

The 16PF® & Leadership: Summary of Research Findings 1954-1992

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Executive Summary

This report describes the development and validation of the 16PF Leadership Potential Index. The index is a weighted combination of 16PF traits and was first developed in 1954 with military leaders. It has since been applied to managers and executives in the private sector.

The population cross-validity correlation coefficient for Leadership Potential was .63 (N = 2413 cases) based a variety of criteria such as: membership in successful groups of managers and executives, leadership style, and ratings of potential by peers. Using 16PF primary traits with multiple regression the average validity coefficient was .54 based on those criteria (N = 560).

The average validity coefficients for group membership, performance, and other criteria were .75, .55, and .46, respectively. The results from 15 samples reviewed throughout this article show substantial validity for the Leadership Potential Index. When taking into account characteristics of creative personalities, suggested from contemporary leadership theories, plus an occasional situationally specific finding, the validity of 16PF traits exceeded generalized validity values for personality traits measured by other inventories as reported by Barrick and Mount (1991). Furthermore, it is projected that the use of the 16PF can deliver a 28-37% increase in the relative efficiency of selection on the basis of the Leadership Potential Index, compared to baseline rates of success.

There were two frequent deviations from the Leadership Profile, where successful managers scored high on Imagination (M+) and Openness to Experience (Q1+). Both M+ and Q1+ are characteristics of the creative personality and the visionary or transformational leadership style. It is recommended that those two scores be used in addition to the Leadership Potential Index if a more creative managerial type is desired. A careful job analysis and situation-specific validity studies are recommended, and attention should be paid to the type of leadership style that would be most effective in a particular situation.

The report begins with a summary of procedures typically used for conducting personnel selection validity studies. It concludes with a theoretical integration of what has been learned about personality and leadership over the past forty years.

Introduction

This report examines the characteristics of successful leaders and managers and integrates those findings into contemporary leadership theory. Of specific concern is the criterion-related validity of the 16PF Leadership Potential and its contributing primary (or first-order) factors for the identification of successful leaders and business managers. This report is organized into eight parts:

1. An overview of how to compose a selection system for managers beginning with job analysis and ending with the development of an appropriate test battery;
2. A brief discussion of the 16PF and its relationship to the Big Five personality trait theory, and how those variables are related to management;
3. A discussion of transformational and transactional leadership, the role of creative functioning in those capacities, and the development of the 16PF Leadership Potential Index and Creativity Composite;
4. An examination of 16PF scores for leaders and business executives from a series of validity studies, where the criteria were observed performance and membership in effective executive groups;

5. An examination of the 16PF scores for business managers and students who would be identified as successful leaders according to other self-report inventories based on leadership style, task and people orientation, motivation, human relations knowledge, and self-reports of past leadership success;
6. Studies of peer leadership in athletic and sensitivity training situation and the relationship of 16PF scores to ratings of the likelihood of future success in corporate leadership, entrepreneurship, election to political offices, and social services;
7. An examination of 16PF scores for British managers;
8. Summary estimates of population validity coefficients for Leadership Potential and for the 16PF overall with the various criteria.

1. How to Compose a Selection System for Managers

In this section of the report we describe the essentials of personnel selection with the goal of developing a selection test battery. Entire books have been written on this subject, and it is necessary, therefore, to limit the discussion to the most fundamental ideas.

Before continuing further, however, it is worthwhile to reference two short documents concerning standards for personnel selection systems: the *Uniform Guideline* (Miner & Miner, 1980), and *Principles for the Validation and Use of Personnel Selection Procedures* (Society for Industrial and Organizational Psychologists [SIOP], 1987). The *Uniform Guidelines* refer to standards for personnel selection as required by Equal Employment Opportunity law.

There are four basic steps to composing a selection battery: (1) job analysis, (2) performance criteria, (3) identification of plausible predictors of success and empirical validation analysis, and (4) assessment of utility. Utility analysis is the expected increase in proficiency of the people selected from the new selection system.

1.1 Job analysis

Job analysis is the most fundamental activity for selecting managers. The objective is to determine what is required to perform a job and, in many cases, to compare requirements among jobs. The most common method of job analysis is a combination of interviews and questionnaires in which the incumbents describe their jobs. Although there are many approaches one might take to job analysis, there are three basic categories: (1) functional job analysis, (2) task-based analysis, and (3) factorial analysis. Each type of job analysis has its assets and limitations; there is no single most preferred method.

Functional job analysis.

Functional job analysis is the type of job analysis used in the *Dictionary of Occupational Titles*, published by the United States Department of Labor. For each job the goal is to prepare a descriptive paragraph detailing what behaviors are necessary to perform the job. Each verbal description is accompanied by numerical ratings on specially constructed scales.

The verbal statements themselves should address the following: the goals of the job in terms of what the worker must accomplish, the tools or other resources needed to accomplish those objectives, the performance standards associated with those objectives, and the training requirements for all of the above. A full description of the functional job analysis scales used in the *Dictionary of Occupational Title* is found in Fine (1989).

Task-based method.

Task-based job analysis begins with a large group of identifiable managerial tasks. The first step would be to compile a nearly exhaustive list of managerial tasks from available work records. Next, the tasks would be made into items on a rating form. Then, for each task, incumbent managers would rate the task for importance, frequency, and possibly its difficulty or time

requirement. Finally, the ratings would be factor analyzed and used to develop performance criteria (Harvey, 1991).

Factorial approach.

The factorial approach to job analysis is typified by the Position Analysis Questionnaire (PAQ; McCormick, Jeanneret, & Meacham, 1972), which is a standardized set of approximately 200 questions about a person's job. PAQ questions are designed to describe the job from the viewpoint of the actions of the incumbent workers, rather than from the viewpoint of the work itself. Results are interpreted using a complex factor structure that was developed for a wide range of jobs. The PAQ was initially developed to provide a taxonomy of Federal jobs, however, it has since been widely adopted by industry. The standard PAQ does not apply to professional level jobs, although an Executive PAQ has become available in recent years.

Management jobs.

Before leaving the topic of job analysis, it is important to call attention to some aspects of managerial work setting from those found in another. The Executive Position Description Questionnaire (EPDQ; Hemphill, 1959), that could distinguish one job from another, or distinguish management jobs found in one is a job analysis survey, similar in principle to the PAQ. In the EPDQ, every management job is thought to contain some amount of each of ten factors, although the amount of some of the factors is trivial for some jobs. The ten aspects of management performance are:

1. Provision of staff service. These activities would entail services performed by managers for the organization as a whole, or for operations (line) personnel.
2. Exercise of broad power and authority, such as opening and closing new manufacturing plants, visiting operations for annual reviews, negotiating with unions, and making long-term financial arrangements.
3. Preservation of assets, such as purchasing insurance policies, making investments, assessing legal risks, and loss prevention.
4. Technical aspects of markets and products, such as research and development, product quality, product design, and marketing.
5. Personal demands, such as extensive travel or unusual conformity pressures.
6. Human, community, and social affairs concerning public relations and the selection of new managers into the organization.
7. Supervision of subordinates' work.
8. International business control, such as cost reduction, maintenance of inventories, preparation of budgets, and enforcement of regulations.
9. Long-range planning, which would include the definition of the company's goals, evaluating business projects, and assessing the impact of new legislation on the activities of the company.
10. Business reputation, including product design, customer service responsibilities, and certain forms of public relations as they pertain to markets and products.

1.2 Performance Criteria

Having determined what a job requires, the second step for the human resource manager is to establish standards of performance, along with a measurement system that captures those standards. Interested readers should consult Carroll & Schneier (1982), Landy and Farr (1980, 1983), and Landy, Zedeck, and Cleveland (1983) for elaborations on the following and many other aspects of performance appraisal. There are two broad categories of criteria: those that involve "objective" work outcomes and those that involve more "subjective" rating methods. Each has its own assets and limitations.

Objective measures.

Examples of "objective" or "hard" criteria would include number of items produced, sold, or scrapped for the manager's work unit; dollar volume of good produced by the manager's work unit; number of social service clients served; cost-efficiency of operations; safety and absence rates for those manager's work unit; or the attainment of specific goals. The major assets of these types of criteria are that they are observable directly and would appear to involve little interpretation or guesswork. The limitation of so-called objective criteria is that many such outcomes are partially the result of environmental and economic influences, or the result of the work of a team, rather than of a single individual. Thus, a certain amount of the outcome lies beyond the control of the individual being assessed.

Subjective measures.

Ratings of work behavior, in principle, are more flexible for isolating a person's contribution to work outcomes. The subjectivity in these criteria lends itself to possible inaccuracies in evaluation. Such inaccuracies may be inherent in the rating scheme itself or a result of errors in judgment on the part of raters using the systems.

Two cautionary notes should be made regarding performance criteria for managers. First, although earlier success in a training program might be meaningful to the organization's training staff, it does not by itself meet the standards in the *Uniform Guidelines* for job-relatedness (Miner & Miner, 1980). According to the *Guidelines*, criteria should represent the job into which the applicant is hired. Success in future jobs in a possible career sequence is not a fair criterion, nor is success in a training program that transpires prior to the actual job. Long-term career success and behaviors in training situations are, nonetheless, very relevant topics of study.

The second cautionary note is that statements of job performance in rating scales should describe *behaviors*, not attributes, personality traits, or other personal characteristics. For instance, modern leadership theory (discussed later in this report) extols the virtues of creativity in management, and it might be tempting to make a rating scale measuring managers' creativity. Creativity, however, is not a behavior, but is instead a cognitive ability or a configuration of personality traits. A better rating scale would focus on behaviors such as "offers original ideas at planning meetings," or "exercises resourcefulness at solving difficult problems." A critical incidents analysis could produce examples of good and poor work that have already been known to occur.

