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PERSONALITY, COGNITIVE ABILITY AND BEHAVIOUR: THE ANTECEDENTS  
OF EFFECTIVE  
AUTONOMOUS WORK TEAMS

BY

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A Dissertation

Submitted to the School of Graduate Studies

In Partial-Fulfilment of the Requirements

For the Degree

Doctor of Philosophy

Faculty of Business

McMaster University

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## THE ANTECEDENTS OF EFFECTIVE AUTONOMOUS WORK TEAMS

DOCTOR OF PHILOSOPHY (1997)  
(Business Administration)

McMaster University  
Hamilton, Ontario

TITLE: Personality, Cognitive Ability and Behaviour: The  
Antecedents of Effective Autonomous Work Teams.

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NUMBER OF PAGES: xx, 190

## Abstract

The aims of this study are three fold: (1) to identify the trait profiles (combination of personality attributes and cognitive ability) of effective team members, (2) to identify those behaviours linking *personality attributes* to effective team performance and (3) to identify those behaviours linking *cognitive ability* to effective team performance. The primary contribution of this study is in meeting the last two objectives. Ultimately, the objective was to relate team members' personality and cognitive ability to the team's performance by better understanding the intervening (in)effective behaviours. Subjects were 480 second year undergraduate business students in 94 teams of 5 to 6 members.

Teams can be examined at two levels – at the level of the individual team member and at the level of the team (by combining individual team member attribute information and relating it to team performance). At the level of the individual team member, three of the Big Five personality traits – extroversion, conscientiousness and cognitive ability -- predict the effectiveness of *team members*. However, team members who are very high in extroversion tend to be unfocused and this is detrimental to their performance. At the team level of analysis, the greater the *proportion* of team members high in cognitive ability, conscientiousness, extroversion and openness to experience the better a *team* performs. Using findings from the two levels, it is suggested that human resource practitioners select team members who are in the top one-third of the population in openness to experience and conscientiousness. They should select extroverts with percentile ranking between 66% and 93%. Lastly, they should seek people high in



cognitive ability.

Team members engage in specific (in)effective behaviours. These behaviours were grouped and a typology emerged that was confirmed through Confirmatory Factor Analysis and builds on previous typologies. The identification of these behaviours is essential to training people to become more effective team contributors. Generally, neurotic team members are unfocused, ineffective in conflict situations and provide the team with little input. Extroverts are active members but tend to be unfocused. Members open to experience generate ideas, encourage others to express ideas and synthesize and summarize team ideas. Agreeable team members communicate effectively, avert conflict and ensure everyone participates. Conscientious team members focus on task-related behaviours -- set goals, get everyone working towards the goals and monitor progress. Team members high in cognitive ability not only take on task-related behaviour but are also socially adept.

## Acknowledgements

Special thanks goes to my advisor Dr. Rick Hackett for his guidance throughout the dissertation process. Thanks to my committee members Dr. Willi Wiesner and Dr. John Medcof for their insightful comments on numerous drafts of this dissertation. Lastly, thanks to my parents for their constant support.

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## CHAPTER 1

### Introduction

The last decade has seen dramatic changes in the way organizations are structured. In general, individualism is “out”, collectivism is “in”. Specialization is “out” and multi-skilling is “in”. Hierarchical organizations are “out,” flat organic structures are “in”. At the center of all these changes sit teams of people ready to respond quickly and flexibly to changing business needs. Whereas the classic bureaucracy limited the scope of individual discretion, current trends should result in individual work behaviour being increasingly influenced by an employee’s disposition.

Despite the growing popularity of autonomous work teams, there is little research on the attributes of successful team members (Manz and Simms 1993). For many years, personality has been recognized as an individual difference that is important to work groups (Driskell, Hogan and Salas 1987) and more recently, to autonomous work teams (Larson and LaFasto 1989). Autonomous work teams (also referred to as self-managed work groups) may require people who can work independently and decisively, are self-motivated and have superior interpersonal skills. Another personal attribute that has been recognized as important when explaining team performance is cognitive ability (intelligence). Teams with members high in cognitive ability generally perform better than do those with members low in cognitive ability (see Kabonoff and O’Brien 1979; Kichuk, 1997; Terborg, Castore and DeNinno 1976).

Many organizations have tried to gain a competitive advantage by selecting or

training "team players." But what are the *behaviours* that these organizations try to select for, facilitate and develop? As surprising as it may seem, research has neglected the behavioural antecedents of successful team performance and cannot say which traits predict that behaviour.

### Personality Profiles of "Effective" Team Members

Little attention has been directed to the effective *staffing* of teams (Klimoski and Jones 1994; Manz and Simms 1993; Thoms, Moore and Scott 1996). The research proposed here seeks to determine the personality profile most associated with effective team member performance. Where such profiles can be identified, they can be used as additional predictive information in staffing decisions. However, the information is most useful when individual team member effectiveness can be shown to predict team performance.

This research differs from earlier studies in that it attempts to derive a personality profile associated with individual team member effectiveness on the basis of the "Five Factor Model" (FFM, also called the Big Five). This model consists of five broad dimensions of personality that have been labelled: neuroticism (or emotional stability), extroversion, openness to experience, conscientiousness, and agreeableness (see Costa and McCrae 1995a, 1995b; Digman 1990; Goldberg 1990, 1993; McCrae and Costa 1996) each of which is described in detail shortly. Each of the five factors is considered a dimension on a continuum. In developing the NEO-PI, a measure of the "Big Five", Costa and McCrae (1992) showed that each factor is multifaceted (consisting of distinct components). A brief overview of facets (components or sub-dimensions of the Big Five)

is provided below in order to aid interpretation of the constructs.

Although there has been little research on autonomous work teams specifically, numerous individual personality traits have been linked to group performance (see Driskell, Hogan and Salas 1987 for a review). In these studies, a common approach to measuring the impact of personality traits on groups is to assess their relationship to “group effectiveness”. Group effectiveness has been defined in terms of “group performance” (e.g., degree to which the group’s output meets requirements of quality, quantity and timeliness; Hackman 1991), member satisfaction with the group experience<sup>1</sup> (Gladstein 1984; Guzzo and Dickson 1996) and putting into place appropriate norms and systems (Gladstein 1984; Guzzo and Dickson 1996). This study focuses on team *performance* (quality, quantity and timeliness of team outcome) on a variety of problem solving tasks over a 13-week period. Accordingly, the following review of the group literature is restricted to studies in which performance was defined in terms of the quality, quantity and/or timeliness of team outcomes.

The following section begins with a description of each of the Big Five and their facets. This description is then followed by a brief literature review.

### The Role of the Big Five in Team Performance

Neuroticism. The neuroticism (opposite of emotional stability) continuum ranges from excitable, angry, insecure and depressed to calm, poised, secure and enthusiastic

(Barrick and Mount 1991). Facets of neuroticism are anxiety, angry hostility, depression, self-consciousness, impulsiveness and vulnerability. *Anxious* individuals are apprehensive, fearful, prone to worry, nervous, tense and jittery. Low scorers on this facet are calm and relaxed. The *angry hostility* scale measures the individual's readiness to experience anger. The *depression* scale measures normal individual differences in the tendency to experience depressive affect. High scorers are prone to feelings of guilt, sadness, hopelessness and loneliness. *Self-conscious* individuals are uncomfortable around others, sensitive to ridicule and prone to feelings of inferiority. *Impulsiveness* refers to the inability to control cravings and urges. The final facet of neuroticism is *vulnerability* to stress. Individuals who score high on this scale feel unable to cope with stress, become dependent, hopeless or panicked when facing emergency situations.

Early writers thought that "neuroticism" would be one of the best traits for predicting group performance (Heslin 1964; Mann 1959). Driskell, Hogan and Salas (1987) in their review of the literature, suggest that neuroticism should be negatively correlated with group performance on all tasks. However, Barrick and Mount (1991) in interpreting their meta-analysis findings, suggest that beyond a critical range of emotional stability there may be no relationship between emotional stability and job performance. In terms of facets of neuroticism, Pettersen (1991) indicates that effective project team

---

<sup>1</sup> It is unclear how team member satisfaction impacts quality, quantity and/or timeliness of team outcomes. A meta-analysis by Iaffaldano and Muchinsky (1985) investigated the relationship between an individual's satisfaction and performance on the job and found a weak correlation ( $r = .17$ ). At the group level, Gladstein (1984) found that group performance in terms of sales revenues did not significantly correlate with a measure of group satisfaction. Therefore, it is safe to assume that the relationship between team performance and team members' satisfaction is weak, or at the least complex in nature, and that the two are not interchangeable.

managers need maturity and self-confidence. Larson and LaFasto (1989) suggest that effective team members require confidence and maturity while Wellins, Byham and Wilson (1991) suggest that empowered work team members need to have tolerance for stress. Finally, Hogan, Curphy and Hogan (1994) concluded that in leadership roles, emotional stability is important for remaining immutable under pressure, resolving conflicts and handling negative feedback. All of these skills should be advantageous to autonomous work team members, but it is unclear whether they effect team performance directly or have an influence through members' satisfaction. Nervousness is associated with reduced team performance (Greer, Galanter and Nordlife 1954; Haythorn 1953) and non-leaders (Cattell and Stice 1954). Group members with a high need for approval (related to Costa and McCrae's (1992) self-consciousness facet) tend to try harder to do what they think is expected of them than do those with a low need for approval (McLaughlin and Hewitt 1972). How this effects team performance is unclear.

Extroversion. The extroversion continuum ranges from outgoing, sociable, active and talkative to cautious, reserved, sedentary and retiring (Barrick and Mount 1991). Facets of extroversion are warmth, gregariousness, assertiveness, active, excitement-seeking and positive emotions. *Warmth* is the facet of extroversion most relevant to issues of intimacy. Another aspect of extroversion is *gregariousness* – the preference for other people's company. *Assertiveness* captures forcefulness, dominance and ascendancy. A person that is highly *active* has a sense of urgency and a need to keep busy. Individuals that are *excitement seeking* crave stimulation – they like bright colours and noisy environments. The *positive emotions* dimension gauges the tendency to experience joy,

happiness, love and excitement.

Effective team members take initiative on tasks (Larson and LaFasto 1989; Wellins et. al. 1991) and communicate frequently with other workers (Larson and LaFasto 1989; Littlepage, Schmidt, Whisler and Frost 1995; Stevens and Campion 1994; Wellins et. al. 1991). Extroverts would be expected to participate frequently in group discussions regardless of topic, situation or group composition, exhibit leadership behaviour and be popular with other team members (see Mann 1959). Extroverted team members tend to communicate more with other team members and are better able to build alliances with those people outside of the team who control relevant resources (Hogan et. al. 1994). In summarizing the research, Shaw (1981) states that extroverts generally facilitate group functioning and influence group decisions more than the average member does. Of the facets of “extroversion,” sociability -- operationalized as the “talkativeness” of team members -- was positively correlated with the group’s product quality (Watson 1971). Williams and Sternberg (1988) found that the average amount of talking done by members of a group and the maximum amount of talking done by any member of the group were positively correlated with the group performance. Dominance has also been positively correlated with group performance (Altman and Haythorn 1967, Shaw and Harkey 1976), participation and task orientation (Watson 1971, see also Mann 1959).

Openness to experience. The openness to experience continuum ranges from sensitive, imaginative and polished to insensitive, narrow-minded and crude (Barrick and Mount 1991). Openness to experience consists of the fantasy, aesthetics, feelings, actions, ideas and values facets. Individuals who are open to *fantasy* have a vivid imagination and

an active fantasy life. Those high on the *aesthetics* dimension have a deep appreciation for art and beauty. Openness to *feelings* implies receptivity to one's own inner feelings and emotions and the evaluation of emotions as an important part of life. *Action* is manifest in the willingness to try different activities, go to new places, or eat unusual foods. The *ideas* dimension of the openness to experience trait has to do with curiosity and intellect. Finally, the *values* dimension taps willingness to re-examine social, political and religious values (Costa and McCrae 1992).

There is relatively little direct evidence to support the contention that “openness to experience” or its facets contribute to team performance, however, there is some indirect evidence. Often self-managed work groups are charged with goal setting, planning, resolving conflict (Stevens and Campion 1994) and solving problems (Larson and LaFasto 1989), all of which require creative and open-minded group members. Accordingly, Pettersen (1991) suggests that openness to experience is an important characteristic of self-managed work group members. Dogmatic people (those rigid in their thinking – tapped by the “openness to value” facet of openness to experience (Costa and McCrae 1992)) take longer to solve complex problems and tend to make more opinionated statements in discussions (Rokeach 1960). Leathers (1969) found that such statements result in a diminished trust, increased tension and inflexibility within the group.

Agreeableness. The agreeableness continuum ranges from co-operative, good-natured and hopeful to uncooperative, ruthless and inflexible (Barrick and Mount 1991). Facets of agreeableness are trust, straightforwardness, altruism, compliance, modesty and



tender-mindedness. Individuals that are high in *trust* are predisposed to believe that others are honest and well-intentioned. *Straightforward* individuals are frank, sincere and ingenuous. The *altruism* facet of agreeableness captures generosity, consideration of others and a willingness to assist others in need of help. *Compliance* concerns characteristic reactions to interpersonal conflicts. *Modest* individuals are humble and self-effacing although they are not necessarily lacking in self-confidence or self-esteem. Lastly, the *tender-mindedness* component of agreeableness gets at attitudes of sympathy and concern for others.

Manz and Simms (1993) found that one well-accepted characteristic of autonomous work teams is that they require members to interact well with others. Wellins et al., (1991) expect that effective team members ask for ideas, offer help, accept suggestions, consider the skills, motives and needs of other team members, work with others to solve problems and recognize and consider others' ideas. Stevens and Campion (1994) listed ten knowledge, skills and abilities (KSAs) which they grouped under interpersonal KSAs required for effective team member performance. The agreeableness facets likely to contribute to a team member's *interpersonal skills* are altruism (willingness to assist others), compliance (capability to inhibit aggression), modesty (being humble) and tender-mindedness (concern for others). Recently, Podsakoff, Aheome and MacKenzie (1997) found that helping behaviour and sportsmanship has significant effects on work group performance quantity and that helping behaviour has a significant impact on performance quality. Hogan, Curphy and Hogan (1994) suggest that agreeableness is related not only to team morale but also to trust and communication.

With respect to one of the facets of “agreeableness,” Bouchard (1969), in a study of group problem solving, found social insight, a factor of three aggregated personality measures including the California Personality Inventory, predictive of the number of “good ideas”. Shaw (1981) suggests that social insight is associated with high need for affiliation. These types of people tend to facilitate social interaction, cohesiveness and satisfaction in groups (Shaw 1981). Individuals high in social insight also tend to behave in ways that enhance their acceptance (Shaw 1981). This may lead one to expect that the degree to which team members like one another should predict team performance; however this is not the case (McGrath 1962; Terborg, Castore and DeNinno 1976). In fact, some studies have found a negative correlation between “liking” and group performance (Bass, 1985; Weick and Penner 1969).

Conscientiousness. Finally, the conscientiousness continuum ranges from careful, responsible, self-disciplined and organized to irresponsible, disorganized and lacking in self-control (Barrick and Mount 1991). According to Costa and McCrae (1992), the facets of conscientiousness, are competence, order, dutifulness, achievement striving and self-disciplined. *Competence* refers to the sense that one is capable, sensible, prudent and effective. Those high in *order* are neat, tidy and well organized. In one sense, conscientiousness implies “governed by conscience” – this aspect is captured in the *dutifulness* dimension. Individuals high in *achievement striving* have high aspirations and work hard to achieve them. The *self-discipline* sub-dimension refers to the capacity to begin tasks and carry them through to completion despite boredom and other distractions. The tendency to think carefully before acting is captured in the *deliberation* component

of conscientiousness.

Stevens and Campion (1994) report that three kinds of capacities are important for work group members to have. These are the capacity to establish specific challenging and accepted team goals, to monitor and evaluate individual and team performance and the capability to establish task expectations. The behaviours associated with these capabilities are expected from individuals who are conscientious – specifically those that are high on the achievement striving dimension. Achievement striving, attention to detail, action orientation and a sense of urgency are expected to be related to work-group member effectiveness (Larson and LaFasto 1989; Wellins et. al. 1991). Groups containing members with high scores on achievement striving, a facet of the broader conscientiousness trait (Costa and McCrae 1992), take less time and produce more solutions in a problem solving exercise, than do groups with members who score low on need for achievement/ambition<sup>2</sup> (Driskell et. al. 1987; French 1958; Schneider and Delaney 1972; Zander and Forward 1968).

Aronoff and Wilson (1985), in their conceptualization of personality in social situations, theorized that the behaviour of achievement striving people tends to be substantially more task-oriented (concern for product and accomplishing goals) than interpersonally motivated. Thus, relatively conscientious group members should make their impact on group performance felt mainly through their task-relevant behaviours. In a meta-analysis, Barrick and Mount (1991) found that conscientiousness is probably

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<sup>2</sup> Hough (1992) found that need for achievement loaded on both extroversion and conscientiousness. However, need for achievement will be treated here as being subsumed under conscientiousness (see Costa and McCrae 1992).

important for any job, regardless of whether it is self-managed or traditionally structured (see also, Barrick and Mount 1993; Barrick, Mount and Strauss 1993). This is possibly because conscientious people tend to be self-motivated and task-oriented (Aronoff and Wilson 1985; Barrick and Mount 1993; Costa and McCrae 1992).

Personality and autonomous work teams. Few studies have empirically examined the role of personality in autonomous work teams (Barry and Stewart 1997) and fewer still have used the FFM. Extroversion, agreeableness and conscientiousness have been related to effective performance of teams in general (Mount and Barrick 1995). In a study of engineering design teams, extroversion, agreeableness and emotional stability differentiated teams able to produce a product from those unable to produce a product (Kichuk 1997). However, within the group of teams that did manage to produce a product the FFM traits did not predict the quality of a team's design. Thoms, Moore and Scott (1996) found that extroversion, conscientiousness and emotional stability were positively correlated with self-efficacy for participation in autonomous work teams. However, Barry and Stewart (1997), found that only *extroversion* and not conscientiousness was associated with group outcomes on creative problem solving tasks in autonomous work teams. Extroverts did not only contribute to team outcomes through their socioemotional input, but, also through their *task* inputs. That is, they take work seriously, are concerned about quality, perform to expected levels, pull their weight and have high expectations. The studies reviewed in the previous section have generally focused on the identification of discrete facets that contribute to effective team performance rather than a combination or *profile* of traits. In doing this, they have usually not used a unifying framework and

thus, the literature to-date is fragmented, incomplete and occasionally contradictory. This study goes beyond previous studies in that it was concerned with personality profiles (patterns of responses on personality traits and facets) based on the unifying five factor model (FFM).

Why examine profiles? Before answering this question one must first define what is meant by a profile. Personality profiles may be defined by simply noting a few distinct traits that in combination predict the criterion of interest. However, in addition to determining the combination of predictive traits, a more appropriate definition of a profile consists of examining trait elevation (how high the person scores on the trait relative to the appropriate normative group). Consider two hypothetical employees whose performance can be predicted by three FFM traits: agreeableness, conscientious and extroversion. Say they are equally intelligent but perform very differently in teams; other team members say that one makes a marginal contribution at best while the second performs very well. The reason for their performance differences may be due to differences in personality elevations. One may have average agreeableness but high conscientiousness and extroversion relative to the applicable norms. The more successful one may perform better because (s)he has a profile average in agreeableness, conscientious and extroversion. In this hypothetical example, the poor performer may have performed poorly as a consequence of his/her high conscientiousness and extroversion. That is, being highly conscientious or extroverted may hinder performance. High conscientiousness may result in too much planning and organizing and not enough action. Average conscientiousness may result in a better balance between planning and

action. High extroversion may result in dominating behaviour while average extroversion may result in a better mix between participation and listening to others' opinions.

