventories* (54) provides supplemental skills and knowledge information, but not all checklist-type documents do so.) Many times these inferences are self-evident, but often slippages can occur—a type of skill or knowledge which is important for acceptable task performance may not be readily apparent, especially to the curriculum designer who has only the task statement to work with and has not had sufficient indepth exposure to the job itself.

The Health Services Mobility Study addressed this problem by incorporating a determination of the required skills and knowledge into the initial data-gathering process. The HSMS skills may be too abstract, not specific enough, for projects in which abstraction is not particularly beneficial, i.e., those in which there is little or no job restructuring or career ladder development contemplated. In such instances, analysts are less interested in generalized skills development which can form the basis for mobility across occupational lines than they are in specific, job-related training content information. Although the HSMS methodology does provide this informa-

tion, a streamlined approach, also incorporating skills and knowledge identification into the initial data-gathering process, could be developed for projects with more limited curriculum development needs. Interviewers might simply ask task performers, and their supervisors, to give some thought to and then list those skills and knowledges required for satisfactory performance of each specific task. This information could then be displayed as an adjunct to the basic task statement, much the way it is in the Functional Job Analysis technique.

Recommendations

The recommendations which follow are directed to the Manpower Administration of the U.S. Department of Labor. That organization has the nucleus of the staff capability required to implement them, although additional personnel and financial resources will be needed in most cases. The Manpower Administration also has programmatic responsibilities with regard to improved human resource utilization which would be well served by a greater emphasis on job analysis.

1. *The Manpower Administration should support research to develop and test procedures for using job analysis in the area of qualifications examining.* The elimination of needlessly restrictive entry requirements is an essential part of job development activities. The courts and the Equal Employment Opportunity Commission provide powerful incentives in this area. But employers need to know not only that they *must* establish equitable hiring policies, but also *how* to do so. The link between job content information and examining procedures which accurately reflect that content has not been firmly established.

The job element examining procedure, which has been developed by the U.S. Civil Service Commission and applied extensively in Federal trades and labor occupations, is clearly worthy of serious attention in this regard. The Manpower Administration's involvement would not necessarily include further development of the job element approach, duplicating the Civil Service Commission's efforts, but rather would concentrate on testing its effectiveness in a variety of occupations. For example, the identification of job elements in essentially manual,

"things-oriented," blue-collar jobs may prove an easier task than similar efforts with administrative or service occupations which involve extensive data or people relationships. Also, job element examining has thus far been practiced primarily by the Federal Government. Its use in smaller organizations, with fewer resources devoted to personnel management, may require procedural modifications. In any event, the goal should be the development of examining techniques which will allow employers of all types and sizes to pursue fair hiring practices.

2. *The Manpower Administration should support research exploring the potential of job analysis in the related areas of productivity measurement and employee performance evaluation.* This research might be carried out in conjunction with other interested organizations, such as the National Commission on Productivity.

Many factors contribute to changes in productivity, including technological advances and other variations in capital inputs. Worker performance, however, plays a significant role, especially in labor-intensive industries such as the human services and in managerial, professional, and scientific jobs. But it is in these jobs, where the outputs are often intangible, that performance evaluation is most difficult. Job analysis can identify these outputs and provide an objective basis for relating them to organizational goals.

Research in this area can also lead to more accurate procedures for evaluating the effectiveness of the various job analysis methodologies. A major reason for conducting an analysis, certainly a major argument for gaining support for it among top managers, is the presumed beneficial effect that the resulting job restructuring alternatives or training curricula will have on organizational productivity. Without reliable performance evaluation criteria, it is impossible to document these effects or even to identify them accurately.

Labor unions and employee organizations will have an interest in job analysis and its impact on performance and productivity measurement. Their involvement in this type of research should be sought so that any resulting analytical tools are not, and are not perceived to be, helpful only to management.

3. *The Manpower Administration should work in cooperation with the Occupational Safety and Health Administration of the Department of Labor to in-*

crease the effectiveness of job analysis as a tool for OSHA personnel in carrying out their inspection and compliance responsibilities. The Physical Demands and Environmental Conditions factors, as described and illustrated in the *Handbook for Analyzing Jobs*, form the basis for a structured approach to the identification of safety hazards in the workplace. Training in their use can be of substantial value to Federal inspectors and to safety officers within individual organizations.

4. *Full dissemination of job analysis research information to personnel and manpower practitioners should be a continuing priority of the Manpower Administration. An important component of this should be the preparation of practical, how-to-do-it manuals for each of the various applications of job analysis data.* The *Handbook for Analyzing Jobs* is an excellent reference work with complete descriptions and illustrations for the Labor Department's methodology. But practitioners at the local level also need to know how to use the data they have gathered and analyzed. The Labor Department's *Handbook for Job Restructuring* provides a precedent, and perhaps a model, for this type of document. Similar publications covering such areas as curriculum development, qualifications examining, and performance evaluation will help encourage the use of job analysis for these purposes.

Advances in the state of the art of job analysis are occurring in many widely dispersed settings. Governmental agencies, private foundations, and educational institutions are all sponsoring or conducting research which should be of interest to practitioners. Also, employers in both the private and public sectors have had valuable experiences in applying analytical techniques. *The Manpower Administration should publish a periodic newsletter reporting on activities in this field.* The newsletter would include both information on basic research and case studies of specific projects.

5. *The Manpower Administration should provide technical support for, and otherwise encourage the development of, task banks for specific occupations, professions, and industries.* In their study of vocational education, the Battelle staff found an "apparent similarity of entry-level skill requirements among employers" which would justify creation of a nationwide test bank. This work could be funded, sponsored, and/or performed by any of several organizations—commercial, industrial, or professional associations, relevant Federal agencies,

and labor unions. For example, in education, support could come from the Office of Education, the National Education Association, and/or the American Federation of Teachers. In law enforcement, the funding might come from the Law Enforcement Assistance Administration or the Police Foundation, with cosponsorship by the International Association of Chiefs of Police. In general purpose State and local governments, there are numerous possibilities—the National League of Cities, the National Governors' Conference, the International Personnel Management Association, and the American Federation of State, County and Municipal Employees. In the automobile industry, a cooperative venture between one of the "big four" manufacturers and the United Auto Workers could contribute to the resolution of some of their labor relations problems which have become increasingly critical. As a general rule, joint labor, management efforts should be encouraged in order to assure the highest quality results and the best chances for ultimate implementation.

The choice of methodology to be employed in gathering the task bank data should of course be a first priority. It should be based on a realistic assessment of the occupation's needs, i.e., in the human services, the Functional Job Analysis (FJA) or Career Opportunities Research and Development (CORD) scales might be used, while in an industrial setting, emphasis might be placed on an expanded and more specific Things scale. Data should be rated on as many dimensions as possible to maximize the potential uses at the local level. The initial effort in such a venture would, of course, be time and resource consuming and procedures for pe-

riodic updates of the data would have to be established. But the potential value, in more efficient and equitable manpower utilization, would be enormous, especially for those local-level practitioners who do not have the resources to do the initial data gathering and analysis themselves.

6 *Further research and development is called for with regard to the Department of Labor's basic job analysis methodology.* For example, the Department of Labor Worker Functions scales need to be modified to reflect both new types of work in today's economy and changes in the way older types of work have been performed. Just as researchers have created new worker functions to accommodate the new emphasis on human services occupations, functions should be developed which are capable of describing more precisely activities associated with emerging technological processes. The world of work is a dynamic one and procedures for understanding it must keep pace.

7. *The Manpower Administration should actively promote training in job analysis and its applications for employer services representatives and other State employment service personnel.* Increased attention is being paid within the U.S. Employment Service, and its State agencies, to enhancing their capability for providing employers with technical personnel management assistance. Job analysis is a logical component of such a strategy. All employer services representatives should be fully aware of job analysis' value in this area so that they may be of greater assistance in addressing individual employers' needs.

APPENDIXES

A. The Task Description

The single most important piece of information gathered during the course of a job analysis is the basic task description. Not only does this description serve, when written properly, as the foundation for the various scalings and other judgments made about worker activities, but it also provides the greater portion of the insights useful for applying the study's data. Most organizations, even those with formal position classification plans, have never looked at their employees' activities in detail greater than that of the general duty statement. The process of reviewing and describing job content in more specific terms can uncover such things as inaccurate job descriptions, overlapping worker responsibilities, and blatantly non-job-related performance standards, qualifications requirements, and training programs. None of this is intended to minimize the importance of the various scales used in analysis, but merely to emphasize the primacy of complete and accurate task data.

Discrepancies in the level of specificity of the data gathered represent a major obstacle to making effective use of those data. An analyst confronted with a melange of duty, task, and element statements will be forced, in most cases, to repeat large segments of the data-gathering process in order to resolve questions. Information which is too general may be useless. That which is too specific may or may not be helpful, but it is often more difficult to manage. Excessively precise data also require the needless expenditure of precious staff resources during the gathering phase.

There is, of course, no one "best" or "right" level of specificity for an analysis. The applications to which the data will be put, the reasons for the study, will determine the appropriate level. Employment test construction, for example, may require data that are more detailed than would be

required for job restructuring. Once the level of specificity is decided upon, however, it is important to insure that all the data gathered are at that level so that the risk of comparing apples and oranges is avoided. One way of doing this is to develop or borrow standardized definitions for each level and to adhere to them faithfully.

The U.S. Department of Labor uses the following definitions in its job analysis methodology.

1. *Element* is the smallest step into which it is practicable to subdivide any work activity without analyzing separate motions, movements, and mental processes involved.

2. *Task* is one or more elements and is one of the distinct activities that constitute logical and necessary steps in the performance of work by the worker. A task is created whenever human effort, physical or mental, is exerted to accomplish a specific purpose.

3. *Position* is a collection of tasks constituting the total work assignment of a single worker. There are as many positions as there are workers in the country.

4. *Job* is a group of positions which are identical with respect to their major or significant tasks and sufficiently alike to justify their being covered by a single analysis. There may be one or many persons employed in the same job. (52, p. 3)

One immediately apparent characteristic of these definitions is their rather imprecise nature. The distinction between a task and an element is not clear. Elements are described simply as being the next larger step above some vague undefined "separate motions, movements, and mental processes." A task is then defined in terms of elements, a position in terms of tasks, and a job in terms of positions. No level, such as "duty," exists to reflect a group of several functionally related tasks which do not, however, constitute a full position. However, it should be noted that several of the projects studied in this report used these definitions and appear to have developed usable information, although it is not known of course, whether more precise definitions would have resulted in even better data. In the

Fremont Police study, staff members developed unwritten but mutually agreed upon guidelines for identifying tasks, based largely on intuitive judgments as to whether individual statements would be too general or too specific for the project's purposes. The Assistant Project Director had responsibility for reviewing the task data to insure uniform levels of specificity. Perhaps this procedure was followed in other research efforts as well. As mentioned before, however, problems can arise when uniformity of the data is not understood to be an important consideration.