A behavioral criterion focuses on the presence or absence of a behavior, not the level of a trait. Abilities and traits can often be inferred from behavior, but the focus on the rating should be on the behavior. Furthermore, ability can only be inferred from work behaviors that offer real opportunities for creative input from the incumbent.

How many criteria?

Personnel psychology recognizes no upper limit to the number of criteria that could be used in a validity study or performance appraisal system. A small number of measures is simpler to use for administrative purposes, and would greatly simplify a test validation study. Larger numbers of more detailed scales, however, are preferable for employee counseling purposes where specific feedback to the employee is desired to help improve performance.

Ultimately, one should use as many criteria as it takes to describe the relevant behaviors of the job. Factor analysis of a large number of scales should make obvious the more pervasive themes underlying performance. Cognitive psychologists have known for years that human information processing capabilities are generally limited in the number of categories, channels, or dimensions of information that can be cogently handled. The limitation is known as "the magical number 7 plus or minus 2" (Miller, 1956). In the case of management, we have identified five general aspects of performance that should at least be considered in the development of any criteria for managerial work.

Our list was derived from several chapters on management or leadership performance in Clark and Clark (1990). From those chapters we extracted 26 ideas or statements that reflected aspects of performance; some of the ideas

overlapped each other. Next, a panel of advanced students in organizational development was asked to sort the 26 statements into categories using as many or as few categories as they thought were necessary to reflect the content of the set of statements. We then condensed these five broad categories on the basis of their conceptual similarity:

1. **Ability to motivate:** the extent to which the incumbent motivated and developed subordinates and built a cohesive work team.
2. **Problem solving and resourcefulness:** the extent to which the incumbent demonstrated competency in solving difficult problems and generating new ideas and strategies.
3. **Communication:** the extent to which the incumbent kept coworkers and upper management properly informed about important matters, and the quality and clarity of those communications.
4. **Commitment to the organization:** the extent to which the incumbent is committed to organizational goals and policies as demonstrated by actions. Note that lack of commitment should not be confused with thoughtful, reasonable, or professional disagreement or differences of opinion.
5. **Planning and control:** how effective the incumbent is at maintaining control over his or her responsibilities and making workable plans to carry out objectives.

How many raters?

Where possible, at least two raters should be used to evaluate a person's performance. Two or more raters would have different opportunities to observe a particular worker and often have different evaluations of the same behaviors. King, Hunter, and Schmidt (1980) reported that the average inter-rater reliability obtained from many studies in which at least two raters observed workers on several scales was .60. This rather low reliability coefficient is not necessarily a result of a flaw in the set of rating scales, but largely a result of differences in situations in which performance is observed.

The information that senior management sees, and may indeed be impressed with, may not reflect the impact that a manager has on his or her workforce. The latest approach for assessing the total impact of manager's performance is the 360° feedback model, whereby the manager is rated by superiors, peers, and subordinates. This performance evaluation technique acknowledges that there are at least three distinct points of view on the manager's behavior.

1.3 Test Validity

Having conducted a job analysis and established the performance criteria, the next steps in the process are to identify some plausible predictors of success and to test whether those predictors are indeed related to success. A discussion of variables known to affect managerial performance appears in a subsequent section of this report. The remainder of this section is devoted to the assessment of validity for a possible selection battery.

It should be noted that validity is not a characteristic inherent in the test itself. Rather, validity lies in the use of a test for a particular purpose. Indeed, as more research is conducted and more is learned, the concept of validity evolves (SIOP, 1987). There are three types of test validity: content, construct, and criterion-relatedness. These types are described below as they apply to personnel selection objectives.

Content validity.

Content validity is the extent to which the test items represent actual work behaviors. One might ask whether the test poses problems or situations as to the examinee that are similar to those that the examinee would face on the job.

Construct validity.

There are two basic definitions of construct validity: The first is the extent to which the test measures what it is supposed to measure. This form of validity is determined by previous research wherein the test was found to correlate

with other measures of the same construct, or perhaps with relevant behaviors.

The second definition of construct validity is closely tied to the first: Does the test measure a psychological construct or theoretical principle that is logically related to the job activities in question? Once again, well-researched tests should have a history of correlation with key job behaviors.

Criterion-related validity.

Criterion-related validity studies are those in which the test scores have been compared against measures of job performance. Conclusions about the suitability of a test are based on research with job incumbents or applicants who were hired in the course of the research project. There are two basic types of research design employed in criterion-related validity studies: predictive and concurrent. The former is ideal. The latter is more common.

Predictive designs establish whether a causal relationship exists between a construct measured at one point in time and behavior at a future date. In predictive studies, all applicants would be tested and hired. The new employees' performance would be measured after a period of time on the job; performance measures would be compared to test scores using correlation coefficients. Unfortunately, predictive studies are difficult and time consuming.

In concurrent designs, incumbent employees are tested and measured on performance at the time of testing, and a correlation between test scores and performance is established. There are two basic problems with concurrent designs. First, training effects need to be taken into consideration. If incumbents are unequally trained, which is often the case, it is necessary to isolate the effect of training from the effect of the test construct.

A second threat to a concurrent validity study is restriction of range. In the classic situations, all or most of the poor performers are not hired in the first place, quit their jobs, or are fired before the study of incumbents takes place. Thus, low scores on the criterion are not represented in the sample. This type of restriction of range results in a lower correlation between the predictor and criterion. It also results in overpredicting the performance of new applicants who would be selected using the test (Olson & Becker, 1983).

Validity generalization.

Validity generalizations or meta-analyses are techniques for determining a population's correlation coefficient between a predictor and a criterion from many different samples. Later in this report we use a rudimentary validity generalization procedure for establishing the generalized validity of 16PF variables, particularly the Leadership Composite, with a variety of performance measures. We will also compare it with a historically older viewpoint, namely, that a test should be validated for each situation where it is used. The *Uniform Guidelines* and selection experts (SIOP, 1987) continue to recommend that validity studies be conducted whenever feasible. Only in cases of unfeasibility due to excessively small sample size or other problems should one rely on generalized validity coefficients to replace an actual study. Moreover, both the *Uniform Guidelines* and SIOP encourage organizations to pool their samples to create a large enough sample to establish validity for a given type of job. Furthermore, if two jobs are similar, as determined by critical features of a job analysis, those incumbents can be pooled into one study.

1.4. Utility

Utility is the translation of a validity coefficient into an estimate of economic impact for the organization. While current thinking on utility estimation is beyond the scope of this report, we provide a brief synopsis of fundamental utility ideas. According to Taylor and Russell (1939), utility can be thought of as *relative efficiency* expressed in percentages of successful people on the job.

Relative efficiency is a function of three parameters; base rate of success, selection ratio, and the validity coefficient. The base rate is the percentage of job applicants who would be successful on the job if the selection device were not used. The selection ratio is the ratio of the number of job openings to the number of applicants. For a given level of validity, the test will have greater

utility if selection ratios are small and base rates of success are low. For a recent review of utility analysis see Boudreau (1991).

2. Personality Variables in Context

It should be recognized that personality traits are not the only relevant predictors of managers' performance. Other predictors would include cognitive abilities, work experience, education, and motivation. Personality measures should not be used by themselves, but used in combination with other predictors for selection purposes. Personality measures are also suited for human relations training and development, career planning, or team development situations.

Another important point is that jobs differ in complexity. In the most complex jobs, the difference in performance between the best and average worker is greater than a similar comparison made for simple jobs. For instance, a factory worker performing repetitive tasks and functioning at the 85th percentile will be, on the average, 25% better than a worker performing at the 50th percentile. For most managers, however, the gap between the 85th percentile employee and the 50th percentile is 48% (Hunter, Schmidt, & Judiesch, 1990). For the more complex jobs, a valid selection system will deliver more utility to the employer than what would be obtained for simple jobs.

2.1. Structure of Personality Traits

R.B. Cattell was one of the pioneers in the development of a theoretically driven taxonomy of personality traits for normal range (i.e., non-clinical) people. Following from the work of Gordon Allport, he found that the English language contained approximately 18,000 trait words that could describe a person. After a long program of research and analysis he found that the 18,000 words could be organized into 16 personality factors. These 16 factors became the basis of the 16PF (Cattell, Eber, & Tatsuoka, 1970).

Not surprisingly, other researchers followed Cattell's ideas and developed their own multi-trait tests with varying numbers of factors. By the early 1960's, there were several instruments available. Norman (1963) found that these traits could be further aggregated into five general factors: Extraversion, Agreeableness, Conscientiousness, Emotional Stability, and Culture. Cattell et al. (1970), who focused on the 16PF traits only, found that they could also be aggregated into five second-order factors, which were very similar to Norman's five factors respectively: Extraversion, Tough Poise, Behavior Control, Anxiety, and Independence. Although Independence is less similar to Culture, the other four are similar to the Norman scales.

More recently, McCrae and Costa (1985) repeated Norman's analyses with the new generation of personality tests, once again including the 16PF. They found almost the same trait structure, with Openness to Experience replacing Culture. Openness to Experience is similar to Cattell et al.'s (1970) Independence second-order factor. McCrae and Costa's taxonomy has since become known as the Big Five personality traits. Other researchers have been successful in replicating the Big Five using various analytic strategies (Goldberg, 1990; Peabody & Goldberg, 1989).

2.2 Generalized Validity of Big Five Variables

Perhaps due to the successful replication of the Big Five traits, it has now become fashionable to reinterpret all personality traits in terms of their location in the Big Five taxonomy. For instance, Barrick and Mount (1991) examined the average validity coefficients of a wide range of personality measures grouped into the Big Five Taxonomy. Then they examined various measures of performance for several broad categories of jobs (professionals, police, managers, sales, and skilled and semi-skilled trades).