Personality profile differences can also be analyzed in terms of *behavioural* differences. Observations of (in)effective team member behaviours were made in this study. Traits were linked to these behaviours. In addition, the optimal subset of behaviours useful in predicting team perform was determined. Team process interventions that focus on developing and/or reinforcing behaviour associated with superior performers will be facilitated by the information from this study. The behaviours identified in this study as differentiating successful team members from their peers can be taught to unsuccessful team members as an intervention or component of an intervention.

Driskell, Hogan and Salas (1987) noted that despite the commonly accepted notion that personality will influence group effectiveness, the empirical evidence is ambiguous, partially due to the failure to examine the effects of personality in the context of specific environments. Another reason for this ambiguity may be mediating variables between personality and group performance such as cognitive ability, the knowledge and skills of group members and the strategies used to accomplish tasks (Thoms, Moore and Scott 1996). This study avoided these criticisms by establishing a specific context and a set of tasks that mimic common work situations and by controlling for the effects of some possible moderators (see later sections for details).

In summary, the research to date suggests that teams with a member (or members) high in each of the FFM traits should perform better than those with a member (or members) low in each of the FFM traits. Exactly which FFM trait based profile leads to

effective individual outcomes in autonomous work teams is unclear and was explored in this study. In addition, how individual team member effectiveness was related to overall team performance was determined. That is, I determined whether a team that was high in effective behaviours performed better than a team that was low in effective behaviours. In addition, I determined whether a team with a greater proportion of effective team members performed better than one with a lower proportion of effective team members.

### Behaviour as a Link between Personality and Performance

The ability of personality measures to predict job performance has been debated for decades. Almost thirty years ago, the usefulness of personality as a predictor of job performance was questioned by those arguing that behaviour is still best predicted by knowledge of the situation in which the individual is placed. Researchers have now shown that job performance can be predicted by some of the FFM personality traits (e.g., Barrick and Mount 1991; Hough, Eaton, Dunnette, Kamp and McCloy 1990; Tett, Jackson and Rothstein 1991).

Yet, even after decades of research, the predictive validity of personality remains modest at best (Adler 1996; Schneider 1996). Even conscientiousness, which has the strongest relationship with performance of the “Big Five”, has an average corrected correlation with job performance (across occupations) of only 0.22 (Barrick and Mount 1991)<sup>3</sup>. The modest personality-job performance correlations may be partially explained by the fact that job performance is often influenced by factors other than an employee’s

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<sup>3</sup> In partial reconsideration of their results, Mount and Barrick (1995) found that the validity of conscientiousness had been underestimated in their prior meta-analysis, and they have suggested that a value of 0.31 is closer to its true validity.

behaviour<sup>4</sup> (e.g., inadequate materials and supplies). When employees cannot perform to standards or to their true potential because of factors outside of their control, the personality-performance correlation will necessarily be weak. However, the *personality-behaviour* component of the *personality-behaviour-job performance* relationship may be quite strong. For this reason there is a need to better understand the strength of the relationship between personality and behaviour. Schneider (1996) concludes that it seems “obvious that the reason for the consistently modest relationship between personality tests and performance is because the focus has been on *performance* and not *behavior*” (p. 292, emphasis added). The current study explored the link between personality traits and performance-relevant behaviour (e.g., behaviours instrumental to task accomplishment). Furthermore, the current study explored the link between these performance-relevant behaviours and both individual and team outcomes (performance). To-date there has been little systematic research to clarify the path by which any one of the personality dimensions of the “Big Five” is linked behaviourally to individual and team performance outcomes (Adler 1996).

In addition to measuring the strength of the personality-behaviour-performance linkages, a “personality→behaviour→individual team member effectiveness→team performance” mapping would allow practitioners to better design interventions directed at eliciting and supporting those behaviours which are instrumental to achieving individual and team performance outcomes (Schneider 1996). Such interventions may be in the form of training, selection, job redesign, reward systems, goal setting, supervision

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<sup>4</sup> See Schneider and Hough (1995) for a review of moderators of personality-performance links.



and so forth. Behavioural change may also be the best way to obtain attitude change (Goldstein and Sorcher 1974).

Although little research has assessed the behavioural correlates of personality (Schneider 1996; Adler 1996; Block 1995), research does suggest that consistent behavioural correlates with personality should exist. For instance, supervisors, co-workers and customers are able to accurately predict an employee's personality make-up (as measured by paper-and-pencil assessments) from his or her behaviour (Mount, Barrick and Strauss 1994). This suggests that behaviour is consistent, observable and allows others to reliably attribute personality traits to individuals.

The only study that has related personality at the FFM level to behaviour and behaviour to job performance was recently completed by Barrick, Mount and Strauss (1993). They reported that conscientious individuals are more likely to set goals for themselves. These goals trigger a greater investment in effort which leads to more effective individual performance (Barrick, Mount and Strauss 1993).

Stevens and Campion (1994), recently offered a synthesis of the group- and organizational-level literature and inferred the individual-level KSAs (knowledge, skills and abilities) of effective team members. These KSAs fell into two overarching categories: interpersonal KSAs and self-management KSAs. Interpersonal KSAs were further divided into conflict resolution, collaborative problem solving and communication categories. Self-management KSAs were grouped into two categories: goal setting and performance management and planning and task co-ordination. Behavioural manifestations of the KSAs in each category are described. The behaviours generated by

team members in this study were compared to those inferred from the literature by Stevens and Campion.

The behaviours generated by team members in this study were also compared to a recent typology offered by Hyatt and Ruddy (1997). They conducted roundtable sessions with 73 team members from which they generated a rating scale to measure work group effectiveness. They found that effective work groups can be expected to be high in process focus, work group support (from management and the organization), goal orientation, work group confidence, customer orientation and interpersonal work group processes.

Personality and context. According to classical interactionist theory, personality and context interact to produce behaviour (Semmer and Schallberger 1996). Empirical evidence illustrating the importance of context in making predictions from personality is mounting (e.g., Lee, Ashford and Bobko 1990; Lee, Early and Hanson 1988). The new “challenge is to design research in which context and personality variation is representative of some target context” (Adler 1996, p 212, also see Schneider and Hough 1995).

Personality and autonomous work teams. This study was mainly concerned with autonomous work teams as the *target context* within which personality traits are manifested in individual and team behaviour that affect team performance. The use of such teams are increasingly popular in organizations (Cohen 1993; Lawler, Mohrman and Ledford 1995; Manz and Simms 1993). Autonomous work teams are characterized by the team taking responsibility for completion of a whole task, taking responsibility for team

maintenance functions (e.g., conflict resolution, providing feedback, decision making) and having discretion over work allocation within the team (Cannon-Bowers, Oser and Flanagan 1992, Goodman, Devadas and Hughson 1988; Guzzo and Dickson 1996). In this context, traits should be an important explanation of behaviour because the context is not expected to dictate behaviour in the same way that it would in a highly structured or automated job. Even with established team-norms, individual team members have considerable discretion over the behaviours they choose to exhibit, which is expected to be a function of his/her own personality make-up. Bouchard (1969) found that the correlation between personality and individual effectiveness in groups was greater than the correlation between personality and performance when individuals attempted problem solving alone.

#### Behaviour as a Link between Cognitive Ability and Performance

Over the past 15 years or so, a great deal of research has investigated the capacity of cognitive ability (intelligence) measures to predict job performance in various occupations (e.g., Campbell 1990; Hunter and Hunter 1984; Perlman 1980; Schmidt, Hunter and Perlman 1981). In their meta-analysis, Hunter and Hunter (1984) concluded that cognitive ability is the single most valid predictor of performance in entry-level jobs. Validities as high as 0.65 have been reported (Campbell, 1990; Lubinski and Dawis 1991; McHenry, Hough, Toquam, Hanson and Ashworth, 1990). Evidence suggests that intelligent people are better at information processing and problem solving (Schmidt, Hunter and Perlman 1981), prioritizing between conflicting roles and adapting to new situations through learning quickly and better applying old leanings to new situations

(Hunter 1986). All of these competencies can be valuable in a team setting. Indeed, numerous studies have noted that teams with members high in cognitive ability generally perform better than do teams with members low in cognitive ability (see Kabonoff and O'Brien 1979; Terborg, Castore and DeNinno 1976). Kichuk (1997) reported that although a team's composite cognitive ability score differentiated engineering design teams successful in coming up with a design from those unable to come up with a design, it was not useful in predicting the quality of performance of successful teams. She concluded that "general cognitive ability appeared to have a "threshold" relationship with team performance" (p. 66) when the tasks being performed are complex. Thus, some minimal amount of cognitive ability may be necessary in order for teams to be minimally successful, after which cognitive ability has no relationship with increments in team performance.

Although cognitive ability has been linked to effective performance by several studies, there is little research describing how intelligent people *behave* in team situations. There is growing evidence that as well as influencing task related behaviour in teams, cognitive ability may also influence socioemotional<sup>5</sup> type team behaviours (Barry and Stewart 1997). Hatch and Gardner (1986), conceptualized interpersonal skills as one form of cognitive ability. Also, individuals higher in cognitive ability have been found to be better at impression management (Barron 1989). However, there is evidence that some effective team member behaviours may not be associated with cognitive ability. Studies have found consistently low correlations between leadership performance and intellectual

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<sup>5</sup> For instance, helping the team work together, stimulating discussion and monitoring the team's focus.

ability (e.g., Bass 1990; Ghiselli 1963; Fiedler and Garcia 1987). Leadership has been linked to an individual's performance within a team and to a team's performance (Cohen, Chang and Ledford 1997).

Cognitive ability and personality may influence behaviour through two distinct processes. Borman, White, Polakos and Oppler (1991) proposed that job performance was comprised of "can-do" and "will-do" components. They conceived of ability, declarative knowledge, procedural knowledge and skills as "can-do" performance components and personality, interests and reward preferences as "will-do" performance components. Borman et. al., (1991) found that cognitive ability influences supervisory ratings of performance primarily through the mediating effect of job knowledge (can-do) rather than motivation (will-do) performance components. In contrast, dependability and achievement orientation (both facets of conscientiousness) were related to supervisory ratings of job performance primarily through the mediating effect of will-do outcome measures (e.g., disciplinary actions, awards and commendations).

Even though cognitive ability may act through different processes, numerous studies have reported personality-cognitive ability associations (see Campbell 1990; Hollenbeck, Brief, Whitener and Pauli 1988; Wright, Kacmar, McMahan and Deleeuw 1992). Day and Silverman (1989) found that cognitive ability is correlated with ascendancy<sup>6</sup> (-0.19), and weakly with other traits including interpersonal orientation (0.04). Barrick, Mount and Strauss (1993) reported that the Wonderlic, a popular measure of general cognitive ability (and the measure used in this study), correlated weakly with

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<sup>6</sup> Ascendancy is composed of dominance and abasement; adapted from the Personality Research Form-E.

conscientiousness (0.07) and agreeableness (0.04), moderately with extroversion (0.10) and emotional stability (0.14), and relatively well with openness to experience (0.30). Others have also noted that openness to experience correlates more highly with cognitive ability than do other personality traits (Costa and McCrae 1985; Holland, Dollinger, Holland and MacDonald 1995; John, Caspi, Robins, Moffitt and Stouthamer-Loeber 1994). Ones et. al., (1993) reported that integrity tests have negligible correlation with cognitive ability tests. Integrity tests consist largely of three of the Big Five; conscientiousness, agreeableness and emotional stability (Dunn et. al. 1995). Thus, conscientiousness, agreeableness and emotional stability may have little correlation with cognitive ability (cf. Hunter 1986). Ones et. al.,'s conclusion has been questioned however, because of the low power of the studies included in their analysis and the problematic operationalization of cognitive ability (Rynes 1993).

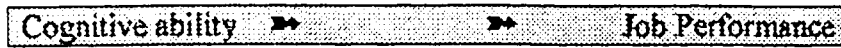
In sum, although cognitive ability and personality appear to be orthogonal traits for the most part, there is sufficient evidence to prompt testing of the predictive validity of personality over and above that of cognitive ability. Cognitive ability is the most often used paper and pencil selection tool in Canada (Thacker and Cattaneo 1987) -- no other construct has been shown to predict job performance as accurately or as universally. Therefore, some practitioners will only use personality if it can be shown to have predictive power over and above a cognitive ability test.

Summary

In summary, the following relationships are well established at the individual level of analysis outside of the team context:



Barrick and Mount 1991; Tett et. al., 1991



Hunter and Hunter 1984; Perlman 1980



Latham and Wexley 1994

The Big Five and cognitive ability may be useful when predicting specific performance relevant behaviour:



See Mount, Barrick and Strauss 1994; Costa and McCrae 1992



See Hunter 1986

The Big Five and cognitive ability may also be useful in predicting the performance relevant behaviours of *team members*. These behaviours should contribute to team performance.



See Barry and Stewart, 1997



This study, using students in a team setting, tested and explored the relationships

diagrammed in Figure 1. The bold broken arrow represents aggregation of individual information with that of all other team members. Detailed hypotheses and expectations are described later.

This study focused on identifying the trait profiles (combination of personality attributes and cognitive ability) of effective team members and the behaviours linking personality attributes and cognitive ability to effective individual and team performance. The research data were collected from 94 intact teams of five to six students each. The teams worked over a 13-week period on various assigned projects involving critical analysis and problem solving (e.g., case analysis, critical review of research reports, designing performance assessment tools) as part of a course requirement. Team performance outcomes were based on an objective grading of team submissions by an independent evaluator. Individual behaviour and performance within each team was assessed by peer evaluations of team members.

The theoretical framework for this research will now be reviewed, followed by a more detailed description of the study hypotheses, expectations, research sample, procedures, analyses, results and discussion.



Context: Autonomous work teams

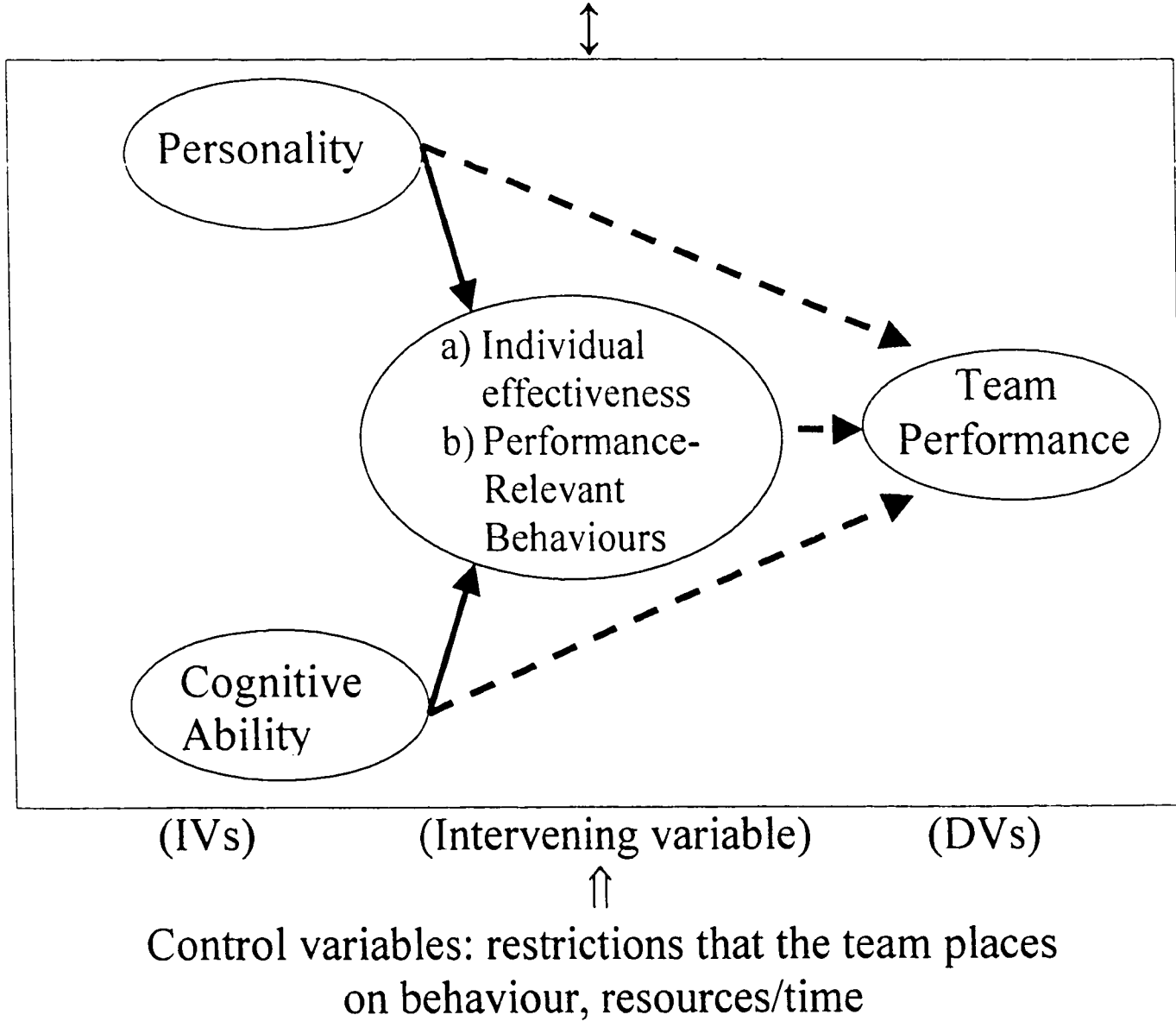


Figure 1. The Relationships to be Studied.

## CHAPTER 2

### Theoretical Framework

#### Trait-Theory

Until recently, trait-theory and personality assessment were highly criticized (e.g., Ghiselli 1973; Guion and Gottier 1965; Locke and Hulin 1962; Mischel 1968; Reilly and Chao 1982; Schmitt, Gooding, Noe and Kirsh 1984). Critics drew attention to the low validity coefficients of personality measures and concluded that because personality constructs only explained about nine percent of the variance in social behaviour, situational variables must explain the remaining variance and should therefore be the focus of research. However, at the time of these publications no well defined taxonomy existed for classifying personality traits. Consequently, it was difficult to determine whether there were consistent and meaningful relationships between personality constructs and performance criteria in different occupations.

Trait psychologists disagreed with the critics. They believed that personality could be reduced to a stable set of conceptual units called traits. Traits formed the molecular structure of personality and could be used to explain differences in behaviour between people. Psychologists uncovered a myriad of trait variables and about 60 years ago it became obvious that the main research question facing trait psychologists was the need for an adequate taxonomy. It was not until the late 1980s that personality psychologists came to a general consensus<sup>7</sup> that five robust factors of the FFM could

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<sup>7</sup> See Block (1995) for a critique of the FFM.

serve as a meaningful and useful taxonomy for organizing the confusing array of findings in the personality literature (see Costa 1996 and Digman 1990).

Validity of the FFM. In application to the “work world,” personality traits have referred to relatively stable internal states that help to explain how a job incumbent or job applicant will behave on the job (Epstien 1979; Furnham 1992; Gangestad and Snyder 1985; Hogan 1991; McCrae and Costa 1990b). Studies based on the FFM have shown personality traits to be a useful predictor of job performance, with validity estimates from 0.24 to 0.45 (Day and Silverman 1989; Hogan 1991; Salgado 1997; Tett, Jackson and Rothstien 1991).

In a meta-analysis, Barrick and Mount (1991) found **conscientiousness** to be a valid predictor of job performance in all occupations and all criteria (job proficiency, training proficiency and personnel data -- corrected  $r = 0.22$ ). Additional support was provided by Hough et. al., (1990), who found that two important facets of conscientiousness (achievement and dependability) were valid predictors of all job-related criteria. In a follow-up study, Barrick and Mount (1993) investigated the relationship between the FFM traits and job performance in a sample of 146 first-line managers who were participating in a training program. Their findings were consistent with earlier meta-analysis results with respect to conscientiousness; conscientiousness correlated significantly with supervisory ratings of job performance (corrected  $r = 0.35$ ). They also found that **extroversion** correlated significantly with job performance (corrected  $r = 0.20$ ). In their meta-analysis, Barrick and Mount (1991) found that extroversion is a valid predictor in occupations requiring frequent interactions with others

(corrected  $r = 0.18$  for management jobs and corrected  $r = 0.15$  for sales).

