5

Management and Teams

The previous three chapters have been devoted to work-oriented methods, worker-oriented methods, and hybrid methods, respectively. All of the methods of job analysis in those chapters are suited for a broad variety of jobs. In this chapter, we describe more specialized methods of analysis that are targeted toward specific types of jobs. In the first half of the chapter, we describe the *Management Position Description Questionnaire* (MPDQ), which (surprise!) is used to analyze managerial jobs. We also discuss the practice of competency modeling, which is a newer form of work analysis typically targeted at managerial and leadership positions. The second half of the chapter is devoted to analyzing the work of teams.

Although there are other methods for analyzing managerial jobs, we chose the Management Position Description Questionnaire for inclusion in this chapter because it appears to be the most comprehensive in scope. We also chose it because it was one of the first job analysis methods developed with software that allows the results of the job analysis to be displayed and used directly for purposes such as job evaluation and performance appraisal. We discuss competency modeling because it has become extremely popular in the business community, but there exists considerable confusion about exactly what it is and how it differs from more traditional job analysis methods. We hope to clarify what competency modeling is and how it fits in (or doesn't!) with the larger work analysis literature.

For the section on job analysis for teams, we present three different sets of descriptors for teams. The first set of descriptors concerns job design. We describe both input and process features that are believed to influence the success of teams. Next we describe the knowledge, skills, and abilities (KSAs) that team members should have to be effective as part of any team. The third set of descriptors concerns team functions. Team functions are things that all teams need to do to reach their goals. For example, teams have to maintain member motivation.

The last part of the chapter is devoted to the *MAP system* (multiphase analysis of performance system). The MAP system is a method of analyzing the work of teams that shows how the team attains its goal and how the work of

individuals within the team relates to the work of other individuals within the team. We provide a simple illustration of how the MAP system can be used to develop team training.

Management and Leadership

In this section, we discuss analyzing managerial jobs. Such jobs usually involve the supervision of other people. For example, in the comics section of many newspapers, we see Dagwood Bumstead's boss kicking Bumstead's chair to wake him up and get him back to work. Other examples of discord between supervisor and subordinate can be found in such comic strips as Beetle Bailey and Dilbert. Managerial jobs also involve functions such as deciding what the business should do. For example, a company near us makes aircraft instruments such as altimeters (What's our altitude?) and vertical speed indicators (How fast are we falling?). Management has decided recently to expand beyond conventional mechanical devices to use electronics for displays, thus illustrating a major decision about the strategy of the business.

Managerial jobs present challenges for job analysis. For one thing, many important managerial tasks are difficult to observe. A case in point is the decision to expand from mechanical to electronic instrument manufacture. One can observe a manager collecting data and informing others of a decision, but the actual decision is primarily mental and therefore difficult or impossible to observe. Some activities that are observable are not very informative. For example, we may observe a manager reading a report or examining a spreadsheet, but that doesn't tell us what information the manager is extracting, what the manager is doing with it, or why it's interesting. Therefore, it is difficult for observers to describe many managerial tasks.

There are other challenges as well. On the interpersonal side, it is difficult to specify what the manager does in behavioral terms. It is usually easier to describe the objectives or goals of the interpersonal interactions than to describe what the manager actually does. For example, it is easier to say that the goal of performance appraisal is to provide performance feedback than it is to describe what the manager is actually doing during a performance review (listening, speaking, pointing, shouting, jumping up and down, warding off blows . . .).

We do not mean to imply that the analysis of managerial jobs is impossible. Even if mental work is more difficult to observe than is physical work, the content of the work can still be described in terms of tasks. It may have occurred to you that cognitive task analysis (which you relished in Chapter 3) might be applied profitably to the headwork involved in managerial jobs.

If one were to attempt to analyze many different managerial jobs in terms of functions, however, one would soon realize that managerial jobs differ in the actual behavioral content and task expertise depending on the nature of the

work supervised. For example, although the functions are similar, the content of the actual work of the manager of a grocery store is different from that of the branch manager of a bank.

There are several functional or role-oriented analyses of managerial work. The simplest of these comes from the Ohio State University leadership work and concerns the broad-level functions of consideration (person centered) and initiating structure (task centered) (for example, Halpin & Winer, 1957; Hemphill & Coons, 1957). A more elaborate analysis based on roles was developed by Mintzberg (1973). Fleishman, Mumford, Zaccaro, Levin, Korotkin, and Hein (1991) summarized the history of taxonomic efforts in the description of leader behavior and offer their own 13-dimension model, which includes the four superordinate dimensions of information search and structuring, information use in problem solving, managing personnel resources, and managing material resources. Borman and Brush (1993) offered a four-factor model based on data from prior studies. Their model covers interpersonal skills, leading others, administrative skills, and instrumental personal behavior. Other trait-based systems are used in managerial assessment centers (business simulations used for selection and training; see Heneman & Judge, 2003). Although these kinds of systems are widely applicable, they are not associated with any specific job content or a structured, standardized job analysis procedure. It is a challenge to describe managerial jobs in ways that are both behavioral and general enough to apply to a large number of jobs. The method that we describe attempts to analyze a broad range of managerial and executive jobs in common behavioral terms.

DEVELOPMENT AND STRUCTURE OF THE MANAGEMENT POSITION DESCRIPTION QUESTIONNAIRE

Page (1988) cited the work of Hemphill (1960) and Tornow and Pinto (1976) as being influential in the development of the Management Position Description Questionnaire (MPDQ). Hemphill had about 90 executives respond to about 575 items in order to describe their jobs. There were problems in the analysis of his data due to having more items than people. Tornow and Pinto expanded on Hemphill's work by including statements relevant to supervisory as well as executive positions; that is, they moved from the top of the organization down the management hierarchy to include more jobs. Page described the thorough development of the MPDQ at Control Data Corporation subsequent to Tornow and Pinto's work. The development was reported to take about 10 years; during that time various versions of the questionnaire were given to more than 7,500 managers (Page, 1988).

Like many of the job analysis instruments we have described, the MPDQ uses quantitative responses to standard items for the analysis of the job. The MPDQ was designed to use managers' self-reports of their jobs. Such

self-reports have obvious advantages and disadvantages. Advantages include speed, lower cost of administration, and that the source of information is the person who knows the job best. An obvious disadvantage is that if the results are used for job evaluation (see Chapter 7), it will be in the incumbent's financial interest to present a puffed-up picture of the job.

Items in the final version of the MPDQ were chosen from a large pool of items based on analyses of managers' answers to the items. Items that remained in the MPDQ proved useful in identifying the managerial level of the job. The items also provided information useful for developing job evaluation dimensions; performance appraisal dimensions; job descriptions; and knowledge, skills, abilities, and other characteristics (KSAOs). Last, the chosen items were clear and easily understood. A description of the MPDQ's sections is shown in Table 5.1.

As you can see from Table 5.1, the major contents of managerial and executive work are summarized by the MPDQ. The main things that managers and executives do might be described as headwork, paperwork, and peoplework. Under headwork, or cognitive tasks, we have such areas as decision making, planning and organizing, controlling, and consulting and innovating. Such tasks have a very strong intellectual requirement. People who hate thinking long and hard will be unhappy with this kind of work. Under paperwork, we have administering, and to a smaller extent, controlling. Such tasks require keeping accurate and timely records. For peoplework, the MPDQ lists supervising, contacts, coordinating, and representing. Each of these categories of behavior requires interpersonal skills to be effective.

There is also a section that lists more than 30 KSAs, that is, what is required by the job rather than describing what managers do. Selected KSAs from the MPDQ include leadership, planning, human relations/sensitivity, oral expression, information management, and professional/technical knowledge (Page, 1988, p. 875). The KSAs in the MPDQ parallel the task dimensions of the MPDQ. One can imagine other attributes that might be useful in managerial work that are not tapped by the MPDQ. For example, managerial work often requires that incumbents accept responsibility for decisions that do not work out. For another, managerial work often requires resistance to stress of various kinds, such as time pressure or tolerance of financial risk.