Table 1 is a summary for results of managers from Barrick and Mount's study. The table shows the 16PF variable name, the Big Five variable name, the number of correlations with performance contributing to the averages, the observed average correlation, the estimated population coefficient, and the 90% confidence value (CV). The estimated population coefficient is the

result of correcting the observed values for unreliability of the criterion and restriction of range. The 90% CV is a lower bound for the population correlation coefficient (ρ); if the 90% CV is .00 or less, then there is no significant relationship between that class of variables and work performance.

Table 1
Generalized Validity of Big Five Traits with Managerial Performance

16PF Trait (Secondary)	Big Five Trait	N of Cases	N of Correlations	Average Correlation	Pop ρ	90% CV
Extraversion	Extraversion	11,335	59	.11	.18	.01
Anxiety	Emotional Stability	10,324	55	.05	.08	-.04
Tough Poise	Agreeableness	8,597	47	.05	.10	.06
Behavior Control	Conscientious	10,058	52	.09	.23	.23
Independence	Openness	7,611	37	.05	.08	-.12
$R^2 = \sum r^2$.025	.095	
$R = \sqrt{\sum r^2}$.141	.309	

Note: CV= Confidence Value; ^aSource: Barrick & Mount (1991).

The table entries from Barrick and Mount (1991) were based on each of the Big Five traits separately. No composite analyses were offered. Composites of personality variables would invariably produce a larger overall validity coefficient. If we assume, however, that the Big Five are uncorrelated in the population, as its theorists contend (Goldberg, 1990), then the multiple regression coefficient, R , is equal to the square root of the sum of the five squared bivariate correlations. In actuality, however, two of the five variables were not correlated with performance in the population (Emotional Stability and Openness to Experience). Therefore, we used only three variables in the calculations of R . The average value of observed R obtained in this fashion was .141. The estimated population value of R was .309. These values serve as useful benchmark values against which to compare results for validity studies with the 16PF.

One possible limitation of the Big Five trait group as a theoretical basis for a personality assessment is that it might not deliver the predictive specificity that could be obtained with the 16 trait taxonomy. Mershon and Gorsuch (1988) showed that prediction of criteria was twice as great when a personality trait taxonomy of eight or more variables was used as opposed to a taxonomy of five or fewer. The following review of studies of managerial behaviors and the 16PF will focus primarily on the 16 primary traits and weighted composites thereof.

3. Characteristics of Creative Leaders and Executives

There is a growing recognition among leadership researchers that theories of leadership popular among industrial managers have suffered from some serious inadequacies. According to Bennis (1988), an unconscious conspiracy has been taking place that explains why leaders cannot lead effectively. Leaders, in his opinion, should be visionary in the sense that they can visualize where the organization should be headed, they do not accept the status quo, they take action to implement their ideas, and most importantly, they can impart their vision to others. The conspiracy comes into play when a would-be leader with vision becomes bogged down with tasks that are merely managerial minutiae which take time away from the ultimate objective of formulating an organization's direction. The hapless leader, additionally, finds him/herself surrounded by people who wish to maintain the status quo, resist changes in direction, and seek to satisfy vested interests at the possible expense of the organizational whole.

In light of these circumstances, leadership theorists with a more empirical orientation have developed the concepts of *transformational leadership* and *visionary leadership*. Transformational leadership was first conceptualized by Bass (1985) as the opposite of *transactional leadership*. The transformational

leader is capable of convincing others of new viewpoints and engaging them in pursuit of new goals. The leader must also share the vision with the constituents, and give them opportunities to participate in the vision (Bennis, 1988). The transactional leader, by contrast, is the managerial functionary who, consistent with academic leadership theories of the past, succeeds in mobilizing a work force to accomplish tasks that have already been laid out and in resolving any interpersonal difficulties among work group members that might arise.

The Visionary Leader

The visionary leader, according to Sashkin (1984; Sashkin & Burke, 1990), is essentially the transformational leader or creative leader in Bass' and Bennis' writings. He or she is characterized by ten traits: (1) focused leadership, (2) communication leadership, (3) trust leadership, (4) respectful leadership, (5) risk leadership, (6) bottom-line leadership, (7) empowered leadership, (8) long-term leadership, (9) organizational leadership, and (10) cultural leadership. These ten characteristics are organized into three themes: (a) visionary leadership potential, (b) visionary leadership behavior, and (c) organizational culture leadership. The last is the degree to which the leader takes control over the culture and imparts the values and direction that he or she envisions for the organization.

3.1. 16PF Leadership Profile

The Leadership Potential Index for the 16PF is a composite of first-order traits that were first identified in an experimental leadership situation. Eight hundred military personnel were divided into small leaderless groups. The leaders who emerged from these groups displayed several common characteristics: greater capability for abstract thought (B+), greater conscientiousness or tendency toward conformity (G+), practicality (M-), conservatism (Q1-), and greater self-confidence (O-) and dominance (E+; Cattell & Stice, 1954; IPAT, 1987). High scores on the composite describe people who are socially skilled and self-confident, have good organizational skills, and are attentive to job details and follow-through. The composite was cross-validated against ratings of managerial effectiveness by Siemens, Havlicek, and Mueller (1966). Furthermore, Clark and Clark (1990) noted that dominance and conscientiousness, as measured by various personality tests (similar in meaning to 16PF E and G scales) were commonly found predictors of managerial success.

In a later expansion of the military study, Cattell and Stice (1960) were able to distinguish three different leadership profiles. One hundred groups of ten military men were assembled to perform some group military problem-solving tasks. Leaders were elected from each group. Later, all leaders were rated for their effectiveness, and it was thus possible to obtain a profile for the 43 leaders who were given the better effectiveness ratings. Other members of the groups were rated for their ability to help the group solve problems.

Elected Leaders

Elected leaders, 92 of whom stayed elected throughout the procedure, displayed several characteristics (at least 0.5 SD above or below the population mean): warmth (A+), intelligence (B+), cheerfulness (F+), conscientiousness (G+), socially bold (H+), trusting (L-), self-assured (O-), conservative (Q1-), group-dependent (Q2-), self-disciplined (Q3+) and relaxed rather than tense (Q4-). *Effective leaders*, on the other hand, were less sociable (A-), self-sufficient (Q2+) and emotionally stable (C+). They shared five other characteristics with the elected leaders (B+, F+, G+, H+, Q3+, Q4-).

Technical leaders

Technical Leaders took on leadership roles only intermittently as the situations appeared to have warranted. They shared some characteristics with the other leaders and displayed a few unique traits. Technical leaders were consistent with both groups on the basis of B+, G+, H+, Q3+, Q4-. They were similar to elected leaders only on the basis of O- and F+. They were also consistent with effective leaders on the basis of C+. Their unique characteristics, compared to the other two groups, were relatively high dominance (E+) and imagination (M+).

3.2. Creative Persons

Cattell et al. (1970) reported the results of several occupational profile analyses of creative professionals such as writers and artists. In another research strategy, professional people who were considered more creative in their profession were compared to others in the same profession. A pattern emerged which is captured in the 16PF Creativity Index. Persons who score high on creativity are similar to leaders on the basis of three traits (B+, E+, and H+), but are opposite of leaders on four others (A-, M+, G-, Q2+). In addition, they show greater sensitivity (I+) and open-mindedness (Q1+) and less pretentiousness (N-) than the general population.

4. Personality Profiles for Leaders and Executives

4.1. Effective Military Leaders

Cattell et al. (1970) presented 16PF mean scores for the 43 effective military leaders discussed above. The mean scores for variables that contribute to the leadership profile are presented in Table 2. It was hypothesized that these leaders would show significant differences on those leadership traits compared to the general population. Therefore, one-sample z tests were calculated, comparing each mean to the population value of $M = 5.5$ and $SD = 2.0$. Values of z were then converted to omega-squared (ω^2), then estimates of the correlation (r); see technical appendix.

Results of the z tests showed that the mean score for Factor A was in the opposite direction hypothesized for Leadership Potential, but in the correct direction for creative management. Significant differences were obtained for B+, C+, G+, H+, Q2+, Q3+, and Q4+. The remaining means were not significantly different from population values.

The 16PF means were entered into the Leadership Potential equation (Cattell et al., 1970), which produces values calibrated in sten scores.

The Leadership Potential mean for effective military leaders was 7.7, which transformed to $r = .74$. Point-biserial r for occupational group membership will generally be greater when the profile of means for the target occupational group (e.g., managers) is significantly different from the population means of 5.5.

This sample-population comparison is not the same type of comparison as the extreme groups research design. The type of extreme groups comparison that is often criticized is the type where a high leadership group such as Fortune 100 corporation presidents are compared to a group that was known to be exceptionally low in leadership potential. Reapplication of the Leadership Potential Index to newer and more varied managerial samples was done whenever possible throughout this report. One-sample tests on those group means would provide evidence of the cross-validity of the original equation.

4.2. Business Executives, Sample A

Cattell et al. (1970) also presented mean 16PF scores for a sample of 178 business executives. Here it should be recognized that there was no indication of the quality of their work, nor their specialty within management. Nonetheless, it was possible to estimate a validity coefficient for the Leadership Composite. Since sample standard deviations were available, one-sample t tests were used.

Five significant differences were actually observed ($p < .01$): A+, B+, H+, N+ and Q1+. The last was contrary to the Leadership Profile, but in the correct direction for a creative leadership group. The estimated validity for Leadership Potential was .328 (Table 2).