The Department of Labor uses the following standardized format for writing task statements.

1. The subject is always the worker (implied but not expressed).
2. The verb, which always begins the sentence, is synonymous with the worker function (i.e., the primary data, people, or things relationship).
3. The immediate object is either data, people, or MTEWA (Machines, Tools, Equipment, and Work Aids):
 - in case of a data function, the object is information in some form.
 - in case of a people function, the object is usually the people to whom a service is being rendered.
 - in case of a things function, the object is a machine, tool, equipment, or work aid through which the action of the verb is performed.
4. The infinitive phrase has a varying influence as a modifier:
 - the infinitive is the work field.
 - the object of the infinitive is MPSMS (Materials Products, Subject Matter, and Services). (52, p. 7)

This format makes the crucial, and very helpful, distinction between what the worker does and what gets done. This distinction is often blurred in everyday speech and can easily lead to confusion when precise information is needed. For example, an employee may describe his task as "processing order forms." Actually, however, the processing of forms is *what gets done*. *What the worker does* may consist of reading the forms to highlight certain information contained in them, reviewing them for accuracy or completeness, comparing information on the forms against standardized guidelines, or any of several other actions. These activities may all be performed by the same worker simultaneously or sequentially or they may each be performed by different workers. An emphasis on identifying what the worker does, as well as what gets done, reveals job restructuring opportunities, training needs, qualifications requirements, and performance standards which would otherwise not have been manifest.

The task definition used in the Functional Job Analysis approach reflects that technique's systems orientation:

A task is an action or action sequence grouped through time designed to contribute a specified end result to the accomplishment of an objective and for which functional levels and orientation can be reliably assigned.

A task is derived from a system objective (that is, it is designed in the first place as a means of moving toward an objective) and when it is executed properly by a worker, the result of the task becomes an input to the accomplishment of that objective. (11, p. 9)

FJA, like the Department of Labor methodology from which it has evolved, stresses the distinction between what the worker does and what gets done. The task statement format is also similar to DOL's with a subject understood to be the worker but not expressed, an action verb telling what the worker does, and an infinitive phrase telling what gets done. Because FJA is goal directed, this "what gets done" portion must be clearly related to the accomplishment of an organizational objective. By the same token, "what the worker does" must be logically related to "what gets done." The materials, tools, equipment, or work aids used in the performance of the task are also specified. The FJA task statement includes an additional component indicating those parts of the task which are prescribed for the worker and those which are left to his or her discretion. This final component is thus related to FJA's Scale of Worker Instructions.

The following is an example of a Functional Job Analysis task statement:

Asks client questions, listens to responses, and writes answers on standard intake form, exercising leeway as to sequence of questions, in order to record basic identifying information. (11, p. 20)

The activities of asking, listening, and writing are logically related to the final result-recording information, and this result contributes to the accomplishment of agency objectives.

Because of its emphasis on actions, results, and objectives, the FJA task statement is more than a still photograph of the activity going on in an organization at a given time. It is intended to serve as a check for an organization concerned with seeing that its work procedures and employee utilization policies reflect the most efficient way of reaching its goals.

The Health Services Mobility Study has produced the most complete task definition of any of the projects reviewed.

A task is a series or set of work activities (elements) that are needed to produce an identifiable output that can be independently consumed or used, or that can be used as an input in a further stage of production by an individual who may or may not be the performer of the task (20, p. 3-2).

In the HSMS methodology, tasks are identified in terms of their output, what is used in producing that output, and the recipients, respondents, or coworkers involved in them. Variations in any of these three factors will result in the identification of a separate task. For example, two workers may both use the same machine to process goods for the same recipient. If, however, one worker must be able to exploit all of the machine's capabilities to produce one type of product (output) while the other performs a relatively simple operation to produce a different product, the workers are performing different tasks. Similarly, if two workers produce the same output for the same recipient but, of necessity, use different kinds of equipment (e.g. manual v. power assisted v. fully automated), each is performing a different task. Finally, different tasks are involved when the recipients differ, for example, a nurse aide who makes a bed for an ambulatory patient as opposed to one who makes a bed for a postoperative patient requiring special handling.

In all these instances, the differences in output, what is used or recipient reflect differences in either the types or levels of required skills or knowledge. The HSMS job and curriculum ladders are to be built around the identification of these required skills and knowledge.

In their search for an adequate task definition, the HSMS staff set several criteria which had to be met. One of these was that each task had to be "sufficiently self-contained to be moved from job to job or from employee to employee" for a job ladder development purposes. This was accomplished by requiring that every task have an "identifiable output" which can be used by a consumer or

by another worker to advance production. An activity which does not result in such an output is an element. For example, the preparation of a surgical instrument tray prior to an operation is a task since the output, the prepared tray, can be used by another worker. The washing of hands by a surgeon prior to an operation, however, is an element, since only the surgeon can use that output, the washed hands.

The "identifiable output" requirement also served to meet a second criterion for a task definition—that it be "sufficiently reliable for different analysts, seeing the same work, to agree on the task units." An analyst who is uncertain as to whether a given worker activity is a task, as opposed to an element, need only determine whether the output of that activity can be used directly by a consumer or by another worker. If it can, the analyst has identified a task. If the output of the activity is of use only to the performer, an element has been identified.

Since the HSMS method requires very complete and detailed task data, the single sentence format used by the Labor Department and FJA was considered to be inadequate. Instead, a new format was developed with places for the three factors in task identification discussed above and for a complete list of elements (figure 1).

The HSMS procedure is complex and cannot be described fully within the confines of this report. Persons encountering it for the first time are often somewhat intimidated by it, although its principles can be mastered with a little concentrated study. Its qualities of precision, inter-rater reliability, completeness, and appropriateness for job restructuring, however, make such study worth the effort.

**FIGURE 1. HEALTH SERVICES MOBILITY STUDY
TASK IDENTIFICATION SUMMARY SHEET**

This is task 3 of 18 for this performer.

This is page 1 of 2 for this task.

Code 33

Performer's Name _____ Analyst(s) _____ Dept. _____
 Job Title _____ Institution _____ Date _____

	List Elements Fully
<p>1. <i>What is the output of this task?</i> (Be sure this is broad enough to be repeatable.) Sutures removed; healing evaluated; wound irrigated, dressed, bandaged, medication prescribed and/or administered; record entered.</p>	<p>Performer removes patient's sutures as a result of:</p> <ol style="list-style-type: none"> Having performed incision and suturing personally, after ordering revisit for removal of sutures. Referral to performer.
<p>2. <i>What is used in performing this task?</i> (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.) Patient's chart, pen, requisition forms, sterile gloves, antiseptic solution, swabs, sterile clamp, forceps or tweezers, scissors, sterile syringe, sterile dressing, bandages, tape, medications as ordered.</p>	<ol style="list-style-type: none"> If appropriate, reviews patient's chart to ascertain relevant medical history. Performer may decide to delegate all or part of procedure to coworker or subordinate. If so, explains what is to be done.
<p>3. <i>Is there a recipient, respondent or coworker involved in the task?</i> Yes . . . () No . . . (X)</p>	<ol style="list-style-type: none"> Performer orders materials to be used or checks materials already prepared.
<p>4. <i>If 'Yes' to q. 3: Name the kind of recipient, respondent, or coworker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions</i> Any patient to have sutures removed; accompanying adult if pediatric patient; subordinate</p>	<ol style="list-style-type: none"> Performer greets patient and accompanying adult if patient is child. Explains what will be done. Performer examines sutures and notes condition and healing.
<p>5. <i>Name the task so that the answers to questions 1-4 are reflected. Underline essential words</i> Removing any patient's sutures, by reviewing case, applying antiseptic, lifting up sutures using clamp; evaluating cutting sutures and removing with forceps or tweezers; evaluating healing; ordering irrigation, bandaging, and or antibiotic medication, ordering followup if needed, recording</p>	<ol style="list-style-type: none"> Performer has patient prepared and dons sterile gloves. May personally swab area with antiseptic solution. Performer uses clamp to hold up stitches; cuts sutures with appropriate scissors. Pulls out sutures with forceps or tweezers.
<p>6. Check here if this is a master sheet . (X)</p>	<ol style="list-style-type: none"> Examines wound for signs of infection. May decide to irrigate with antiseptic or order wound irrigated. May use syringe or pour on solution. If performer decides that antibiotics are needed, orders and administers or has administered by subordinate. Writes and/or signs order for medication. Performer may explain to patient (or accompanying adult) how to take medication at home.
	<ol style="list-style-type: none"> Performer may dress and bandage wound or have subordinate dress and bandage, specifying what to use and any medications. May order followup examination. Enters record of what was done and any medication prescribed on patient's chart.

B. Task Dimensions

Clear, precise, and comprehensive task descriptions are necessary, but not sufficient, for job restructuring, training program development, and similar human resource management activities. Several scales have been developed, by the Department of Labor and others, which highlight certain aspects of each task, provide bases for ranking by level of complexity, and facilitate comparisons among tasks. None of these scales should be thought to have equal applicability to all possible manpower development or personnel management purposes. However, many are valuable analytical tools when used in appropriate situations for appropriate purposes. This section discusses the various scales which have been developed for different job analysis methodologies, assesses their strengths and weaknesses when a basis for such judgments exists, and suggests appropriate uses for each.

Worker Functions

The Worker Functions (data-people-things) scales occupy a central place in the Department of Labor methodology (figure 2). They were used by several of the projects reviewed in this report. They have been subjected to criticism, some of it valid, some of it predicated on misunderstandings concerning their purpose and their proper use.

The Worker Functions concept is based on the premise that every task calls for its performer to function in relation to each of three primitives—Data, People, and Things. Scales have been developed for each primitive showing the various levels of complexity at which a relationship may exist. Each of these scales is said to be hierarchical in nature with the levels arranged from the relatively simple to the complex.