Response Scales

For most of the items in the MPDQ, the incumbent responds to a scale such as the following (Page, 1998, p. 864):

0 = Definitely not part of the position

1 = Minor significance to the position

2 = Moderate significance to the position

3 = Substantial significance to the position

4 = Crucial significance to the position

Table 5.1 Structure and Content of the MPDQ

MPDQ Section	*Illustrative Content*	*Number of Items*
1. *General Information*	Name and title. Description of HR and financial responsibilities.	16
2. *Decision Making*	Complexity of decisions. Make final and mostly irreversible decisions.	22
3. *Planning and Organizing*	Long-range planning. Choice of business activities.	27
4. *Administering*	Record keeping. Documentation. Send requisitions.	21
5. *Controlling*	Analyze projects. Analyze budgets.	17
6. *Supervising*	Schedule subordinate activities. Coach subordinates on technical aspects.	24
7. *Consulting and Innovating*	Contribute special expertise to specific problems. (Usually done by technical experts such as lawyers or industrial psychologists.)	20
8. *Contacts*	Type of individual contacted and purpose of contacts. (See the matrix example in Table 5.2.)	16
9. *Coordinating*	Cross existing organizational boundaries to coordinate efforts of others that are not under the incumbent's control.	18
10. *Representing*	Sell or market products. Negotiate contracts.	21
11. *Monitoring Business Indicators*	Review information on local market or U.S. economy (usually executive function).	19
12. *Overall Ratings*	Estimate importance and time spent in categories described by the MPDQ.	10
13. *Knowledge, Skills, and Abilities*	Estimate proficiency required by the job in each KSA or competency.	31
14. *Organization Chart*	Attach copy of organizational chart showing location of focal job in relation to other supervisory jobs.	1
15. *Comments and Reactions*	Provide feedback on the questionnaire.	7

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These are the instructions to the incumbent to rate significance:

> Indicate how significant each activity is to your position by entering a number between 0 and 4 in the column next to it. Remember to consider both its importance in light of all other position activities and frequency of occurrence. (Page, 1988, p. 864)

Note that the significance scale is not defined precisely. Presumably, a task would be significant if it were either important to the job or frequent in occurrence. However, it would be reasonable to expect different people to judge differently the significance of a single task. A few other response scales are used as well, including a scale for the nature of the decision-making role and a scale for the importance of functions in the overall ratings section. The contacts section provides a matrix in which the manager places a number indicating significance into each box (see Table 5.2). In Table 5.2, the matrix for internal contacts is shown. There is another similar matrix for external contacts.

RESEARCH AND APPLICATIONS OF THE MPDQ

The MPDQ has been used for several different applications, including job evaluation, job design, training and development, performance appraisal, staffing, and job description. We briefly describe a few of these applications. There has also been some research on the reliability of the MPDQ and its value for job evaluation, which we also describe.

The MPDQ contains more than 250 items and takes about 2.5 hours to complete for the average incumbent (Page, 1988). Not surprisingly, the first order of the day is to reduce the quantity of information into fewer, more manageable numbers of scales. The data from the items have been combined into scales using both data-based and judgmental methods. The specific dimensions differ depending on the intended use of the MPDQ.

Management Work Factors

One set of dimensions was labeled *management work factors* (see Table 5.3). This set of dimensions was derived mainly from a kind of data analysis called *factor analysis* that places similar items into groups or clusters called factors (this is discussed a bit more in Chapter 9, on doing job analysis). The management work factors are used mainly to help distinguish jobs based on clusters of relatively independent contents. An illustration of the use of the dimensions can be seen in Figure 5.1, in which a specific job is compared with the average of a group of similar managers.

Because the MPDQ is proprietary, we have created simplified graphs that do not present all the information shown by the MPDQ. They do, however, illustrate the kind of presentation possible. As can be seen in Figure 5.1, several of the work dimensions are listed. Each bar graph shows the levels of significance

Table 5.2 Internal Contacts Section of the MPDQ

	Purpose of Contact		
Internal Contacts	Share information regarding past, present, or anticipated activities or decisions	Influence others to act or decide in a manner consistent with your objectives	Direct the plans, activities or decisions of others
1. Executives	4	4	2
2. Group managers (managers report to position)			
3. Managers (supervisors report to position)			
4. Supervisors (no supervisors report to position)			
5. Professional/ Administrative (exempt)			
6. Clerical or support staff (nonexempt)			
7. Other nonexempt employees			

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for each work dimension. The target position (our manager, Jane Doe) is represented by a solid bar; a reference group of managers (for example, other human resources managers) is represented by a light bar. Figure 5.1 shows that the target manager finds planning and organizing less significant than the average manager, decision making and administering to be about the same as the average manager, and consulting and innovating more significant than does the average manager. Such a graph allows you to see at a glance both where the target manager has the most significant involvement and how the target manager relates to a comparison group of managers.

Table 5.3 Work Factors of the MPDQ

1. *Decision Making.* Evaluating information and options; taking appropriate considerations into account in making decisions; making decisions that might have a substantial impact on the organization.
2. *Planning and Organizing.* Formulating long-term and short-term plans, including planning long-range objectives, business activities, and strategic business plans as well as short-range planning and scheduling, such as planning the design, development, production, and/or delivery of products/services.
3. *Administering.* Preparing and maintaining records or documents; monitoring and implementing action to ensure compliance with policies and regulations; obtaining and distributing information; providing staff services to management.
4. *Controlling.* Controlling and adjusting the allocation of human, financial, and material resources; requisitioning materials, equipment, or services; establishing expense controls.
5. *Consulting and Innovating.* Applying advanced techniques to address unique problems, issues, or questions; providing decision makers with crucial inputs; identifying and developing new products or markets; keeping up to date with the latest technical developments.
6. *Coordinating.* Coordinating with other units to achieve organizational goals; directing and integrating the efforts of others over whom you exercise no direct control; negotiating for organizational resources; handling conflict or disagreements when necessary.
7. *Representing.* Interacting with groups/individuals, such as customers, suppliers, government and community representatives, stockholders, and applicants; promoting or selling the organization's products or services; negotiating contracts or terms.
8. *Monitoring Business Indicators.* Monitoring key business indicators, such as total net income, sales volume, international business and economic trends, and competitors' product lines and services.

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Job Evaluation Factors

The MPDQ has also been used extensively for job evaluation. The dimensions used for job evaluation are described in Table 5.4; they also appear in Figure 5.2. Job evaluation points shown in Figure 5.2 provide an estimate of

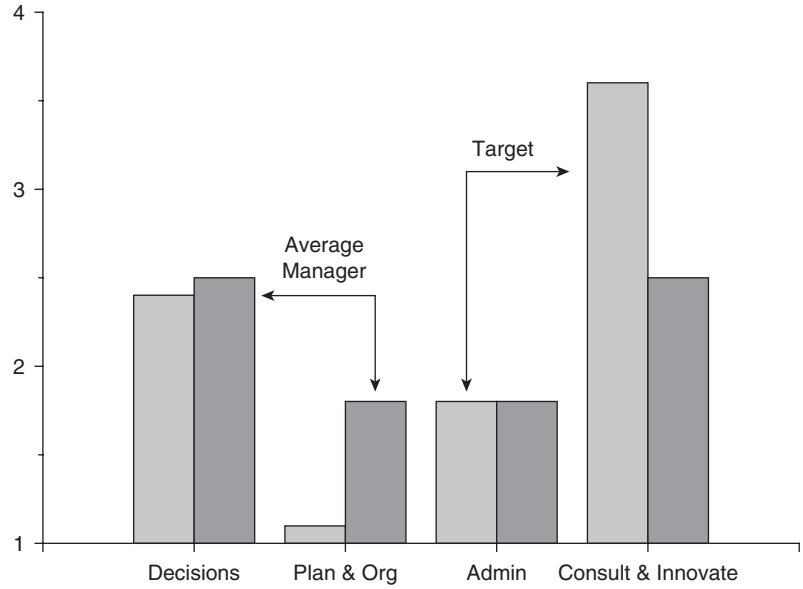

Figure 5.1 Individual Position Profile Adapted From the MPDQ

the value of the job to the company. These can be converted into salary levels as will be described in Chapter 7. The dimensions were initially developed through expert judgment. Later work changed some items to make them more applicable to a wide variety of jobs and organizations. We mentioned earlier that using the MPDQ for job evaluation might cause problems because self-reports are used. The evidence to date for its use, however, is actually quite positive. Page (1988) reported several different studies in which MPDQ responses were used to predict salary grade levels for various jobs. Correlations between actual and MPDQ-predicted salary grade levels were all high, ranging from .79 to .96. People at Control Data who were the users of the MPDQ job evaluation system found it preferable to other systems that the company used.