Table 2
Sample-population Comparisons of Leadership Traits
for Effective Military Leaders and Business Executives

16PF Trait	Effective Military Leaders (N = 43)				Business Executives, Sample A (N = 178)			
	Mean	z	w ²	r	Mean	z	w ²	r
A	4.7	-2.62	.120	-.35	7.8	12.27**	.457	.68
B	7.8	7.54**	.565	.75	7.5	16.68**	.609	.78
C	6.2	2.30*	.090	.30	5.7	1.27	.003	.06
E	5.9	1.31	.017	.13	5.8	1.54	.008	.09
F	5.5	0.00	.000	.00	5.3	-1.27	.003	-.06
G	6.1	1.97*	.063	.25	5.5	0.00	.000	.00
H	7.0	4.92**	.350	.59	6.6	7.72**	.248	.50
I	5.0	-1.64	.037	.19	5.6	0.67	.000	.00
L	5.0	-1.64	.037	.19	5.4	-0.67	.000	.00
M	5.1	-1.31	.017	.13	5.7	1.27	.003	.06
N	5.9	1.31	.017	.13	6.2	4.67**	.105	.32
O	5.0	-1.64	.037	.19	5.5	0.00	.000	.00
Q1	5.6	0.33	.000	.00	6.4	6.32**	.180	.42
Q2	6.2	2.30*	.090	.30	5.5	0.00	.000	.00
Q3	6.5	3.28**	.185	.43	5.8	1.74	.011	.11
Q4	3.8	-5.57**	.412	.64	5.3	-1.33	.004	.07
LP	7.7	7.18**	.54	.74	6.2	4.74**	.107	.33

Note: LP = Leadership Potential *p < .05, **p < .01.

4.3. Business Executives, Sample B

In what was essentially a replication study of the Leadership Profile for business executives, 43 executives of a financial institution completed the 16PF (IPAT, 1980). Means for 16PF scales were compared against population values. This time, significant differences between the sample and population were noted for nine variables: A+, B+, E+, F+, G+, I-, N-, O-, Q1+. Those means and standard deviations are listed in Table 3, along with values for the one-sample *t* and its conversion to *w*² and *r*. The *r* for the Leadership Potential with group membership was .59. Q1 was, once again, an observed deviation from the profile and related to the creative personality.

Table 3
Sample-population Comparisons of Leadership Traits
for Financial Executives (IPAT, 1980)

16PF Trait	Mean	T	w ²	r
A	6.74	3.95**	.254	.50
B	7.14	7.74**	.578	.76
C	5.93	1.95	.002	.14
E	7.63	7.63**	.571	.76
F	7.02	5.24**	.381	.62
G	6.98	4.80**	.339	.58
H	7.02	5.39**	.395	.63
I	4.74	-2.51*	.110	.33
L	5.40	-0.33	.000	.00
M	5.79	1.04	.002	.05
N	4.49	-3.54**	.212	-.46
O	4.35	-4.83**	.342	-.59
Q1	6.88	4.83**	.340	.58
Q2	5.14	-1.35	.019	-.14
Q3	5.81	1.35	.019	.14
Q4	5.30	-0.64	.000	.00
LP	7.00	4.91**	.349	.59

Note: LP = Leadership Potential *p < .05, **p < .01.

4.4 Potentially Visionary Executives, Sample C

The following is a case study of a group profile for 13 executives from a Midwestern firm. All that is known about them is that they were in fact executives from one firm, their average age was 45, and they were all tested at the same time in early 1989. This group was particularly interesting because its members showed characteristics of both leaders and creative persons. Thus, in spite of the contradictions that have been thought to exist between the two categories of people, it is possible to envision a personality prototype that captures the desirable attributes of both.

The group's personality scores were compared against general population norms using one-sample *z* tests (population *M* = 5.5, *SD* = 2.0). Significant differences were noted for both Leadership Potential and Creativity, dominance (E+), self-sufficiency (Q2+), abstract thought (B+), self-discipline (Q3+), self-assuredness (O-), and the second-order factors Independence and Behavior Control. The five first-order factors just mentioned were consistent with results for effective leaders. B+ and E+ contribute to creative personality as well (Table 4). One gets the distinct impression that this group lives effectively in both worlds: imaginative when required to be so, but ultimately practical in their courses of action.

The one-sample *z* tests in Table 4 for Leadership and Creativity Composites test the following hypotheses: If the profile developed by Cattell and Stice (1954) and subsequent researchers accurately depicts leadership, then a random sample of executives should display above average leadership potential. If there is truth to the contemporary theories that successful leadership should display creativity, and if creativity is captured by the 16PF scale, then the sample of executives should also display above average creative potential. Indeed both hypotheses were upheld; estimated point-biserial correlations for both Leadership and Creativity with group membership were .60.

Table 4
Distinguishing Characteristics of an Executive Group
Expressed as Validity Coefficients (N = 13)

16PF Variable	Mean	Z	w ²	r
Leadership	7.1	2.88**	.359	.60
Self-sufficiency (Q2)	7.0	2.70**	.326	.57
Abstract Thinking (B)	8.0	4.51**	.598	.77
Dominance (E)	8.0	4.51**	.598	.77
Insecurity (O)	4.0	-2.70**	.326	-.57
Creativity	7.1	2.88**	.359	.60
Independence	7.4	3.43**	.452	.67
Self-discipline (Q3)	7.0	2.70**	.326	.57
Adjustment	7.0	2.70**	.326	.57
Behavior Control	6.6	1.98*	.183	.43

5. Other Self-report Leadership Indices

In the previous section of this report, validity of the Leadership Potential Index was established by comparing 16PF profiles of managers to the population means. In this section, we discuss how people who score higher on different measures of leadership would also score comparably well on the 16PF Leadership Potential Index.

5.1. Response to Power

The Human Resource Development Report for the 16PF presents three leadership styles in addition to the previously discussed Leadership Potential Index. These styles are Assertive, Facilitative, and Permissive; they were first conceptualized by Sweney (1970) and assessed by the Response to Power Measure. The Assertive Style is characterized by the use of persuasion to accomplish objectives. A later study of 185 managers (Sweney & Fiechtner, 1974; Sweney, 1977) showed that the Assertive Style can be characterized by seven 16PF variables: dominance (E+), cheerfulness (F+),

conscientiousness (G+), suspiciousness (L+), experimentativeness (Q1+), lack of tension (Q4-) and pragmatism (M-; $R^2 = .18, p < .01$). The assertiveness composite has since been correlated .44 with Leadership Potential (IPAT, 1987). The Facilitative Style is characterized by the use of example and involvement to attain objectives (Sweney, 1970). The Facilitative Style can be described by six 16PF variables: conservatism (Q1-), cheerfulness (F+), trust (L-), imagination (M+), prudence (H-), and lack of tension (Q4-; $R^2 = .26, p < .01$; Sweney, 1977). High scores on the Facilitative Style composite would typify the team builder. Ironically, scores on Facilitative Style were correlated only .17 with the composite for Leadership Potential (IPAT, 1987). This lack of association appears to indicate that overall leadership potential and the propensity to use the Facilitative Style are the result of relatively independent aspects of personality.

The Permissive Style emphasizes the maintenance of harmony and the avoidance of conflict (Sweney, 1970). Persons exhibiting Permissive Style would be characterized by the 16PF as cool (A-), sensitive (I+), practical (M-), and insecure (O+), ($R^2 = .18, p < .01$; Sweney, 1977). Permissive Style was negatively correlated ($r = -.61$) with Leadership Potential (IPAT, 1987). According to Sweney (1970), a leader may use any of the three styles interchangeably, although any one particular style may predominate for an individual.

5.2. ORI, How Supervise, Power Motivation

The following study explored the relationships between 16PF traits and three other measures of leadership or managerial potential: TAT Picture Story Exercise, the Orientation Inventory, and the How Supervise. These measures are more susceptible to training and environmental modification than basic personality traits.

TAT Picture Story Exercise.

According to motive acquisition theory, which underlies the TAT Picture Story Exercise, the only form of social motivation is generalized arousal. Arousal can take the form of motives for achievement (nAch), affiliation (nAff) and power (nPow). The three motives are learned, are environmentally shaped, and can be enhanced through training (McClelland, 1961, 1975). The Picture Story Exercise measures these motives in the form of a TAT-like projective, whereby the examinee views a picture, then writes a story about the people and events depicted.

Briefly, nAch is the motive to meet or surpass a standard of excellence (self-imposed or otherwise), accomplish something unique, or commit oneself to work for long periods of time in pursuit of some goal. nAff is the motive to establish or maintain a warm, friendly or loving relationship, or to partake in convivial activities with others. nPow is the need to convince others of a point of view, control resources that affect other people, create an emotional impact on others, or develop one's own reputation.

Motive acquisition theory makes several predictions regarding leadership or managerial behavior. nAch is the key predictor of educational, technical, and economic attainment (McClelland, 1961). For managers of non-technical work groups, success is predicted by a combination of high nPow and low nAff (McClelland, 1975; McClelland & Boyatsis, 1982). The configurations of high nPow and low nAff is known as the Leadership Motive Profile. Entrepreneurs would display both the Leadership Motive Profile and high nAch.

Orientation Inventory (ORI).

The ORI consists of three scales: task orientation, relationship orientation, and self orientation (Bass, 1977). Task orientation is virtually synonymous with "structure" (Fleishman & Harris, 1962) or "concern for production" (Blake & Mouton, 1964) in other two-factor leadership characteristic theories. Relationship orientation is akin to "consideration" or "concern for people." According to Blake and Mouton, concern for both the task and people is characteristics of the "team builder."

If a manager is low on both task and relationship orientation, he/she is by default high on self orientation. Persons high in self orientation could be expected to accomplish organizational goals to the extent that these goals were consistent with personal career objectives. As another point of comparison, task oriented managers are relatively tolerant of deviant

opinions expressed by group members, while self-oriented managers are relatively intolerant of deviant opinions. Relationship oriented persons are more likely than others to succumb to group conformity pressures (Bass, 1977).

How Supervise.

How Supervise is a test of human relations knowledge that has often been used to select first-line supervisors and middle managers (File & Remmers, 1971). Topics covered by How Supervise include supervision practices, company policy implementation, and opinions about supervision. The test has been found to correlate with ratings of supervisory performance, and it has been used as a dependent measure of progress in training programs.

Subjects and procedure.