According to the *Dictionary of Occupational Titles*, "each successive relationship includes those that are simpler and excludes the more complex." This general principle, however, is violated at least partially in all three scales. The Labor Department itself notes that "as each of the relationships to People represents a wide range of complexity resulting in considerable overlap among occupations, their arrangement is somewhat arbitrary and can be considered a hierarchy only in the most general sense." Thus, a Supervising task will not necessarily include such "simpler" functions as Diverting or Persuading although it will always exclude the higher level relationships such as Instructing. (50, vol. II, p. 649)

The same point can be made about the Data scale although the Labor Department does not do so. For example, an Analyzing task will always exclude Coordinating but will not necessarily include Computing or Copying. One critic of worker functions contends that Data levels 4, 5, and 6 (Computing, Copying, and Comparing) "are more representative of different types of work than levels. Level 4 involves arithmetic functions, while level 5 is basically concerned with clerical and posting duties. Level 6 would clearly include many low-level testing and inspection jobs. In a sense, what we see here is a 'hierarchy,' which, in the final analysis reflects the lowest skilled data relationship for three different kinds of jobs." (37, p. 37)

Finally, the Department of Labor's *Handbook for Analyzing Jobs*, published 7 years after the *Dictionary of Occupational Titles*, points out that the Things scale is actually two separate scales with the determining factor being the use of a machine in the performance of the task. When a machine is involved, the appropriate Things relationship should be Setting Up, Operating-Controlling, Driving-

FIGURE 2. DEPARTMENT OF LABOR WORKER FUNCTIONS

DATA: Information, knowledge, and conceptions, related to data, people, or things, obtained by observation, investigation, interpretation, visualization, mental creation, incapable of being touched; written data take the form of numbers, words, symbols; other data are ideas, concepts, oral verbalization.

0—Synthesizing. Integrating analyses of data to discover facts and or develop knowledge concepts or interpretations.

1—Coordinating. Determining time, place, and sequence of operations or action to be taken on the basis of analysis of data; executing determinations and/or reporting on events.

2—Analyzing. Examining and evaluating data. Presenting alternative actions in relation to the evaluation is frequently involved.

3—Compiling. Gathering, collating, or classifying information about data, people, or things. Reporting and or carrying out a prescribed action in relation to the information is frequently involved.

4—Computing. Performing arithmetic operations and reporting on and or carrying out a prescribed action in relation to them. Does not include counting.

5—Copying: Transcribing, entering, or posting data.

6—Comparing. Judging the readily observable functional, structural, or compositional characteristics (whether similar to or divergent from obvious standards) of data, people, or things.

PEOPLE: Human beings, also animals dealt with on an individual basis as if they were human.

0—Mentoring. Dealing with individuals in terms of their total personality in order to advise counsel, and/or guide them with regard to problems that may be resolved by legal, scientific, clinical, spiritual, and/or other professional principles.

1—Negotiating. Exchanging ideas, information, and opinions with others to formulate policies and programs and/or arrive jointly at decisions, conclusions, or solutions.

2—Instructing. Teaching subject matter to others, or training others (including animals) through explanation, demonstration, and supervised practice; or making recommendations on the basis of technical disciplines.

3—Supervising. Determining or interpreting work procedures for a group of workers, assigning specific duties to them, maintaining harmonious relations among them, and promoting efficiency.

4—Diverting: Amusing others.

5—Persuading. Influencing others in favor of a product, service, or point of view.

6—Speaking-Signaling. Talking with and or signaling people to convey or exchange information. Includes giving assignments and/or directions to helpers or assistants.

7—Serving. Attending to the needs or requests of people or animals or the expressed or implicit wishes of people. Immediate response is involved.

THINGS. Inanimate objects as distinguished from human beings, substances or materials, machines, tools, equipment, products. A thing is tangible and has shape, form, and other physical characteristics.

0—Setting Up. Adjusting machines or equipment by replacing or altering tools, jigs, fixtures, and attachments to prepare them to perform their functions, change their performance, or restore their proper functioning if they break down. Workers who set up one or a number of machines for other workers or who set up and personally operate a variety of machines are included here.

1—Precision Working. Using body members and or tools or work aids to work, move, guide or place objects or materials in situations where ultimate responsibility for the attainment of standards occurs and selection of appropriate tools, objects, or materials, and the adjustment of the tool to the task require exercise of considerable judgment.

2—Operating-Controlling. Starting, stopping, controlling, and adjusting the progress of machines or equipment designed to fabricate and or process objects or materials. Operating machines involves setting up the machine and adjusting the machine or material as the work progresses. Controlling equipment involves observing gages, dials, etc., and turning valves and other devices to control such factors as temperature, pressure, flow of liquids, speed of pumps, and reactions of materials. Setup involves several variables and adjustment is more frequent than in tending.

3—Driving-Operating. Starting, stopping, and controlling the actions of machines or equipment for which a course must be steered, or which must be guided, in order to fabricate, process, and or move things or people. Involves such activities as observing gages and dials, estimating distances and determining speed and direction of other objects, turning cranks and wheels, pushing clutches or brakes, and pushing or pulling gear lifts or levers. Includes such machines as cranes, conveyor systems, tractors, furnace charging machines, paving machines, and hoisting machines. Excludes manually powered machines, such as handtrucks and dollies, and power assisted machines, such as electric wheelbarrows and handtrucks.

FIGURE 2 (continued)

4—*Manipulating*. Using body members, tools, or special devices to work, move, guide, or place objects or materials. Involves some latitude for judgment with regard to precision attained and selecting appropriate tool, object, or material, although this is readily manifest.

5—*Tending* Starting, stopping, and observing the functioning of machines and equipment. Involves adjusting materials or controls of the machine, such as changing guides, adjusting timers and temperature gages, turning valves to allow flow of materials, and flipping switching in response to lights. Little judgment is involved in making these adjustments.

6—*Feeding-Offbearing* Inserting, throwing, dumping, or placing materials in or removing them from machines or equipment which are automatic or tended or operated by other workers.

7—*Handling*. Using body members, handtools, and/or special devices to work, move, or carry objects or materials. Involves little or no latitude for judgment with regard to attainment of standards or in selecting appropriate tool, object, or material.

NOTE Included in the concept of Feeding-Offbearing, Tending, Operating-Controlling, and Setting Up is the situation in which the worker is actually part of the setup of the machine, either as the holder and guider of the material or holder and guider of the tool.

Operating, Tending, or Feeding-Offbearing. When no machine is involved, for example when the worker uses handtools in performing the task, one of the nonmachine functions, Precision Working, Manipulating, or Handling, is appropriate. Even these subscales, moreover, do not meet the Labor Department's definition of hierarchical. For example, an airline pilot's task of flying an airplane (Things level 3, Driving-Operating) can hardly be called less complex than his navigator's task of operating navigational equipment (level 2, Operating-Controlling), while neither task includes Feeding-Offbearing (level 6).

The foregoing discussion indicates strongly that the Worker Functions scales have serious drawbacks with regard to measuring task complexity. If they are used for this purpose, it should be done only in conjunction with other scales, such as those for General Educational Development. The primary value of the Data-People-Things scales is descriptive rather than hierarchical. They provide explicit, tightly controlled language for use in describing specific worker activities. Their value in this respect is suggested by an excerpt from a classic in the field of position classification:

The use of such ambiguous terms as "assist," "prepare," "handle," "edit," "examine," "conduct research," "supervise," "review" etc., without any explanation of the processes, tasks, or operations constituting the assistance, handling, or preparation almost invariably is a sign of inadequacy of information.

The word "assist," when used alone, is capable of so wide a latitude of interpretation as to render it almost meaningless for classification purposes. An employee who assists in a given piece of work may perform such simple duties as searching files and assembling material for the use of a

supervisor subject to the latter's close supervision, or he may perform other duties ranging from the most simple ones all the way up the scale to the point where he performs exactly the same duties as the one whom he assists, the only difference being the element of higher responsibility for the work inherent in the senior position. . . .

Much, or very little, may be contained within the meaning of the word "prepare." For example, "to prepare statistical tables (of a certain sort)" might mean that the employee on his own initiative seeks out or develops sources of basic information, plans the schedules or outlines other means of collecting the information required, designs the tables, and writes interpretative text as well, or it might simply mean that he copies numbers from given places on a schedule, posts them to a given column and line on a tabulation sheet, adds columns, and computes averages and percentages on a calculating machine. (5, p. 87)

Although the above passage was written more than 30 years ago, ambiguous terminology remains a common feature of position descriptions and other statements of job content. Each level on the three Worker Functions scales is accompanied by a definition written in precise terms. The *Handbook for Analyzing Jobs* also contains several illustrative worker activities for each function. For example, "coordinating" is a popular term on employee résumés and job descriptions. According to the Labor Department, coordinating is defined as "determining time, place, and sequence of operations or action to be taken on the basis of analysis of data; executing determinations and/or reporting on events." An illustrative situation would be "plans and establishes collection routes and directs assignment of personnel and equipment in the operation of a municipal sanitation department." (Note. Not all of the Labor Department's illustrative situations are tasks. This example would be a position, or

perhaps a duty if such a level existed in their methodology.)

Job Analysis, 1970, by C. Harold Stone and Dale Yoder, contains an Activity Verb List which provides even greater precision in the defining of terms relating to worker activities. This list includes, and defines, several additional verbs under each worker function on the Data and People scales. For example, under "copying" are listed record, post, tabulate, list, transpose, duplicate, transcribe, and quote. This expanded list gives the job analyst an additional tool to insure that worker activities are assigned their appropriate functional ratings. At the time of their report, Stone and Yoder concluded that "it appears . . . that task statements in the 'things' area can be ranked in terms of their verbs only when the verbs are considered in context." (42, appendix C, p. 3)

Use of the Data-People-Things scales requires the job analyst to provide clear, specific information on what the worker does as well as on what gets done. In order to decide whether a given task involves a Negotiating or simply a Speaking-Signaling People relationship for example, it is necessary to determine the exact nature of the interactions going on and the circumstances under which they are occurring. Questions concerning subtleties such as the knowledge and the authority which the worker brings to the task cannot be left unresolved if the proper worker functions are to be assigned. In this sense then, the scales provide a quality control check on the completeness and accuracy of the basic task statements. They also provide a means of making generalized comparisons with, and distinctions among, tasks.

The Worker Functions concept, then, appears to have definite value in job analysis, although it is, perhaps, not always appropriate for the uses to which it is put. The specific worker functions given in the *Handbook for Analyzing Jobs*, on the other hand, may not necessarily be the best for describing the job-worker situations which are found in any given organization.

Since the Labor Department scales were developed in connection with the *Dictionary of Occupational Titles*, they have an industrial and bureaucratic orientation which accurately reflects the predominant worker relationships of the present and the recent past. As the United States becomes what has been called a "post industrial society," however, new relationships are emerging. This is especially true in the People and, to a lesser extent, Data

areas. Although the manufacturing sector of the economy continues to grow, it is doing so at a slower rate than the services sector. Workers still relate to machines and they still relate to other people as coworkers in a bureaucratic, hierarchical way. But, to an increasing extent, they are also dealing with people who are clients or consumers of their services. Thus, several researchers have found it necessary to make adaptations to the Worker Functions scales in order to establish levels which are capable of accurately describing and discriminating among activities performed in specific work contexts.