Computer Use

The MPDQ was one of the first computerized job analysis systems. The system produced professional quality customized reports and graphics. Simplified examples of the kind of reports available can be seen in Figures 5.1 and 5.2. As you can imagine, there is a great saving in time and energy realized when respondents input data directly to the computer, which will then compute, display, and print any desired report. The MPDQ can also create tailored

Table 5.4 Job Evaluation Dimensions of the MPDQ

1. *Decision Making.* The level of authority in making decisions, considering the nature, magnitude, and complexity of the decisions as well as the amount of autonomy exercised in making decisions.
2. *Problem Solving.* The level of analytical or creative thinking required to resolve problems that arise, taking into account the nature and scope of the problems to be addressed and the inventiveness of the solutions.
3. *Organizational Impact.* The magnitude of organizational impact, including the extent to which the position is critical for achieving organizational goals, developing or delivering products or services, creating strategic or business plans, developing policies and procedures, and meeting revenue, profit, and performance objectives.
4. *Human Resource Responsibility.* The degree of supervisory responsibility as measured by the number and level of employees reporting to the position, and the complexity of supervision provided.
5. *Know-How.* The degree to which the position requires knowledge and expertise that will solve key organizational problems and the degree to which this knowledge and expertise must be applied to special problems, issues, questions, or policies facing the organization.
6. *Contacts.* The scope and level of internal and external contacts defined by the level of the contact, the purpose of the contact, and the frequency with which contacts are made.

SOURCE: Adapted from Page, R. C. (1988). Management Position Description Questionnaire. In S. Gael (Ed.), *The job analysis handbook for business, industry, and government* (Vol. II, pp. 861–879). New York: Wiley. Reprinted by permission of John Wiley & Sons, Inc.

performance appraisal forms so that those items that were endorsed as most significant by the manager under given dimensions will appear on the appraisal form along with the dimension descriptions.

Reliability

There have been several different kinds of estimates of the reliability of the responses to the MPDQ. Because it takes so long to complete, fatigue might be an issue. To explore this, one study examined the consistency of responses to items that were deliberately repeated in the questionnaire and found the median item reliability to be .83. This indicates good response consistency at

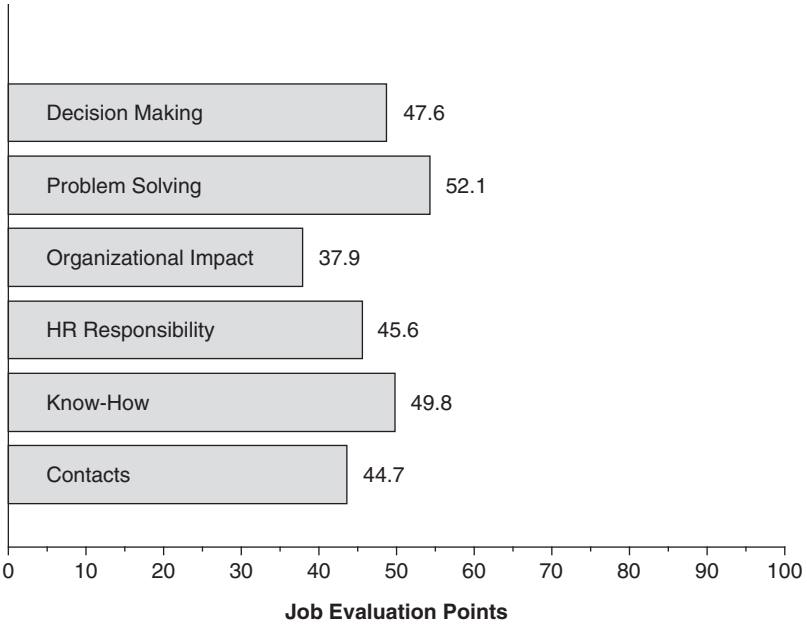

Figure 5.2 Job Evaluation Graph Similar to the MPDQ

least for most items. Agreement between different people reporting on the same job has been much lower. For example, when incumbents and their managers were asked to complete MPDQs for the incumbents' jobs, the median item reliability was about .40. Furthermore, managers who completed a short form of the MPDQ and repeated the short form about 3 months later showed a median item reliability of .55. On the other hand, when managers and incumbents were asked to complete MPDQs for job evaluation purposes and the reliability of the job evaluation scales (not items) was examined, the reliability was again above .80 (Page, 1988), which is quite good.

SUMMARY OF THE MPDQ

As we stated at the beginning of the chapter, the MPDQ appears comprehensive, with about 250 questions and typically requiring more than 2 hours to complete. Because it is standardized, results can be compared across incumbents and managerial jobs. The MPDQ appears to have several applications, including job descriptions, performance appraisal, and job evaluation. It also has software that allows users to generate professional, custom reports based on the job analysis.

Competency Modeling

A more recent approach to understanding managerial jobs has occurred under the broad label of "competency modeling." At the core of competency modeling is the notion of managerial or leadership competencies. The idea that competencies are important for success (as opposed to more cognitive attributes) was articulated by McClelland (1973). Despite criticisms of the concept (for example, Barrett & Depinet, 1991), a focus on managerial or leadership competencies has become quite prominent in the applied and consulting realm. The process of identifying competencies and then linking them to a variety of human resource management systems has been termed competency modeling.

Shippmann et al. (2000) found that between 75 and 80 percent of surveyed companies are currently using some form of competency-related application. Given its popularity, it is important to describe some of the major features of competency modeling. Unlike work on the MPDQ, there is no accepted taxonomy of competencies nor is there consensus on methods to use in competency modeling. In addition, there is less published research on competency modeling methods than other forms of work analysis. In fact, competency modeling is primarily practiced by business consultants using proprietary systems. Nonetheless, because of its popularity, we thought it was important to summarize some of the major features of competency modeling. It is important to recognize that what we discuss here is something of a composite of different approaches. Actual results may vary!

As a practice, competency modeling appears to have been given a boost by the influential work of Prahalad and Hamel (1990), who described core competencies of businesses. Their idea was to focus on the essential skills that form the competitive advantage of the business (not the individual). This general idea was taken up by the consulting community and then taken down to the individual level (where job analysis typically is practiced). Competency modeling concerns identifying organizationally valued personal characteristics required of individual employees by jobs or roles. The key idea in competency modeling is to somehow link the specific business strategy to the competencies needed in people to pursue the strategy. Suppose an organization decided it valued innovation (think 3M and Post-it notes or Pfizer and finding the next blockbuster drug like Viagra). Such an organization would want to hire, develop, and reward individuals who possessed competencies—for example, creativity—that enabled them to be innovative. You might find it helpful to think of competency modeling as a search for characteristics that separate the best workers from the rest. Recall that this was also the main question asked by the Job Element Method. Competency modeling practice typically gathers information about such traits across jobs, often across all managerial jobs within an organization; it tends to ignore tasks.

The human attributes identified in competency models tend to be broad, and not linked directly to specific tasks (Jackson & Schuler, 1990; Snow & Snell, 1992). Proponents of competency modeling have suggested that once articulated, competency models can form the foundation for all human resource systems (for example, selection, training, performance management, and so on) across all manner of different jobs in an organization.

Literally hundreds of competencies have been identified in a range of academic and practitioner publications (for a sample, see Bartram, 2005; Borman & Brush, 1993; Boyatzis, 1982; Lucia & Lepsinger, 1999; Spencer & Spencer, 1993; Tett, Guterman, Bleier, & Murphy, 2000). Even the federal government has gotten in on the act, with the U.S. Department of Labor identifying a set of critical competencies in the Secretary's Commission on Achieving Necessary Skills (SCANS) report (http://wdr.doleta.gov/SCANS/), the Office of Personnel Management's set of competencies across occupational groups (http://www.opm.gov/workforceplanning/tools/), and last but not least, the various descriptor domains of O*NET (which some might suggest detail the range of competencies needed for successful job performance).

This proliferation of lists of competencies is a little bewildering. As one example, Bartram (2005) recently described the competency approach utilized by the consulting firm SHL (see Table 5.5). This system includes eight competency factors (dubbed "the Great Eight," no doubt in homage to the Big Five personality factors. Never underestimate the power of a "grabby" label), 20 competencies, and 112 components. Similarly lengthy lists of competencies can be found in any of the above referenced sources. Although achieved through different means, all attempt to describe the breadth of managerial work (similar to the work of Mintzberg, 1973, and Fleishman et al., 1991, noted earlier). Despite the variety of labels across systems, there is considerable overlap among the desirable characteristics. If you are curious about the degree of overlap, we recommend that you compare the work factors of the MPDQ in Table 5.3 to the Great Eight competencies in Table 5.5.