Subjects were 164 undergraduates of whom 78 were male and 86 were female.¹ The subjects were either students in an advanced course in organizational development ($N = 20$), an upper division course in industrial psychology ($N = 66$), or a course in introductory psychology ($N = 78$).

Analyses and results.

The hypotheses tested were whether people classified as having strong leadership potential on the basis of ORI, How Supervise, or TAT would also be categorized as leaders using the 16PF Leadership Potential Index. A sample-population comparison strategy, similar to the one used above with executive group membership, was used to assess the connection between Leadership Potential and the other leadership measures.

First, 53 subjects who scored above the population median on both relationship and task orientation were identified. The mean score on Leadership Potential for those 53 cases was significantly above the population average (see Table 5). They also scored significantly higher than the population on Assertive Style and dominance, and significantly lower than the population on Facilitative and Permissive Styles. The value of t obtained for the Leadership Potential scale converted to a correlation of .49.

Second, 21 subjects who scored above the population median on How Supervise were identified. The mean score Leadership Potential for those 21 people was also significantly above the population average. They also scored significantly higher than the population average on Assertive Style, dominance, and Extraversion, and less than the population average on Permissive Style. The value of t obtained for Leadership Potential converted to a correlation of .78.

Third, 31 subjects who fit the TAT Leadership Motive Profile, based on university norms ($N = 403$) were identified. A case fit the profile if nPow was above the median value, and the standard score for nPow was greater than the standard score for nAff. The mean score on the 16PF Leadership Potential scale for those 31 people was once again significantly above the population average. They also scored higher than average on Assertive Style, dominance and Extraversion, and lower than average on Facilitative Style. The value of t obtained for the sample-population comparison converted to a correlation of .45.

5.3. Self-report of Leadership Behavior

The students who participated in the previously described study also completed a biographical questionnaire. The questionnaire contained two items of interest to this leadership investigation: (1) In the past three years, have you ever organized a team, club, action or interest group? (2) Have you ever been the recognized leader of a group in the past five years? Students who answered Yes to both questions were identified ($N = 75$) and their 16PF scores compared against population values.

Students who reported both types of leadership behavior scored significantly higher than the population average on Leadership Potential ($t = 4.16$, $N =$

¹ Authors wish to thank their research assistants for their roles in test administration and scoring: Peter G. Boghossian, Christine Hansen, Laura J. Hamilton, and Tanja Senical.

75, $p < .01$), Assertive Style ($t = 8.55$, $N = 69$, $p < .01$) and dominance ($t = 6.44$, $N = 69$, $p < .01$). They scored significantly lower than average on Facilitative ($t = -4.48$, $p < .01$) and Permissive Styles ($t = -2.98$, $p < .01$). The value of t for Leadership Potential converted to a correlation of .42.

6. Peer Leadership and Peer Ratings

Leadership skill is obviously important for the managers and executives who have authority over others. According to Cartwright and Zander (1960), one of Cattell's major contributions to leadership theory was the discovery that leadership is not solely an attribute of the person who is the designated leader of a group, even though it is generally true that the person who rises to the leadership role has greater leadership potential than those who do not. Rather, leadership characteristics are widely distributed among group members and are expressed by the specific roles that each member assumes in the course of a group task. According to Hall (1983), the presence of leadership characteristics among team members is essential for positive team functioning; he referred to this phenomenon as "peer leadership."

Two studies of leadership potential among group members are discussed next. In the first example, sports team members who performed better were those who also had good leadership skills. The second example is very different but related in principle. Members of T-groups who studied team building as well as sensitivity issues rated each other on potential success in each of four avenues of leadership expression.

Table 5
Sample Population Comparisons of 16PF Scales for Leadership Sample

16PF Scale	Orientation Inventory (N=47) ^a			How Supervise (N=21)			TAT Managerial Profile (N=29) ^b		
	Mean	SD	t	Mean	SD	t	Mean	SD	t
Leadership Potential	6.4	1.6	4.23*	7.2	1.3	5.88	6.2	1.4	2.97*
Assertive Styles	7.2	1.4	8.15*	7.9	1.5	7.02*	7.2	1.7	5.65*
Facilitative Styles	4.8	1.5	-2.86	4.9	1.4	-2.01	4.6	1.4	-3.30*
Permissive Styles	4.6	2.1	-2.89*	3.5	1.8	-5.19*	5.0	1.9	-1.52
Dominance (E)	7.0	1.7	5.92*	7.6	1.5	6.13*	7.0	1.7	4.49*
Extraversion	6.1	2.1	1.97	7.6	1.9	5.06*	6.7	1.8	3.67*

Note: Criteria: ORI Self Score; <25; How Supervise; >48; Managerial Profile: nPow > 6 and standardized nPow score greater than the standardized nAff. ^aN for leadership = 53.

^bN for leadership = 31. * $p < .01$.

6.1. Sports team performance

Garland and Barry (1990) investigated the role of personality variables in the performance of members of a college football team. The team concept in work organizations is often likened to sports teams in discussions of team effects by managers. Of course, the sports team analogy is limited since the competition aspects of sports is often absent from most working groups, where the winner-loser phenomenon is something to be actively avoided. On the other hand, the work of some management teams reflects a direct competition with other organizations. In many situations, however, cooperative efforts and coalitions among organizations are possible in more ways than they are in sports situations.

Participants were a total of 272 football players, of which 101 were classified as regulars (best performing group), 94 as substitutes (middle performance group), and 77 as survivors. Stepwise multiple regression of primary and secondary 16PF variables identified four significant predictors of

performance: Extraversion, emotional stability (C+), toughmindedness (I-), and group dependence (Q2-). The overall multiple *R* was .54.

Table 6 shows means and standard deviations for the best performing players on the four variables related to their performance. Table 6 also includes *t* tests for sample population comparisons and estimates of *r* using the w^2 procedure. Extraversion consists of four primary traits: warmth (A+), cheerfulness and optimism (F+), social boldness (H+), and group dependence (Q2-). Two of the Extraversion traits (F+ and H+) are part of the Leadership Potential Index. A+ appears only intermittently on profiles of leaders and managers, and may be specifically relevant to good teamwork along with Q2-. C+ and I- are part of the Leadership Potential Index. Other leadership traits either did not make a unique contribution or were not relevant to performance as a football player.

Table 6
Sample-Population Comparisons of 16PF Scores for Best-performing Football Players

Variable	Mean	SD	<i>t</i>	<i>r</i>
Extraversion	6.60	1.23	8.99 *	0.66
Emotional Stability	5.58	1.45	0.21	0.00
Tough-mindedness	3.84	1.30	12.83*	0.49
Group Dependence	4.23	1.69	7.55*	0.60

Note: Source was Garland and Barry (1990).

**p* < .01

6.2. Peer Ratings of Leadership Potential

The following study investigated the role of 16PF traits for explaining peer ratings of leadership potential in a variety of leadership circumstances. Participants were 63 graduate and undergraduate students enrolled in an experiential learning seminar course in organizational development. Most of the participants were employed; their jobs included personnel management, educational counseling or administration, small business operations, and non-profit organization management.

The course format covered a fairly wide range of topics in organizational change and was itself structured like a T-group. During the early weeks of the seminar, the participants completed the 16PF and the TAT Picture Story Exercise to measure motivation. Throughout the course they had an opportunity to observe themselves and others in a variety of encounter sessions. On the last day they were asked to rate each other on leadership potential.

The rating instructions read as follows: "Lists of your classmates appear below. In your opinion how likely is it that each person will, in the next ten years: (1) hold a top level management position, (2) operate a small business, (3) hold an elected public office, (4) hold a major office in a non-profit or social service organization? Please rate each person, including yourself, using a 1 to 5 scale as follows: 1 = 0-20% likelihood, 2 = 21-39%, 3 = 40-59%, 4 = 60-79%, 5 = 80-100%."

Analyses for 16PF and leadership.

The four criteria measures were the average classmate rating each person received. The analyses for 16PF and leadership were organized in two stages. First, stepwise multiple regression analysis was performed on each criterion with the four leadership composite variables (Leadership Potential, Assertive Style, Facilitative Style, Permissive Style) as independent variables. At the second stage, stepwise multiple regression was performed with the 16PF primary traits as independent variables.

Results from the first stage of analysis showed that one leadership composite was sufficient to describe three of the four criteria. The original Leadership Potential Index was best correlated with holding a top level management position in a large corporation (*p* < .05). Permissive Style was negatively correlated with owning one's own business (*p* < .001), and a career in elected politics (*p* < .001). None of the composites was associated with success in a non-profit organization.

Results for the multiple regression analysis with primary traits showed significant relationships between leadership or creativity variables with peer ratings. Ratings of potential in a large organization were associated with group dependence (Q2-) and dominance (E+), as was success in politics. Business ownership was associated with boldness (H+) and self-confidence (O-). Imagination (M+) was the only variable associated with ratings of potential success in social service or non-profit organizations. These results are summarized in Table. The analysis for 16PF secondary (or Big Five) traits showed that the one predictor of success in a large organization or politics was Extraversion. Independence and Extraversion were correlated with small business ownership and with the sum of the four ratings. Lack of Behavior Control was the variable primarily associated with success in social service work; a strong nonconformity theme is suggested here.

Analysis and results for motivation.

Analyses and results were again organized in two stages. First, motivation variables were tested as possible predictors of peer ratings using stepwise regression. There were 55 cases for analyses involving motivation variables. Achievement motivation was the only unique predictor of success in large organizations ($r = .41, p < .01$) or small business ownership ($r = .34, p < .01$). None of the motivation variables was significantly correlated with ratings for social services and non-profit organizations. The sum of ratings were predicted from two motivation variables, achievement and affiliation ($R = .49, F(2,52) = 8.25, p < .001$). The latter was negative suggested by McClelland and Boyatzis (1982).