Among the more extensive modifications of the Worker Functions scales are those developed for the Functional Job Analysis technique (11). Most of these additions occur in the People scale.

Two of the Labor Department People functions, Persuading and Diverting, were placed on the same level on the FJA scale and joined by a new function, Coaching. It is defined as:

befriends and encourages individuals on a personal, caring basis by approximating a peer or family-type relationship either in a one-to-one or small group situation, gives instruction, advice, and personal assistance concerning activities of daily living, the use of various institutional services, and participation in groups

This function appears to be an attempt to describe work performed in entry-level "aide" positions in human services agencies. Although these positions have existed in limited numbers in some areas, such as health care, for several years, their greatest growth has occurred within the last decade. Many persons in aide positions come from the same socioeconomic background as the agency's clientele and are often hired for their ability to relate effectively with that clientele. FJA's Coaching function, then, can be seen as a means of identifying those interpersonal relations tasks currently performed by highly paid and highly credentialed workers which might be done by aides. An analyst using FJA would, however, refer to other scales such as General Educational Development and Worker Instructions before assigning a Coaching task to an aide position.

The next higher level on FJA's People scale consists of three functions—the Labor Department's Instructing, slightly modified, and two new functions:

Consulting—serves as a source of technical information and gives such information or provides ideas to define, clarify, enlarge upon, or sharpen procedures, capabilities, or product specifications.

Treating—acts on or interacts with individuals or small groups of people or animals who need help (as in sickness)

to carry out specialized therapeutic or adjustment procedures. Systematically observes results of treatment within the framework of total personal behavior because unique individual reactions to prescriptions (chemical, physical, or behavioral) may not fall within the range of prediction. Motivates, supports, and instructs individuals to accept or cooperate with therapeutic adjustment procedures when necessary.

While the Labor Department's Instructing function includes both teaching, training and "making recommendations on the basis of technical disciplines," FJA removes the latter activity and places it at the center of the Consulting function. Consulting and, especially, Treating appear to represent alternative interim steps between entry-level Coaching tasks in human services agencies and the more traditionally professional tasks which would be rated Mentoring. Thus, they should have application in the design of career ladders for paraprofessionals within those agencies.

FJA has also added a new function to the Data scale, Innovating, which is on the same level as Coordinating. Innovating is defined as:

Modifies, alters, and/or adapts existing designs, procedures, or methods to meet unique specifications, unusual conditions, or specific standards of effectiveness within the overall framework of operating theories, principles, and/or organizational contexts.

Both Innovating and Coordinating are concerned with putting the analysis of data into action. Innovating, as its name implies, appears to be the more change oriented of the two, while Coordinating would typically take place within the confines of the existing organizational procedures and environment. However, the Department of Labor definition of Coordinating has been expanded upon to include making decisions on "the need for revision of goals, policies or procedures." Innovating, on the other hand, involves the actual making of those revisions. It differs from Synthesizing in that it consists of modifying old approaches to problems, rather than conceiving new approaches without necessarily having the benefit of tradition, experience, or guidelines.

The strict hierarchical nature of the Labor Department scales has been softened somewhat in FJA by placing more than one function on some levels.

This was the case in all the new functions discussed above and was done because empirical evidence did not make hierarchical distinctions clear. It was also done, for the same reason, on the Data scale with Computing and Compiling. The Data functions of Copying and Comparing continue to occupy the two lowest rungs on their ladder, however. This conceptualization contrasts with the comment by Scoville, noted above, to the effect that Computing, Copying, and Comparing should each be considered the lowest level relationship for different kinds of jobs.

The most radical surgery on the scales has been done in the Things area where FJA leaves only three levels. Each of the three nonmachine functions, Precision Working, Manipulating, and Handling, occupies its own level. As with the Labor Department scales, the degree of precision required and the number of objects, materials, and tools involved are the major determinants of level. The machine functions are viewed as merely special cases of the nonmachine functions which happen to involve the use of machines. Thus, a Setting Up task is one performed in relation to a machine and having the same precision requirements and the same number of objects, etc., as any other Precision Working task. Operating-Controlling and Driving-Controlling have the same relationship to Manipulating, as do Feeding-Offbearing and Tending to Handling. In this way, the machine/nonmachine dichotomy of the Labor Department Things scale has been eliminated by subjecting the former to the complexity criteria of the latter.

The Career Opportunities Research and Development (CORD) project, conducted by the Young Men's Christian Association of Metropolitan Chicago, also made significant changes in the Worker Functions scales (figure 3). Some of their modifications, like those of FJA, were designed to make the People scale more useful in the human services setting. Also, several additions were made to the Data scale. Finally, the Things scale was substantially revised to make it more appropriate for use with office machines (57).

FIGURE 3. CAREER OPPORTUNITIES RESEARCH AND DEVELOPMENT PROJECT WORKER FUNCTIONS

(Definitions are given only for new functions or when they differ significantly from DOL's.)

DATA

- 10—Composing: Same as Department of Labor's Comparing
- 9—Copying
- 8—Computing
- 7—Compiling
- 6—Translating. Placing information into a different language or a more desirable form to facilitate improved communication.
- 5—Coding. Transferring data and other information into some numerical or pictographic symbolism in order to facilitate swift computation and analysis.
- 4—Organizing. Bringing together various data, things, and or structures in order to produce some activity or concerted action and attain some definite results.
- 3—Analyzing
- 2—Coordinating
- 1—Planning. Looking into the future, foreseeing needs, services, situations before they arrive and making the necessary arrangements to provide the structures, activities, and things to meet the needs. Providing the direction in which activities, functions, structures are moving.
- 0—Synthesizing

PEOPLE

- 12—Helping
- 11—Serving
- 10—Persuading (no Speaking-Signaling)
- 9—Diverting
- 8—Checking. Following up operations, frequently routine, for purposes of ascertaining information about the delivery of goods or services, the functioning of people, or the performance of operations
- 7—Observing-Listening. Sitting or being with another person to watch events for purposes of administration of assistance, acquisition of data, or to provide company and understanding.
- 6—Arranging. Bringing together the necessary ingredients in terms of people, situations, and things to facilitate activities, developments, and interaction.
- 5—Interviewing. Talking or otherwise communicating with others for the purpose of extracting information or evaluating a particular or generalized circumstance
- 4—Supervising
- 3—Instructing
- 2—Negotiating
- 1—Mentoring
- 0—Therapy. Administration of various forms of physical or mental assistance, through well developed principles, procedures, and techniques.

THINGS

- 5—Handling
- 4—Tending. Making adjustments (minor) and checking the operation, condition, and functioning of equipment and situations
- 3—Operating-Driving. Guiding or steering various machines or pieces of equipment (cars, buses, etc.) Administering simple devices.
- 2—Operating-Controlling-Working. Controlling, starting stopping, supervising the operations of various equipment (Xerox, multilith, typewriter, therapeutic equipment) Administering complex devices.
- 1—Preparing. Getting equipment ready for use, making connections and adjustments, cleaning, acquiring necessary equipment. Organizing materials for use
- 0—Servicing. Keeping various forms of equipment in working order. Repairing or replacing. Ordering, planning, and scheduling use. Inventing/devising equipment or operations.

Social, Educational Research and Development, Inc., relied primarily on a combination of Labor Department, FJA, and CORD scales for their work with library jobs in Illinois (41). Their Things scale represents an alternative for dealing with office machines and equipment (figure 4).

The decision on whether to develop new Worker Functions scales depends, of course, on project needs and objectives. The Labor Department scales are certainly not sacrosanct, nor were they intended to be. The People scale, in particular, leaves yawning gaps to be filled. For the most part, though, persons making revisions would be well advised to concentrate on creating functions and definitions which are descriptive of the work to be analyzed, and not to attempt to place them in any but the most general hierarchical levels of complexity. The development of more specifically delineated levels would probably require a greater expenditure of project resources than the results would warrant, especially since there are better ways to measure task complexity.

Also, new functions should be developed only after it has been carefully determined that existing ones are not appropriate to project needs. In addition to the obvious waste of time and effort creating unnecessary new levels, there is the proliferation issue. The Labor Department scales were, in part, an attempt to generalize about work performed—to bring together apparently diverse but essentially similar activities under a few categories to highlight similarities among jobs and thus facilitate comparisons. If the Worker Functions concept is to be

employed at all, new functions should refine existing ones or fill in the gaps in coverage. They should not simply express old functions in new terminology or needlessly subdivide functions into two or three more specific ones. The ultimate goal should be an improved set of standardized functions which are applicable to all types of jobs.

Measurements of Task Complexity

The Department of Labor's General Educational Development (GED) scales (figure 5) are intended to measure the extent to which a worker activity requires:

- a. Reasoning development and ability to follow instructions.
- b. "Tool" knowledges such as language and mathematical skills.

These factors are normally acquired through the formal educational process rather than through specific job-related training. They may also be the result of life or work experiences or self-study.

Initially the temptation to equate each GED level with a specified number of years of schooling was resisted because, as Fine has written, "high school graduation" or "12 years" of education can mean different things for different areas of the country, for different schools in the same city, or for different periods of time. Furthermore, the number of years of schooling has little relevance to job tasks in many instances." (10, p. 366)

FIGURE 4. SOCIAL, EDUCATIONAL RESEARCH AND DEVELOPMENT, INC., THINGS WORKER FUNCTIONS SCALE

- 1—*Handling*. Using body or handtools to move and carry objects, books, or materials.
- 2—*Monitoring*. Observing, checking, or standing by while equipment, activity, process, or objects operate or function and calling for assistance in the event of malfunction.
- 3—*Servicing*. Performs simple repairs or adjustments requiring few or no tools, techniques, skills, or time and usually completed at work station.
- 4—*Operating*. Controlling, starting, stopping, or working machines, equipment, objects, or materials.
- 5—*Preparing Set-Up*. Cleaning equipment, materials, or facility ready for use, cleaning, acquiring necessary equipment and supplies.
- 6—*Maintenance*. Checking, testing, determining, and measuring the exact nature and scope of malfunctioning equipment, materials, and objects, using technical knowledge and/or skill to restore same to operative condition.
- 7—*Storage, Retrieval*. Selecting, placing, or procuring tools, objects, materials, or equipment with some latitude, judgment, or precision since a system or procedure is applied.
- 8—*Not applicable*.
- 9—*Other*.