In the interests of scientific parsimony it would be desirable if there could be some way to reconcile these different sets, but given their proprietary nature, such an outcome is unlikely (and unfortunate, in our minds). Consulting organizations have developed their own proprietary dictionaries of fixed sets of competencies that can be applied to a range of jobs or roles. They also provide a means to translate customized sets or others' dictionaries into their own lexicon. Alternately, they offer a means to customize their dictionaries or modify them in the face of newly discovered or company specific competencies.

One of the fundamental problems facing competency modeling is that there is no agreed-on definition of a competency (Shippmann et al., 2000). For example, competencies have been defined as demonstrated knowledge, skills,

Table 5.5 Description of the "Great Eight" Competencies

Competency Label	*Description*
1. Leading and Deciding	Tells other people what to do. Decides what action to take.
2. Supporting and Cooperating	Works well with other people; team player.
3. Interacting and Presenting	Persuades others; has social confidence and presentation skills.
4. Analyzing and Interpreting	Analyzes problems effectively; comfortable with data.
5. Creating and Conceptualizing	Deals effectively with change. Moves things forward according to the big picture.
6. Organizing and Executing	Plans work to meet objectives; ensures customer satisfaction.
7. Adapting and Coping	Handles pressure and bounces back after setbacks.
8. Enterprising and Performing	Focuses on results. Understands finances.

or abilities (Ulrich, Brockbank, Yeung, & Lake, 1995); a mixture of knowledge, skills, abilities, motivations, beliefs, values, and interests (Fleishman, Wetrogan, Uhlman, & Marshall-Mies, 1995); a motive, trait, skill, aspect of one's self-image or social role, or a body of knowledge (Boyatzis, 1982); a knowledge, skill, ability, or characteristic associated with high performance on a job (Mirabile, 1997); a written description of measurable work habits and personal skills used to achieve work objectives (Green, 1999); and "sets of behaviors that are instrumental in the delivery of desired results or outcomes" (Bartram, Robertson, & Callinan, 2002, p. 7). You may have noticed that academics such as ourselves dwell on definitions, just as statisticians dwell on assumptions of their models. Is this really worth all the time and paper spent, or are authors receiving kickbacks on the sales of aspirin and coffee?

There has been a debate about whether competency modeling is superior to job analysis or whether competency modeling is simply another name for job analysis (for example, Pearlman, 1997). Shippmann et al. (2000) addressed this question by polling experts from a number of different areas to address systematically the similarities and differences between job analysis and competency modeling. Experts were asked to evaluate both job analysis and competency

modeling as they are typically used on the following attributes: method of investigation, type of descriptor, procedures for developing descriptor content, level of detail of descriptors, link to business goals and strategies, content review, ranking of descriptor importance, assessment of reliability, process of content revision, and documentation of the procedure. (What a load of work! Maybe you can send them a box of chocolates for their effort.) The gist of their findings was that job analysis was judged superior to competency modeling with one exception: the link to business goals and strategies. Although job analysis tends to do a better job of obtaining the right information, it comes up short on communicating the value of what it does. Both the procedures used and the descriptors used in competency modeling speak to business management in a way that makes clear the value of the information gathered. Competency modeling usually involves a concerted effort to understand the organization's context, strategy, and goals (Shippmann et al., 2000). Furthermore, it usually proceeds to link explicitly the results of the modeling effort with the organization's outcomes of interest.

The use of broader rather than narrower traits may help cope with broader jobs with ill-defined boundaries. On the other hand, job analysis typically is focused on the task performance for a job as the outcome of interest (although the training cycle is an exception; see Chapter 8).

Yet there are well-known problems with more global or holistic judgments about work (Butler & Harvey, 1988). If a competency modeling process involves the identification of numerous abstract competencies, the potential for a misspecified competency model may result. For example, Morgeson, Delaney-Klinger, Mayfield, Ferrara, and Campion (2004) found that global competency ratings were inflated compared to more decomposed task and ability ratings. This could have the effect of producing long lists of "important" competencies even though some might not be so important. Interestingly, research has found that the quality of competency modeling is improved by using more rigorous job analysis techniques (Lievens, Sanchez, & De Corte, 2004). Clearly it would be worth attempting to link traditional job analysis efforts more closely to business goals and strategies. Such a strategy would eliminate the one identified weakness of job analysis while retaining the rigor that is needed when using job analysis to develop human resource systems.

On the other hand, in support of competency modeling we have received information that in-house, proprietary research and development efforts resulted in numerous successful applications of competency modeling, and in more refined specifications of competencies themselves. We look forward to seeing more of this research in rigorous, peer-reviewed outlets.

After all this debate we expect that you may want a description of an actual competency modeling process. Here is an example drawn from a research study conducted by Lievens et al. (2004; study 2 to be exact). These authors

relied on subject matter expert (SME) panels to formulate competency models for three jobs—design and manufacturing engineer, technical production operator, and management accountant. A different SME panel was assembled for each job and consisted of a job incumbent, supervisor, human resources (HR) specialist, and internal customer (ideally we would like to have larger SME panels). Familiarity with the focal job and knowledge about the organization's business and human resource strategies were required to be included on an SME panel. To begin, the SMEs completed a half-day training session that familiarized them with the particular competency modeling approach to be used. Each trained participant then received a set of 67 commercially available cards on which were listed a standard set of behaviorally linked competencies, one per card. Their task was to sort the 67 cards into five categories ranging from "essential for success" to "not important." Their sorts had to follow guidelines such that the number of cards falling into each category was fixed and resembled a normal curve with most falling into the middle category and few at the extremes. Although such a "forced distribution" will aid in prioritizing the competencies, this approach has undesirable measurement properties. (The technical term is that this type of rating process produces an ipsative set of scores. This produces dependency in the competency ratings that can pose problems when conducting statistical analyses. There, now you know the rest of the story.) An alternative to this rating process would be to have SMEs simply rate each competency in terms of its importance. Because their analyses were designed to answer research questions and not be used for job analysis purposes, Lievens et al. (2004) do not describe what to do with the SME results. Let us fill in the gap. From this point a number of analytic strategies could be used. One might be to do scale ratings for each card (for example, 1 = essential for success, 5 = not important) and average these to prioritize the competencies. Or the subject matter experts could meet and decide which competencies belonged in what categories.

SUMMARY OF COMPETENCY MODELING

Although you might think of competency modeling as a quick and dirty worker-oriented method of job analysis, its practice is likely here to stay in one form or another. It explicitly addresses the link between business strategy and goals and the attributes needed in the workforce to compete effectively. As such, it addresses a common weakness in job analysis. In addition, it has helped highlight a broader set of attributes that are likely to be helpful when thinking about managerial work, particularly at higher organizational levels. Yet, there are many weaknesses in competency modeling that are not yet addressed in the scientific literature. Research has begun to investigate and improve competency modeling, but much more needs to be done. Or, where in-house proprietary

research has been done, it needs to appear in rigorously reviewed scientific publications. These recommendations are particularly crucial in light of potential legal challenges to human resource management systems built upon a competency modeling approach.

Job Analysis for Teams

People are limited in what they can do individually. However, when people organize and work together in harmony, there is virtually no limit to what can be accomplished. Also, many tasks simply cannot be carried out by a single person. Such tasks include performing a symphony, operating a submarine, and refueling a jet in flight, among many others.

The definition of a team and the difference between a team and a group are slippery concepts that are not universally agreed on. It is useful to think about teams in terms of at least three attributes: (1) multiple people, (2) interdependent work, and (3) a shared goal. To have a team, clearly there must be at least two people (some people say three, but we don't see a compelling reason for this, so never mind). By interdependent work, we mean that the team members' tasks are connected in some important way, and each member has a defined role to play. For example, the surgeon cannot proceed (better not!) until the anesthesiologist has the patient sedated. Or for another example, two programmers may divide the task of writing code for a program, but when the two pieces of code are compiled, they must share data or pass the data properly from one part of the program to the other. In essence, the two pieces of the program have to fit together like two legs on a pair of pants. The shared goal defines the team by establishing its purpose. The shared goal also provides some idea of how to tell the effectiveness of the team. Examples of goals include winning a competition, providing service to a customer, building a machine, and maintaining equipment.