Next the 16PF primary variables were correlated with motivation variables, with personality traits as the predictor variables. The one unique variable associated with achievement was N-; achievement-motivated people were more forthright than shrewd ($r = -.41, p < .01$). None of the traits correlated with affiliation motivation. Concrete thought (B-) was the one trait correlated with the need for power ($r = .27, p < .05$). Personalized power was associated with warmth (A+) and concrete thought (B-; $R = .43, F(2,53) = 5.94, p < .01$).

Table 7
Results of Multiple Regression for 16PF Traits with Peer Ratings of Leadership Potential

16 PF Trait	Multiple Correlation	F Value
	<u>Top Level of Large Organization</u>	
Q2-(Group dependence)	.36	
E+ (Dominance)	.45	7.82**
Extraversion	.27	4.95*
	<u>Small Business Ownership</u>	
H+ (Boldness)	.39	
O- (Self-assuredness)	.46	7.98***
Independence	.40	
Extraversion	.47	8.57***
	<u>Elected Politics</u>	
Q2- (Group dependence)	.41	
E+ (Dominance)	.54	12.07***
Extraversion	.45	15.74***
	<u>Non-profit or Social Service</u>	
M+ (Imagination)	.40	11.82**
Behavior Control	.26	4.41*
	<u>Sum of Four Ratings</u>	
O- (Self-assuredness)	.39	
E+ (Dominance)	.49	
Q2- (Group dependence)	.55	8.66***
Extraversion	.39	
Independence	.45	7.87***

* $p < .05$ ** $p < .01$ *** $p < .001$.

7. British and Australian Studies

The 16PF has been used successfully for selecting managers in organizations located outside U.S.A. Handyside (1988) reported two such validity studies for management samples from the U.K. In the first, neither leadership nor creativity variables were closely related to the criterion. In the second, traits usually associated with leadership and creativity were most closely related to performance. In a very recent paper, Bartram (1992) prepared profiles of mean 16PF scores for nearly 1800 British managers. The last study pertains to engineering management and originated in Australia. (Dowling & DeCieri, 1992).

7.1 Automobile Plant Managers

The first sample consisted of 27 automobile manufacturing plant directors who completed the 16PF. The dependent measure was a rating of effectiveness given to each of them by their peers. There was one significant variable, which was the secondary trait Tough Poise ($r = .53$). The value of r obtained for the comparison of the sample to the population on this variable was .74.

7.2 Depot Managers

In the second study, the subjects were 13 depot managers of a soft drink company. There were three significant bivariate correlations between traits and a composite of 16 performance appraisal scales: A+, E+, and I+. A unit-weighted composite of those three variables was highly correlated with the

criterion ($r = .78$). Jack-knife analysis (also known as the leave-out-one technique) was used to determine the extent to which the validity coefficient would fluctuate due to sampling error. The lower bound of r was .75.

7.3 Large Sample of Managers

Bartram's (1992) sample of 1796 managers was composed of short-listed applicants who were being tested prior to a job offer. They differed from the general British population on virtually every 16PF scale; the most extreme sten scores were obtained for boldness (H+) and self-assurance (O-). All means for the British managers were deflected in the same direction as the means for the U.S. Leadership Profile, with two exceptions: M+ and Q1+. The mean score on the Leadership Potential for this sample was 8.25. This sample-population difference would correspond to a point-biserial $r = .81$, using the w^2 method.

A few gender differences were noted and accounted for more than 2% of the scale scores' raw score variance. Females showed a tendency toward greater sensitivity (16.2%), less self-confidence (3.6%), greater tension and drive (3.5%), and less dominance (1.9%).

7.4 Engineering Management

Dowling and DeCieri (1992) studied 16PF profiles for 470 Australian engineers who were employed in eight different job categories. They reported that the eight engineer profiles were not significantly different from each other except for two variables, Q2 and I. They did not mention, however, whether any cumulative effects emerged when the groups were compared on composite variables such as Leadership Potential, or when the groups were aggregated. We made those comparisons as follows.

Because production management and management services involved more supervision of work than the other job types, profiles for engineers in production management ($N = 36$) and management services ($N = 61$) were aggregated and compared against the average profile for the remaining six job categories ($N = 373$). The mean Leadership Potential score for the high supervision groups (6.5) was significantly greater ($p < .01$) than the mean Leadership Potential score for the remaining job types (5.8), and converted to a correlation of .44 using the omega squared method.

The group of 470 engineers was additionally distinguished by their high scores on the 16PF Creativity Index (mean = 7.1). Particularly noteworthy were the means for the high supervision groups on Factors M (6.7) and Q1 (7.1). The latter two means converted to correlations of .52 and .61, respectively, for the contrast between group membership and the general population.

8. Summary

In this final section of the report, we summarize the findings of the individual studies reported above in the form of average validity coefficients with the criteria that have been studied. These average values are fairly stable estimates of population validity coefficients for Leadership Potential. The population estimate, in turn, is used to estimate the utility of a selection procedure based on the 16PF, and to compare the utility of the 16PF with that of other personality tests that have been used with managers in the past.

8.1. Generalized Validity

The results of all the studies presented above are summarized in Table 8. Validity coefficients are arranged in two columns. One column of the table lists validity coefficients for the Leadership Potential composite variable only. In Samples 1-4, 6-9, 12, and 14-15, the table entry is the point-biserial correlation for the sample-population contrast. The listings for Samples 10-13 are ordinary correlations. In Sample 11, Permissive Style was the largest non-significant correlate of success in a non-profit or service organization, and its coefficient is included in Table 8.

Table 8
Summary of Validity for the 16PF Leadership Potential and Primary
Traits Across 15 Samples and Various Criteria

	Sample	Criterion	Leadership Potential	Multiple Correlation
USA Samples				
(1)	43 Effective Military	Ratings with GM	.74	
(2)	178 Business Execs	Group Membership	.33	
(3)	43 Finance Execs	Group Membership	.59	
(4)	13 Executives	Group Membership	.60	
(5)	185 Mangers	Leadership style		.43
(6)	53 Students	Task & relationship orientation	.49	
(7)	21 Students	How Supervise	.78	
(8)	31 Students	Leader Motivation	.45	
(9)	75 Students	Leadership involvement	.42	
(10)	272 Football players	Performance		.54
(11)	63 T-group	Peer, top corporate	.27	.45
	63 T-group	Peer, own business	.44	.46
	63 T-group	Peer, politics	.43	.54
	63 T-group	Peer, social service	.24	.40
British and Australian Samples				
(12)	27 Auto mfg managers	Peer, performance		.53
	27 Auto mfg managers	Group Membership		.74
(13)	13 Depot managers	Performance		.75
(14)	1796 Managers	Group Membership		.81
(15)	97 Engineering mgrs.	Group Membership		.44
Weighted Average, USA Samples (1-11)			.324	.531
Standard Error			.027	.089
95% Confidence Value			.271	.358
Weighted Average, All Samples (1-15)			.629	.539
Standard Error			.045	.060
95% Confidence Value (lower bound)			.541	.422

The average correlation, weighted by sample size between the Leadership Potential Composite and the various criteria was .32 in the U.S. samples. The weighted average correlation was .63 for U.S.A., British, and Australian samples combined. The difference between the two correlations is related to the types of studies available for inclusion in this review rather than to national differences. Indeed, the Leadership Potential Index, which was developed on leaders in the U.S.A., transported very well to the other English-speaking nations' samples.

The last column of Table 8 lists multiple regression coefficients. Those values allow for any of the 16PF traits to emerge as potential predictors of success. Most of the variables that were found to be significantly related to the management criteria were from the Leadership Potential Index. The most common deviations from the Leadership Potential profile were usually in favor of traits that were part of the creativity profile, notable M+ and Q1. Sample 12 was an exception, however, in the sense that Tough Poise was the best and only predictor of performance. Because Tough Poise is a composite of

primary traits, the obtained bivariate r was entered in the table as a situationally specific multiple regression coefficient, even though the weights were obtained from the population instead of from the sample. The weighted average coefficient of multiple regression was .53 for the U.S.A. samples and .54 for all samples combined.

Taken collectively, the results from the 15 samples show substantial validity for the Leadership Potential Index. When characteristics of creative personalities, plus an occasional situationally specific finding, were taken into account, the validity of the 16PF for predicting management or leadership criteria was substantially greater. In both viewpoints, the generalized validity of 16PF traits exceeded generalized validity values for other personality traits measured by other inventories as reported by Barrick and Mount (1991).

Several types of criteria were encountered in this review: occupational group membership, correlation with scales or classifications from other inventories, and performance measured by a rating of some sort. Group membership criteria were the most common. In much of Cattell et al.'s work (1970), the criterion of occupational success was membership and survival in that occupation. While performance on organization work assignments was not irrelevant, it was not the ultimate criterion either. The occupation membership criterion was an outgrowth from Cattell's clinical profile development, where the criterion was membership in a diagnostic category; the diagnosis would have been made independently of the 16PF.

The results in Table 8 are reorganized by type of criterion in Table 9. If both a correlation coefficient for Leadership Potential and a multiple regression coefficient were available for a sample, the larger of the two values was used in the table. The coefficient for Sample 1 was included in two criterion summaries because it was based on both a group membership criterion and a measure of performance. For Sample 11, the average of four performance ratings was used in Table 9. Results showed that the average validity coefficient for 16PF variables with group membership was .75, and average values for performance and other criteria were .55 and .46, respectively.

Table 9
Summary of Validity for the 16PF Traits by Type of Criterion

Criterion	Samples	Total N	Population Correlation
Group Membership	1 2 3 4 12 14 15	2197	.75
Performance	1 10 11 12 13	418	.55
Other Measures	5 6 7 8 9	365	.46

Note: Samples are defined in Table 8.