FIGURE 5. DEPARTMENT OF LABOR SCALE OF GENERAL EDUCATIONAL DEVELOPMENT (GED)

Level	Reasoning Development	Mathematical Development	Language Development
6 College 3 and 4	Apply principles of logical or scientific thinking to a wide range of intellectual and practical problems. Deal with non verbal symbolism (formulas, scientific equations, graphs, musical notes, etc) in its most difficult phases Deal with a variety of abstract and concrete variables. Apprehend the most abstruse classes of concepts.	Advanced calculus: Work with limits, continuity, real number systems, mean value theorems, and implicit function theorems. Modern algebra: Apply fundamental concepts of theories of groups, rings, and fields. Work with differential equations, linear algebra, infinite series, advanced operations methods, and functions of real and complex variables. Statistics: Work with mathematical statistics, mathematical probability and applications, experimental design, statistical inference, and econometrics.	Reading: Read literature, book and play reviews, scientific and technical journals, abstracts, financial reports, and legal documents. Writing: Write novels, plays, editorials, journals, speeches, manuals, critiques, poetry, and songs. Speaking: Conversant in the theory, principles, and methods of effective and persuasive speaking, voice and diction, phonetics, and discussion and debate.
5 College 1 and 2	Apply principles of logical or scientific thinking to define problems, collect data, establish facts, and draw valid conclusions. Interpret an extensive variety of technical instructions in mathematical or diagrammatic form. Deal with several abstract and concrete variables.	Algebra: Work with exponents and logarithms, linear equations, quadratic equations, mathematical induction and binomial theorem, and permutations. Calculus: Apply concepts of analytic geometry, differentiations and integration of algebraic functions with applications. Statistics: Apply mathematical operations to frequency distributions, reliability and validity of tests, normal curve, analysis of variance, correlation techniques, chi-square application and sampling; theory, and factor analysis.	Same as Level 6
4 Grades 9-12	Apply principles of rational systems to solve practical problems and deal with a variety of concrete variables in situations where only limited standardization exists. Interpret a variety of instructions furnished in written, oral, diagrammatic, or schedule form	Algebra: Deal with system of real numbers, linear, quadratic, rational, exponential, logarithmic, angle and circular functions, and inverse functions; related algebraic solution of equations and inequalities, limits and continuity and probability and statistical inference. Geometry: Deductive axiomatic geometry, plane and solid; and rectangular coordinates. Shop Math: Practical application of fractions, percentages, ratio and proportion, mensuration, logarithms, slide rule, practical algebra, geometric construction, and essentials of trigonometry.	Reading: Read novels, poems, newspapers, periodicals, journals, manuals, dictionaries, thesauruses, and encyclopedias. Writing: Prepare business letters, expositions, summaries, and reports, using prescribed format and conforming to all rules of punctuation, grammar, diction, and style. Speaking: Participate in panel discussions, dramatizations, and debates. Speak extemporaneously on a variety of subjects.

FIGURE 5 (continued)

Level	Reasoning Development	Mathematical Development	Language Development
<p>3 Grades 7-8</p>	<p>Apply commonsense understanding to carry out instructions furnished in written, oral, or diagrammatic form. Deal with problems involving several concrete variables in or from standardized situations.</p>	<p>Compute discount, interest, profit, and loss, commission, markup, and selling price, ratio and proportion, and percentage. Calculate surfaces, volumes, weights, and measures.</p> <p>Algebra: Calculate variables and formulas; monomials and polynomials; ratio and proportion variables; and square roots and radicals.</p> <p>Geometry: Calculate plane and solid figures; circumference, area, and volume. Understand kinds of angles, and properties of pairs of angles.</p>	<p>Reading: Read a variety of novels, magazines, atlases, and encyclopedias. Read safety rules, instructions in the use and maintenance of shop tools and equipment, and methods and procedures in mechanical drawing and layout work.</p> <p>Writing: Write reports and essays with proper format, punctuation, spelling, and grammar, using all parts of speech.</p> <p>Speaking: Speak before an audience with poise, voice control, and confidence, using correct English and well-modulated voice.</p>
<p>2 Grades 4-6</p>	<p>Apply commonsense understanding to carry out detailed but uninvolved written or oral instructions. Deal with problems involving a few concrete variables in or from standardized situations.</p>	<p>Add, subtract, multiply, and divide all units of measure. Perform the four operations with like common and decimal fractions. Compute ratio, rate, and percent. Draw and interpret bar graphs. Perform arithmetic operations involving all American monetary units.</p>	<p>Reading: Passive vocabulary of 5,000-6,000 words. Read at rate of 190-215 words per minute. Read adventure stories and comic books, looking up unfamiliar words in dictionary for meaning, spelling, and pronunciation. Read instructions for assembling model cars and airplanes.</p> <p>Writing: Write compound and complex sentences, using cursive style, proper end punctuation, and employing adjectives and adverbs.</p> <p>Speaking: Speak clearly and distinctly with appropriate pauses and emphasis, correct pronunciation, variations in word order, using present, perfect, and future tenses.</p>
<p>1 Grades 1-3</p>	<p>Apply commonsense understanding to carry out simple one- or two-step instructions. Deal with standardized situations with occasional or no variables in or from these situations encountered on the job.</p>	<p>Add and subtract two digit numbers. Multiply and divide 10's and 100's by 2, 3, 4, 5. Perform the four basic arithmetic operations with coins as part of a dollar. Perform operations with units such as cup, pint, and quart; inch, foot, and yard; and ounce and pound.</p>	<p>Reading: Recognize meaning of 2,500 (two- or three-syllable) words. Read at rate of 95-120 words per minute. Compare similarities and differences between words and between series of numbers.</p> <p>Writing: Print simple sentences containing subject, verb, and object, and series of numbers, names, and addresses.</p> <p>Speaking: Speak simple sentences, using normal word order, and present and past tenses.</p>

* Examples of rational systems are bookkeeping, internal combustion engines, electric wiring systems, house building, nursing, farm management, and navigation.

However, some critics maintain that "to be useful for educational planning, they (GED scales) must be given year-equivalents." (37, p. 41) Perhaps in response to such comments, DOL assigned the grade level equivalents shown in figure 5.

The primary value of the equivalents appears to be in assessing jobseekers, not jobs. Thus, a personnel specialist or an employment service counselor can take into consideration an applicant's educational background, in conjunction with several other factors, and arrive at an estimated GED level. This level can then be compared with the required levels for currently available employment opportunities. Even for this purpose, however, it is important that the grade level equivalents not be followed slavishly to the exclusion of life and work experiences which may also have contributed to the applicant's general educational development. When GED is used to analyze jobs or tasks, levels should be determined by comparing worker activities against the Department of Labor definitions and the illustrative situations contained in the *Handbook for Analyzing Jobs*. It should never be assumed that all or most of the tasks in a job would properly be rated at GED level 4, for example, simply because the current qualifications requirements for that job include a high school diploma.

The Career Options Research and Development project of Chicago has developed GED scales which are based on, but differ substantially from, the Labor Department's (figure 6). CORD retains the three major categories—reasoning, mathematics, and language development. Each scale consists of three primary levels. Each of these levels is further subdivided into three more specific levels.

The CORD reasoning scale is based on differences in the nature and extent of data manipulation involved in a given activity. The highest primary level includes assimilative, interpretive, and judgmental activities. The middle level consists of operations which set up or predigest data to prepare it for further action. The lowest level includes activities proceeding from already treated data or action involving the maintenance of data. No rationale is provided for the primary levels in the mathematics and language scales. These scales reflect essentially the same processes covered by the Labor Department—CORD simply defines these processes in slightly different terms and distributes them over nine, rather than six, levels.

The decision on whether to use the CORD, as opposed to the DOL, scales would rest on several

factors, including the purpose of the analysis, the nature of the work being analyzed, the nature of the organization being studied, and the project's resources. CORD was concerned with linking the work performed in several social service agencies with existing educational resources at the community college level for the purpose of developing a model core curriculum. Thus, they decided that general educational development data which were more precise than those provided by the Department of Labor's scales were required. Other projects, however, may be less concerned with curriculum development. Or they may need only generalized data on task complexity because the type of work they are analyzing or the organization in which they are operating is not conducive to the development of more than a few employment levels within any occupation. For example, each job in a small organization may contain tasks of widely varying complexity. It may not be feasible to restructure in such a way that significantly greater specialization is achieved. In such a case, the Labor Department scale would appear to be adequate for separating the simpler from the more complex activities. Another consideration is the fact that more precise information requires more time and, or staff to put it into manageable form. If the greater precision is not actually needed, these resources are thus wasted.

The GED scales developed at the Upjohn Institute for the Functional Job Analysis approach are only slightly modified versions of the DOL scales. Some of the FJA-level definitions may be useful as supplements to those of the Labor Department in clarifying the scales, however, and should be consulted.

FJA has contributed an additional tool to the measurement of work complexity—the Scale of Worker Instructions (figure 7). According to Fine and Wiley,

All tasks have prescribed and discretionary components. The prescribed components of a task represent those areas where the worker has no choice over what he does. . . . Prescription can be set on the worker actions (means) as well as on the results expected (ends).

The discretionary components of work consists of those areas of tasks where the worker is expected—in fact required—to use his own judgment in the planning and execution of his tasks. In other words, a worker's area of discretion is synonymous with his authority to make decisions in that area. (11, p 20)

The Scale of Worker Instructions is designed for use in indicating the relative proportions of prescription and discretion found in any given task. Thus a task rated at level 1 on this scale would consist of work which is almost entirely prescribed for the

**FIGURE 6. CAREER OPTIONS RESEARCH AND DEVELOPMENT PROJECT
DESCRIPTION OF LEVELS OF REASONING, MATHEMATICS, AND LANGUAGE SCALES**

Descriptions of Levels of Reasoning Ability Scale

- C-1 Simple one- or two-step operations are performed upon instructions where circumstances of work are nonvariable (Delivers articles, messages, receives, dispenses, loads, unloads, moves people and things, runs machines.)
- C-2 Follows complex instructions with variable circumstances of work. (Stocks supplies, checks stores, guards, cleans, works as aide, relays, sorts records, accompanies, brings food, installs simple equipment, runs machines.)
- C-3 Supervises or instructs lower C levels as well as coordinates their function with one another and with higher levels of operation. Supervises for above mentioned functions by directing goods, equipment, and people. Controls and organizes work teams. (Supervises play groups, social activities, lifeguards, polices, carries out tactical instructions, repairs simple equipment; runs machines.)
- B-1 Collects, copies, arranges data or materials entering into the structure or exiting from it. (Clerks, survey clerks, runs machines; arranges outings, social functions, receptionist, interviewer, cashier.)
- B-2 Codes, installs sophisticated equipment, compiles, classifies incoming and outgoing information, material, and people. Computation begun. Does computer coding, makes graphs, charts, processes information, tests (Gives therapy, repairs sophisticated equipment, mechanic, electrician, carpenter, nurse, technician, musician, secretary.)
- B-3 Supervises all lower B levels and C-3 supervisors. On this level information or data is verified, conclusions drawn, decisions made, and directions issued. Here also, any computations are completed. Supervises all above. (Runs work teams, guides work and study groups, figures costs, taxes, accounting, programs computers, runs social workshop; director, group worker, investigator.)
- A-1 Data are translated from language to language, or system to system. Reports or extracts are prepared and issued. Mode of presentation decided upon and designed. Representations of data prepared and issued. Plans from higher levels carried out (Interpreter, writer, composer, commercial artist, reader, psychiatric social worker, social worker, teacher.)
- A-2 Data are subjected to some analysis, calculations, and computations, manipulations of a sophisticated variety are carried out upon it. Information is extracted from data, and new relationships drawn. Exploratory operations are carried out on problems and data. Plans are completed. (Engineers, chemists, mathematicians, statisticians, doctors, psychologists, physicists.)
- A-3 Final manipulations are performed. Data analyzed, synthesized, and interpreted in a finalized manner. New ideas and symbols are formulated and created. Definitions are fixed, and all lower levels are supervised. Plans are formulated (Psychiatrist, theoretical scientist, architect, research scientist).