"Why," you wonder, "should we worry about analyzing the work of teams?" Analyzing work for teams serves many of the same functions as it does for jobs. That is, we want to know about selecting people for teams, training teams, compensating teams and team members, and designing jobs for teams. We also analyze the work of teams to reduce a very complex whole into more manageable parts. You might also ask why we cannot simply analyze the jobs of each of the team members instead of analyzing the work of the team as a whole. Well, of course we can and we will, but if that is all we do, then we will lose sight of the forest for the trees. Another analogy is the group of folks describing an elephant: One who examines only a leg says an elephant is like a tree trunk, another who looks only at the trunk says it's like a rope, another who sees only the ear says it's like a giant leaf. Sometimes you need the big picture.

Teams are an increasingly popular type of work organization. There is at present a great deal of interest in business and the military in creating, managing, and evaluating teams of every description (for example, Brannick, Salas, & Prince, 1997; Jones & Schilling, 2000; Wheelan, 1999). Job analysis for teams should be helpful for all these purposes.

Job analysis for teams is similar to job analysis for jobs in that we can think about the same building blocks for teams as for jobs, namely (you guessed it), the descriptors, the methods of data collection, the sources of information, and the units of analysis. We introduce a fifth building block, information storage, retrieval, and dissemination. As you will see, analyzing the work of teams forces us to consider a number of issues that typically do not arise when analyzing single jobs.

JOB DESIGN FOR TEAMS

Most theories of team effectiveness follow an input-process-output model (for example, Dickinson & McIntyre, 1997; Gladstein, 1984; Guzzo & Shea, 1992; for exceptions, see Sundstrom, De Meuse, & Futrell, 1990, and Ilgen, Hollenbeck, Johnson, & Jundt, 2005). The input factors include such items as organizational resources and other contextual factors. The process factors concern what the team actually does, such as communicate. The output factors typically include effectiveness measures (Did they win?) as well as satisfaction with the team (Can the team members stand to work together again?). Campion and his colleagues (Campion, Medsker, & Higgs, 1993; Campion, Papper, & Medsker, 1996) reviewed the literature and compiled a list of factors that they believed could be used to design effective teams. They developed a survey that can be used to measure teams on the characteristics of interest. The factors and a sample item for each factor are shown in Table 5.6.

Four of five factors considered under job design are factors considered in the job characteristics theory (Hackman & Oldham, 1980). The factors from job characteristics theory are autonomy, variety, task identity, and task significance. Self-management in teams is analogous to autonomy in individual jobs. Teams may have formal leaders who are given responsibility and authority to make decisions such as the assignment of tasks and hiring and firing members of the team. As self-management increases, the leader becomes more of a coach than a boss, and in extreme cases, there may be no formal leader; the functions of management are taken over by the team. Participation refers to the degree that all members contribute to team decision making, and it is highly related to self-management. Self-management and participation are thought to help promote feelings of responsibility in team members.

Task variety, task identity, and task significance are all attributes of jobs that are thought to motivate people. A job with variety causes people to develop and use multiple skills. Task identity refers to the work being a whole entity rather

Table 5.6 Team Design Elements

Characteristic	*Sample Item*
Job Design	
1. Self-management	My team rather than my manager decides who does what tasks within the team.
2. Participation	My team is designed to let everyone participate in decision making.
3. Task variety	Most everyone on my team gets a chance to do the more interesting tasks.
4. Task significance	My team helps me feel that my work is important to the company.
5. Task identity	My team is responsible for all aspects of a product for its area.
Interdependence	
6. Task interdependence	Within my team, jobs performed by team members are related to one another.
7. Goal interdependence	My work goals come directly from the goals of my team.
8. Interdependent feedback and rewards	My performance evaluation is strongly influenced by how well my team performs.
Composition	
9. Heterogeneity	The members of my team vary widely in their areas of expertise.
10. Flexibility	Most members of my team know each other's jobs.
11. Relative size	The number of people in my team is sufficient for the work to be accomplished.
12. Preference for group work	I generally prefer to work as part of a team.
Context	
13. Training	The company provides adequate technical training for my team.
14. Managerial support	Higher management in the company supports the concept of teams.
15. Communication/ cooperation between groups	Teams in the company cooperate to get the work done.

(Continued)

Table 5.6 (Continued)

Process	
16. Potency	My team can take on nearly any task and complete it.
17. Social support	Members of my team help each other out at work when needed.
18. Workload sharing	Everyone on my team does their fair share of the work.
19. Communication/ cooperation within the work group	Members of my team cooperate to get the work done.

SOURCE: Adapted from Campion, M. A. Medsker, G. J. Higgs, A. C. (1993). Relations between work group characteristics and effectiveness: Implications for designing effective work groups. *Personnel Psychology, 46,* 823–850. Adapted by permission of Personnel Psychology.

than a fraction (for example, building a whole car versus just seat covers). Task significance refers to the impact of the work on other people (for example, a surgeon has a significant job). Identity and significance are thought to influence team members' sense that their work is meaningful and important.

The interdependence factors include task and goal interdependence, which are two of our defining properties of teams. The interdependent feedback and rewards concerns the degree to which individual members' feedback and rewards depend on team outcomes. The interdependence of the work will influence the degree to which members feel that they are part of a team. The greater the interdependence, the greater the feeling of being part of a team.

The composition factors refer to the mix of people that belong to the team. *Heterogeneity* refers to the variability of backgrounds in team members in such characteristics as race, sex, and cognitive ability. *Flexibility* refers to the degree to which team members can change their assignments. To be flexible, the team must have the authority to change assignments and the skill by some members to cover the jobs of other members. *Relative size* refers to the number of people relative to the amount of work that needs to be done. As the size of a team increases, coordination demands also increase. According to the theory, there is an optimal size for each team.

The context factors are so labeled because they come from outside the team. *Training* of team members is a support activity provided by management that is intended to increase the effectiveness of the team either through improved task functioning, improved process such as better decision making, or both. *Managerial support* concerns other types of support such as provision

of materials and information. *Communication and cooperation* between groups concerns the quality of relations across teams within an organization. The organization may be characterized as relatively cooperative or relatively competitive.

According to input-process-output models of team effectiveness, all of the factors we have described so far fall into the input part of the model. The process factors fall into the process part of the model (surprise!). *Potency* is the team's belief in its own competence. For example, a football team may feel confident that it will win an upcoming game or it may feel that a win would be miraculous. *Social support* refers to team members getting along well interpersonally. *Workload sharing* is the adjustment of work across individuals to avoid slacking by some team members. *Communication and cooperation* within the team refers to passing information among members. The process variables are thought to influence team effectiveness either by motivating team members to work hard and to persist (potency and social support) or by directly increasing the effectiveness of work (workload sharing and communication).

Campion and colleagues developed a survey to measure the properties of teams in organizations. They also measured the effectiveness of teams in several ways. They examined both the productivity of the teams and the satisfaction of the team members with their work. They found that most of the team characteristics were related to most of the outcome measures. This evidence supported their model of team design characteristics.

According to the theory, the factors are supposed to be related to effectiveness and subject to control by management (that is, they can be changed). The research to date, however, deals only with differences in existing teams rather than the results of experiments in which team characteristics were manipulated. Therefore, whether manipulating these factors will result in improved effectiveness remains to be seen. However, this line of research has provided a rich source of descriptors to consider when analyzing the work of teams.

TEAM KNOWLEDGE, SKILLS, AND ABILITIES

As we describe in Chapter 10 on the future of job analysis, many people predict that work in the future will be accomplished by small teams of people who have flexible, dynamic jobs. In that case, it is difficult to analyze specific tasks to infer the required KSAs. One solution to the problem is to select people for *generic* traits that are valuable for a range of jobs. In the case of teams, researchers have developed a list of KSAs thought to be helpful, and even a paper-and-pencil test that attempts to sort people into better and worse prospects for team membership (Stevens & Campion, 1994, 1999).

The list of 14 KSAs for teams is presented in Table 5.7. As you can see, there are two main types of KSAs: interpersonal skills and self-management skills. Both of these main types are further subdivided. Included under interpersonal skills are skill in conflict resolution, problem solving, and communication.