**Openness to experience**, which correlates with cognitive ability more highly than other personality traits (Costa and McCrae 1985; Holland, Dollinger, Holland and MacDonald 1995; John, Caspi, Robins, Moffitt and Stouthamer-Loeber 1994), was a valid predictor of training proficiency (corrected  $r = 0.25$ ; Mount and Barrick 1991). Not surprisingly, it has also been found to correlate significantly with academic performance (Dollinger and Orf 1991; John et. al. 1994; Mervielde, Buyst and DeFruyt 1995). Also, openness to experience has also been found to correlate highly with creativity (King, Walker and Broyles 1996; McCrae 1987).

Barrick and Mount's (1991) meta-analysis suggests that **emotional stability** and **agreeableness** were generally not predictive of performance criteria. Emotional stability and agreeableness correlated best with personnel data<sup>8</sup> (corrected  $r = 0.09$  and corrected  $r = 0.14$  respectively).

Advances in the definition and the structure of personality, along with the associated predictive validity of the Big Five, have prompted the increased use of personality inventories in business and in industry (Barrick and Mount 1991; Hogan 1991; Hough et. al. 1990; Moore 1987; Pervin 1993; Saville, Sik, Nyfield, Hackston and MacIver 1996; Tett, Jackson and Rothstien 1991). In Canada, personality inventories are the most commonly used paper and pencil selection tool after cognitive ability tests (Thacker and Cattaneo 1987).

Even with all the progress in personality research in recent years the criterion-

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<sup>8</sup> Personnel data were data from employee files, such as salary level, turnover, status change and tenure.

related validity coefficients emerging from application of the FFM remain modest with some personality dimensions of the FFM unrelated to performance criteria (Schneider 1996). Adler (1996) suggests that this is partially attributable to the way in which performance is defined in organizations. Performance measures, he argues, are generally weighed towards the aggregate output produced by the employee. The job may not allow personality-rooted stylistic influences in on-the-job behaviour to affect the aggregated output. However, since employee personality impacts the perceptions that supervisors have of an employee, personality of an employee impacts the supervisor's perception of the employee's performance. This may be why personality variables are correlated more strongly with subjective appraisals of job performance (average validity of 0.26) than with objective performance criteria (average validity of 0.14, Barrick and Mount 1991). Adler's argument is supported by Hogan (1991).

Non-linear personality-outcome relationships. Lower than expected personality-performance correlations may also be due to a non-linear relationship between some personality traits and performance. Personality researchers have generally tested only for linear relationships; Day and Silverman (1989) being the most notable exception. Day and Silverman (1989) reported a significant quadratic trend in their polynomial regression analysis of the impulse-expression trait with "work within allotted time" and "working in a positive and professional manner with co-workers" criteria. Their data demonstrated that moderate scores were more predictive of success. They concluded that these findings "are somewhat troublesome in that linear models are most common in predicting job success" (p. 34). More recently, Kichuk (1997) suggested that the reason

she found no relationship between extroversion and the performance of successful engineering design teams was because the relationship was non linear. Barry and Stewart (1997), reported that extroversion related to team performance in a clear inverted-U relationship, with “groups having 20% to 40% high-extroversion members outperforming groups with either fewer or more such members” (p. 75). Schneider and Hough (1995) note that “many other instances of curvilinearity in personality-performance relationships seem plausible....Future research in the area of personality-performance relations should continue to investigate curvilinearity” (p. 117. Also see Murphy 1996). For example, in this study, a moderate amount of agreeableness may make a team member co-operative while too much agreeableness may make that person overly dependent and unassertive. The resultant agreeableness-individual effectiveness relationship would be an inverted-U shape. Other relationships may be discontinuous; Barrick and Mount (1991) suggest that beyond a critical range there may be no relationship between emotional stability and job performance. It seems clear that any study relating personality to outcomes needs to consider both linear and non-linear associations.

### Interactionist Theory

The principal legacy of researchers of the 1960s is a recognition of the influence of the situation on behaviour. Behaviour is caused and maintained not only by a person's trait based predisposition but also by the perceived consequences arising from external sources (e.g., externally inflicted rewards and punishment). Interactionist theory suggests that although there is a connection between personality and behaviour, the power of personality traits to predict behaviour may be limited to a fairly specific set of situations;

Wright and Mischel provided initial support for this proposition (Shoda, Mischel and Wright 1989, 1993; Wright and Mischel 1987). Support for Wright and Mischel's proposition is evident in more recent personality theories (Moskowitz 1994; Roberts and Donahue 1994; Schmit, Ryan, Stierwalt and Powell 1995).

Barrick and Mount's (1991) meta-analysis provides additional support for interactionist rationale. They found that even for conscientiousness, which has the highest average corrected correlation with performance, 43% of the variance in correlations across settings is due to variation in factors other than sampling error, reliability and restriction of range. This suggests that substantial variation across situations affects the strength of the relationship between personality traits and the job performance criteria (Adler, 1996; Barrick and Mount, 1991).

The extent to which cognitive ability influences behaviour seems also somewhat contingent upon the environment. Fiedler (1995), wrote that "if we wish to maximize the utilization of intellectually superior people, it behooves the organization to create an environment that is relatively free of interpersonal stress and uncertainty" (p. 20). According to Misumi and Maiya (1995), "cognitive ability cannot be expected to operate effectively under chaotic and short-term conditions" (p. 41). Thus, it seems that cognitive ability may be a better predictor of behaviour in contexts that provide the opportunity for people to think without pressure.

Situational strength. One fairly well established influence on the validity of personality is situational strength (Mischel 1977; Monson, Helsely and Chernick 1982). Situations are strong to the extent that they lead individuals to interpret particular events

in the same way, create uniform expectancies regarding the most appropriate behaviour, provide adequate incentives for the performance of that behaviour and require skills that everyone possesses roughly to the same extent. Herriot (1981) has discussed the selection interview in this fashion noting that the roles of both the interviewer and the interviewee are frequently well known and people often behave very similarly in these situations. In strong situations individual differences have low potential to vary action. Empirical evidence confirms that degree of autonomy of action, a proxy for strength of the situation, determines the extent to which personality influences behaviour (Barrick and Mount 1993). Similarly, Huttcuff, McDaniel and Roth (1996) found increased interview structure reduced the correlation between interview scores and cognitive ability -- the interviewee's behaviour was less determined by his or her cognitive ability.

A weak situation is one with opposite characteristics -- it is not uniformly interpreted, does not generate uniform expectations, does not offer sufficient incentives for one type of behaviour and is one in which a variety of skills may produce acceptable behaviour. Autonomous team situations could be classified as weak because they provide the worker with freedom, discretion and self-determination in planning and carrying out tasks. In the team situation, therefore, traits would be expected to be an important explanation of behaviour. Accordingly, if team members are uncertain about appropriate behaviour, they are expected to act in accordance with trait personality attributes in addition to team norms. The fewer restrictions that the team places on behaviour the stronger the personality-behaviour or cognitive ability-behaviour association.

The research context. Optimizing human potential in the workplace through the



creation of an involving and motivating organizational environment is the goal of many organizations (Lawler 1992; Pfeffer 1994). To this end, organizations are removing hierarchical layers, decentralizing and seeking to increase employee involvement and responsibility (Handy 1989). One way organizations have tried to increase employee involvement, responsibility and thus motivation, while remaining adaptable to the changing business environment, has been through use of autonomous work teams (Cohen 1993; Hollenbeck, LePine and Ilgen 1996; Lawler, Mohman and Ledford 1995).

Companies organize teams for a good reason -- there is considerable evidence that they can produce dynamic benefits when implemented correctly (Anfuso 1994; Buggie 1995; Davenport 1994; Ferrero 1994; Jourden and Heath 1996; Martha, Harker and Messerman 1994; Morley and Heraty 1995; Philips 1994; Reiste and Hubrich 1995). A recent survey of *Fortune 1,000* firms found that 67% use autonomous work teams with at least some employees, and that they are one of the fastest growing forms of employee involvement (Lawler, Mohman and Ledford 1995). Due to the increasing presence of teams in organizations, and because they are designed to allow autonomy in problem solving and task completion, teams are a fitting context for this study.

Research on trait based individual differences of group members has generally focused on the achievement of a specific task (e.g., idea generation) in a contrived experimental settings (generally laboratory settings) with data collection at the group level (Barry and Stewart 1997). In work settings teams complete a variety of tasks, over extended time periods.

Although contrived settings allowed control of extraneous variables that could

confound results, they have also restricted the “group experience” to a relatively short time period. That is, the experiment usually lasts a few hours; in that time groups are formed, tasks completed and outcome data collected. Since teams appear to go through different stages of development (Tuckman and Jensen 1977) the study of groups that have been together for a short period of time may have limited applicability to work teams that are intended to be on-going. At most, they contribute to our understanding of early group interaction.

Further, Stevens and Campion (1994) note that the “team as the level of analysis has been the predominate focus of most previous literature” (p. 504) (e.g., Hyatt and Ruddy 1997; Kichuk 1997). However, most HR management systems are applied, at least in part, to the individual employee (Stevens and Campion 1994). This study complements previous literature by focusing on individuals in teams as well as the team level of analysis.

The personal characteristics that are predictive of effective team member performance may vary with the nature of the tasks that must be completed (cf. Davis and Harless 1995, Murphy 1996). Some tasks are additive (Steiner 1972). This means that the potential performance can be predicted by adding the performance of individual members together. For example, typing of the team’s final report may be considered an additive task because it is possible to estimate the outcome by summing each member’s typing skills. Some tasks are disjunctive (Steiner 1972). This means that the potential performance of the team depends on the performance of the best member. Suppose that a team has to analyze the logic of a complicated argument. In this case the performance of

the team might hinge upon it containing at least one bright, attentive, logical individual. Some tasks are conjunctive (Laughlin and Ellis 1986). Conjunctive tasks are those in which the performance of the team is limited by the poorest performer. For example, if each member in a team is allocated a specific task and the person who is to write up the report does a poor job of communicating to the reader the team's solution, then this person's poor performance damages the effectiveness of the whole team. Generally, in the workplace, teams must complete at different times, all three task types. This study seeks personality traits predictive of effective team performance over all three task types.

In short, methodologically, a strength of the present study is that it analyzed behaviour in work teams experiencing genuine performance incentives over a series of tasks. Research in this area has predominantly used laboratory methods in short-lived post-hoc groups. Hackman and Morris (1975) note that in these laboratory experiments a group "does not have a chance to develop its own history or its own unique normative structure" (p. 59). By using autonomous work teams that remained intact for thirteen weeks it was assumed that meaningful norms developed that were unique to each group. These norms differ from team to team because they are influenced by the traits of each team's members.

### Theory of Personal Dispositions

Lykken, McGue, Tellegen and Bouchard (1992) argue that broad personal dispositions often emerge from a particular configuration of traits. According to Adler (1996), "configural research may often yield conceptually simpler models than those typically tested through three-, four-, and five-way analysis of variance which treat each

personality predictor independently” (p. 213). Basically, the theory suggests that personality needs to be described in profile terms in order to begin to capture what it might mean in terms of the integrated functioning of a person (cf. Murray 1938).

Personality profiles. In the management literature, there have been several studies directed at the discovery of personality profiles. However, few of these have examined personality profiles across the Big Five. Most notable amongst studies that have looked at profiles at the Big Five level are those focused on integrity. People high in integrity are likely to have a profile high in conscientiousness, agreeableness and emotional stability (Dunn et. al. 1995, Ones, Viswesvaran and Schmidt 1993, see also Hogan and Hogan 1989 and Hough et. al. 1990). Ones, Viswesvaran and Schmidt (1993), in their meta-analysis of integrity tests, found integrity correlated 0.42 with conscientiousness, 0.40 with agreeableness and 0.33 with emotional stability. Correlations between integrity and the other FFM traits, extroversion and openness to experience, were considerably lower. Eysenck (1991), argued that those high in psychoticism have a profile high in agreeableness and conscientiousness. High performers in a flight training program were profiled as high in extroversion, openness and agreeableness (Cellar, Miller, Doverspike and Klawnsky 1996). McDaniel and Frei (1994), in their meta-analysis, found that customer service-oriented people are high in agreeableness, emotional stability and extroversion. Managerial potential has been strongly associated with conscientiousness, emotional stability and extroversion (Costa and McCrae 1995b).

Entrepreneurs have been profiled, at levels below the Big Five (i.e., at the facet level), as creative, achievement oriented, hard-working, self-confident, highly energetic,

outgoing, controlling, neurotic and self-centered (King and Roberts 1992; Lewis 1984; Ramamurti 1986; Savielle et. al. 1996). According to McClelland and Boyatzis (1982), effective leaders are high in activity inhibition, power motive and low in affiliation motivation. Cunningham, Wong and Barbee (1994) found those high in integrity are emotionally stable, optimistic about human nature, rigid in attitudes or beliefs and motivated to excel. McLellan and Paajanen (1994) advocate a 16 facet profile of individuals high in customer service orientation<sup>9</sup>. Customer service-oriented people can be characterized as resilient and coolheaded; cautious, planful and thoughtful; and willing to cooperate and defer to others (Costa and McCrae 1985; Costa, McCrae and Dye 1991; Hogan and Hogan 1992). In a study of the predictors of worker's salary, job level and tenure, the personality traits of independence, toughness, and extroversion, were found to be good predictors (Melamed 1995).

To-date, no profile has been sought for effectively behaving autonomous work team members. In addition, prior profile analysis has generally not taken into account trait elevation. Lastly, profile analysis has not included cognitive ability as one of the potentially predictive traits.

#### Peer-assessment of Frequency of Behaviour Exhibited

In the present study, the frequency with which team members' exhibit (in)effective team behaviours was determined by peer assessment using a behavioural

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<sup>9</sup> The personality dimensions were sociable, communicative, courteous, positive body language, perceptive, responsive, cooperative, tactful, even-tempered, flexible, open, accepting of authority, optimistic, externally rewarded, reliable, and competent.

observation scale (BOS) developed through critical incident analysis. Peer ratings are the second most commonly used method of determining on-the-job performance (Bernardin and Beatty 1984); evaluations from supervisors being the most common method (Cascio 1991; Cleveland, Murphy and Williams 1989).

In assessing behaviours by averaging peer ratings for each team member, it was plausible that the resultant measure of the frequency of behaviour could suffer from bias (e.g., liking or similarity). In the case of the behaviour-individual team member effectiveness relationship both the dependent and the independent variables could suffer from bias because they are both determined through averaging peer ratings.

Liking and similarity have received the most research attention so these types of criterion contamination will be considered in greater detail. Research on similarity and liking is most often based on the theory that similarity can lead to increased interpersonal attraction (e.g., liking) (e.g., Hunt and Armstrong 1976; Ross and Ferris 1981; Wexley and Nemeroff 1974). This is because similarity results in a consensus of views, which is rewarding. Moreover, the ratee's clothing or attractive facial features may also increase or decrease interpersonal attraction or liking (Byre 1971). This theory raises a concern regarding bias when a team member's performance is evaluated by requiring the ratee to evaluate the occurrence of desired behaviour and the effectiveness of overall performance, as was the case in this study. This is of particular concern given that how liked team members are does not seem to predict team performance (McGrath 1962; Terborg, Castore and DeNinno 1976). The use of multiple raters may reduce this type of bias somewhat. However, if all assessors are similarly affected by interpersonal attraction

factors, that promote shared feelings of liking or disliking toward a team member, then a more subtle form of criterion bias may occur.

Theory has recognized criterion bias as a significant problem (e.g., Blum and Naylor 1968; Thorndike 1949). However, empirical evidence does not support treating bias as a significant problem (Barry and Stewart 1997; Schmitt, Pulakos, Nason and Whitney 1996). Overall, peer-appraisals have been shown to be fairly *accurate* indicators of job performance (Kane and Lawler 1978; Schmidt, Gooding, Noe and Kirsch 1984; Wexley and Klimoski 1984). A recent meta-analysis found peer sample size weighted mean interrater *reliability* across six specific dimensions of job performance was 0.42. For ratings of overall job performance interrater reliability for peer ratings was *also* 0.42 (Viswersaran, Ones and Schmidt 1996).

### Hypotheses

In each of the relationships tested and explored below, situational strength was treated as a covariate. Part of the analysis in this study was exploratory in nature. The primary focus of the exploration was to capture those behaviours that mediate the relationship between: 1) personality and team performance and 2) cognitive ability and team performance. This does not lend itself to a-priori listing of specific hypotheses because there is insufficient prior research to state what (in)effective team behaviours are. Some general expectations are forwarded instead.

All hypotheses with personality as a predictor were first tested assuming linear relationships. Subsequently, non-linear analyses were conducted. In addition, personality-outcome tests first involved relating discrete personality dimensions to dependent

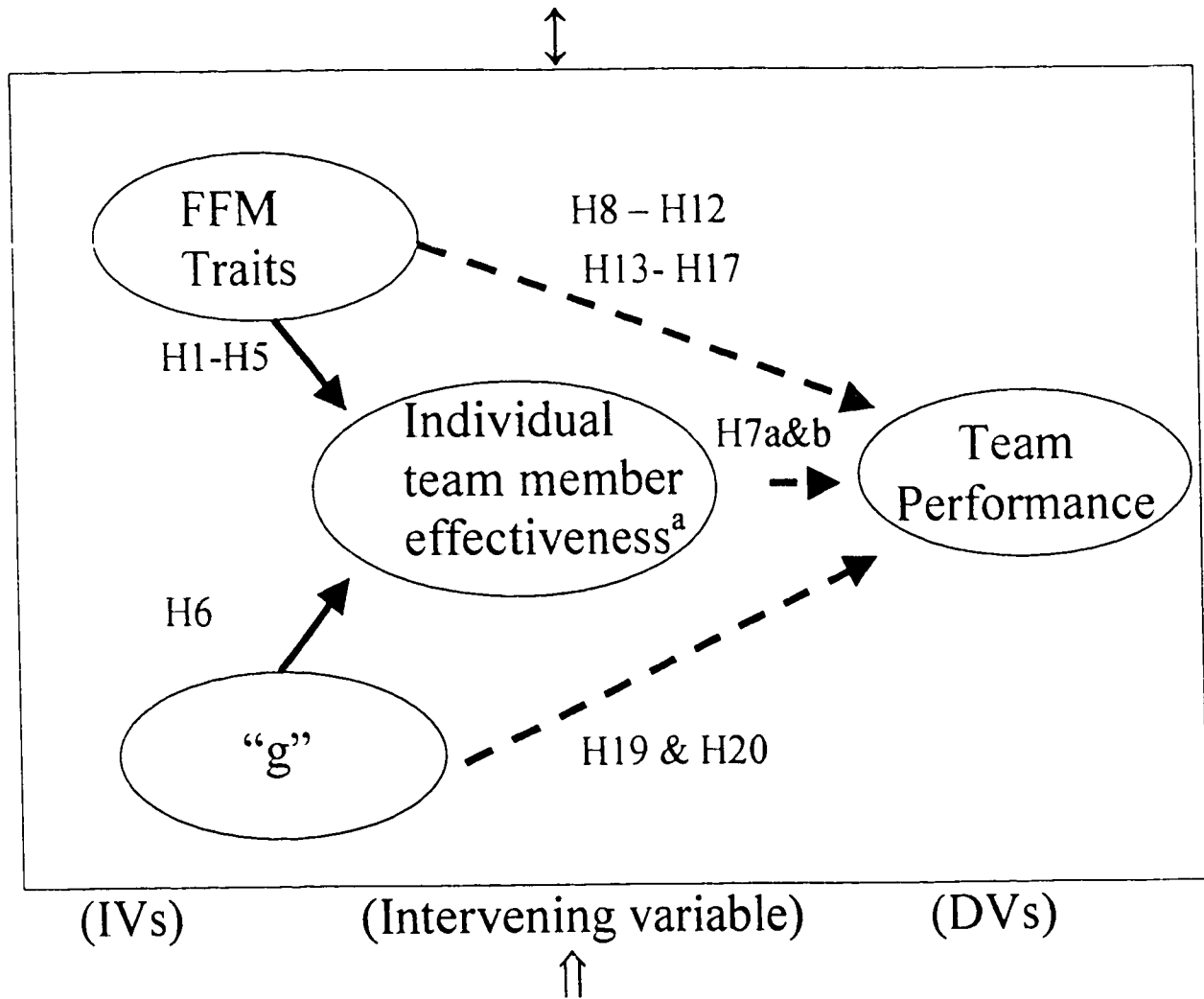
variables. Next, trait profiles were explored in order to determine the most predictive combination of traits (personality and cognitive ability). The exploratory portion of this study is presented under a separate heading.