Descriptions of Levels of the Mathematics/Arithmetic Scale

- C-1 Counting: Able to count four significant figures.
- C-2 Addition, Subtraction. Conversant with processes of addition subtraction of whole numbers of all varieties.
- C-3 Multiplication, Division, Fractions. Know how to multiply divide whole numbers. Work processes of addition and subtraction on common fractions and decimals.
- B-1 Fractions, Multiplication, Division. Know how to multiply and divide common fractions and decimals.
- B-2 Percentages, Interest, Compounding, tax tables, Charts/Graphs, Algebra, Exponents, logarithms, linear equations, quadratics, Permutations, combinations.
- B-3 Algebra, Factoring equations with two three unknowns, Determinants, matrix algebra, circular functions, Plane Geometry, Trigonometry, Probability, Product of probabilities, independent probability.
- A-1 Plane Geometry, Analytic Geometry, Trigonometry, Statistics.
- A-2 Statistics, Calculus, Differential Equations, Modern Algebra, Vector Analysis.
- A-3 Open, Mathematical skills beyond those listed above.

Descriptions of Levels of Language Development Scale

- C-1 Writing: Prints simple sentences, names, addresses, and numbers.
Reading: Reads simple sentences. Vocabulary approximately 2,500 words. Reads comic books. Compares work similarities.
Speaking: Speaks simple sentences with reasonable word arrangement and delineation of past and present tenses.
- C-2 Writing: Writes simple and compound sentences with interior and exterior punctuation.
Reading: Reads compound sentences with understanding. Reads instructions for carrying out designated operations. Knows how to use a dictionary.
Speaking: Speaks clearly with appropriate pauses and emphasis.

FIGURE 6 (continued)

- C-3 Writing: Writes complex as well as compound sentences, punctuates well, and utilizes perfect and future tenses.
 Reading: Reads complex sentence structure with understanding Vocabulary of 5,000 to 6,000 words. Uses the dictionary to look up words.
 Speaking: Able to speak as above, but incorporating good conventional usages with all tenses.
- B-1 Writing: Writes reports. Prepares schedules. Fills out questionnaires, applications, and other forms.
 Reading: Reads magazines, novels, atlases, encyclopedias.
 Speaking: Able to give verbal descriptions of a complete nature. Uses good English, with well-modulated voice before small audiences.
- B-2 Writing: Writes business letters and prepares summaries. Makes use of all parts of speech and punctuation, uses the proper format for preparing work.
 Reading: Able to read road manuals, periodicals, etc. Uses a thesaurus and an encyclopedia.
 Speaking: Able to give detailed descriptions, instructions, and explanations. Can speak fairly well extemporaneously.
- B-3 Writing: Writes descriptive essays and expositions.
 Reading: Novels, poems, journals are read with general understanding.
 Speaking: Able to speak on a variety of subjects extemporaneously and to engage in dramatics
- A-1 Writing: Writes translation and technical reports. Writes songs and/or poetry.
 Reading: Can read material in foreign texts. Reads abstracts, reports.
 Speaking: Speaks one or more foreign languages and/or specialized languages for handicapped people or animals.
- A-2 Writing: Writes argumentative essays, critiques, manuals, journal articles, and speeches.
 Reading: Reads scientific journals, financial reports, and legal documents.
 Speaking: Able to discuss or debate. Delivers lectures or highly developed explanations.
- A-3 Writing: Writes novels, nonfictional and technical material, symphonic music. Composes journal articles and theoretical works.
 Reading: Reads theoretical works (political, social, scientific), nonfiction.

worker, with a minimal discretionary component. A task rated at level 8, on the other hand, would be almost entirely discretionary. The worker would have at his disposal only the most general guidelines for determining the means to be employed in performing the task and would enjoy extensive latitude with regard to the form of his final result, as long as it advanced organizational objectives.

According to the FJA approach, a task's rating on the Scale of Worker Instructions should be related closely to its Data (Worker Functions) and Reasoning (GED) ratings. In fact, FJA says that, in most cases, there should not be more than a one-level spread among the three ratings. Thus, a task which involves an Analyzing function (which would be rated at level 4 on FJA's Data scale) should be rated either between 3 and 4 or 4 and 5 on both the Reasoning and Worker Instructions scales. The rationale behind this guideline is that "each of these three scales looks at intellectual functioning (although) from a somewhat different point of view." Thus, sharp discrepancies among ratings are unlikely. It should be emphasized that this general rule has not attained the status of dogma. Exceptions can occur. However, when they do, the analyst should review his ratings to see if each can be justified.

The Manpower Management institute uses a chart (figure 8) in its task analysis and job restructuring workshops which shows the relationships between the

Department of Labor's Data and Reasoning scales. Although the Labor Department's numbering system does not allow clear delineation of the "one-level spread" rule (the Worker Functions scales are "upside down" with the most complex level given the lowest number), it is clear that the two scales closely parallel each other. Again, the chart should be used only as an aid and should not be considered a substitute for careful rating of each task on both scales.

Health Services Mobility Study Scales

The Health Services Mobility Study methodology uses scales which differ significantly from those discussed above:

The HSMS job analysis method is based on the premise that, if the jobs in a ladder (upgrading sequence) are arranged to reflect rising levels of related skills and knowledge (education), the educational costs and training time between each step on a ladder can be kept to the minimum needed to bridge the gap between the jobs. This would be far less than that required to train for each job "from scratch" or for job sequences unrelated in skills or knowledge. For this reason, job tasks are the basic unit of observation and are evaluated in terms of the *levels* of the learnable skills (and knowledges) required for their performance. These skills and knowledge categories can then be treated as statistical variables and can be used to cluster tasks into related hierarchies. From the point of view of HSMS objectives the skills needed for the method must have the property of being learnable, because all the rungs on the job ladders must be reachable through training and education (20, pp. 2-10 and 2-11)

FIGURE 7. W. E. UPJOHN INSTITUTE
SCALE OF WORKER INSTRUCTIONS

Level	Definition
1	Inputs, outputs, tools, equipment, and procedures are all specified. Almost everything the worker needs to know is contained in his assignment. He is supposed to turn out a specified amount of work or a standard number of units per hour or day.
2	Inputs, outputs, tools and equipment are all specified, but the worker has some leeway in the procedures and methods he can use to get the job done. Almost all the information he needs is in his assignment. His production is measured on a daily or weekly basis.
3	Inputs and outputs are specified, but the worker has considerable freedom as to procedures and timing, including the use of tools and equipment. He has to refer to several standard sources for information (handbooks, catalogs, wall charts). Time to complete a particular product or service is specified, but this varies up to several hours.
4	Output (product or service) is specified in the assignment, which may be in the form of a memorandum or of a schematic (sketch or blueprint). The worker must work out his own ways of getting the job done, including selection of tools and equipment, sequence of operations (tasks), and obtaining important information (handbooks, etc.). He may either carry out the work himself or set up standards and procedures for others.
5	Same as (4) above, but in addition the worker is expected to know and employ theory so that he understands the whys and wherefores of the various options that are available for dealing with a problem and can independently select from among them. He may have to do some reading in the professional and/or trade literature in order to gain this understanding.
6	Various possible outputs are described that can meet stated technical or administrative needs. The worker must investigate the various possible outputs and evaluate them in regard to performance characteristics and input demands. This usually requires his creative use of theory well beyond referring to standard sources. There is no specification of inputs, methods, sequences, sources, or the like.
7	There is some question as to what the need or problem really is or what directions should be pursued in dealing with it. In order to define it, to control and explore the behavior of the variables, and to formulate possible outputs and their performance characteristics, the worker must consult largely unspecified sources of information and devise investigations, surveys, or data analysis studies.
8	Information and/or direction comes to the worker in terms of needs (tactical, organizational, strategic, financial). He must call for staff reports and recommendations concerning methods of dealing with them. He coordinates both organizational and technical data in order to make decisions and determinations regarding courses of action (outputs) for major sections (divisions, groups) of his organization.

FIGURE 8. MANPOWER MANAGEMENT
INSTITUTE'S DEPARTMENT OF LABOR
DATA/REASONING RELATIONSHIPS

Data	Reasoning
0	6 5
(Synthesizing)	
1	6 5 4
(Coordinating)	
2	6 5 4
(Analyzing)	
3	4 3 2
(Compiling)	
4	6 5 4 3 2
(Computing)	
5	3 2 1
(Copying)	
6	2 1
(Comparing)	

Thus, HSMS uses 16 skills scales, a knowledge scale, and a task frequency scale.

The skills scales are intended to be unidimensional and cumulative and have reliable values. A scale is unidimensional when it measures a single skill which is found, in progressively higher degrees, at each higher level. A scale on the Human Interaction skill (figure 9), then, would be concerned only with the amount and sensitivity of human interaction required in a given task. By contrast, the Worker Functions concept can be described as multidimensional since, on the People scale for example, one level such as Instructing embraces several skills which may differ from those encompassed in other levels such as Supervising, Diverting, or Persuading.

According to HSMS, a scale is cumulative when its lower levels are present in all higher levels and no higher level is found in a lower level. It has reliable values when independent observers can agree on the descriptions for each of its levels and on the values assigned to them. Interrater reliability is another requirement for the HSMS scales. This means that

FIGURE 9. HEALTH SERVICES MOBILITY STUDY HUMAN INTERACTION SKILL SCALE

Note This skill refers to the degree of sensitivity to others required of the performer in the task being scaled. The skill involves the performer's perception of the relevant characteristics or state of being of the other person(s), the performer's attention to feedback as the interaction occurs, and the performer's appropriate modification of his behavior so as to accomplish the task. The skill is involved if the task requires any personal contact or interaction with others.