Table 5.7 Generic Teamwork Skills

I. Interpersonal KSAs

A. Conflict Resolution KSAs

1. The KSA to recognize and encourage desirable, but discourage undesirable team conflict.
2. The KSA to recognize the type and source of conflict confronting the team and implement an appropriate resolution strategy.
3. The KSA to employ an integrative (win-win) negotiation strategy, rather than the traditional distributive (win-lose) strategy.

B. Collaborative Problem Solving KSAs

4. The KSA to identify situations requiring participative group problem solving and to utilize the proper degree and type of participation.
5. The KSA to recognize the obstacles to collaborative group problem solving and implement appropriate corrective actions.

C. Communication KSAs

6. The KSA to understand communication networks, and to utilize decentralized networks to enhance communication where possible.
7. The KSA to communicate openly and supportively, that is, to send messages which are (a) behavior- or event-oriented, (b) congruent, (c) validating, (d) conjunctive and (e) owned.
8. The KSA to listen nonevaluatively and to appropriately use active listening techniques.
9. The KSA to maximize the consonance between nonverbal and verbal messages and to recognize and interpret the nonverbal messages of others.
10. The KSA to engage in small talk and ritual greetings and a recognition of their importance.

II. Self-Management KSAs

D. Goal Setting and Performance Management KSAs

11. The KSA to help establish specific, challenging, and accepted team goals.
12. The KSA to monitor, evaluate, and provide feedback on both overall team performance and individual team member performance.

E. Planning and Task Coordination KSAs

13. The KSA to coordinate and synchronize activities, information and tasks between team members.
14. The KSA to help establish task and role assignments for individual team members and ensure proper balancing of workload.

SOURCE: Reprinted from Stevens, M. J., & Campion, M. A. (1994). The knowledge, skill and ability requirements for teamwork: Implications for human resource management. *Journal of Management, 20,* 503–530, with permission from Elsevier Science.

The self-management skills involve performance management, including goal setting and feedback and planning and task coordination. Take a few minutes to read through the list in the table. Try to imagine a situation that requires each of the KSAs. For example, conflict may be desirable when it concerns the best way to accomplish an agreed-on goal in an atmosphere of trust (for example, "How can we keep our competition from selling to our clients?"). For more on the benefits of conflict, see Amason (1996), Amason, Thompson, Hochwarter, and Harrison (1995), or Nemeth (1992). Conflict is usually not desirable when it is personal or reflects deep differences in values (for example, "I'm going to get you, you stupid #$%*!").

A sample item from the teamwork test is as follows:

> Suppose that you find yourself in an argument with several co-workers about who should do a very disagreeable, but routine task. Which of the following would likely be the most effective way to resolve this situation?
>
> 1. Have your supervisor decide, because this would avoid any personal bias.
> 2. Arrange for a rotating schedule so everyone shares the chore.
> 3. Let the workers who show up earliest choose on a first-come, first-served basis.
> 4. Randomly assign a person to do the task and don't change it. (Stevens & Campion, 1999, pp. 225–226; the keyed answer for this question is 2)

Researchers have tried using the test to select members for teams. Although there is some support for the idea that the test helps identify better team members, a surprising finding is that scores on the team KSA test were very highly correlated with scores on cognitive ability tests. In other words, the teamwork test pretty much amounts to testing how smart somebody is. Also note that the team KSA test does not assess agreeableness or other personality traits that might be desirable in team members. Research indicates that teamwork KSAs, several personality traits, and social skills contribute uniquely to performance in team environment (Morgeson, Reider, & Campion, 2005), suggesting that teamwork KSAs are only one important part of success in team environments.

We have included the team KSA test here because it is also a rich source of descriptors that may be useful in describing the work of teams, especially some of the interpersonal aspects. The descriptors appear especially useful for self-managed work teams. Many of the descriptors are things that might fall under leadership or management in traditional hierarchical organizations. For example, conflict resolution is something likely to be required of any work group manager.

TEAM FUNCTIONS

As you just saw, teams are likely to require certain kinds of knowledge and skill of their members, regardless of the specific work of the team. Another approach to analyzing the work of teams that is not tied to the specific task

content is to analyze team functions that are thought to be generic or universally required. A set of such functions was identified by Nieva, Fleishman, and Reick (1978; see also Fleishman & Zaccaro, 1992). There are five general functions, each of which is divided into two or more specific functions.

1. *Orientation* functions allow team members to know what they are doing, that is, what the team's goal is and what resources they have to achieve the goal. During orientation, the team must also exchange information about environmental features and assess what tasks need to be completed in what order.
2. *Resource distribution* functions allow the team to place people into tasks so that people have work and there is some matching of individual talent to the task requirements.
3. *Timing* functions deal with the patterning of activity within the team. Timing is concerned with the general pace of activities, both for the team and for the individuals.
4. *Coordination* concerns the requirements for patterning of team members' actions.
5. *Motivational* functions deal with team members' level of effort as well as managing conflict among the members. Norms for performance must be developed and adopted. Team rewards need to be established.

Researchers have developed a set of scales so that judges can rate different teams and their functions (Shiflett, Eisner, Price, & Schemmer, 1982). The scales have been used to show differences in requirement profiles for different military teams. The team functions taxonomy has not been widely applied to teams in companies, however. Again, we have provided the list as a rich source of descriptors for analyzing the work of teams. In our view, the team function approach leads to a fairly complete picture of what a team needs to do. It is left for other approaches to describe how the team accomplishes the required functions.

THE MULTIPHASE ANALYSIS OF PERFORMANCE SYSTEM

The multiphase analysis of performance (MAP) system was developed to analyze team tasks primarily for team training (Levine & Baker, 1990; Levine, Brannick, Coovert, & Llobet, 1988). The idea is to start with the team's mission or goal, and then move to the functions that people must fulfill to achieve the goal, and then to the tasks that individuals must fulfill to carry out the functions. Once the tasks are identified, several different types of analyses can be carried out to determine the content of training. The term *MAP* was also chosen in part because of a geographical analogy. One starts with a big picture to locate the general position of the team, and then fills in finer detail as needed to get to where one wants to be in terms of training. The exercise is something

like planning a trip from Tampa to a specific street in Detroit. You would start with a country map, move to state maps, and conclude the trip with a city map.

Building Blocks for Team Job Analysis

The MAP system is based on four of the building blocks that you have come to know and love over the course of this book, namely, the descriptors, sources of information, the methods of collecting data, and the units of analysis (we now recognize planning for using the information after the job analysis is important, but that is not part of the original MAP system beyond a final report). Comprehensive lists of each of the building blocks were given in Chapter 1 (see Table 1.3; add "team" to "job" and "worker" as appropriate). Levine and Baker (1990) organized the building blocks for the MAP system in a series of feasible sets that depend on the kind of training to be done. For example, if we are training a team on an entirely new piece of equipment, team members are not feasible sources of information for job analysis data because there are no team members working on the job until after the training. On the other hand, equipment designers or other experts could be used.

The organizing principle used by Levine and Baker to generate the feasible sets was composed of three factors. The first factor was whether the training was intended to be applied to individuals or the team as a whole. For example, even though pilots may fly together as a crew, the pilot training may or may not involve other crew members; some tasks require other members but some do not. The second factor was whether the training was intended primarily for interpersonal relations or primarily for production of products or services, that is, the technical aspects of the job. The third factor was whether the team was mature or immature. By immature teams we do not mean adolescent or giggly; rather, we mean teams that do not have prior experience with the task. Together the three factors create a grid of eight cells for training. For each cell, a subset of building blocks is recommended.

Using Levine and Baker's (1990) example of simulated training for jet fighter pilots, Table 5.8 presents a grid of recommended building blocks for each cell. (The numbers in the cells are taken from Table 1.3 in Chapter 1. Each number refers to a particular building block.) Cell 1, for example, is for providing individual training on interpersonal aspects of teamwork for mature (experienced) team members. Cell 1 lists the feasible descriptors, sources of information, methods of data collection, and units of analysis. Some useful descriptors (D) include physical and psychological demands on team members. Useful sources of information (S) include team members and team trainers. Useful methods of data collection (C) include interviews and questionnaires, and units of data analysis (A) include job dimensions such as leadership behaviors and team member attribute requirements such as assertiveness.