All the hypotheses that were tested are presented diagrammatically in Figure 2. The bold broken arrow represents the relationship between individual team member effectiveness and team performance. Peers were asked to assess how *frequently* their fellow team members exhibited (in)effective behaviours on a behavioural rating scale (Behavioural Observation Scale – BOS). The scores were aggregated for each team member so that a high score represented a team member that exhibited effective team behaviour relatively often. The average rating received by a team member from his or her peers was the measure of the effectiveness of that individual's performance. Team performance was the average rating of the quality, quantity and timeliness of the team's outcomes on a variety of tasks performed over a 13 week period as assessed by an independent assessor.

Relating team member attributes to team performance. Individual team member attributes can be related to team performance in two ways. One way involves averaging member scores. That is, aggregating members' scores on the attribute and determining the average score on that attribute for the team. Recent studies that have used this method are by Cohen, Chang and Ledford (1997), Hyatt and Ruddy (1997) and Kichuk (1997). The other method, involves determining the proportion of team members that score relatively high on the attribute. One may then determine the association between the proportion of high-attribute people in a team and that team's performance. Barry and



Context: Autonomous work teams



Control variables: restrictions that the team places on behaviour, resources/time

<sup>a</sup>Based upon performance relevant behaviours

Figure 2. Summary of the Hypotheses to be Tested

Stewart (1997), most recently used this method in their study of team member personality and team performance. Arguments can be made for the use of either method. Consider two teams. Team one has three members. They have cognitive ability scores of 25.00, 25.00 and 10.00 respectively. Team one therefore has two relatively high scorers and one low scorer. Team two has one high and two average scores – 30.00, 15.00 and 15.00 respectively. Both teams' average ability level is 20.00. If the two teams performed differently because the first contained one more member very high in cognitive ability than did the second team, then the team's average cognitive ability score would not be a useful predictor of team performance. The proportion of high-ability members would be useful.

Yet, on tasks that are largely disjunctive (e.g., solving a problem), only one high-ability team member is required to increase the performance of the team substantially. The number of high-ability team members beyond the one high-ability team member should not significantly predict task performance. On these kinds of tasks the team's average cognitive ability should not be any better a predictor of the team's performance than the proportion of high-ability team members. On additive tasks, it is possible to estimate the team's outcome by summing each member's performance. In this case, the average cognitive ability of the team should be a better predictor of the team's outcome than is the proportion of high-ability members of a team. On conjunctive tasks, the team's performance is limited by the performance of the poorest performing team member – a weak link in the chain. On conjunctive tasks the proportion of high-ability team members would be a poor predictor of the team's performance. This is because in most cases one

can not determine if there is a weak link in the chain – only the number of strong links is being considered (unless all the team was composed of high-ability members in which case one can be sure that there are no weak links). Thus, when examining the two possible methods of relating individual team member attributes to the team's performance from the perspective of tasks, it seems that the averaging method is superior.

In summary, there are arguments supporting both methods of relating individual team member attributes to team performance. In addition, both methods have been used in previous studies. There is sufficient support for using both methods in this study.

FFM and individual effectiveness (H1-5). The first set of hypotheses (1-5) assessed whether each of the Big Five personality traits was predictive of a team member's total score on the behavioural observation scale (BOS). The behavioural scale contained performance-relevant behaviours on which team members could be rated by their peers. Ineffective behaviours were reverse scored so that cumulative scale scores represented the frequency of effective behaviours exhibited by team members. Once ineffective behaviours had been reverse scored, an individual's cumulative BOS score reflected how often (s)he exhibited effective team member behaviours over the thirteen week period during which the team was together. This cumulative scale score was the measure of individual team member effectiveness.

Specifically, it was hypothesized that each of the Big Five personality traits – neuroticism (H1), extroversion (H2), openness to experience (H3), agreeableness (H4) and conscientiousness (H5) -- is positively correlated with an individual's effectiveness (a team member's score on the behavioural rating scale) when situational strength is

controlled for. Each FFM trait was addressed as a separate hypothesis because some FFM traits may be significantly correlated with individual effectiveness within a team while others are not.

Cognitive ability and individual effectiveness (H6). Intelligent people tend to perform better than do less intelligent people in various occupations and on various criteria (Hunter and Hunter 1984). Intelligent people were expected to have the wherewithal to exhibit effective team behaviours more often than do less intelligent people. Therefore, they should score higher on the BOS since it measures the effectiveness of a team member's performance. Thus:

Team member cognitive ability is positively associated with the effectiveness of individual team member performance. (Hypothesis 6)

Individual effectiveness on the BOS and team performance (H7a/b). The foregoing hypotheses addressed the relationship between personal characteristics and an individual's contribution to performance in a team setting. Next, the association between individual team member effectiveness and the team's performance was explored. At a general level, teams with many members that score high on the behavioural scale (those with scores in the top 33% of this study's sample) were expected to perform better than were teams with fewer members that scored high on the behavioural scale. It was also expected that the team's mean on the BOS was associated with team performance. That is, teams with a higher average score on the BOS (the team's effectiveness score) would perform better than teams with a lower average score on the BOS. Thus:

The team's mean score on the BOS is positively associated with the team's performance. (Hypothesis 7a)

The proportion of individuals in a team having relatively high scores on the behavioural rating scale is positively related to that team's performance. (Hypothesis 7b)

FFM and team performance (H8-17). The foregoing hypotheses addressed the mechanisms through which personal attributes relate to an individual's contribution to performance in a team setting. However, it is important to acknowledge that the role of personality dispositions in the team as a whole may differ. Finding significant predictive validity for traits at the individual level does not necessarily argue for creating work teams having members with only these traits. An assessment of team-level dynamics required analysis of the *combined* affects of team member personalities.

Each team member's composite score was aggregated to obtain a mean for the team. The team's personality should predict the team's performance. Hypotheses (8-12) assessed whether each of the Big Five personality factors, when aggregated to form a team mean, predicted the team's performance. Specifically, it was hypothesized that each of the FFM traits at the team level (neuroticism (H8), extroversion (H9), openness to experience (H10), agreeableness (H11) and conscientiousness (H12)) is positively associated with the team's performance.

The personality-team performance relationship was also studied in terms of the proportion of people in a team that score high on a particular personality trait. A high-trait score was one that was in the top third of population scores – the 66% cut-off point for each of the Big Five was provided by the personality inventory publisher. The proportion of team members receiving high scores on each of the FFM traits (neuroticism (H13), extroversion (H14), openness to experience (H15), agreeableness (H16) and

conscientiousness (H17)) were hypothesised to relate positively to team performance.

Cognitive ability and team performance (H19 and H20). Above, it was argued that an assessment of team-level dynamics requires analysis of the *combined* effects of team member personalities. The same argument can be made for cognitive ability.

Each team member's composite score was aggregated to obtain a mean for the team. Hypothesis 19 assessed whether team members' cognitive ability, when aggregated to form a team mean, predicted team performance. Specifically, it was hypothesized that the team's cognitive ability was positively associated with the team's performance (H19).

The individual effectiveness-team performance relationship can also be studied in terms of the proportion of team members that score high in cognitive ability. A high-ability score was one that was in the top third of the sample of scores obtained in this study. The proportion of high-ability team members was hypothesised to positively correlate with team performance (H20).

#### Exploratory Portion of the Study

Explorations of interest are presented diagrammatically in Figure 3. The broken arrow represents the relationship between individual team member effectiveness, when aggregated, and team performance.

### Context: Autonomous work teams

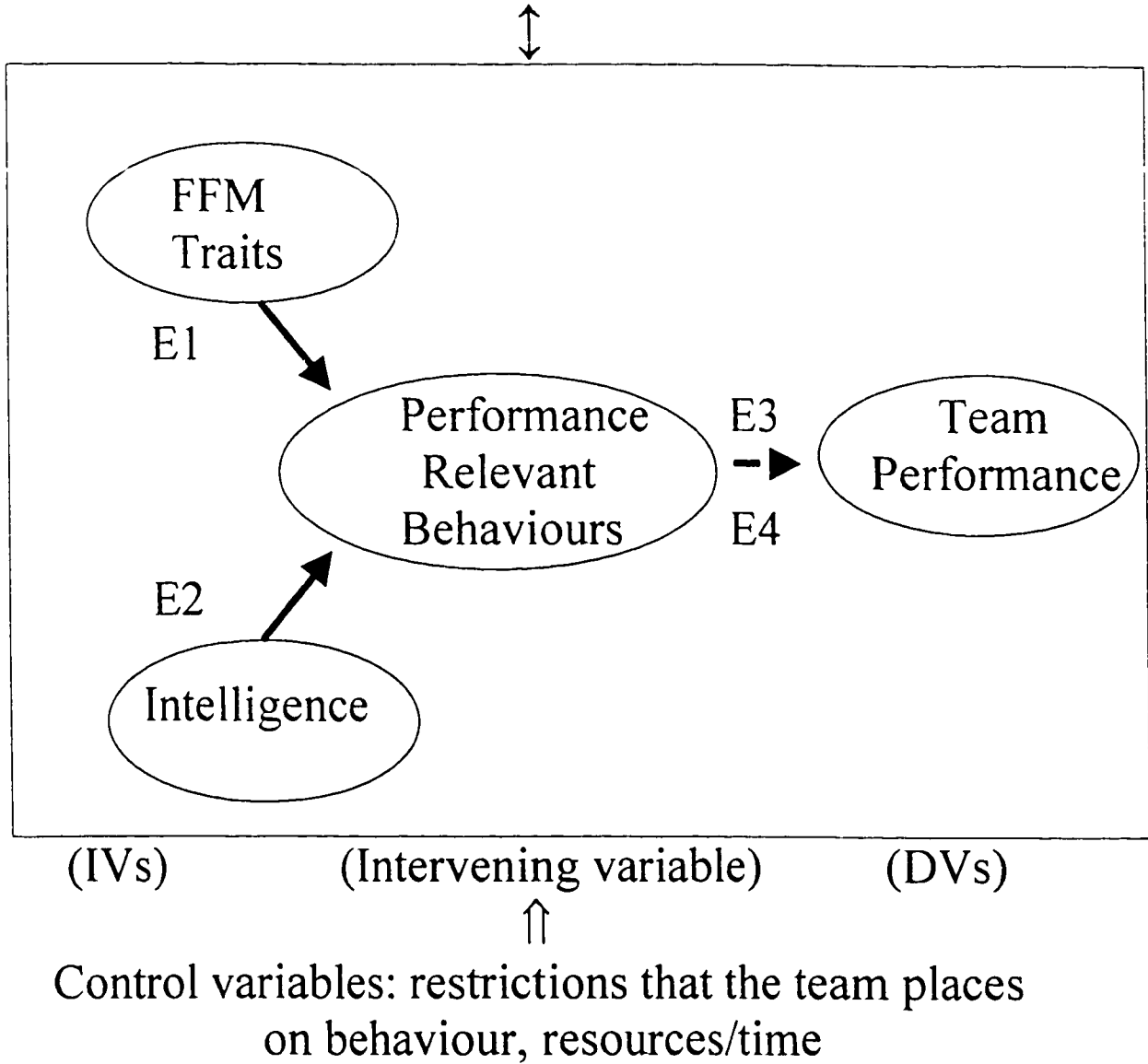


Figure 3. Summary of the Exploratory Analysis.

Personality and “effective” behaviours within teams (E1). The relationships between personality and global ratings of overall individual effectiveness within teams may be weak or moderate<sup>10</sup>, partially due to personality measures *not* being related to more specific criteria that they are most likely to impact. That is, reliance on a global measure of effectiveness may mask significant relationships between personality and specific behavioural performance criteria. The impact of personality on performance is mediated through specific behaviour; behaviour is more proximal to personality than is a global rating of overall individual effectiveness. Accordingly, the relationship of personality to individual performance-relevant *behaviours* within teams was investigated (exploration 1). The behaviours were obtained from specific examples of (in)effective behaviours experienced by the subjects in this study. These behaviours were used to construct the BOS on which team members rated the frequency with which their peers engage in specific (in)effective behaviours.

Recall that Stevens and Campion (1994) had suggested that team performance is enhanced where: (1) specific, challenging and accepted team goals are established, (2) team performance is monitored and evaluated and (3) where task expectations of team members are clarified. These are the behaviours one might expect of individuals high in *conscientiousness*. Accordingly, the relationship between conscientiousness and within-team performance-enhancing behaviours (measured by the BOS) of this sort was investigated.

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<sup>10</sup> According to Cohen (1977), a weak relationship is one with an effect size of around 0.02, a moderate relationship is one with an effect size of 0.13, and a strong relationship is one with an effect size of around 0.26.



As mentioned previously, effective team members take initiative on tasks (Larson and LaFasto 1989; Wellins et. al. 1991), communicate frequently with other workers (Larson and LaFasto 1989; Stevens and Campion 1994; Wellins et. al. 1991) and participate frequently in group discussions (Hogan et. al. 1994). These behaviours were expected more from the extroverted than from the introverted members of a team. Accordingly, a positive relationship between *extroversion* and these initiative-taking behaviours (e.g., participation in team discussions and initiating communications with others) within teams was anticipated and were examined.

Wellins et. al., (1991) expected that effective team members ask for ideas, offer help, accept suggestions, consider the skills, motives and needs of other team members, work with others to solve problems and consider others' ideas. Stevens and Campion (1994) suggested that effective team members listen non-evaluatively. These behaviours appear to be related to *agreeableness* -- accordingly, it was anticipated that agreeableness would correlate positively to behaviours of this sort (e.g., seeking input from others, accepting suggestions and working co-operatively).

According to Hogan, et. al., (1994) *emotional stability* influences reactions to conflicts and negative feedback; emotionally stable individuals react less defensively and they do more to resolve conflict than do less stable individuals. Thus, resolution-seeking behaviours were expected to relate positively to team members' scores on the measure of *emotional stability*.

Lastly, there is evidence to suggest that *openness to experience* positively contributes to team performance during problem solving (Larson and LaFasto 1989) and

conflict resolution (Steven and Champion 1994). This may be due to the creativity and open-mindedness of team members who are high in openness to experience. Accordingly, it was expected that openness to experience would correlate positively with the frequency with which individuals' actively listen, ask relevant questions and offer unique suggestions within their teams.

Cognitive ability and "effective" behaviours within teams (E2). Team member cognitive ability may impact some team behaviours more than others. For instance, cognitive ability may predict team member behaviour related to effective problem solving (e.g., Schmidt, Hunter and Perlman 1981), prioritizing between conflicting roles and adapting to new situations (e.g., Hunter 1986). However, correlations with leadership type behaviour may be weak (e.g., Bass 1990; Fiedler and Garcia 1987; Ghiselli 1963).

Although cognitive ability has been linked to effective performance by several studies, there is little research describing how high cognitive ability people behave in team situations. The team context is unique. One may not be able to extrapolate cognitive ability-behaviour relationships found in traditionally structured jobs to the team context. That is, the strength of the relationship is dependent on the context in which it is measured (Fiedler 1995; Misumi and Maiya 1995). Hence, this study explored the different types of performance-relevant team behaviours that could be predicted by cognitive ability.

Behaviour and team performance (E3). Although the BOS contained team member behaviours already deemed to be (in)effective, the relative contribution of these

behaviours to team performance is unknown. Consequently, an exploration of the associations between behavioural dimension scores aggregated over team members and team performance was conducted.

Non-linear FFM traits-outcome relationships. Lower than expected personality-performance correlations may also be due to a non-linear relationship between some personality traits and performance (Barry and Stewart 1997; Day and Silverman 1989; Schneider and Hough 1995). Hypotheses 1-5 and 8-13 were re-tested using a non-linear procedure.

FFM trait profiles. Stronger relationships between personality and individual effectiveness within teams are likely when considering personality *profiles* across the Big Five. Accordingly, follow-up exploratory analyses assessed whether there was a unique profile across the Big Five that distinguished more effective team members (as determined by peer evaluations) from less effective team members. In this analysis, cognitive ability was treated as a covariate to get at the contribution of personality after the affects of cognitive ability had been statistically controlled. Situational strength was also treated as a covariate. Non-linear profile analysis was also conducted.

At the team level, linear profile analyses were conducted for the team's aggregated personality and for the proportion of high scoring team members on each of the FFM traits. The exploratory analyses determined whether there was a unique profile across the Big Five that distinguished effective teams while statistically controlling for situational strength and cognitive ability.

## CHAPTER 3

### Method

#### Participants

The subjects were 480 second year undergraduate business students enrolled in a mid-sized Ontario university's Organizational Behaviour course. In the sample, 58% of the students were female and the average student age was 21.10 years old. Each student self-selected membership into a team of five to six individuals, during week one of a thirteen week course, in order to participate in team assignments requiring critical thinking and problem solving. The median number of students in each group was five. Each team met at least once a week for 50 minutes. No team leader was designated. Of a student's overall course grade, 20% was determined by the teams' output over a thirteen week period. Completion of group assignments, peer evaluations and self-analysis measures was mandatory. However, students were free to indicate whether they wished to have their scores included in the study. As an incentive to allow their data to be used in the study, students were offered a one-percent bonus mark, performance feedback on each of the measures taken and assurance of individual anonymity. All students agreed to have their scores included in the study.

Rationale for the use of a student sample. The sample for this study was comprised of university students. The advantages of this sample include the: 1) ready accessibility to a large number of intact work teams that are working on the same tasks, 2) ease with which these individuals can be monitored and measured for several hours, 3)

homogeneity of prior teamwork experience and 4) similar accessibility to resources (e.g., time, outside resources, etc.). Moreover, within an actual business setting there may be much more homogeneity in personality than is the case for university students. Processes of recruitment, selection and attrition in organizations may contribute to this homogeneity on important personality traits (Judge and Cable 1997; Schneider 1987; Semmer and Schallberger 1996). For example, introverts are less likely to be attracted to an organization with rewards and structures that encourage interpersonal interaction. If an introvert is recruited by such an organization (s)he is less likely to be hired due to a mismatch between personality and organization culture. If hired (s)he is more likely to be fired or to leave than would the extrovert (Adler 1996). This results in a restriction on introversion for employees of that organization. Schneider's (1987) model hypothesizes that individuals select themselves into and out of organizations and that different types of people make up different types of organizations. This system of homogenization may explain why Tett et. al., (1991), in their meta-analysis, found that the average corrected correlation between personality and job performance for job applicant samples was 0.27 while it was only 0.12 for incumbent samples (Adler 1996).

The student sample in this study should not have the same restriction of range in personality that may be observed among a sample of workers from one organization because the primary selection criteria for university admittance is past grades (indirectly, cognitive ability). Therefore, the use of a student sample, rather than an actual work sample, should allow for a more accurate determination of personality relationships. There may however be a restriction of range in cognitive ability and corrections that can

be made for this will be discussed later if necessary.