The validity coefficients in Tables 8 and 9 were not corrected for restriction of range or criterion unreliability. Restriction of range is not thought to be a problem since some of the studies involved sample versus population comparisons. Sample-population contrasts give maximal estimates of validity for the composite with group membership. Furthermore, the size of the point-biserial correlation for group membership will be larger for groups that have more extreme personality characteristics than for less extreme groups.

Criterion unreliability was thought to have only a small influence because most criteria were defined as group membership. Most of the self-report indices that were used as criteria were treated as group membership variables; unreliability would influence only the categorization of those subjects whose scores fell close to the cut-off point or points for group membership. By not making corrections for artifacts, it was possible to provide estimates of validity that more closely resembled results a researcher might expect from a situationally specific validity study.

8.2. Utility

The utility of a selection procedure using the 16PF Leadership Potential Index can now be evaluated. According to Hogan (1990), a recent study showed that, on the average, 54% of managers in the U.S.A. today are rated as incompetent. The base rate of success for manager is 56%, which we will round up to 60% for simplified use of the utility expectancy tables (Guion, 1965). The selection ratio is assumed to be small enough such that the organization can pick people from the top 20% of Leadership Potential scores (sten scores of 7.2 or above). The resulting selection efficiency from a multiple R of .54 (third to last row of Table 8) is an 88% chance of success, which is a 28% improvement over the base rate. The resulting selection efficiency from a validity coefficient of .63 is a 92% chance of success, which is a 32% increase over the base rate.

For higher level management jobs where the base rate of success is lower (e.g., 30%), the multiple R of .54 would produce a relative efficiency of 60%, which is a 30% improvement over the base rate. Similarly, a validity coefficient of .63 would produce a relative efficiency of 67%, which is a 37% improvement over the base rate.

The utility estimates above can be compared with those obtainable from other personality instruments, based on the results from Barrick and Mount (1991) which we have summarized in Table 1. Given a population multiple R of .31 for those other tests and the same base rate and selection ratio conditions, other tests would produce a relative efficiency improvement of 16% for either level of management. The 16PF would therefore produce a 12% to 21% improvement over and above the improvement possible with other tests. In other words, theoretically, the 16PF delivers up to twice the benefit of other tests. Those benefits would transform directly into dollars, although the dollar functions would vary greatly for different industries.

8.3. Other findings

One important observation throughout this series of studies was that most of the meaningful deviations from the Leadership Profile were in the direction of creative personality, especially Q1+ and M+. It would follow, therefore, that transactional and transformation leadership could be characterized in terms of basic personality traits. The variables comprising Leadership Potential would, in isolation, describe the transactional form of leadership, while the variables comprising the Creativity Composite would characterize transformational leadership. Of course, several well-designed studies would be required to test the observations directly as hypotheses.

Another striking finding from this analysis was that the leadership characteristics developed in the 1950's remain meaningful and valid today. The 16PF thus portends to be valid for the selection of a variety of candidates for positions involving leadership. A careful job analysis would be required, however, to determine whether the desired profile should more closely resemble the Leadership Profile or the Creativity Profile.

8.4. Theoretical Integration

A long-standing conclusion about the role of individual traits in leadership is that there is a great deal of situational specificity as to which traits are actually associated with leadership. In spite of that ambiguity, traits such as intelligence, dominance, conscientiousness, and self-esteem are most often cited as relevant to successful leadership (Barrick & Mount, 1991; Clark & Clark, 1990; Cartwright & Zander, 1960). Research with the 16PF beginning with Cattell and Stice (1954) has gone a long way toward clarifying this complicated subject; we now know that some trait configurations denote overall leadership potential while others denote leadership style.

Perceptions of leadership by would-be subordinates are just as important as performance measures as other criteria in leadership studies. Cattell and Stice (1954) demonstrated what casual social observers have long noticed, that elected or perceived leaders and competent leaders are not one and the same. The 16PF Leadership Potential Index, which is based on leaders who were both effective and elected, describes the core set of traits common to

effective leaders and managers. Its cross-validity has withstood forty years of social evolution and generalizes to at least three English-speaking nations.

According to Cartwright and Zander (1960), another of Cattell's major contributions to leadership theory was to find that leadership traits are often widely distributed throughout a group and not confined to the person who is the acknowledged leader. The diffusion of leadership traits is evidenced by the specific types of initiative that group members exhibit, such as asking questions, clarifying facts, making suggestions, and resolving conflicts. Effective teams appear to have greater levels of leadership potential among their members (Hall, 1983; Garland & Barry, 1990). The peer rating study that was presented for the first time in this report illustrated not only the validity of core leadership constructs and style variables, but also that members of a group play different leadership roles that are perceptible to other persons.

The early leadership studies in the 1930's isolated three prototypic leadership styles: Autocratic (or Authoritarian), Democratic, and Laissez-faire (Lewin, Lippitt, & White, 1939; White & Lippitt, 1960). These styles were evidenced not only by the way a leader responded to his or her leadership role, but also by the nature and quality of interaction among group members. Later leadership research, as a general rule, focused on some aspects of these styles or sought to isolate leadership characteristics that would predict an effective leadership style (e.g. Blake & Mouton, 1964; Fleishman & Harris, 1962). Theories and approaches varied to the extent that situational specificity was addressed.

The leadership style work culminated in the development of the 16PF leadership style variables (Sweney, 1977). They were renamed the Assertive, Facilitative, and Permissive Styles, and correspond to the Autocratic, Democratic, and Laissez-faire styles, respectively. Table 10 integrates what is known about leadership potential and style. The profiles of traits listed in the table are the result of superimposing the traits associated with the various styles on the core Leadership Potential trait group.

It is important to note that Lewin et al.'s (1939) work led to different but related lines of research, having to do with processes in organizations as a whole. The list of theorists in this area stretch from Meltzer (1942) to McGregor (1960), Likert (1961), deCharms (1976) and Argyris (1980), all of whom advocated a democratic style and empowerment of others. According to the McClelland (1975), the purpose of power is to give it away. Ironically, the Democratic or Facilitative Style is less common in 16PF profiles than the other two styles.

The latest chapter in the theory behind leadership style was the discovery of transformational, visionary, or creative leadership (Bass, 1985; Bennis, 1988, Sashkin 1984). Personality research has long ago discovered that creative personalities and personality profiles of leaders were opposite in several ways (Cattell et. al., 1970). Nonetheless, Cattell and Stice (1960) did identify a "technical leader" who, although not the acknowledged leader in the group, was the member responsible for the intellectual breakthroughs needed in order for the group to accomplish its goals. The ultimate leader, it would appear, would have a strong core Leadership Potential score, the characteristics of creative personalities, and a sufficiently democratic style to engage others in sharing his or her vision and empowering them to carry it out.

It should be clear that a rigorous body of knowledge concerning leadership and personality has been developed over the years. In spite of these advances, we must reiterate that selection of personnel should be based on several types of information, such as mental abilities and relevant past experience, and not on personality data alone. Thus, if the 16PF were to be used in addition to other types of valid predictors, the utility projections given above would be underestimates of what could be accomplished by a total system. Once again, the *Uniform Guidelines* for the use of pre-employment tests require that the employer conduct a validity study whenever there are sufficient numbers of people in similar jobs available for testing.

Table 10
Integration of Core Leadership Traits and Leadership Styles

	Primary Personality Trait	Autocratic	Facilitative	Visionary & Creative		Relevant Opposite
(E+)	Assertive, dominant, responds well to competitive situations	Left	Middle	Left	(E-)	Unassertive, prefers non-competitive situations
(F+)	Friendly, optimistic, enthusiastic	Left	Left	Depends	(F-)	Sober, serious
(G+)	Conscientiously meets responsibilities; follows rules and standard procedures	Left	Left	Right	(G-)	Searches for new and different approaches for unstructured situations
(H+)	Adventurous, socially bold	Left	Left	Left	(H-)	Timid, shy
(I-)	Tough-minded, self-reliant	Left	Left	Right	(I+)	Empathetic and socially perceptive
(M-)	Practical, objective	Left	Left	Right	(M+)	Imaginative, finds ways of integrating diverse views
(N+)	Polished, diplomatic, aware of impact on other people	Left	Left	Left	(N-)	Straight-forward, unpretentious
(O-)	Self-assured, confident	Left	Left	Left	(O+)	Apprehensive, Self doubting
(Q3+)	Controlled self-discipline	Left	Left	Right	(Q3-)	Can "go with the flow;" makes suggestions often

Traits that further affect style, but not overall leadership potential

(A+)	Warm, outgoing	Depends	Depends	Depends	(A-)	Aloof, reserved
(L+)	Skepticism (directed at people rather than ideas)	Left	Right	Right	(L-)	Trusting
(Q1+)	Experimental critical, open-minded	Left	Right	Right	(Q1-)	Cautious, prudent
(Q4-)	Relaxed, tranquil, composed	Left	Left	Depends	(Q4+)	Tense, driven

Note: Left = Characteristic at the LEFT pole applies. Right = Characteristic at RIGHT pole applies. Middle = A score in the middle of the two poles is optimal for this style. Depends = Level of this trait depends strongly on situational requirements.

Technical Appendix

The omega-squared formula (w^2) was developed as a measure of percentage of variance accounted for by a set of nominally scaled experimental groups such as those commonly found in analysis of variance (ANOVA) statistical models. It is comparable in meaning to eta-squared, which is in turn comparable to r^2 when there is no nonlinear effect present. (There is no nonlinear effect possible when the independent variable consists of a contrast between two groups.) The conversion of a t test to w^2 is a special case of the main principle:

$$w^2 = (t - 1) / (t^2 + df) \sim r^2, \text{ or}$$

$$r = [(t - 1) / (t^2 + df)]^{1/2}$$

where df represents the total degrees of freedom for the problem. Note that the w^2 formula is similar to the more common transformation of t to the point-biserial correlation:

$$r_{pb} = [t / (t^2 + df)]^{1/2},$$

but differs with respect to the -1 term in the numerator. Thus w^2 would render lower values of r than the more common method.