Table 5.8 MAP Building Blocks

	Individual Training	
	From Mature Team	*From Immature Team*
	Cell 1	Cell 2
Interpersonal	D: 5,9, 12, 13, 14 S: 4, 6 C: 2, 4 A: 4, 5, 6, 7	D: 5, 9, 12, 13 S: 2, 5, 6 C: 2, 3 A: 4, 5, 6, 7
	Cell 3	Cell 4
Production	D: 5, 7, 8, 12, 13 S: 4 C: 2, 4 A: 1, 2, 6, 7	D: 1, 5, 7, 8, 12, 13 S: 2, 5, 6 C: 2, 3, 7 A: 1, 2, 6, 7
	Team Training	
	From Mature Team	*From Immature Team*
	Cell 5	Cell 6
Interpersonal	D: 3, 5, 9, 12, 13, 14 S: 2, 4, 5, 6 C: 2, 3 A: 4, 5, 6, 7	D: 3, 5, 9, 12, 13 S: 2, 3, 5, 6, 9 C: 2, 3 A: 4, 5, 6, 7
	Cell 7	Cell 8
Production	D: 3, 5, 7, 8, 12, 13, 14 S: 2, 3, 4, 6, 9 C: 2, 4 A: 4, 5, 6, 7	D: 1, 3, 5, 7, 8, 12, 13 S: 2, 3, 5, 6, 9 C: 2, 3 A: 4, 5, 6, 7

SOURCE: Adapted from Levine, E. L., & Baker, C. V. (1990). *Team task analysis: A test of the multiphase analysis of performance (MAP) system.* Contract No DAAL03–86-D-001. Orlando, FL: Naval Training Systems Center. Adapted by permission of the author.

NOTE: D refers to descriptors; S refers to sources of information, C refers to methods of data collection; A refers to units of analysis. Numbers are keyed to Table 1.3.

As we mentioned earlier, the analysis begins with the team's mission and proceeds through increasingly fine-grained phases until the information needed for training is complete. Levine and Baker (1990) illustrated the use of the MAP system by analyzing a laboratory team task in which two people work together

to "fly" a microcomputer simulation of a jet fighter. The task was set up so that one of the two people works the joystick and the other works the keyboard. The joystick controls the direction of the jet. The keyboard controls the speed of the jet and the weapons used to fire on an enemy fighter. The task is structured so that neither crew member can complete the task alone; they must work together to achieve their goal, which is to shoot down an enemy fighter.

Levine and Baker (1990) began by considering the type of training that would be most desirable. Because they were dealing with a laboratory task, teams had no prior experience with it, and so the immature teams were chosen (cells 2, 4, 6, and 8) as the most relevant. Then production training was chosen as the most relevant (cells 4 and 8) for the demonstration.

Descriptors

The descriptors that they chose correspond to the numbers 1, 3, 5, 7, and 12 (see Table 1.3 for an explanation of these numbers). To conserve space, we will mention only those items most directly connected to teams. The second item in the list (item 3) was responsibilities and mission of the team and team members. The first goal of the analysis was to determine the main goal or mission of the team. In this case, the mission was to shoot down an enemy jet. After the mission is established, the functions of the team members should be discovered and described in a general fashion as they contribute to reaching the team mission. In our example, one member steers the jet in position to lock on target and holds it there. Then the other member fires the weapons, and so forth.

The fourth item (item 7) was machines, tools, work aids, and equipment. This will be a major item in equipment-intensive tasks such as the current one. The analysis should focus on the computer, joystick, keyboard, maps, headphones, and other machines and tools that are part of the job. In a typical job analysis (not for teams), all the mechanical devices refer to the target job. In job analysis for teams, however, there needs to be some indication of the relations between the mechanical items and each of the team members. In our case, only one member uses the joystick, but both use headphones.

The fifth and final descriptor they chose was team and team member tasks and activities (item 12). Levine and Baker (1990) developed a list of tasks and activities for each team member by gathering a panel of subject matter experts (SMEs), who were directed to develop a task inventory (see Chapter 2). In the development of the inventory, the SMEs were reminded of the overall mission and the functions that are relevant to the accomplishment of the mission. Then each function was broken into a series of tasks by individual position. For example, for the joystick position, the aiming function was broken into search, approach, and maintain (lock) steps. The first two steps involve interpreting information displayed by radar, but the third involves interpreting information displayed through and on the cockpit window.

Flowcharts and Time Charts

Team members are connected to one another by the work. Teamwork always involves coordination of task performance through sequence (for example, imagine a bucket brigade in which each person passes a bucket of water to the next until the last person douses a fire), simultaneity (for example, in an orchestra, different musicians must play different notes at the same time), or both. Sequence may involve physical things as in auto assembly, or it may involve the passage of information as in air traffic control, where one controller "hands off" an aircraft to another controller. Simultaneity can involve physical effort such as when multiple people have to pull together to remove a tank tread. It can also involve sending information through multiple channels such as two different types of radio, one for signaling an emergency and one for transmitting speech. A flowchart can diagram the teamwork necessary to accomplish a task.

An example of a flowchart is shown in Figure 5.3 (Levine & Baker, 1990). In this flowchart, actions (task performance) are shown in rectangles and decisions are shown in diamonds. The sequence of activities is shown by arrows. Thus, one of the main descriptors associated with flowcharts is the relations among actions. That is, the flowchart tells us whether one action precedes another. Flowcharts also allow us to illustrate loops or repetitive sequences of actions. For example, if we fire at the enemy and miss, then we try again.

Time charts can also be useful for understanding a work process. An example of such a chart is shown in Figure 5.4. Typically, three people are needed to operate a tank. One person drives the tank to put it in proper position for action (see the top line in Figure 5.4). A second person decides on a target and what type of ammunition to use (the line second from the top). A third person aims and fires the main gun (the third line in Figure 5.4). A couple of points are worth noting in this example. First, each arrow represents one activity. Time is represented as a line passing from left to right. Therefore, sequences of activities are shown as sets of arrows pointing from left to right. The three different arrow heights indicate how the task is typically done by the three crew members. Such a representation is much like a musical score used by the conductor of an orchestra. It shows all that is done, and how the parts relate to one another through time. Such charts are helpful in understanding how the work is done and in thinking about how to change the work to make it more effective or efficient.

In a musical score, there is little discretion in terms of timing—all the notes are shown in temporal relations to one another. However, in representations such as Figure 5.4, some of the relations are fixed, but others can be changed. For example, one has to decide on the type of ammunition and load it before firing, so the relations among these tasks are rigid. On the other hand, one can aim the tank before, during, or after maneuvering it, so the relations among maneuvering and aiming are flexible. It is possible to mark graphs such as Figure 5.4 in such a way to show which relations are rigid and which are flexible.

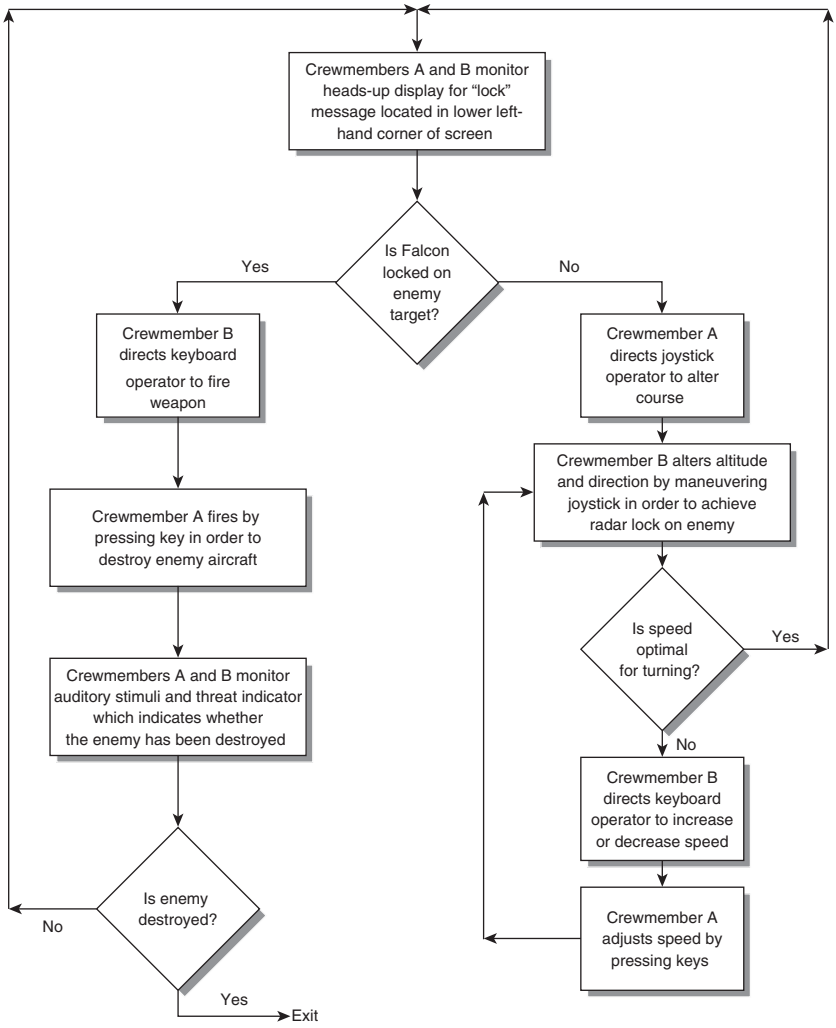

Figure 5.3 Flow Diagram for Shooting Down Enemy Aircraft

SOURCE: Adapted from Levine, E. L., & Baker, C. V. (1990). *Team task analysis: A test of the multiphase analysis of performance (MAP) system.* Contract No DAAL03–86-D-001. Orlando, FL: Naval Training Systems Center. Adapted by permission of the author.