### Measures

Personality. Personality was measured by the revised NEO-PI-R. Distributional properties are in Appendix A. The revised NEO Personality Inventory (NEO-PI-R; Costa and McCrae 1992) is a commercially available 240-item self-administered paper and pencil measure of normal personality. Item responses are coded on a five-point Likert scale ranging from “Strongly Disagree” (1) to “Strongly Agree” (5). The inventory yields scores for the Big Five plus 30 facet scales (previously described). The NEO-PI-R is the most frequently used and the best-researched measure of the Big Five (Costa and McCrae 1992). This instrument was selected because, as noted in the test manual (Costa and McCrae 1992) and in literature reviews (Hogan 1992; Leong and Dollinger 1990), the NEO-PI-R has sound psychometric properties, including impressive reliability and has been validated against most other commonly used personality inventories. Further, the NEO-PI-R is valid and reliable when administered to college students (Costa and McCrae 1992). The factor structure of the NEO-PI-R has been replicated in several diverse cultures (McCrae and Costa 1997) and similar factor structures have been found for men and women, older and younger adults and whites and non-whites (Costa, McCrae and Dye 1991; Piedmont 1994).

Internal consistency for the Big Five ranges from 0.86 to 0.95 and for the eight item facets scales ranges from 0.56 to 0.81 (Costa, McCrae and Dye 1991). The test-retest reliability coefficients are estimated to be approximately 0.79, 0.79, 0.80, 0.75 and 0.83 for emotional stability, extroversion, openness to experience, agreeableness and

conscientiousness, respectively (Costa and McCrae 1992). Correlations between the NEO-PI-R, and two other operationalizations of the FFM, the Hogan Personality Inventory (Hogan 1992) and the California Q-set (Block 1961), support the construct validity of the NEO-PI-R (Goldberg 1989; McCrae, Costa and Busch 1996).

Cognitive ability. General cognitive ability was measured by the commercially available Wonderlic Personnel Test; a timed, 12-minute paper and pencil test<sup>11</sup>. Test-retest reliabilities reported in the test manual range from 0.82 to 0.94 and the manual also provides evidence of the validity of the measure (Wonderlic and associates 1992). The Wonderlic correlates well (0.60 to 0.70) with training program grades in industrial settings, 0.92 with the Wechsler Adult Cognitive ability Scale (Hawkins, Faraone, Pepple and Seidman 1990) and 0.74 with the GATB (McCormick, Mecham and Jeanneret 1989).

Overall team performance. Each week teams completed an exercise. Exercises included critical analysis of newspaper articles, case analyses, evaluation of common selection instruments, design and construction of a structured interview and performance appraisal instrument (Appendix B contains a selection of the exercises completed). Tasks involved decision making, seeking additional information and consulting various resources (e.g., library research), critical thinking, creative problem solving and report generation. Minimum guidance was provided on how to complete tasks. The teams are similar to other types of work teams in that they need to communicate with each other if they are to perform effectively. Specifically, team members need to communicate about such matters as prioritizing tasks, available expertise within the team and task and time

allocation. All these issues will affect the quality of the team's report. They are also similar to other types of work teams in that they have team goals, are evaluated in terms of the team outcome and think of themselves as a team. In summary, the autonomous work team members are task- and outcome-interdependent in that members must rely on each other and work together in order to perform effectively and efficiently.

Almost every exercise had to be completed during an in-class 50 minute session. Reports had to be submitted prior to a team leaving the session. An independent evaluator scored reports submitted by the teams each week. The average score over the thirteen-week period served as the measure of overall team performance. Distributional properties are in Appendix A.

Effective and ineffective team member behaviour. Critical incident analysis was used to determine (in)effective team member behaviour. Critical incident analysis is a method often used in human resources management (Gatewood and Field 1994). In this study it was used to gather specific examples of (in)effective behaviours on which attributes of team member performance were made. Each critical incident card asked team members to think about their team experience over the thirteen weeks that their team had worked together and to remember at least one example of effective (good) and at least one example of ineffective (poor) team behaviour that they *personally* observed. Appendix C, contains the critical incident cards that were completed. There is one card each for effective and ineffective team member behaviours. Each card asked team

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<sup>11</sup> Most of the evidence suggests that subsets of ability (i.e., verbal, spatial, math, etc.) do not add meaningful incremental validity to the prediction of job performance (Ree, Earles and Teachout 1994; McHenry, Hough, Toquam, Hanson and Ashworth 1990).



members to describe: (1) what circumstances lead up to the incident, (2) what exactly the team member did that was (in)effective, (3) what were the consequences of the team member's actions and (4) how they rate the incident in terms of overall effectiveness (on a five-point Likert scale ranging from "ineffective" (1) to "very effective" (5)).

The Behavioural Observation Scale (BOS) was developed from the critical incident cards. It consisted of statements related to observable effective or ineffective team member behaviours. Students then rated, on a five-point Likert scale, the frequency with which each team member had been observed engaging in each of the behaviours.

Individual team member effectiveness. To determine the effectiveness of individual team member effectiveness, the average of the peer assessments, using the BOS, was utilized. Peer assessments are amongst the most accurate assessment methods (Kane and Lawler 1978; Schmidt, Gooding, Noe and Kirsch 1984; Wexley and Klimoski 1984).

Situational strength. Situational strength was measured by two items that were included in the BOS. The first item asked respondents to evaluate the degree to which the team imposed structure and constraints on his/her *own* behaviour and the second item asked the respondent to evaluate the degree to which the team imposed structure and constraints on the behaviour of *other* team members. Responses were recorded on a five-point Likert scale ranging from "strongly agree" (1) to "strongly disagree" (5).

### Procedure

In week one of this study, students were assigned to nine sections of

approximately 53 students each<sup>12</sup>. Within these sections, students self-selected team membership. A written script was used when the personality, cognitive ability and BOS measures were taken. This helped to ensure that each section received the same information. Prior to taking the personality, cognitive ability and BOS measures, subjects were reminded that their responses were to be kept confidential.

Research design. In most business research, variables of interest cannot be manipulated and subjects cannot be assigned to treatment and control groups (Cook and Campbell 1979; Emory 1985). When this is the case, an ex post facto (which means “after the fact”) design is often the only one feasible (Emory 1985). According to Emory (1985),

“With an ex post facto design, investigators have no control over the variables in a sense of being able to manipulate them. They can only report what has happened or what is happening. In fact, it is important in this design that the researchers not influence the variables; to do so is to introduce bias” (p. 60).

Since personality and cognitive ability cannot be manipulated, but the causal relationship between these traits and individual and team performance was of interest, the design of this study is best described as ex post facto. Instead of manipulating and/or controlling exposure to an experimental variable, in this study the existing levels of traits as independent variables were measured. Various tasks were assigned to autonomous teams and outcomes measured.

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<sup>12</sup> Assignment was not random – it was done to avoid conflicts with other courses. Assignment into tutorials was done for teaching purposes unrelated to this study but it also provides an opportunity for the researcher to administer measures to no more than nine teams at a time and to answer any queries or concerns. It is particularly important to administer the cognitive ability test to small groups of subjects because the investigator is required to examine each person’s answers to the sample question to ensure that they understood the instructions.

Measurement of personality. Data collection began in week eleven of the study. The first measure to be completed was the NEO-PI-R. The students were provided with a NEO-PI-R Item Booklet and a hand-scoring answer sheet. They were asked to follow along, while the investigator read the instructions on the cover page of the Item Booklet aloud. Feedback was provided to each student using the NEO Summary form obtained from the inventory publisher.

Critical Incident Cards. Critical incident cards were distributed in week twelve. Students were asked to write down at least one example of effective and one example of ineffective team member behaviour. They were reminded that their examples should be actual behaviours observed in their teams over the previous eleven weeks. An example of a completed card was provided before they began.

Cognitive ability. In week eleven, cognitive ability was also measured. Subjects were asked to follow the instructions on the cover page of the test booklet while the proctor reads them aloud, and to complete the sample questions provided on the front page of the test booklet. The test began once the investigator was convinced that each subject had accurately completed the sample questions. After all data were collected, subjects received their scores as feedback and had access to estimated population norms supplied for comparative purposes by the test publisher.

BOS development and administration. The generation of a BOS from the subjects' critical incident cards involved three steps.

1. Two people who were familiar with critical incident analysis were hired to work together to sort the critical incident cards gathered from each team member into

“meaningful clusters” (i.e., groups of incidents describing essentially the same behaviour). A randomly selected ten percent sample of the incidents were set aside in order to test the reliability of the clusters at a later point in time (step two).

Descriptive behavioural items were written to “capture” each cluster of highly similar incidents. These “summary items” were then grouped, based on content similarity, to form the subscales of the BOS. For example, two incidents, which described a team member’s development of a thorough action plan, might have formed one behavioural item described as “develops an action plan prior to starting the task.” This item along with similar items might form an overall behavioural scale labelled, “planning and scheduling.” Thus, similar incidents were clustered together to form a behavioural item and similar behavioural items were clustered together to form a behavioural scale of the BOS. These behavioural scales were given descriptive dimension labels.

2. After grouping critical incidents, the first test of content validity was conducted. The incidents set aside in step one were examined to determine if any of them described behaviours not captured by the dimension desired. If some behaviours had not been captured then additional critical incidents would have been generated from the subjects and step one repeated. This was done to ensure that the BOS scales comprehensively sample the full domain of (in)effective individual behaviours within teams. However, all behaviours were captured in the existing dimensions and this step was unnecessary.
3. Two new people who were familiar with critical incident analysis served as judges in establishing inter-judge agreement. They received the same critical incidents that the

sorters had in step one. The incidents were in random order. The judges were asked to work together to reclassify the incidents according to the descriptive dimension labels established in step one. The ratio of inter-judge agreement was calculated by counting the number of incidents that both the sorters in step one and the judges in step three agreed should be placed in a given dimension. If the ratio of correctly classified incidents/total number of incidents, in a given dimension was 0.8 or greater, then the dimension was deemed to adequately represent the behaviours. If the hit rate was below 0.8, the dimension was examined for possible rewriting to increase specificity or the incidents were reclassified.

The BOS was developed so that the major dimensions and the most frequently occurring incidents under each dimension were represented. Next, the “situational strength” items were added to the BOS. Each team member evaluated fellow team members, using the BOS, in week thirteen of the study. The BOS is in Appendix D.

### Analysis

The analysis section is organized so as to match the structure of the hypothesis section. Six main types of analyses were conducted: confirmatory factor analysis, partial Pearson product-moment correlation, standard multiple and hierarchical regressions and stepwise regression (to determine the best combination of traits to predict individual effectiveness and team performance). In addition, non-linear regression analysis was conducted. The non-linear regression analysis involved dummy variable coding. The incremental validity of non-linear solutions over linear solutions, as determined by the

partial-F test<sup>13</sup>, was the measure of the benefit of the non-linear approach. Initial data cleaning<sup>14</sup> and all regression analyses were conducted using SPSS 6.1. Confirmatory factor analysis was conducted through Lisrel 8 (Jöreskog and Sörbom 1993).

In the regression analyses, the *dependent variable* was either individual team member effectiveness, overall team performance or BOS behavioural criteria (see above for operational definitions). The *independent variables* were either the Big Five (neuroticism, extroversion, openness to experience, agreeableness and conscientiousness) or cognitive ability.

Before actual analyses could be conducted however, composite scores for each of the Big Five and individual team member effectiveness were calculated. In addition, average team scores on the BOS and the proportion of group members scoring high on the scale was determined. Lastly, at the team level, average team FFM scores and proportion of team members scoring high on each trait was calculated.

FFM trait scores. The main criticism of the *NEO-PI-R* is its lack of orthogonality (Block 1995; Costa and McCrae 1995). To enhance discriminant validity while obtaining scores for each of the Big Five traits, factor scores were calculated using the scoring matrix provided in the *NEO-PI-R* manual (see Costa and McCrae 1992, p. 8). Factor scores are better than unit weight composites, from a psychometric point of view, because they combine information from each of the 30 facets to estimate each of the factors (BOS dimensions). They also benefit from secondary factor loadings. In addition

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<sup>13</sup> Reference Wesolowsky (1975; p. 66).

<sup>14</sup> Data cleaning included: listwise deletion of missing variables, analysis of univariate and multivariate outliers, check for normality, linearity, homoscedascity, and multicollinearity.

to factor scores being more nearly orthogonal, they tend to have somewhat higher validities against external criteria (Costa and McCrae 1992).

Team level personality. In order to examine the aggregate effects of personality on team performance, individual team members' personality scores were aggregated and an average obtained – referred to as the “*team's personality*” or the “*team's aggregated personality*”. Say, that a team has three members. Member one achieves a extroversion score of 12, member two scores 16 and member three scores 14. Then the team's extroversion personality score is  $(12 + 16 + 14)/3$  (number of team members) = 14.

The proportion of team members scoring high on a personality trait – “*high-personality*” -- was determined by first calculating T scores (standardized measures with  $M = 50$ ,  $SD = 10$ ) for each individual. Following conventional practices in scoring personality profiles, T scores above 55 were interpreted as high scores (*high personality* scores comprise Costa and McCrae's high and very high categories). This practice results in a classification nearly identical to choosing individual scores in the top third (66<sup>th</sup> percentile or top 33 percent of population scores) of the distribution for each trait<sup>15</sup>. Thus, in this study the proportion of group members scoring high on a trait category was operationalized as the proportion of members with a T score above 55 on that trait which

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<sup>15</sup> Although percentages vary somewhat with the shape of the distribution, of all individuals administered the NEO-PI-R, approximately 38% score in the average range (T = 45 to 55), 24% score in the high range (T = 56 to 65) and 7% score in the very high range (T = 66 and higher) (Costa and McCrae 1992; p. 13). High personality is operationalized as those people that score in the high (24% of individuals) and very high (7% of individuals) categories defined by Costa and McCrae (1992). Choosing Costa and McCrae's “very high” category (top 7% of individuals) only, would not provide a sufficient sample size for the analysis described later.

is identical to selecting the scores above the 66<sup>th</sup> percentile (top third)<sup>16</sup>.

Team level cognitive ability. In order to examine the aggregate effects of cognitive ability on team performance, team members' cognitive ability score was aggregated and an average obtained in the manner described above for personality. This average is referred to as the "*team's ability*" of the "*team's aggregated ability*"

The proportion of team members scoring high in ability was determined by selecting the top third of the distribution of scores. Thus, in this study the proportion of group members scoring high was operationalized as those with scores above the 66<sup>th</sup> percentile. In presenting study results, "*high-ability*" refers to scores above the 66<sup>th</sup> percentile (top third) on the Wonderlic Personnel Test in our sample.

BOS factor scores. As part of the development of the BOS, critical incidents were gathered by independent judges into "meaningful clusters" and given dimensional labels. To assess the fit of the BOS dimensions to the observed behaviours that are items of the BOS, CFA was conducted using LISREL 8. Because the measurement units were uniform (five-point Likert scales) analyses involved Pearson product-moment correlations as input matrices (Jöreskog and Sörbom 1993). LISREL 8 produces several statistics that show the degree to which the input data fits the expected model. Although chi-square ( $\chi^2$ ) is sometimes used as a fit statistic, it is sensitive to sample size, departures from the multivariate normality assumption and model complexity (Bentler and Bonnet 1980b;

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<sup>16</sup> For each personality trait the distribution of scores corresponded well to the distribution reported for the population by the test publishers.



Oliver and Bearden 1985). In recognition of these problems, the present study also employed: (a) a goodness-of-fit index developed by Jöreskog and Sörbom (1993), (b) a comparative fit index, a fit measure that prevents the underestimation of fit likely to occur in small samples (Bentler 1989) and (c) Bentler's normed fit index (Bentler and Bonnet 1980a, 1980b) which compares a theoretical model's chi-square value with that obtained from the null model that constrains all parameters except the error coefficient to zero. T-tests were also used to check if the factor loading (Lambdas) of each item onto its BOS dimension was significant.

A composite score on a CFA verified BOS dimension (factor), was the algebraic sum (unit weights) of those items that loaded significantly on that factor. Team member effectiveness was a person's score over all BOS dimensions. It was calculated by simply adding up the factor composite scores for each individual and calculating an average score for all the raters evaluating that team member. For instance, if John had two raters and he received ratings of 15, 20, 25, 20 and 20, on BOS factors one to five respectively, from rater one, and ratings of 20, 15, 20, 20 and 25 from rater two, his total score would be  $((15 + 20 + 25 + 20 + 20) + (20 + 15 + 20 + 20 + 25))/2$ . Thus, peer-ratings of overall team member performance was a continuous dependent variable.

Team level behaviour. In order to examine the aggregate effects of behaviour on team performance, team members' assessments of their peer's behaviour were aggregated and an average obtained. For example, if there is a three-person team, member one receives peer evaluations of 88 and 89 on the BOS. Member two receives a rating of 78 and 98 and member three receives a rating of 98 and 56. Then the team's cumulative

behavioural score is  $((88+89)/2) + ((78 + 98)/2) + ((98 + 56)/2) = 253.5$  and the “*team's effectiveness*” is  $253.5/3$ (number of members in the team) = 84.5. Note that each team member's cumulative BOS score was obtained after ineffective behaviours had been reverse scored.

The proportion of team members scoring high on the BOS was determined by selecting the top third of the distribution of scores. Thus, in this study the proportion of group members scoring high was operationalized as those with scores above the 66.6<sup>th</sup> percentile score and are referred to as “*high-effectiveness*” members.

Linear test of all hypotheses (H1-19). The degree to which dependent variables and independent variables are *linearly* related to each other was examined through a partial Pearson product-moment correlation analysis<sup>17</sup>. All hypotheses were tested in one correlation matrix, controlling for the effect of situational strength. Significance tests were one-tailed. Correlations were calculated with team member performance (dependent variable) corrected for attenuation (lack of reliability). The reliability of peer ratings was estimated by the average interrater reliability for the sample. That is, each team member was rated by four to five people. The interrater agreement statistic,  $r_{wg}$ , (James, Demaree and Wolf 1984) between these ratings was the measure of reliability. The interrater reliability for all subjects was averaged to obtain the overall reliability for the sample.

Because the correction is only a “good approximation,” wholly uncorrected correlations were also calculated when appropriate.

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<sup>17</sup> While the Pearson product-moment correlation coefficient was originally developed to deal with ratio scales it has proven quite robust in dealing with likert scales (Nunnally 1978).

Traits and “effective” behaviours within teams (E1-2). The degree to which cognitive ability and each of the FFM traits is linearly related to the behavioural dimensions of the BOS (explorations 1 and 2) was examined via a partial Pearson product-moment correlation analysis. Situational strength was controlled for. All significance tests for explorations were two-tailed.

Team behaviour and team performance (E3 and E4). The partial Pearson product-moment correlation procedure was used to explore the strength of association between the team’s performance and: 1) effectiveness on BOS dimensions aggregated and then averaged for analysis at the team level (E3) and 2) proportion of high-effectiveness members on BOS dimensions (E4).

Non-linear personality-outcome relationships. Lower than expected personality-performance correlations may also be due to a non-linear relationship between some personality traits and performance (Barry and Stewart 1997; Day and Silverman 1989; Schneider and Hough 1995). Thus, hypotheses 1-5 and 8-17 were re-tested using a non-linear analysis procedure.

The best way to handle *non-linear* data is through dummy variable coding (Tabachnick and Fidell 1989; Wesolowsky 1975). That is, “one can analyze the data by treating the continuous independent variable as a categorical [dummy] variable” (Kerlinger and Pedhazur 1973, p. 208).

The advantage of using dummy variables to represent a continuous variable is that no assumption about the shape of the response need be made. For a continuous variable, we must specify its effect as linear or transformed linear. Dummy variables will produce their own shape” (Wesolowsky 1975, p. 112).

The dummy variable is one that takes on one of two values, 0 or 1. Thus, it can be represented by a single binary digit. See the example that follows shortly for further clarification.