The difference in estimated r would be slight when t and df are large, but the difference in estimates would be greater when t and df are small.

The differences in estimated r produced from the two formulas is most pronounced for $t < 1$, where all estimated values of r would be zero when applying the w^2 formula and nonzero for the common formula. We preferred to use the w^2 formula for two reasons. First, because it produces smaller values of r , we felt that it minimized the risk of exaggeration of the r estimates for our sample-population comparisons. Second, the w^2 formula recognizes t as a ratio between an observed difference between means and the standard error of those differences; it is only when the ratio substantially exceeds 1.00 that there is any correlation taking place. (The asymptotically minimum significant value of t is 1.96 at $p < .05$.) Therefore, a value of $t < 1.00$ represents a mean difference that is less than what could occur by chance, and furthermore must represent a population estimate of $r = .00$.

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References

- Argyris, C. (1980). Inner contradictions of rigorous research. New York: Wiley.
- Barrick, M. R., & Mount, M. K. (1991). The big five personality dimensions and job performance: A meta-analysis. Personnel Psychology, *44*, 1-26.
- Bartram, D. (1992). The personality of UK managers: 16PF norms for short-listed applicants. Journal of Occupational and Organizational Psychology, *65*, 159-172.
- Bass, B. M. (1977). Manual for the Orientation Inventory. Palo Alto, CA: Consulting Psychologists Press.
- Bass, B. M. (1985). Leadership and performance beyond expectations. New York: Free Press.
- Bennis, W. (1988). Why leaders can't lead. San Francisco: Jossey-Bass.
- Blake, R., & Mouton, J. S. (1964). The managerial grid: Key orientation for achieving production through people. Houston, TX: Gulf.
- Boudreau, J. W. (1991). Utility analysis for decisions in human resource management. In M. D. Dunnette and L. M. Hough (Eds.), Handbook of industrial and organizational psychology, vol. 2 (pp. 621-745). Palo Alto, CA: Consulting Psychologists Press.
- Carroll, S. J., & Schneier, C. E. (1982). Performance appraisal and review systems. Glenview, IL: Scott Foresman.
- Cartwright, D., & Zander, A. (1960). Group dynamics research and theory. Evanston, IL: Row, Peterson.
- Cattell, R.B., Eber, H.W., & Tatsuoka, M. M. (1970). Handbook for the sixteen personality factor questionnaire. Champaign, IL: Institute for Personality and Ability Testing.
- Cattell, R.B., & Stice, G. F. (1954). Four formulae for selecting leaders on the basis of personality. Human Relations, *7*, 493-507.
- Cattell, R. B., & Stice, G. F. (1960). The dimensions of groups and their relations to the behavior of members. Champaign, IL: Institute for Personality and Ability Testing.
- Clark, K.E., & Clark, M. B. (1990). Measures of leadership. West Orange, NJ: Leadership Library of America.
- deCharms, R. (1976). Enhancing motivation: Change in the classroom. New York: Wiley.
- Dowling, A. J., & DeCieri, H. (1992). Human resource management for engineers. In D. Samson (Ed.), Management for engineers (pp. 179-207). Melbourne, Australia: Longman Cheshire.
- File, Q. W., & Remmers, H. H. (1971). Manual for How Supervise. New York: The Psychological Corporation.
- Fine, S. A. (1989) Functional job analysis scales (Revised Edition). Milwaukee, WI: Author.
- Fleishman, E. A., & Harris, E. F. (1962). Patterns of leadership behavior related to employee grievances and turnover. Personnel Psychology, *15*, 43-56.

Garland, D. J., & Barry, J. R. (1990). Personality and leader behaviors in collegiate football: A multidimensional approach to performance. Journal of Research in Personality, 24, 355-370.

Goldberg, L. R. (1990). An alternative "description of personality": The Big Five factor structure. Journal of Personality and Social Psychology, 59, 1216-1229.

Guion, R. (1965). Personnel testing. New York: McGraw-Hill.

Hall, D. T. (1983). The effect of the individual on the organization's structure, style and process. In F. J. Landy, S. Zedeck, & Cleveland, J. (Eds.), Performance measurement and theory (pp. 11-30). Hillsdale, NJ: Lawrence Erlbaum Associates.

Handyside, J. D. (1988). Occupational validity studies in the UK. In Independent Assessment and Research Centre (Eds.), The analysis of personality in research and assessment: In tribute to Raymond B. Cattell (pp. 125-130). London, UK: Editor.

Harvey, R.J. (1991). Job analysis. In M. D. Dunnette and L. M. Hough (Eds.), Handbook of industrial and organizational psychology, vol. 2 (pp. 71-163). Palo Alto, CA: Consulting Psychologists Press.

Hemphill, J. K. (1959). Job descriptions for executives. Harvard Business Review, 37, 55-67.

Hogan, R. (1990). The darker side of charisma. In Clark, K. E., & Clark, M. B. (Eds.), Measures of leadership. West Orange, NJ: Leadership Library of America.

Hunter, J. E., Schmidt, F. L. & Judeisch, M. K. (1990). Individual differences in output variability as a function of job complexity. Journal of Applied Psychology, 75, 28-42.

Institute for Personality and Ability Testing (1980). A two-tiered model of executive leadership effectiveness. [Technical report]. Champaign, IL: IPAT.

Institute for Personality and Ability Testing (1987). The Human Resource Development Report User's Guide. Champaign, IL: IPAT.

King, L. M. Hunter, J. E. & Schmidt, F. L. (1980). Halo in a multidimensional forced choice performance scale. Journal of Applied Psychology, 65, 507-516.

Landy, F. J. (1985). Psychology of work behavior. Homewood, IL: Dorsey Press.

Landy, F. J. & Farr, J. C. (1980). Performance rating. Psychological Bulletin, 87, 72-107.

Landy, F. J. & Farr, J. C. (1983). The measurement of work performances: Methods, theory, and applications. New York: Academic Press.

Landy, F., Zedeck, S., & Cleveland, J. (Eds. 1983). Performance measurement and theory. Hillsdale, NJ: Lawrence, Erlbaum.

Lewin, K. Lippitt, R., & White, R. (1939). Patterns of aggressive behavior in experimentally created "social climates." Journal of Social Psychology, 10, 271-299.

Likert, R. (1961). New patterns of management. New York, McGraw-Hill.

McClelland, D. C. (1961). The achieving society. New York, Van Nostrand.

McClelland, D. C. (1975). Power: The inner experience. New York: Wiley.

McClelland, D. C. & Boyatzis, R. E. (1982). Leadership motive pattern and long-term success in management. Journal of Applied Psychology, *67*, 737-743.

McCormick, E. J., Jeanneret, P., & Meacham, R. C. (1972). A study of job characteristics of job dimensions as based on the Position Analysis Questionnaire [Monograph]. Journal of Applied Psychology, *36*, 347-368.

McCrae, R. R., & Costa, P. T. Jr. (1985). Updating Norman's "adequate taxonomy:" Intelligence and personality dimensions in natural language and in questionnaires. Journal of Personality & Social Psychology, *49*, 710-721.

McGregor, D. M. (1960). The human side of enterprise. New York: McGraw-Hill.

Meltzer, H. (1942). Explorations in humanizing relations of key people in industry. American Journal of Orthopsychiatry, *12*, 517-528.

Mershon, B., & Gorshuch, R. L. (1988). Numbers of factors in the personality sphere: Does increase in factors increase predictability of real-life criteria? Journal of Personality and Social Psychology, *59*, 675-680.

Miller, G. A. (1956). The magical number seven plus or minus two: Some limits on our capacity for processing information. Psychological Review, *63*, 81-97.

Miner, M. G., & Miner, J. B. (1980). Uniform guidelines on employee selection procedures. Washington, DC: Bureau of National Affairs.

Norman, W. T. (1963). Toward an adequate taxonomy of personality attributes: Replicated factor structure in peer nomination personality ratings. Journal of Abnormal and Social Psychology, *66*, 574-583.

Olson, C. A., & Becker, B. E. (1983). A proposed technique for the treatment of restriction of range in selection validation. Psychological Bulletin, *93*, 137-148.

Peabody, D., & Goldberg, L. R. (1989). Some determinants of factor structures from personality-trait descriptors. Journal of Personality and Social Psychology, *57*, 552-567.

Sashkin, M. (1984). The leader behavior questionnaire, King of Prussia, PA: Organization Design and Development.

Sashkin, M., & Burke, W. W. (1990). Understanding and assessing organizational leadership. In K. E. Clark & M. B. Clark, Measures of leadership (pp. 297-325). West Orange, NJ: Leadership Library of America.

Siemens, J., Havlicek, L., & Mueller, W. J. (1966). A study of leaders in the manufacturing division of the Hessdon Corporation. Hutchinson and Wichita, KS: Management Research & Development Institute, Inc.

Society for Industrial and Organizational Psychology (1987). Principles for the validation and use of personnel selection procedures (Third Edition). College Park, MD: Author.

Sweney, A. B. (1970). Organizational power roles. Professional Management Bulletin, *10*, 5-13.

Sweney, A. B. (1977). Response to power measure handbook. Wichita, KS: Test Systems.

Sweney, A. B., & Fiechtner, L. A. (1974). Personality factors in the organizational role preferences of middle managers. Multivariate Experimental Clinical Research, *1*, 108-117.

Taylor, H. C., & Russell, J. T. (1939). The relationships of validity coefficients to the practical effectiveness of test in selection: Discussion and tables. Journal of Applied Psychology, 23, 565-578.

White, R., & Lippitt, R. (1960). Leader behavior and member reaction in three "social climates." In D. Cartwright and A. Zander (Eds.), Group dynamics research and theory. Evanston, IL: Row, Peterson.



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