Flowcharts and time charts are valuable not only for team training. They can be used for the design of team tasks (Dieterly, 1988) and for inferring ability requirements (Mallamad, Levine, & Fleishman, 1980) that might be used for selection as well.

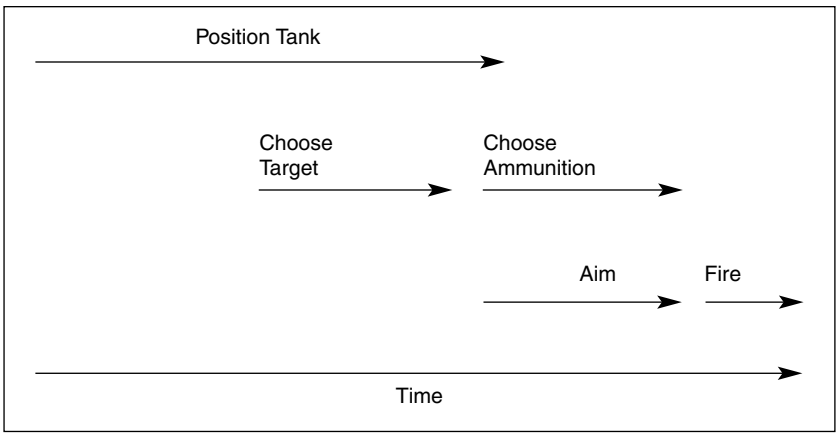

Figure 5.4 Time Flow Diagram for the Process of Firing a Tank's Main Gun

Sources and Methods of Data Collection

Before we began describing the beauty and wonder of flowcharts and diagrams, we were describing the Levine and Baker (1990) study that analyzed a simulated air combat mission. Let us resume thinking about that study, and specifically, about the sources of information and methods of data collection they used. The feasible sources of information included officers/supervisors, high-ranking officials, experts, trainers, and written documents. The people actually used in the study to provide information were experts and trainers. The feasible methods of data collection included observation, interviews, technical conferences, review of relevant documents, and doing the work (if feasible). They watched experts perform the job, interviewed experts, and called a technical conference to develop a task inventory.

Ratings (Units of Analysis)

Levine and Baker (1990) recommended that the task generation meeting should have a goal of 12 to 15 team functions and at least 50 individual position tasks. The position tasks should be listed hierarchically under the functions. After the tasks have been generated and organized, another meeting of SMEs is called to generate the KSAOs needed to complete each task successfully (note that these steps are very similar to C-JAM, described in Chapter 4). After the list of tasks and KSAOs are completed and revised as necessary, they can be rated by SMEs to provide information used in specifying the training content.

Each task should be rated for both difficulty to learn and criticality. The ratings can be analyzed later to provide a composite index of importance for

training. The KSAOs should be rated on two factors. The first factor is whether the attribute is essential in new team members. The second factor is whether the given KSAO distinguishes the superior from the average team member.

Data Analysis

Once the ratings are completed for each task and KSAO (difficulty to learn, criticality, KSAOs essential to new workers, and distinguishes average from superior), summary statistics can be computed for each task and KSAO. The summary statistics can then be presented to those responsible for developing the actual training. We would expect tasks that are rated higher on criticality and difficulty to learn, and KSAOs rated higher on distinguishing average from superior performance to be good candidates for training. Typically, there is a fair amount of judgment in the final decisions about what to train. These decisions also depend on other factors such as the amount of time and money available for the training program.

Storing and Retrieving Information

At the end of the job analysis, a report will be written that documents the process and outcomes (for example, task inventory and ratings) of the analysis. Job experts will be invited to review the report for accuracy and completeness. Any necessary revisions will be made at this time. Although Levine and Baker (1990) did not consider this issue beyond filing a final report, we know now that it is an important concern. Much of the work on job analysis is very applied, and so, even though it is very useful, it is not easy to publish and so it is hard to retrieve. Putting such a report on the World Wide Web would make it much more accessible (for example, see O*NET; the address is listed in Chapter 4). Also, data can be organized into a database that might allow retrieval of information about the individual positions or the team as a whole.

Chapter Summary

THE MPDQ

The Management Position Description Questionnaire was designed to analyze managerial and executive jobs for multiple purposes, including job evaluation, job description, performance appraisal, and job design. The MPDQ was developed and refined over several years to be useful in a wide variety of jobs. The items of the MPDQ are largely behavioral in nature, although there is a section on managerial KSAOs as well. The instrument is completed by the job incumbent. The rating scales for the MPDQ are not precise and require the responses of several incumbents to describe a job reliably at the item level.

The MPDQ features a useful array of software that allows the results to be tailored to the user's purposes.

COMPETENCY MODELS

Competency modeling focuses on describing a set of (most frequently) managerial attributes that are specifically linked to an organization's business strategy and goals. It has been well received in the business community, but there are a number of potential shortcomings associated with its use. Combining elements of a competency modeling approach with more rigorous job analysis procedures is likely to result in a more useful and valid competency model.

TEAMS

We provided snapshots of four different approaches to understanding the work of teams. The first approach was job design for teams. Researchers reviewed the literature to identify aspects of teams that might be controlled and that contribute to team effectiveness. The factors were organized into five main clusters. The first of the clusters was labeled job design, and included factors comparable to those in the job characteristics for motivation literature such as task variety and task significance. The second set of factors (labeled interdependence) are those that distinguish teams from groups, namely, task interdependence, goal interdependence, and feedback and reward interdependence. The third set of factors was labeled composition, and included such characteristics as heterogeneity or diversity and relative size. The fourth set of factors was labeled context, and included such factors as training and managerial support. The fifth and final set of factors was labeled process, and included such factors as potency, the belief of a team about its own capacity to accomplish its mission, and social support.

We next described the team KSA approach. In this approach, the work of teams is thought to depend on two classes of generic skills. One class of skills concerns interpersonal relations. Team members need to know how to resolve conflicts, collaborate on work-related problems, and communicate effectively. The other class of skills concerns . . . both planning and organizing one's own work and managing the connected or cooperative part of the work.

The third approach involved examining functions that teams fulfill to achieve their goals. For the orientation functions, team members need to exchange information about the team's goal and about the members' resources and constraints. The resource distribution functions take care of assigning tasks to the members so that there is some balance of the work across members and members are assigned work that is appropriate for their skills. Timing

functions help the team set a good pace for the work. Response coordination functions are used to achieve proper patterning of task performance. Motivational functions help to establish norms of behavior in the team and to reinforce individual contributions toward the team's goal.

The fourth and final approach that we described was the MAP system. The idea in the MAP system is to start with the team's mission and proceed through increasingly detailed phases to develop team training of various sorts. The system provides an organizing principle based on the type of team and the type of training desired that resulted in a feasible set of building blocks for each analysis. We then reviewed a trial of the MAP system using a two-person microcomputer flight simulator. The illustration showed specific descriptors, methods of collecting data, sources of data, and units of analysis. Of particular interest were flowcharts and time charts, which may be particularly useful for understanding the work of teams.

The last issue we considered was storing and retrieving information about job and team analysis. Use of the World Wide Web or other computer networks offers a solution to the problem of accessibility.