In order to use dummy variable coding in the non-linear analysis of personality, scores on personality dimensions must be grouped into mutually exclusive categories. In some cases, Costa and McCrae (1992) have found it useful to categorize NEO-PI-R scores into five groupings: “very low,” “low,” “average,” “high” and “very high.” They report that approximately 38% of scores generally fall in the “average” range, 24% in the “high” and “low” ranges and 7% in the “very high” or “very low” ranges. These categories were used in the dummy variable regression analyses. Exact category delimiters vary with gender, age and the personality dimension of interest; the applicable cut-offs for male and female university students were obtained from the test publisher. Costa and McCrae’s “high” and “very high” categories should not be confused with the “high-personality” groupings described previously. The “high-personality” grouping captures the top 33% of our sample and corresponds to the “high” and “very high” categories delineated by Costa and McCrae.

Suppose that we employed four dummy variables to represent the five personality groupings of the agreeableness trait and that:

	$X_1$	$X_2$	$X_3$	$X_4$
▪ if a person is very high in agreeableness	0	0	0	0
▪ if a person is high in agreeableness	1	0	0	0
▪ if a person is average in agreeableness	0	1	0	0
▪ if a person is low in agreeableness	0	0	1	0
▪ if a person is very low in agreeableness	0	0	0	1

The regression model is

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \epsilon$$

Where  $Y$  = effectiveness of individual team member performance.

Say that the least-square estimates of the personality level parameters were found to be

$$\hat{\beta}_1 = 9.2$$

$$\hat{\beta}_2 = 20.3,$$

$$\hat{\beta}_3 = 33.3,$$

$$\hat{\beta}_4 = 66.3.$$

These coefficients indicate that a person scoring “high” in agreeableness can be expected to score 9.2 points higher on individual effectiveness than does a person that scores “very high” in agreeableness. Likewise, a person who scores “average” on agreeableness could be expected to score 20.3 points higher on effectiveness than a person that scores very high. Note that all of these coefficients are interpreted with respect to the “null” state, that is, with respect to the classification “very high” in this case.

The use of dummy variables in this example indicates that the relationship between individual team member effectiveness and agreeableness is non-linear. Instead of an across-the-board increase of 9.2 with each unit change in individual team member

effectiveness (as would be the case if there was a linear relationship), the respective increases are 9.2 from “very high” to “high”, 11.1 (parameter two less parameter one = 20.3 – 9.2) from “high” to “average”, 13.0 (parameter three less parameter two = 33.3 – 20.3) from “average” to “low”, and 33.0 (66.3 – 33.3) from “low” to “very low”. Figure 4 is a plot of individual team member effectiveness and agreeableness in this hypothetical example. It illustrates the non-linear nature of the relationship.

A partial-F test is an F-test for the additional contribution of variables above the contributions of those variables already in the regression equation. Partial-F tests were used to determine whether a non-linear model provides incremental validity over a linear model. The procedure involved entering situational strength and the linear model as an initial block and then entering the dummy variable coded personality trait as a second block. By specifying that independent variables enter in blocks, one can set up combinations of hierarchical<sup>18</sup> and standard regressions. The regression is hierarchical over blocks but standard within a block. Consider the case where extroversion (independent variable) is being used to predict individual team member effectiveness. The objective is to determine whether the non-linear solution has incremental validity over the linear solution. The model can be represented as

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \delta_1 D_1 + \delta_2 D_2 + \delta_3 D_3 + \delta_4 D_4 + \epsilon$$

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<sup>18</sup>Hierarchical regression analysis will be used because it is a particularly powerful and largely unconfounded technique for examining predictive increments of variables over and above other variables (Cohen and Cohen 1975; Paunonen and Jackson 1985; Tellegen, Kamp and Watson 1982).

Where  $Y$  = individual team member effectiveness

$$\left. \begin{array}{l} X_1 = \text{situational strength} \\ X_2 = \text{extroversion as a continuous} \\ \quad \text{variable} \end{array} \right\} \text{Block 1, entered first}$$

$$\left. \begin{array}{l} D_1 \text{ through } D_4 \text{ are dummy variables that} \\ \text{indicate the level of extroversion} \end{array} \right\} \text{Block 2, entered second}$$

$\beta_0$  = value of  $Y$  when all independent variables are zero.

We can test whether block 2 variables have contributed significantly to reducing the unexplained variation in the dependent variable (individual effectiveness). The formula to do this is:

$$\text{Partial-F} = \frac{\text{Unexplained sum of squares with block 1 only} - \text{Unexplained sum of squares for block 1 and block 2}}{\frac{\text{Number of variables in block 2}}{\text{Unexplained sum of squares for block 1 and block 2}}}$$

$$\text{Sample size} - (\text{Number of independent variables} + 1)$$

Thus, the partial-F value is calculated as the ratio of the additional sum of squared errors explained by including block 2 variables and the sum of squared errors left after adding block 2 variables (each divided by the appropriate degrees of freedom). If the partial-F value is not significant at the appropriate risk level, block 2 does not provide incremental validity over block 1. All hypotheses with personality as the independent variable (H1-5 & 8-17) were addressed using the dummy coding and partial-F test procedures described above.

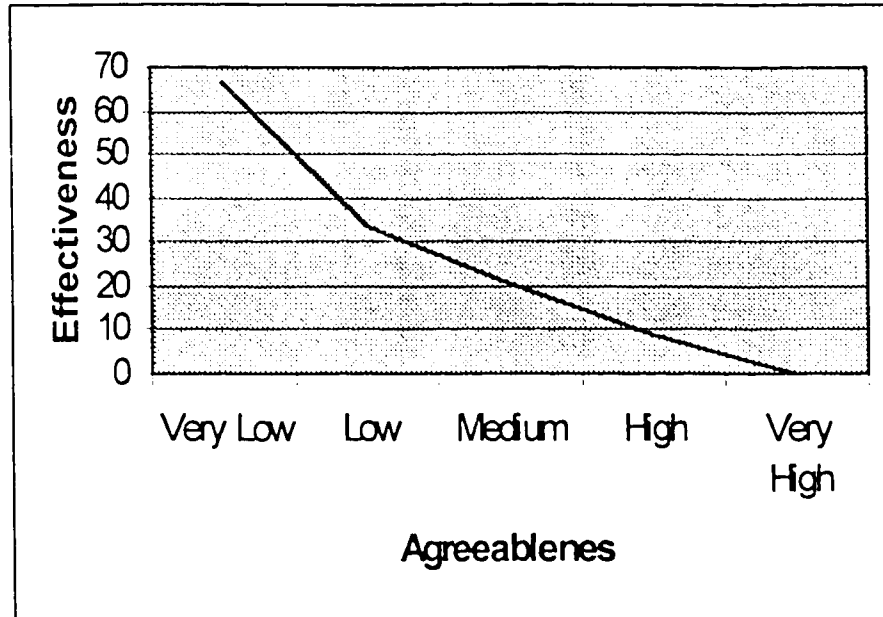


Figure 4. Example plot of Individual Team Member Effectiveness with Agreeableness



Personality profiles. In the hypothesis section it was suggested that stronger relationships between personality and individual effectiveness or team performance are likely when considering personality *profiles* across the Big Five. Accordingly, this exploratory analysis assessed whether there was a unique profile across the Big Five that distinguished more effective team members from less effective team members and well performing teams from poorly performing teams. In this analysis, cognitive ability was treated as a covariant along with situational strength. For comparison purposes both linear and non-linear analyses were conducted at the individual team member level.

Personality profiles were explored through stepwise regression analysis. The stepwise regression procedure enters variables with the most power to dispel unexplained variation in the dependent variable and deletes those with the least. The procedure maximizes  $R^2$  when  $F_{in} = 1.0$  and  $F_{out} = 0.9$  (see Wesolowsky 1975). Team member effectiveness or team performance (dependent variables) was regressed onto the Big Five (independent variables) after first controlling for situational strength and cognitive ability. This was accomplished by specifying that independent variables enter in blocks. Situational strength and cognitive ability were designated as one block and were entered first. Personality dimensions were another block and were entered second. Within the second block, the regression analysis was stepwise.

An example of the non-linear stepwise analysis at the team member level should clear up any confusion. The variables being initially considered by the model can be represented as

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \delta_1 D_1 + \delta_2 D_2 + \delta_3 D_3 + \delta_4 D_4 + \phi_1 D_5 + \phi_2 D_6 + \phi_3 D_7 + \phi_4 D_8 + \gamma_1 D_9 + \gamma_2 D_{10} + \gamma_3 D_{11} + \gamma_4 D_{12} + \eta_1 D_{13} + \eta_2 D_{14} + \eta_3 D_{15} + \eta_4 D_{16} + \varphi_1 D_{17} + \varphi_2 D_{18} + \varphi_3 D_{19} + \varphi_4 D_{20} + \epsilon$$

Where Y = overall individual team member effectiveness

X<sub>1</sub> = cognitive ability

X<sub>2</sub> = situational strength

D<sub>1</sub> through D<sub>4</sub> indicate levels of neuroticism scores, D<sub>5</sub> through D<sub>8</sub> indicate levels or elevations of extroversion scores, D<sub>9</sub> through D<sub>12</sub> indicate levels of openness to experience scores, D<sub>13</sub> through D<sub>16</sub> indicate levels of agreeableness scores and D<sub>17</sub> through D<sub>20</sub> indicate levels of conscientiousness scores<sup>19</sup>. Table 1 presents a categorical breakdown of the coding.

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<sup>19</sup> The  $\delta, \phi, \gamma, \eta$  and  $\varphi$  notations are used as coefficients of dummy variables for clarity.



## CHAPTER 4

### Results

BOS Dimension Scores. As part of the development of the BOS, critical incidents were gathered by independent judges into dimensions and given labels. The *judges* produced 14 dimensions in this manner: 1) goal setting/achievement (includes how goals are to be achieved), 2) focusing on the task-at-hand, 3) performance management (i.e., assign tasks to other team members, sets time deadlines, etc.), 4) team citizenship (involves “going beyond the call of duty” for the team), 5) participation in team problem solving, 6) synthesis of ideas, 7) commitment to the team (i.e., attending meetings, being punctual), 8) preparation for meetings, 9) reaction to feedback/providing feedback, 10) communication, 11) involvement of others, 12) reaction to conflict, 13) strategy to address conflict and 14) averts conflict. In total the BOS contained 46 behavioural items of which 16 were ineffective team member behaviours. Ineffective behaviours were reverse scored for all analyses.

To assess the fit of the 14 BOS dimensions to the 46 observed behaviours on the BOS, Confirmatory Factor Analysis (CFA) was used. Analysis of the measurement model yields a chi-square of 1646.21 with 902.00 degrees of freedom. The goodness-of-fit index is 0.97, which is well above the 0.90 generally accepted as representing an acceptable fit (Bagozzi and Yi 1988; Jöreskog and Sörbom 1993). The comparative fit index also has a value of 0.90 as the generally acceptable desired fit (Bentler 1989) – the fit statistic for our model is 0.98. The normed fit index is 0.96, which is well above the suggested 0.90 cut-off

for good fit suggested by Bentler and Bonnet (1980a/b). There are no condition codes<sup>20</sup> or other signs of model misspecification. Thus, it is concluded that the theoretical model fits the data. Table 2 contains the T-tests of factor loadings (lambdas) of each item onto its BOS dimension. Factor loadings are high, averaging 0.82. Each item loaded onto its dimension significantly ( $p < 0.05$ ).

Personality and cognitive ability as predictors of individual effectiveness: Linear test of hypotheses 1-6. Hypotheses 1-6 pertain to the degree to which a team member's personality and cognitive ability are linearly related to his or her individual effectiveness. This was initially examined through partial correlation analyses. The effects of situational strength (the degree to which the team imposes structure and constraints on the respondent's behaviour and the degree to which the team imposes structure and constraints on the behaviour of other team members) were controlled statistically. Inter-correlations without correction for attenuation in the measurement of individual team member effectiveness are presented in the lower triangle of Table 3, along with means and standard deviations.

Each team member was rated by four to five people. The reliability of peer ratings was estimated by the average interrater agreement statistic,  $r_{wg}$ , (James, Demaree and Wolf 1984). The interrater reliability for all subjects was averaged to obtain the overall reliability for the sample. Thus, for each of the 480 participants,  $r_{wg}$  (interrater reliability) was calculated for composite BOS scores. Although an interpretation of this statistic as a

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<sup>20</sup> Condition codes indicate problems in the estimation process. This may be due to linear dependencies between parameters or problematic boundary parameters and may cause difficulty in the interpretation of results. See Bentler (1989) for a detailed description.

reliability indicator does not strictly conform to standard measurement principles (Schmidt and Hunter 1989), it provides a useful index of consensus among raters (Barry and Stewart 1997; James, Demaree and Wolf 1993; James 1982). Values of 0.70 or better are considered to be indicators of good agreement (Barry and Stewart 1997; George and Bettenhausen 1990). The average value of  $r_{wg}$  was 0.78. Inter-correlations corrected for interrater reliability are presented above the diagonal of Table 3.

Some of the personality traits in Table 3 are significantly inter-correlated as high as 0.22 (e.g., negative correlation between conscientiousness and neuroticism). These inter-correlations are consistent with those reported in the NEO PI-R personality inventory manual. The extent to which traits are correlated with each other is an index of the overlap or redundancy of the information they provide. According to Tabachnick and Fidell (1989), when two predictor variables are inter-correlated the use of a simple correlation analysis to determine the strength of the relationship between any one of the two predictor variables and a criterion variable is inappropriate. This is because the correlation between the particular predictor and criterion variable may reflect variance shared by the predictor and the criterion, but, some of that variance may also be predictable from the other predictor variable. For instance, it may be that the reason neuroticism appears to predict individual team member effectiveness is because neuroticism scores provide some of the same information that is given by another predictor, the team member's conscientiousness. The question then might be asked, "Does neuroticism still predict individual effectiveness if we exclude the contribution

Table 2  
T-values of Factor Loadings of each BOS Item onto its Dimension

Dimension (Factor)	Items corresponding to each factor	T-value
Goal setting/achievement	Does not participate in setting team goals (R)	16.87
	Participates in developing strategies to achieve team goals	16.87
Focusing on the task-at-hand	Draws team members into off-topic discussions (R)	5.07
	Does not try to bring off-topic team members back on topic (R)	23.44
	Participates in off-topic conversations (R)	2.66
	Draws team members into discussions that are relevant to achieving the goal	30.74
	Asks for help in order to get other team members to focus on the goal	30.98
Performance management	Reminds other team members of the team's goal	24.82
	Assigns tasks and roles to team members	25.51
	Sets time deadlines for achieving tasks	25.34
	Tells the team how much time they have left to do a task	31.49
Team citizenship	Uses humour to create a positive team atmosphere	32.91
	Volunteers to do things that no one else wants to do	34.60
	Keeps working when others quit	32.52
	Exercises initiative by acting independently for the benefit of the team (e.g., makes a photocopy for all team members)	36.99
	Takes the lead in coming up with ideas	26.72
	Seeks information from resources from outside of the team (e.g., books, people etc.)	24.54
Participates in problem solving	Offers ideas	37.97
	Asks relevant questions	36.50
	Accepts team roles and tasks as required	36.75
	Voices unique ideas	37.36
Synthesis of ideas	Builds on the group's ideas by offering solutions	22.66
	Summarizes and organizes the group's ideas	22.66
Commitment to team	Misses team meetings (R)	11.20
	Comes to team meetings late (R)	11.20

R – Reversed items

Table 2 continued  
T-test of Factor Loadings of each BOS Item onto its Dimension

Dimension (Factor)	Items corresponding to each factor	T-value
Preparation for meetings	Does not read the required material prior to team meetings (R)	10.82
	Brings the required material to the team meetings	10.81
	Personally attacks individuals that provide negative feedback (R)	24.62
Providing feedback/reaction to feedback	Criticizes others' contributions (suggestions, ideas and behaviour) without offering alternatives (R)	20.22
	Provides constructive feedback to team members for behavioural improvement	20.94
	Says positive things to team members regarding their performance	20.96
	Dominates the discussion (R)	2.56
Communication	Ignores what other team members are saying (R)	2.41
	Carefully listens to what others are saying (e.g., maintains eye contact, nods etc.)	2.50
	Clarifies and explains issues when someone does not understand	20.40
	Asks other team members what they think	20.41
Involvement of others	Leaves conflicts unresolved by not saying anything or ignoring some team members (R)	10.12
	Leaves a conflict unresolved by leaving the meeting (R)	10.48
	Leaves a conflict unresolved by moving on to another topic (R)	10.13
Reaction to conflict	Clarifies contentious issues in a conflict	31.87
	Politely gives advice in a conflict	30.62
	Politely confronts team members on their tardiness	21.24
	Provides an alternative solution that is agreeable to other team members when a conflict occurs	31.60
Averts conflict	Resorts to personal attacks when a problem arises (R)	1.77
	Tries to calm down team members that are in a conflict	2.11
Strategy to address conflict	Takes a stance on an issue and is not willing to budge (R)	2.10

R – Reversed items



**Table 3**  
**Descriptive Statistics and Correlation Matrix to Test Hypotheses 1-6: Associations Between Team Member's Personality, Cognitive Ability and Individual Effectiveness after Controlling for Situational Strength**

	1	2	3	4	5	6	7
1. Neuroticism	1.00						-.10*
2. Extroversion	-.06	1.00					.08
3. Openness to experience	-.09*	.02	1.00				.17***
4. Agreeableness	.15**	.08	.06	1.00			.11*
5. Conscientiousness	-.22***	-.15**	.16***	-.10*	1.00		.27***
6. Cognitive Ability	-.18***	.04	.12**	-.17***	-.03	1.00	.25***
7. Individual Performance	-.09*	.07	.15*	.10*	.24***	.22***	1.00
Mean	49.55	50.68	59.74	41.66	50.44	26.00	3.90
Standard Deviation	11.55	10.76	11.73	8.87	11.31	5.80	.35

N= 480 team members (94 teams), \*p<.05 \*\*p<.01 \*\*\*p<.001, one-tailed

Note: Inter-correlations without correction for attenuation are presented in the lower triangle. Inter-correlations with correction for attenuation are presented in the upper triangle ( $f_{wg}$  - average interrater agreement statistic was 0.78)

Personality means and standard deviations are for factor scores

made by conscientiousness?" To answer this type of question, a post-hoc standard multiple linear regression procedure was used, with situational strength statistically controlled by entering it in an initial block. The regression addresses two issues: 1) what is the size of the overall relationship between traits and individual team member effectiveness? and 2) how much of the relationship is contributed *uniquely* by each trait. Table 4, presents the results of the post-hoc regression analysis.

In the regression equation about 12 percent of the variation in individual team member effectiveness (total score of an individual on all of the items making up the BOS averaged over all peer ratings) can be accounted for by personality and cognitive ability ( $R^2 = 0.12$ ,  $F = 7.40$ ,  $p < 0.001$ ; Table 4). Beta weights<sup>21</sup> ( $\beta$ ) show that conscientiousness contributes most to explaining individual team member effectiveness ( $t = 4.21$ ,  $p < 0.001$ ; H5), followed by cognitive ability ( $t = 3.83$ ,  $p < 0.001$ ; H6) and openness to experience ( $t = 2.19$ ,  $p < 0.05$ ; H3). Hypotheses 1 (neuroticism), 2 (extroversion) and 4 (agreeableness) are not supported.

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<sup>21</sup> One difficulty with multiple regression is that of multicollinearity. When such a condition exists, regression coefficients may not be good indicators of the relative importance of predictor variables. It is generally accepted that correlations between independent variables of 0.80 or greater indicate unacceptable multicollinearity (Emory 1985; Tabachnick and Fidell 1989). Table 3, reveals no inter-correlations as high as 0.80. Eigenvalues of the scaled and uncentered cross-products matrix, condition indices, variance-decomposition proportions, variance inflation factors (VIF) and tolerances for individual variables were examined in this and all subsequent regression analyses in order to verify that there were no collinearity problems.