The level of the skill rises as the degree of perceptiveness and sensitivity required of the performer rises, and as the subtlety of the feedback to which he or she must respond increases. The scale level is not determined by the level of knowledge required.

Scale Value	Descriptive Statement
0	The task does not require the performer to be in contact with or to interact with other people.
1	The task requires the performer to be in only <i>general contact</i> with other people. <i>Very little sensitivity to or perception of the other person(s)' relevant general characteristics or state of being</i> is required, and <i>little awareness of very obvious feedback</i> is required for the performer to adjust his behavior to perform the task.
3	The task requires the performer to interact with others in the performance of the task. The performer is required to be <i>somewhat sensitive to or perceptive of the other person(s)' relevant general characteristics or state of being</i> and to be aware of <i>very obvious feedback</i> so as to adjust his behavior accordingly.
5	The task requires the performer to interact with others in the performance of the task. The performer is required to be <i>quite sensitive to or perceptive of the other person(s)' relevant characteristics or state of being</i> and to be aware of <i>fairly obvious feedback</i> so as to adjust his behavior accordingly.
7	The task requires the performer to interact with others in the performance of the task. The performer is required to be <i>keenly sensitive to or perceptive of the other person(s)' relevant characteristics or state of being</i> and to be aware of <i>fairly subtle or complex feedback</i> so as to adjust his behavior accordingly.
9	The task requires the performer to interact with others in the performance of the task. The performer is required to be <i>keenly sensitive to or perceptive of the other person(s)' relevant characteristics or state of being</i> and to be aware of <i>very subtle or very complex feedback</i> so as to adjust his behavior accordingly.

different raters, with similar qualifications, would tend to agree on the scale values given to the same task observations.

The skill scales can be grouped into six broad areas—manual, interpersonal, language, general intellectual, decisionmaking, and responsibility.

The HSMS literature review found references to several manual skills. However, most of them were felt to be more accurately defined as aptitudes in the sense that they described the individual's probable ease or rate in learning the skills rather than the skill itself. Also, the HSMS approach requires that skills be learnable through practice, even though didactic instruction may also be required. Three manual, essentially psychomotor, skills, each dealing with precision and coordination in the use of the body or its parts, were finally agreed upon. They are Locomotion (the body's movement through space), Object Manipulation (the control of objects), and Guiding or Steering (the control of objects moving in space in relation to external stimuli).

Two Interpersonal skills were identified—Human Interaction and Leadership. As its name implies, the first of these is involved whenever the performance of a task requires contact with other persons. Central to Human Interaction is sensitivity on the part of the

task performer to the relevant characteristics of other persons involved with the task. Also important is awareness of feedback transmitted by other persons in varying degrees of subtlety. Leadership skill is called for when the task performer must influence his subordinates' work behavior in order to accomplish his own objectives. This scale contains some interesting insights into the nature of leadership. A task performer is considered to need high leadership skill when:

1. He has little power over his subordinates' conditions of employment (firing, favorable assignments, promotions, etc.).
2. His communications channels with his subordinates (for assigning and reviewing work) are informal and poorly defined.
3. His subordinates' tasks are vaguely defined and require considerable discretionary judgment from them.

Thus, leadership is seen as motivation and guidance rather than the straightforward exercise of widely agreed upon and specifically delineated formal authority. There is, after all, very little sensitivity required in interpersonal relationships characterized by nearly absolute power on one side and nearly complete submission on the other.

The Oral, Written, and Reading Use of Language constitute three separate HSMS skills. These skills are concerned with the level of precision a task requires in the use of language to convey or receive meaning. They do not involve familiarity with specialized or technical vocabularies or with the rules of grammar or literary form. These are types of knowledge and, if required in a task, would be measured on the Knowledge scale.

The HSMS thus separates the three kinds of language skills which are combined by the Labor Department in its General Educational Development Language Scale. The HSMS approach has obvious value in rating those tasks which require two types of language use, but not all three, or which require each use at a different level of complexity. The descriptive statements for the levels on the HSMS scales are somewhat vague, however. For example, one level on the Reading Use Scale requires the task performer to "comprehend the general meaning of simple written language." The next level calls for the performer to "generally comprehend the meaning of moderately complex written language." These descriptions would benefit from supplementary examples to give more concrete meanings to such terms as "simple" and "moderately complex." This problem is mitigated, somewhat, by the fact that HSMS includes written instructions with each of its scales.

There are two HSMS scales measuring the amount of decisionmaking required in a task—Decision Making on Methods and Decision Making on Quality. A task is rated high on the Methods Scale when the circumstances under which it is performed can vary widely and the performer must choose from among several possible ways to accomplish it. At the very highest level, the performer must apply his own guidelines in selecting the most appropriate method. A task's method includes what is done, when, in what order, what to use, and whom to involve.

Decision Making on Quality is called for in all tasks except those in which the performer has absolutely no influence on the quality of his output. Two criteria are involved in determining level—the extent to which the performer by improving on standards of acceptable performance, can affect the output's quality and whether or not the output is subject to review or inspection before it is used.

Decisionmaking can be deduced on a piecemeal basis from some of the Worker Functions and General Educational Development scales, but the Labor

Department approach has no direct means of identifying or measuring it. The Functional Job Analysis Scale of Worker Instructions offers a more comparable tool. The HSMS scales, like FJA's, can be seen as portraying a prescription, discretion continuum. But no attempt is made, on the Scale of Worker Instructions to distinguish between discretion with regard to methods and that with regard to quality. Presumably this is due to the belief that no useful analytical purpose would be served by separating them.

The definitions for levels on the Scale of Worker Instructions tend to emphasize methods over quality. Direct comparisons with HSMS are complicated however, by certain conceptual differences regarding each technique's definition of a task. One of the determinants of level on the Scale of Worker Instructions is the extent to which the performer must choose the most appropriate task output for advancing the organization's objectives. The extent to which an output is appropriate for achieving specified objectives is certainly a reflection of its quality. But according to HSMS, any given task can have only one output. If some other output results, another task is involved. Thus it is inherently contradictory, under HSMS definitions, for an individual task to be rated on the basis of the extent to which the performer must decide his output. Both the HSMS scales and the Scale of Worker Instructions provide valuable insights into task dimensions. Persons contemplating the development of a synthesis of the two approaches or using the two in combination should be aware, however, that each is clearly the product of, and bound by the context of, its own methodology and definitions.

The HSMS General Intellectual Skills were heavily influenced by the work of J. P. Guilford at the University of Southern California. Guilford's "structure of intellect" model contains 120 distinct mental abilities (17, 18) According to this approach, an individual may possess certain of these abilities to a very high degree, while being almost completely lacking in others and somewhere in between on the rest. This contrasts with the commonly held general intelligence theory, which holds that intelligence is unidimensional. Most employment examining procedures and requirements are based, perhaps unconsciously, on the general intelligence theory. A college graduate who scores well on a general intelligence test is presumed to be capable of performing any of several entry-level "professional" positions. The person who fails such a test, on the other hand, is considered to

lack the ability to do any but the least demanding of jobs (47).

Using Guilford's work as a theoretical base, the HSMS staff identified four General Intellectual Skills. Figural, Symbolic, Taxonomic, and Implicative. They are not represented as encompassing the totality of mental activities. Rather, they were chosen because they seemed to be "independent of one another," "observable and scalable in the task situation," and "relevant for the purpose of clustering tasks into related hierarchies."

Figural Skills are involved when the worker is required to manipulate mentally the figural properties (size, shape, form, etc.) of visual or mental images and their interrelationships to achieve some predetermined figural standard or objective. This manipulation may include evaluating, creating, arranging or responding to figural relationships, patterns, or compositions. Symbolic skills are called for when the task performer must use or mentally manipulate abstract symbols in terms of their symbolic properties. They involve systems of notations where the symbols stand for characteristics, relationships, or operations. Typical systems are mathematical notations, including numbers and signs, computer languages, codes, and musical symbols.

Taxonomic skills involve the conscious use of organizing or classifying principles to make judgments concerning conceptual materials. A librarian cataloging books uses this skill, as does a job analyst isolating individual tasks from a mass of job content data and rating them on the various scales discussed. The skill may include the application of existing organizing or classifying principles or the creation of new ones. Implicative skills involve the drawing of nonroutine inferences or coming to nonroutine conclusions about information in the task situation. The considering of alternatives and foreseeing of consequences are included. None of these processes is applicable, however, in the context of simple cause and effect or of other obvious relationships.

The HSMS staff cautions against confusing one general intellectual skill for another. For example, the task of proofreading sheet music may at first seem to require Symbolic Skills since musical notations are involved. The proofreader, however, is interested in the *figural* properties of the notation, insuring that the shape and location of the individual note correspond with the predetermined standards represented by the originals from which the sheet music is being printed. The worker is not concerned with the *symbolic* properties of the notation, and need not

understand the system involved, since he is not required to interpret it. Persons using these skills scales should study their definitions carefully to prevent such confusion, especially if the analyst is predisposed, by habit, to thinking of intelligence as unidimensional.

It is also important to distinguish between the four skills scales and the knowledge scale which will be discussed shortly. At this point, it will suffice to say that the skills deal with mental processes or activities while knowledge reflects the substantive content which is being processed or acted upon.

The final set of skills in the HSMS methodology consists of those dealing with consequences of error. Two separate skills were identified—Financial Consequences of Error and Consequences of Error to Humans. Implicit in any task is the possibility that errors may be committed in performing it. The consequences of those errors will vary according to the specific tasks. Some tasks, when done improperly, result in no physical or financial harm, while others have the gravest of consequences. Workers have perceptions concerning the seriousness of possible errors in the tasks they perform. These perceptions endow them with a sense of responsibility, which HSMS maintains is learnable. This sense of responsibility can be developed to varying degrees. Tasks with very serious perceived consequences of error will require a very highly developed sense of responsibility.

Levels on the Financial Consequences of Error scale are determined by the *relative* amount of financial damage to the employing organization which would result from the most serious, likely error in performing a given task. *Absolute* dollar values are not a factor. A thousand dollar mistake will have a much more harmful impact on some organizations than on others.

The Consequences of Error to Humans scale is also concerned with the most serious, likely error in the performance of a given task. The level on this scale rises as the seriousness of the harm increases and the remedialness of the damage declines. The key factors include whether the harm is remediable and the extent of the victim's loss of ability to function. The remedialness of the damage ranges from very trivial situations where no remediation is required to the most irreversible damage—immediate and inevitable death.

Knowledge is dealt with in the HSMS methodology through a Knowledge Classification System and a single Knowledge Scale. According to HSMS:

Knowledge is information about facts and concepts and

includes how or why things function or what to do to have them function. Knowledge may be acquired by formal didactic means such as in a classroom, or by less formal means such as self-study, personalized instruction, or by watching others.