Table 4  
 Post-hoc Standard Multiple Linear Regression of Individual Member Effectiveness on Individual Member Personality and Cognitive Ability after Controlling for Situational Strength<sup>a</sup> (Hypotheses 1-6)

Personality	B	$\beta$	t	R <sup>2</sup>	Adj. R <sup>2</sup>	R	F
Neuroticism	.00	.02	.36	.12	.10	.34	7.40***
Extroversion	.00	.03	.57				
Openness to Experience	.00	.17	2.19*				
Agreeableness	.00	.08	1.58				
Conscientiousness	.00	.22	4.21***				
Cognitive Ability	.00	.20	3.83***				
Constant	2.83		12.53***				

N= 480 team members (94 teams). \* $p < .05$  \*\* $p < .01$  \*\*\* $p < .001$ . B - Regression coefficient,  $\beta$  - Beta coefficient (standardized regression coefficient).

<sup>a</sup> Entered in an initial block, statistics not reported here. The results presented here are of analyses that exclude situational strength. Situational strength explains 2% additional variance.

Relationship of team performance with team aggregated measures of personality, cognitive ability and individual effectiveness: Linear test of hypotheses 7a, 8-13 and 19.

The focus of the next analysis was on the degree to which a *team's* personality, cognitive ability and effectiveness are linearly correlated with its performance, after statistically controlling for situational strength. Correlation results are in Table 5. Table 5 reveals significant inter-correlations between variables so a post-hoc regression analysis was performed.

About 27 percent of the variation in team performance can be accounted for by team aggregated measures of personality, cognitive ability and member effectiveness ( $R^2 = 0.27$ ,  $F = 4.23$ ,  $p < 0.001$ ; Table 6). Aggregated team member effectiveness contributes most to explaining team performance ( $\beta = 0.31$ ,  $t = 3.11$ ,  $p < 0.001$ ; H7a), followed by aggregated cognitive ability ( $\beta = 0.28$ ,  $t = 2.64$ ,  $p < 0.001$ ; H19) and aggregated conscientiousness ( $\beta = 0.21$ ,  $t = 2.09$ ,  $p < 0.05$ ; H12)<sup>22</sup>. No significant relationship was found between the team's performance and neuroticism (H8), extroversion (H9), openness to experience (H10) or agreeableness (H11).

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<sup>22</sup> Multicollinearity is no problem here – refer to footnote 21.

Table 5  
Descriptive Statistics and Correlation Matrix to Test of Hypotheses 7a, 8-13 and 19: Associations Between Team Personality, Cognitive Ability, and Member Effectiveness with Team Performance after Controlling for Situational Strength

	1	2	3	4	5	6	7	8
1. Neuroticism	1.00							
2. Extroversion	-.41***	1.00						
3. Openness to experience	.15	-.60**	1.00					
4. Agreeableness	.38***	-.51***	.34***	1.00				
5. Conscientiousness	.35***	-.63***	.59***	.37***	1.00			
6. Cognitive ability	-.23**	.26**	.00	-.16	-.04	1.00		
7. Individual Performance	-.10	-.05	.08	-.05	.18*	.09	1.00	
8. Team Performance	-.11	-.07	.14	-.06	.29**	.24*	.38**	1.00
Mean	49.19	52.11	58.93	40.92	49.55	26.69	3.89	16.52
Standard Deviation	8.00	15.13	9.01	6.55	8.57	4.31	.24	1.33

N= 94 teams, \*p<.05 \*\*p<.01 \*\*\*p<.001, one-tailed

Note: Inter-correlations without correction for attenuation are presented in the lower triangle. Inter-correlations with correction for attenuation are presented in the upper triangle.

Table 6  
 Post-hoc Standard Multiple Linear Regression of Team Performance on a Team's Personality, Cognitive Ability and Member Effectiveness after Controlling for Situational Strength<sup>a</sup> (Hypotheses 7a, 8-13 and 19)

Personality	B	$\beta$	t	R <sup>2</sup>	Adj. R <sup>2</sup>	R	F
Neuroticism	-.03	-.08	-.75	.27	.20	.52	4.23***
Extroversion	-.01	-.03	-.28				
Openness to Experience	.01	.01	.12				
Agreeableness	.04	.14	1.37				
Conscientiousness	.07	.21	2.09•				
Cognitive Ability	.17	.28	2.64**				
Individual effectiveness	2.69	.31	3.11**				
Constant	-1.73		-.29***				

N= 94 teams, (480 team members). \*p<.05 \*\*p<.01 \*\*\*p<.001. B - Regression coefficient,  $\beta$  - Beta coefficient (standardized regression coefficient).

• Entered in an initial block, statistics not reported here for brevity. The results presented here are of analyses that exclude situational strength. Situational strength explains 1% additional variance.

Relationship of team performance and the proportion of team members scoring high in personality, cognitive ability and individual effectiveness: Linear test of hypotheses 7b, 13-17 and 20. The analyses above were repeated, this time with the *proportion* of high-scoring team members on personality traits, cognitive ability and individual effectiveness as the independent variables. Results of the correlation analysis are in Table 7 and the post-hoc regression analysis is in Table 8.

Table 8 shows that *66 percent* of the variation in team performance can be accounted for by the proportion of high personality, high cognitive ability and high performing members in a team ( $F = 8.88, p < 0.001$ ). All regression coefficients except that for neuroticism (H13) are significantly different from zero. Successfully performing teams have a greater number of high-scoring team members that are extroverted (H14;  $t = 2.05, p < 0.05$ ), open to experience (H15;  $t = 2.05, p < 0.05$ ), agreeable (H16;  $t = 2.08, p < 0.05$ ), conscientious (H17;  $t = 2.14, p < 0.05$ ) and behave effectively (H7b;  $t = 2.40, p < 0.05$ ). In addition, successfully performing teams have a greater number of high cognitive ability team members (H18;  $t = 2.21, p < 0.05$ ).

Post-hoc analysis to determine the influence of a team's highest- and lowest-scoring member on team performance. The team member *highest* in a relevant trait or in individual team performance may contribute substantially to team performance. Possibly, the highest scoring team member on a personal attribute may explain more of his or her team's performance than the attribute score of all other team members combined. To

Table 7  
Descriptive Statistics and Correlation Matrix to Test Hypotheses 7b, 13-18 and 20: Associations Between the Proportion of Team Members Scoring High on Personality, Cognitive Ability and Overall Effectiveness to Team Performance after Controlling for Situational Strength

	1	2	3	4	5	6	7	8
1. Neuroticism	1.00							
2. Extroversion	.10	1.00						
3. Openness to experience	-.31***	.17**	1.00					
4. Agreeableness	.09	.09	.08	1.00				
5. Conscientiousness	-.36***	.17	.53***	.10	1.00			
6. Cognitive Ability	.14	.25**	.17	.04	.06	1.00		
7. Individual Performance	-.06	.18**	.13	-.34***	.60***	-.26**	1.00	
8. Team performance	.06	.40***	.19**	.21**	.29**	.27***	.36**	1.00
Mean	1.80	1.96	2.78	1.82	2.18	1.95	2.44	16.52
Standard Deviation	1.01	1.09	1.33	1.07	1.34	1.04	1.59	1.33

N= 94 teams, (480 team members). \*p<.05 \*\*p<.01 \*\*\*p<.001, one-tailed.



Table 8  
Post-hoc Standard Multiple Linear Regression of Team Performance on Proportion of Team Members Scoring High in Personality, Cognitive Ability and Member Effectiveness after Controlling for Situational Strength<sup>a</sup> (Hypotheses 7b, 13-18 and 20)

Personality	B	$\beta$	t	R <sup>2</sup>	Adj. R <sup>2</sup>	R	F
Neuroticism	.04	.02	.20	.66	.59	.81	8.88***
Extroversion	.30	.17	2.05*				
Openness to Experience	.30	.18	2.05*				
Agreeableness	.31	.18	2.08*				
Conscientiousness	.33	.19	2.14*				
Cognitive Ability	.43	.21	2.21*				
Individual effectiveness	.46	.22	2.40*				
Constant	10.75		13.67***				

N= 94 teams, (480 team members), \*p<.05 \*\*p<.01 \*\*\*p<.001. B - Regression coefficient,  $\beta$  - Beta coefficient (standardized regression coefficient).

<sup>a</sup> Entered in an initial block, statistics not reported here for brevity. The results presented here are of analyses that exclude situational strength. Situational strength explains 1% additional variance.

discover the extent to which this is true, a post-hoc hierarchical regression analysis was conducted. This analysis sought to determine the contribution to team performance made by the highest scoring team member on an attribute compared to scores of other team members on that attribute. To this end, all team members scores except the score of the highest or lowest team member on the particular attribute were averaged. These averages entered the regression equations first. The highest or lowest team member score was entered next. The “t-value,” thus obtained, indicates whether the highest or lowest team member score significantly explains team performance over and above the scores of other team members. Correlations and regression analyses are in Table 9.

A significant correlation was observed between team performance and the highest scoring team member’s cognitive ability ( $r = 0.21, p < 0.05$ ) and individual effectiveness ( $r = 0.27, p < 0.01$ ). However, the team member with the highest cognitive ability score did not significantly impact team performance over and above other team members’ cognitive ability ( $t = 0.64, p > 0.05$ ). Similarly, the team member with the highest individual effectiveness rating did not significantly impact team performance over and above other team member’s average performance ( $t = -0.78, p > 0.05$ ). Thus, the highest scoring team members on the attributes studied cannot be said to have more impact on overall team performance than their peers.

Table 9  
 Post-hoc analyses: 1) Correlation of Team Performance with Top/Lowest Scoring Team Member's on Traits and Individual Effectiveness and 2) Hierarchical Regression to Determine the Impact of Top/Lowest Team Member's Attributes on Team Performance after Entering the Other Team Members' Average Score and Controlling for Situational Strength<sup>a</sup>

	Hierarchical Regression <sup>b</sup>										
	Correlations			Other Team Members' Average Score				Top/Lowest Score			
	Team Performance	Intercept (t-values)	B <sub>1</sub>	β <sub>1</sub>	t	B <sub>2</sub>	β <sub>2</sub>	t	R <sup>2</sup>	Adj. R <sup>2</sup>	F
<i>Highest Team Member score</i>											
Neuroticism	-.15	19.01(10.23***)	-.03	-.09	-.60	-.02	-.08	-.54	.03	.00	.16
Extroversion	.11	15.01( 6.57***)	-.06	-.15	-1.06	.07	.22	1.48	.02	.00	.15
Openness to experience	.07	13.43( 5.61***)	.06	.15	1.04	-.01	-.04	-.26	.02	-.01	.02
Agreeableness	.16	13.97( 7.32***)	-.04	-.10	-.64	.08	.23	1.56	.03	.01	.18
Conscientiousness	.08	15.75(13.73***)	.08	.24	1.93	-.08	-.04	-.30	.05	.03	.22
Cognitive Ability	.21*	12.03( 6.80***)	.10	.18	1.30	.05	.09	.64	.06	.04	.25
Individual effectiveness	.27**	5.30( 1.37)	4.16	.49	2.85**	-1.28	-.13	-.78	.15	.13	.39
<i>Lowest Team Member Score</i>											
Neuroticism	-.12	18.64(10.81***)	-.04	-.12	-.84	-.01	-.04	-.24	.02	.00	.15
Extroversion	-.02	16.07( 7.01***)	.00	.02	.90	.00	-.03	-.21	.00	-.02	.02
Openness to experience	.02	13.45( 5.67***)	.06	.17	1.33	-.02	-.07	-.58	.02	.00	.14
Agreeableness	-.07	13.97( 7.35***)	.10	.24	1.64	-.06	.04	-1.61	.03	.01	.18
Conscientiousness	.00	16.16(16.29***)	.02	.38	2.74**	-.03	-.24	-1.77	.08	.06	.29
Cognitive Ability	.19	12.67( 7.99***)	.14	.24	1.52	.00	.00	.03	.06	.04	.24
Individual Effectiveness	.21*	1.57( .46)	5.02	.59	3.70***	-1.40	-.26	-1.66	.17	.15	.41

\* Entered in an initial block, statistics not reported here for brevity. The results presented here are of analyses that exclude situational strength.

Situational strength explains 1% additional variance.

<sup>b</sup> Contribution of the top/lowest score over the team's score. N=94 teams (480 team members). β - Beta Weights. \*p<.05 \*\*p<.01 \*\*\*p<.001.

The team member *lowest* in a trait or in individual team performance may dramatically impact his or her team's outcomes. To assess this possibility a post-hoc hierarchical regression analysis similar to that described above was done. Correlations and regression analysis appear in the lower portion of Table 9. The poorest performing team member's score on individual effectiveness significantly correlates with team performance ( $r = 0.21, p < 0.05$ ). However, the team member with the lowest individual effectiveness does not explain team performance over and above the average individual effectiveness score of other team members ( $t = -1.66, p > 0.05$ ). The team member *lowest* in a trait or in individual team performance does not impact his or her team's outcomes more so than other members in that team who score higher on that attribute.

Traits as predictors of (in)effective behaviours within teams (E1-2). The degree to which cognitive ability and each of the FFM traits is linearly related to the behavioural dimensions of the BOS (those generated during the grouping of the critical incidents) was examined via a partial Pearson-product moment correlation analysis. Situational strength was again controlled for. Table 10 presents a portion of the correlation matrix. Due to inter-correlations between BOS dimensions a post-hoc standard regression analysis, controlling for situational strength, was conducted to determine traits associated with BOS dimensions<sup>23</sup>. Results are presented in Tables 11 to 24.

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<sup>23</sup> Multicollinearity was not deemed a problem with the regressions.

Table 10  
Exploratory Correlation Matrix of Traits and “Effective” Behaviours Within Teams (E1-2)

	Neuroticism	Extroversion	Openness to exp.	Agreeableness	Conscientiousness	Cognitive ability	Overall Effectiveness
1. Goals setting/achievement	-.12**	.15**	.10*	.05	.29***	.20***	.82***
2. Focus on the task	-.09*	-.09*	.09*	.08	.32***	.14**	.72***
3. Performance management	-.12*	.20***	.09*	.03	.14**	.17***	.76***
4. Team citizenship	-.07	.14**	.16***	.11*	.17***	.20***	.84***
5. Participation	-.22***	.35***	.26***	.01	.20**	.41***	.85***
6. Synthesis of ideas	-.14**	.16***	.29***	.06	.23***	.37***	.84***
7. Commitment to the team	.05	-.14**	.13*	.09*	.17***	-.02	.35***
8. Preparation	.07	.00	.02	.09*	.36***	.12*	.56***
9. Feedback	-.10*	.06	.07	.09*	.13**	.08	.73***
10. Effective communication	-.09*	-.27***	.11*	.22***	.01	-.20***	.33***
11. Involving others	-.07	.12**	.24***	.11*	.15**	.34***	.84***
12. Reaction to conflict	-.31***	-.09*	-.03	.00	.06	.06	.43***
13. Addresses conflict	-.11*	.21***	.11*	.05	.13**	.16***	.75***
14. Averts conflict	-.08	.00	.09*	.24***	.07	.02	.39***

N=480 team members (94 teams). \* $p < .05$  \*\* $p < .01$  \*\*\* $p < .001$ , two-tailed.

Table 11  
 Post-hoc Standard Regression of "Goal Setting/Achievement" Behaviours on Personality and Cognitive Ability Controlling for Situational Strength<sup>a</sup>

	B	$\beta$	t	R <sup>2</sup>	Adj. R <sup>2</sup>	R	F
1. Neuroticism	.00	-.01	-.08	.15	.14	.39	10.03***
2. Extroversion	.03	.09	1.68				
3. Openness to experience	.00	.03	.05				
4. Agreeableness	.00	.04	.93				
5. Conscientiousness	.01	.30	5.03***				
6. Cognitive ability	.02	.31	5.53***				
Constant	2.36		6.81***				

N= 480 team members (94 teams). \* $p < .05$  \*\* $p < .01$  \*\*\* $p < .001$ . **B** - Regression coefficient,  $\beta$  - Beta coefficient (standardized regression coefficient).  
 • Entered in an initial block, statistics not reported here for brevity. The results presented here are of analyses that exclude situational strength.  
 Situational strength explains 2% additional variance.

Table 12  
 Post-hoc Standard Regression of "Focus on the Task-at-Hand" Behaviours on Personality and Cognitive Ability Controlling for Situational Strength<sup>a</sup>

	B	$\beta$	t	R <sup>2</sup>	Adj. R <sup>2</sup>	R	F
1. Neuroticism	.00	-.20	-3.56***	.11	.10	.34	9.02***
2. Extroversion	.00	-.18	-3.27***				
3. Openness to experience	.00	.02	.38				
4. Agreeableness	.00	.07	1.51				
5. Conscientiousness	.00	.18	3.59***				
6. Cognitive ability	.00	.01	.28				
Constant	3.14		6.81***				

N= 480 team members (94 teams). \* $p < .05$  \*\* $p < .01$  \*\*\* $p < .001$ . **B** - Regression coefficient,  $\beta$  - Beta coefficient (standardized regression coefficient).  
 • Entered in an initial block, statistics not reported here for brevity. The results presented here are of analyses that exclude situational strength.  
 Situational strength explains 2% additional variance.

Table 13  
 Post-hoc Standard Regression of "Performance Management" Behaviours on Personality and Cognitive Ability Controlling for Situational Strength<sup>a</sup>

	B	$\beta$	t	R <sup>2</sup>	Adj. R <sup>2</sup>	R	F
1. Neuroticism	.00	-.13	-2.55**	.17	.16	.40	8.74***
2. Extroversion	.00	.08	1.41				
3. Openness to experience	.00	.01	.25				
4. Agreeableness	.00	.02	.32				
5. Conscientiousness	.00	.31	5.23***				
6. Cognitive ability	.01	.27	4.64***				
Constant	1.60		4.21***				

N= 480 team members (94 teams). \*p<.05 \*\*p<.01 \*\*\*p<.001.

<sup>a</sup> Entered in an initial block, statistics not reported here for brevity. The results presented here are of analyses that exclude situational strength. Situational strength explains 2% additional variance.

Table 14  
 Post-hoc Standard Regression of "Team Citizenship" Behaviours on Personality and Cognitive Ability Controlling for Situational Strength<sup>a</sup>

	B	$\beta$	t	R <sup>2</sup>	Adj. R <sup>2</sup>	R	F
1. Neuroticism	.00	.01	.26	.19	.17	.43	9.23***
2. Extroversion	.00	.12	2.14*				
3. Openness to experience	.00	.06	1.22				
4. Agreeableness	.00	.07	1.41				
5. Conscientiousness	.00	.13	2.56**				
6. Cognitive ability	.02	.19	4.05***				
Constant	1.81		5.42***				

N= 480 team members (94 teams). \*p<.05 \*\*p<.01 \*\*\*p<.001. B - Regression coefficient,  $\beta$  - Beta coefficient (standardized regression coefficient).

<sup>a</sup> Entered in an initial block, statistics not reported here for brevity. The results presented here are of analyses that exclude situational strength. Situational strength explains 2% additional variance.

Table 15  
 Post-hoc Standard Regression of "Participation in Team Problem Solving" Behaviours on Personality and Cognitive Ability  
 Controlling for Situational Strength<sup>a</sup>

	B	$\beta$	t	R <sup>2</sup>	Adj. R <sup>2</sup>	R	F
1. Neuroticism	.00	-.18	-3.82***	.35	.32	.59	14.58***
2. Extroversion	.00	.19	3.94***				
3. Openness to experience	.00	.18	3.19***				
4. Agreeableness	.00	.01	.19				
5. Conscientiousness	.00	.14	3.00**				
6. Cognitive ability	.02	.27	5.82***				
Constant	2.36		7.63***				

N= 480 team members (94 teams). \* $p < .05$  \*\* $p < .01$  \*\*\* $p < .001$ . B - Regression coefficient,  $\beta$  - Beta coefficient (standardized regression coefficient).  
 \* Entered in an initial block, statistics not reported here for brevity. The results presented here are of analyses that exclude situational strength.  
 Situational strength explains 2% additional variance.