The definitions and the categories which are part of the HSMS Knowledge Classification System reflect the uses of knowledge in work settings. The groupings of the categories reflect their hierarchical relationships. The categories were conceived of and devised to be additive and scalable in the same way in which the HSMS skills are additive and scalable (rising from low to high levels cumulatively, according to scaling principles.) The categories require the effort of being learned in the context of a curriculum, and they can be applied in more than one setting.

The concept of the *transferability of knowledge* assumes that some kinds of knowledge are capable of being used in varying situations, or can be treated as additive from lower to higher levels of application, i.e. that knowledge is scalable. The concepts of transferability and scalability of knowledge underlie the HSMS Knowledge Classification System.

The HSMS Knowledge Classification System's categories are limited to the following types of knowledge

1. Subject categories which represent organized bodies of knowledge which can be conceived of as ranging in content from simple to advanced levels and which can be required at varying levels in a variety of tasks.
2. Subject categories which are not merely the names of the individual steps of tasks.
3. Subject categories which, even at lowest levels of use, require a learning effort beyond everyday experience and beyond the usual process of maturation. The learning effort involved may be formal or informal, but it must involve a conscious effort to be acquired so that it can be applied in different situations.

*This quotation has been slightly altered as the result of a telephone conversation with Dr. Gilpatrick

4. Subject categories which can be identified as being required in competent task performance. (20. p. 3-13 and 3-14)*

Figure 10 consists of a sample page from the Knowledge Classification System.

Once it has been decided that a specific category of knowledge is called for in a task, that category is rated on the Knowledge Scale (figure 11). A minimum condition for rating a category above zero on the Knowledge Scale in a given task is that the knowledge takes some time and effort to acquire and thus is usable in another context; e.g., in a higher level upward mobility position. A final HSMS scale is that for Task Frequency, which, as its name implies, measures the approximate number of times a worker performs a given task.

Among the written materials produced by the HSMS staff are manuals which give instructions on applying the methodology. Training in this approach, however, is not yet as readily available as it is for the Department of Labor methodology. This, plus the fact that the approach is relatively time-consuming, may discourage persons contemplating a job analysis from giving HSMS serious consideration. It is not our purpose to recommend for or against any particular methodology. It would be a mistake to ignore the HSMS work, however, since several of its components can serve to identify task dimensions which are dealt with inadequately, if at all, in other techniques.

FIGURE 10. HEALTH SERVICES MOBILITY STUDY
KNOWLEDGE CLASSIFICATION SYSTEM (Sample Page)

	1	2	3	4	5	6	7	8
10000000								
11000000								
11100000								
11200000								
11300000								
11400000								
11500000								
11600000								
11700000								
11710000								
11720000								
11730000								
11731000								
11731100								
11731200								
11731300								

FIGURE 11. HEALTH SERVICES MOBILITY STUDY LEVELS OF KNOWLEDGE

Note This scale refers to the level of knowledge in a given subject category required of the performer in the task being scaled. The knowledge categories which are required for each task are identified, and each category is rated with this scale. To be rated above zero on the scale, the task must require knowledge beyond the simple memorization of the overt steps of the task.

The scale rises with the amount of detailed knowledge which must be consciously applied and with the depth of understanding required in the subject area, in terms of the subject area's content, the structure of its ideas, and its uses. "Detailed knowledge" covers such things as technical or special terms or facts. "Consciously applied" means that the performer is able to (but need not) articulate his use of the knowledge in the task situation.

The level of knowledge for a category is not determined by the level of any intellectual skills required, nor by the level for any other knowledge category required for the task, nor by the level of the category required for any other tasks of the job involved.

Scale Value	Descriptive Statement
00	The task does <i>not</i> require the performer to consciously apply knowledge in this subject category which has been gained in a <i>learning experience requiring more than the memorization of the overt steps of the specific task being scaled</i>
—	
15	The task requires that the performer consciously apply a <i>limited amount of detailed knowledge</i> in this subject category, including such things as technical or special terms or facts.
—	
25	The task requires that the performer have a <i>general awareness</i> of this subject category in terms of its content, the structure of its ideas, and its uses. The performer must consciously apply a <i>limited amount of detailed knowledge</i> in this subject area, including such things as technical or special terms or facts
—	
35	The task requires that the performer have a <i>general awareness</i> of this subject category in terms of its content, the structure of its ideas, and its uses. The performer must consciously apply a <i>moderate amount of detailed knowledge</i> in this subject area, including such things as technical or special terms or facts
—	
—	
—	
55	The task requires that the performer have a <i>considerable degree of understanding</i> of this subject category in terms of its content, the structure of its ideas, and its uses. The performer must consciously apply a <i>moderate amount of detailed knowledge</i> in this area, including such things as technical or special terms or facts
—	
—	
70	The task requires that the performer have a <i>considerable degree of understanding</i> of this subject category in terms of its content, the structure of its ideas, and its uses. The performer must consciously apply a <i>very great amount of detailed knowledge</i> in this subject area, including such things as technical or special terms or facts
—	
80	The task requires that the performer have a <i>very deep understanding</i> of this subject category in terms of its content, the structure of its ideas, and its uses. The performer must consciously apply a <i>moderate amount of detailed knowledge</i> in this subject area, including such things as technical or special terms or facts
—	
90	The task requires that the performer have a <i>very deep understanding</i> of this subject category in terms of its content, the structure of its ideas, and its uses. The performer must consciously apply a <i>very great amount of detailed knowledge</i> in this subject area, including such things as technical or special terms or facts

In addition to the basic task definition discussed in appendix A, the HSMS scales on Interpersonal Relations, Decision Making, and Consequences of Error are primary examples. Also, the General Intellectual Skills represent an important attempt to apply Guilford's insights into the multidimensional aspects of intelligence to the areas of human resource management.

Northwestern University

The Northwestern University study, *Restructuring Paramedical Occupations*, conducted by Drs. Horowitz and Goldstein did not use scales to measure task dimensions (15) That information which was gathered, in addition to basic job content or task data, concerned such matters as the percentage of time spent on each task and whom the performer thought should perform each task. Initially, the following questions (obviously based on the HSMS) were to be asked concerning each task but were discarded because they were felt to be of little value.

- a. "Do you perform this task:
 - i. alone
 - ii. with a coworker
 - iii. under supervision
 - iv. some combination of the above?"
- b. "What equipment, instruments, or supplies do you use in performing this function?"
- c. "What is the end result of this function?"
- d. "Is there any type of patient or whom or with whom you cannot perform this task?"

The tasks in each hospital department studied were ranked in order of difficulty by the researchers

with the assistance of selected supervisors and performers. This represents the study's only attempt at determining task complexity.

The Northeastern University study was described in the 1973 edition of the Labor Department's *Manpower Research and Development Projects* as developing a "short cut" method of job analysis. This is evidenced by the fact that the study relies for its conclusions primarily on the task statements themselves, ranked in very rough order of complexity. This approach should appeal to managers concerned about the time-consuming nature of a more detailed analysis. A caveat is in order, however, concerning the practice of using supervisors, performers, and other experts to determine task difficulty. This approach is somewhat subjective and could easily become biased in support of the status quo. That is, a group of task performers might agree that none or very few of their own tasks are simple enough to be assigned to lower-level workers.

Also, unless the tasks are very precisely and completely described, the experts may have inadequate or divergent notions of the activities they are ranking. One expert may interpret a task statement in one way, and rank the task accordingly, while another expert may see the statement differently and assign a different ranking. Also, each expert may use his or her own criteria in determining task complexity. These are typical of the problems which can result when the data gathering is performed by one person and the ranking or rating is performed by another at a later date.

It should be stated that the purpose of this project was not to produce a sophisticated job analysis technique but, rather, to develop a simplified procedure which hospital officials might be persuaded to use in analyzing their own personnel structures and procedures.

C. Names and Addresses of Researchers in Job Analysis

U.S. Department of Labor

Inquiries regarding the U.S. Department of Labor's job analysis methodology may be directed to:

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or to any of the Occupational Analysis Field Centers:

Occupational Analysis Field Center
California Department of Employment
3223 West 6th Street—Ninth Floor
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Occupational Analysis Field Center
1212 Florida Avenue, Room 160
Tampa, Fla. 33602

Occupational Analysis Field Center
Michigan Employment Security Commission
7310 Woodward Avenue
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Occupational Analysis Field Center
Missouri Division of Employment Security
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Health Services Mobility Study

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Job Analysis, 1970

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or

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Job Task and Requirements Analysis

Dr. Samuel B. Marks
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Humanic Designs Corporation
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*Manpower Utilization and Cost Analysis Study of
the Fremont (California) Police Department*

Mr. Ralph Showalter, President
Social Development Corporation
4905 Del Ray Avenue
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Position Analysis Questionnaire

Dr. Ernest J. McCormick
Occupational Research Center
Department of Psychological Sciences
Purdue University
West Lafayette, Ind. 47907

*Psychological Assessment of Patrolman Quali-
fications in Relation to Field Performance*

Dr. Melany E. Baehr
Industrial Relations Center

University of Chicago
1225 East 60th Street
Chicago, Ill. 60637

Restructuring Paramedical Occupations

Dr. Harold M. Goldstein
Department of Economics
Northeastern University
360 Huntington Avenue
Boston, Mass 02115

*A Task Analysis of Library Jobs in the State
of Illinois*

Ms. Mercedese M. Miller
Vice President for Administration
and Planning
Social, Educational Research
and Development, Inc.
Suite 1285, 5454 Wisconsin Avenue
Chevy Chase, Md. 20015

*A Task Analysis Method for Improved Man-
power Utilization in the Health Sciences*

Health Manpower Council of California
1 Camino Sobrante
Orinda, Calif. 94563

Task Analysis by Selected Criteria

Dr. J. William Ullery
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Technical Education Research Centers
44 Brattle Street
Cambridge, Mass. 02138

Upward Mobility Through Job Restructuring

Mr. David Futransky
Bureau of Policies and Standards
U.S. Civil Service Commission
1900 E Street, NW.
Washington, D.C. 20415

*Vocational Education in Michigan (An Exploratory
Study to Analyze New Skill Content in Selected Oc-
cupations in Michigan and the Mechanism for Its
Translation into Vocational Education Curricula)*

Battelle Memorial Institute
Columbus Laboratories
505 King Avenue
Columbus, Ohio 43201

**D. Selected Listing of Projects Employing The W. E. Upjohn
Institute's Functional Job Analysis Technique**

A Systems Approach to Health Manpower Utilization. A Technical Procedures Manual, Institute for Health Research. New Health Careers Demonstration Project, 1973 (HSMHA-NCHSRD-Manpower Grant HS 00221).

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