Table 16  
 Post-hoc Standard Regression of "Synthesis of the Team's Ideas" BOS Dimension on Personality and Cognitive Ability  
 Controlling for Situational Strength<sup>a</sup>

	B	$\beta$	t	R <sup>2</sup>	Adj. R <sup>2</sup>	R	F
1. Neuroticism	.00	-.02	-.44	.15	.14	.39	12.54***
2. Extroversion	.00	.04	.78				
3. Openness to experience	.00	.17	3.13***				
4. Agreeableness	.00	.04	.93				
5. Conscientiousness	.01	.19	3.91***				
6. Cognitive ability	.03	.27	5.90***				
Constant	1.85		5.15***				

N= 480 team members (94 teams). \* $p < .05$  \*\* $p < .01$  \*\*\* $p < .001$ . B - Regression coefficient,  $\beta$  - Beta coefficient (standardized regression coefficient).  
 \* Entered in an initial block, statistics not reported here for brevity. The results presented here are of analyses that exclude situational strength.  
 Situational strength explains 2% additional variance.



Table 17  
 Post-hoc Standard Regression of "Commitment to the Team" Behaviours on Personality and Cognitive Ability Controlling for Situational Strength<sup>a</sup>

	B	$\beta$	t	R <sup>2</sup>	Adj. R <sup>2</sup>	R	F
1. Neuroticism	.00	.08	1.63	.11	.09	.33	8.90***
2. Extroversion	-.01	-.22	-3.96***				
3. Openness to experience	.00	-.03	-.63				
4. Agreeableness	.00	.11	2.35**				
5. Conscientiousness	.01	.20	3.76***				
6. Cognitive ability	.00	.01	.20				
Constant	4.22		12.93				

N= 480 team members (94 teams). \*p<.05 \*\*p<.01 \*\*\*p<.001. B - Regression coefficient,  $\beta$  - Beta coefficient (standardized regression coefficient).

<sup>a</sup> Entered in an initial block, statistics not reported here for brevity. The results presented here are of analyses that exclude situational strength.

Situational strength explains 2% additional variance.

Table 18  
 Post-hoc Standard Regression of "Preparation for Team Meetings" Behaviours on Personality and Cognitive Ability Controlling for Situational Strength<sup>a</sup>

	B	$\beta$	t	R <sup>2</sup>	Adj. R <sup>2</sup>	R	F
1. Neuroticism	.00	.00	-.05	.34	.32	.59	14.42***
2. Extroversion	.00	.03	.44				
3. Openness to experience	.00	.03	.60				
4. Agreeableness	.00	.08	1.68				
5. Conscientiousness	.01	.31	6.25***				
6. Cognitive ability	.00	.14	2.77**				
Constant	2.53		6.81***				

N= 480 team members (94 teams). \*p<.05 \*\*p<.01 \*\*\*p<.001. B - Regression coefficient,  $\beta$  - Beta coefficient (standardized regression coefficient).

<sup>a</sup> Entered in an initial block, statistics not reported here for brevity. The results presented here are of analyses that exclude situational strength.

Situational strength explains 2% additional variance.

Table 19  
 Post-hoc Standard Regression of "Feedback" Behaviours on Personality and Cognitive Ability Controlling for Situational Strength<sup>a</sup>

	B	$\beta$	t	R <sup>2</sup>	Adj. R <sup>2</sup>	R	F
1. Neuroticism	.00	-.23	-4.17***	.14	.10	.37	9.72***
2. Extroversion	.00	.03	.47				
3. Openness to experience	.00	.01	.09				
4. Agreeableness	.00	.07	1.34				
5. Conscientiousness	.00	.17	3.56***				
6. Cognitive ability	.00	.02	.44				
Constant	3.59		12.59***				

N= 480 team members (94 teams). \* $p < .05$  \*\* $p < .01$  \*\*\* $p < .001$ . B - Regression coefficient,  $\beta$  - Beta coefficient (standardized regression coefficient).  
 • Entered in an initial block, statistics not reported here for brevity. The results presented here are of analyses that exclude situational strength.  
 Situational strength explains 2% additional variance.

Table 20  
 Post-hoc Standard Regression of "Effective Communication" Behaviours on Personality and Cognitive Ability Controlling for Situational Strength<sup>a</sup>

	B	$\beta$	t	R <sup>2</sup>	Adj. R <sup>2</sup>	R	F
1. Neuroticism	.00	-.09	-1.71	.34	.31	.58	13.96***
2. Extroversion	.00	-.28	-4.28***				
3. Openness to experience	.00	.06	1.10				
4. Agreeableness	.00	.24	3.83***				
5. Conscientiousness	.00	.02	.34				
6. Cognitive ability	-.01	-.22	-3.58***				
Constant	4.87		18.28***				

N= 480 team members (94 teams). \* $p < .05$  \*\* $p < .01$  \*\*\* $p < .001$ . B - Regression coefficient,  $\beta$  - Beta coefficient (standardized regression coefficient).  
 • Entered in an initial block, statistics not reported here for brevity. The results presented here are of analyses that exclude situational strength.  
 Situational strength explains 2% additional variance.

Table 21  
 Post-hoc Standard Regression of "Involving Others" Behaviours on Personality and Cognitive Ability Controlling for Situational Strength<sup>a</sup>

	B	$\beta$	t	R <sup>2</sup>	Adj. R <sup>2</sup>	R	F
1. Neuroticism	.00	-.03	-.62	.15	.12	.39	10.02***
2. Extroversion	.00	.01	.13				
3. Openness to experience	.00	.22	4.06***				
4. Agreeableness	.00	.23	4.49***				
5. Conscientiousness	.00	.05	1.08				
6. Cognitive ability	.02	.29	5.02***				
Constant	2.29		5.39***				

N= 480 team members (94 teams). \* $p < .05$  \*\* $p < .01$  \*\*\* $p < .001$ . B - Regression coefficient,  $\beta$  - Beta coefficient (standardized regression coefficient).

\* Entered in an initial block, statistics not reported here for brevity. The results presented here are of analyses that exclude situational strength. Situational strength explains 2% additional variance.

Table 22  
 Post-hoc Standard Regression of "Reaction to Conflict" Behaviours on Personality and Cognitive Ability Controlling for Situational Strength<sup>a</sup>

	B	$\beta$	t	R <sup>2</sup>	Adj. R <sup>2</sup>	R	F
1. Neuroticism	.00	-.25	-4.86***	.12	.11	.35	8.97***
2. Extroversion	.00	-.22	-4.06***				
3. Openness to experience	.00	.02	.31				
4. Agreeableness	.00	.01	.16				
5. Conscientiousness	.00	.07	1.31				
6. Cognitive ability	.00	1.31	.18				
Constant	4.76		15.26***				

N= 480 team members (94 teams). \* $p < .05$  \*\* $p < .01$  \*\*\* $p < .001$ . B - Regression coefficient,  $\beta$  - Beta coefficient (standardized regression coefficient).

\* Entered in an initial block, statistics not reported here for brevity. The results presented here are of analyses that exclude situational strength. Situational strength explains 2% additional variance.

Table 23  
 Post-hoc Standard Regression of "Addresses Conflict" Behaviours on Personality and Cognitive Ability Controlling for Situational Strength<sup>a</sup>

	B	$\beta$	t	R <sup>2</sup>	Adj. R <sup>2</sup>	R	F
1. Neuroticism	.00	-.07	-1.35	.10	.09	.32	7.74***
2. Extroversion	.00	.15	2.83**				
3. Openness to experience	.00	.24	4.50***				
4. Agreeableness	.00	.04	.79				
5. Conscientiousness	.00	.00	.01				
6. Cognitive ability	.01	.12	2.40*				
Constant	2.61		6.93***				

N= 480 team members (94 teams). \*p<.05 \*\*p<.01 \*\*\*p<.001. B - Regression coefficient,  $\beta$  - Beta coefficient (standardized regression coefficient).  
 \* Entered in an initial block, statistics not reported here for brevity. The results presented here are of analyses that exclude situational strength.  
 Situational strength explains 2% additional variance.

Table 24  
 Post-hoc Standard Regression of "Averts Conflict" Behaviours on Personality and Cognitive Ability Controlling for Situational Strength<sup>a</sup>

	B	$\beta$	t	R <sup>2</sup>	Adj. R <sup>2</sup>	R	F
1. Neuroticism	.00	-.14	-2.80*	.17	.14	.42	11.97***
2. Extroversion	.00	.08	1.42				
3. Openness to experience	.00	.18	3.11***				
4. Agreeableness	.00	.26	4.93***				
5. Conscientiousness	.00	.04	.76				
6. Cognitive ability	.00	.03	.56				
Constant	3.63		14.75***				

N= 480 team members (94 teams). \*p<.05 \*\*p<.01 \*\*\*p<.001. B - Regression coefficient,  $\beta$  - Beta coefficient (standardized regression coefficient).  
 \* Entered in an initial block, statistics not reported here for brevity. The results presented here are of analyses that exclude situational strength.  
 Situational strength explains 2% additional variance.

*Cognitive ability* is significantly predictive of nine of the fourteen BOS dimensions – goal setting/achievement ( $t = 5.53, p < 0.001$ ; Table 11); performance management ( $t = 4.64, p < 0.001$ ; Table 13); team citizenship ( $t = 4.05, p < 0.001$ ; Table 14); participation in problem solving ( $t = 5.82, p < 0.001$ ; Table 15); synthesis of team ideas ( $t = 5.90, p < 0.001$ ; Table 16); preparation for team meetings ( $t = 2.77, p < 0.01$ , Table 18); effective communication ( $t = -3.58, p < 0.001$ ; Table 20); involving other ( $t = 5.02, p < 0.001$ ; Table 21); addresses conflict ( $t = 2.40, p < 0.05$ ; Table 23).

*Conscientiousness* also is significantly and positively predictive of nine of the fourteen behavioural dimensions -- goal setting/achievement ( $t = 5.03, p < 0.001$ ; Table 11); focus on the task-at-hand ( $t = 5.59, p < 0.001$ ; Table 12); performance management ( $t = 5.23, p < 0.001$ ; Table 13); team citizenship ( $t = 2.56, p < 0.01$ ; Table 14); participation in problem solving ( $t = 3.00, p < 0.01$ ; Table 15); synthesis of team ideas ( $t = 3.91, p < 0.001$ ; Table 16); commitment to the team ( $t = 3.76, p < 0.001$ ; Table 17), preparation for team meetings ( $t = 6.25, p < 0.001$ ; Table 18); providing feedback/reacting well to feedback ( $t = 3.56, p < 0.001$ ; Table 19).

*Extroversion* is predictive of seven dimensions. Four of these relationships are negative -- focus on the task at hand ( $t = -3.27, p < 0.001$ ; Table 12); team citizenship ( $t = 2.14, p < 0.05$ ; Table 14); participation in problem solving ( $t = 3.94, p < 0.001$ ; Table 15); commitment to the team ( $t = -3.96, p < 0.001$ ; Table 17); effective communication ( $t = -4.28, p < 0.001$ ; Table 20); reaction to conflict ( $t = -4.86, p < 0.001$ ; Table 22); addresses conflict ( $t = 2.28, p < 0.05$ ; Table 23), .

*Neuroticism* contributes significantly to the prediction of six of the BOS

dimensions – all negatively -- goal setting/achievement ( $t = -3.56, p < 0.001$ ; Table 11), performance management ( $t = -2.55, p < 0.01$ ; Table 13); participation in problem solving ( $t = -3.82, p < 0.001$ ; Table 15); providing feedback/reacting well to feedback ( $t = -4.17, p < 0.001$ ; Table 19); reaction to conflict ( $t = -4.86, p < 0.001$ ; Table 22); averts conflict ( $t = -2.80, p < 0.05$ ; Table 24).

*Openness to experience* is significant in five of the regression equations -- participation in problem solving ( $t = 3.19, p < 0.001$ ; Table 15); synthesis of team ideas ( $t = 3.13, p < 0.05$ ; Table 16); involving other ( $t = 4.06, p < 0.001$ ; Table 21); addresses conflict ( $t = 4.50, p < 0.001$ ; Table 23); averts conflict ( $t = 3.11, p < 0.001$ ; Table 24).

Lastly, *agreeableness* contributes significantly to prediction of four of the dimensions -- commitment to the team ( $t = 2.35, p < 0.01$ ; Table 17); effective communication ( $t = 3.83, p < 0.001$ ; Table 20); involving other ( $t = 4.49, p < 0.001$ ; Table 21); averts conflict ( $t = 4.93, p < 0.001$ ; Table 24).

Personality and cognitive ability are modest to relatively strong predictors of BOS dimensions. At one extreme, about 35 percent of the variance in “*team member participation in problem solving*” can be accounted for by personality and cognitive ability ( $F = 14.58, p < 0.001$ ; Table 15 ). At the other extreme, only about 10 percent of the variance in “*addresses conflict*” can be accounted for by personality and cognitive ability ( $F = 7.74, p < 0.001$ ; Table 23).

Team behaviour and team performance (E3 and E4). Partial Pearson product-moment correlation analysis was used to explore the associations between a *team's*

*aggregated effectiveness* on the 14 BOS dimensions<sup>24</sup> and that team's performance.

Table 25 presents the correlation matrix.

Due to the inter-correlations between BOS dimensions, a post-hoc stepwise regression analysis was conducted in order to determine the most *predictive combination* of BOS dimensions (Table 26). The variables that entered and stayed in the equation are: 1) synthesis of team's ideas, 2) participation in team problem solving, 3) focus on the task-at-hand, 4) involving others, 5) commitment to the team, 6) goal setting/achievement, 7) performance management, 8) providing feedback/reacting to feedback and 9) team citizenship. Together these behaviours account for about 72 percent of the variation in team performance ( $R^2 = 0.72$ ;  $F = 36.29$ ,  $p < 0.001$ ).

Partial Pearson product-moment correlation analysis was also used to explore the associations between team performance and the *proportion* of highly-effective team members on BOS dimensions. Table 27 presents the correlation matrix and reveals that a team's performance is significantly correlated with the proportion of highly-effective team members for all BOS dimensions.

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<sup>24</sup> 1) goal setting/achievement (includes how goals are to be achieved), 2) focusing on the task-at-hand, 3) performance management (i.e., assign tasks to other team members, sets time deadlines, etc.), 4) team citizenship (involves "going beyond the call of duty" for the team), 5) participation in team problem solving, 6) synthesis of ideas, 7) commitment to the team, 8) preparation for meetings, 9) providing feedback, 10) communication, 11) involvement of others, 12) reaction to conflict, 13) strategy to address conflict and 14) averts conflict.

Table 25  
Correlation Matrix for Exploration E3: Aggregated Team Effectiveness on BOS Dimensions and Team Performance

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.Goals	1.00														
2.Focus	.55***	1.00													
3.Performance management	.50***	.61***	1.00												
4.Team citizenship	.64***	.57***	.52***	1.00											
5.Participation	.68***	.54***	.59***	.71***	1.00										
6.Synthesis	.70***	.57***	.64***	.71***	.79***	1.00									
7.Team commitment	.23**	.14	.16	.33***	.30***	.32***	1.00								
8.Preparation	.37***	.38***	.44***	.51***	.42***	.37***	.29***	1.00							
9.Feedback	.64***	.52***	.49***	.65***	.64***	.64***	.20*	.44***	1.00						
10.Commun.	.47***	.44***	.23**	.32***	.45***	.41***	.12	.36***	.59***	1.00					
11.Involving others	.66***	.54***	.49***	.70***	.82***	.72***	.21*	.35***	.67***	.46***	1.00				
12.Reaction to conflict	.46***	.40***	.24**	.38***	.42***	.46***	.12	.26**	.44***	.48***	.38***	1.00			
13.Addresses conflict	.54***	.40***	.50***	.74***	.63***	.65***	.15	.27**	.54***	.23**	.65***	.29***	1.00		
14.Averts conflict	.21*	.35***	.18*	.30***	.27**	.22**	.08	.31***	.42***	.36***	.23**	.34***	.21*	1.00	
15.Team Performance	.55***	.52***	.49***	.52***	.59***	.67***	.35***	.39***	.61***	.48***	.55**	.46***	.46***	.34***	1.00
Mean	4.12	3.64	3.18	3.54	4.15	3.89	4.53	3.97	4.00	4.15	3.97	4.36	3.25	3.96	16.52
Std. Deviation	.36	.29	.41	.34	.31	.38	.30	.45	.27	.31	.40	.33	.41	.31	1.33

N= 94 teams (480 team members). \*p<.05 \*\*p<.01 \*\*\*p<.001, two-tailed.



Table 26  
 Post-hoc Linear Stepwise Regression of Team Performance on the Team's Average Effectiveness on BOS Dimensions

Model	Variables Entered	$\Delta R^2$	B	$\beta$	t	R <sup>2</sup>	Adj R <sup>2</sup>	R	F
1. <sup>E</sup>	Synthesis of team's ideas		1.13	.72	10.08***	.55	.54	.74	147.71***
2. <sup>E</sup>	Participation in team problem solving	.03	1.18	.76	11.96***	.58	.57	.76	143.10***
3. <sup>E</sup>	Focus on the task-at-hand	.05	1.02	.66	9.91***	.63	.62	.79	86.68***
4. <sup>E</sup>	Involving others	.02	.45	.28	2.63**	.65	.64	.81	63.38***
5. <sup>E</sup>	Commitment to the team	.02	.44	.16	2.75**	.67	.66	.82	52.45***
6. <sup>E</sup>	Goal setting/achievement	.02	.28	.18	2.14*	.69	.67	.83	44.34***
7. <sup>E</sup>	Performance management	.01	.19	.15	2.08*	.70	.68	.84	38.88***
8. <sup>R</sup>	Focus on the task-at-hand	-.01	--	--	--	.69	.68	.83	45.77***
9. <sup>E</sup>	Providing feedback/reacting to feedback	.01	.47	.15	2.16*	.71	.69	.84	40.30***
10. <sup>E</sup>	Team citizenship	.01	.40	.16	2.07*	.72	.70	.85	36.29***
Constant			13.74		11.96***				

N=94 teams. \*p<.05 \*\*p<.01 \*\*\*p<.001. <sup>E</sup> - entered <sup>R</sup> - removed. B - Regression coefficient,  $\beta$  - Beta coefficient (standardized regression coefficient).

Due to the inter-correlations between BOS dimensions revealed in Table 27, a stepwise regression analysis was conducted in order to determine the most predictive combination of BOS dimensions. The results of the stepwise regression procedure are in Table 28. The variables that entered and stayed in the equation were: 1) synthesis of team's ideas, 2) participation in team problem solving, 3) preparation for team meetings and 4) involving others. Together these variables explain about 53 percent of the variation in team performance ( $R^2 = .53$ ;  $F = 26.41$ ,  $p < 0.001$ ). Participation in team problem solving is the only behavioural dimension found to be predictive in this analysis but not predictive in the analysis of a team's aggregated effectiveness on BOS dimensions in Table 26.

Non-linear personality-outcome relationships: Retest of hypotheses 1-5 and 8-12.

Hypotheses 1-5 and 8-12 were retested using regression analysis with dummy variable coding in order to explore non-linear relationships. For hypotheses 1-5, the non-linear regression analysis was concerned with: 1) the variance explained by a non-linear solution and 2) the additional explained variance in a prediction equation for individual team member effectiveness after situational strength and a linear solution had already entered the equation. The regression results are presented in Table 29. The first part of the table is concerned with non-linear analysis results when situational strength and cognitive ability was entered as block 1 and a dummy coded FFM trait was entered as block 2. The partial-F test reported in Table 29 was conducted on a regression analysis with situational strength, cognitive ability and the particular continuous FFM trait entered as block 1 and the same dummy coded FFM trait entered as block 2.

Table 27  
 Correlation Matrix for Exploration E4: The Proportion of Effective Team Members Based on BOS Dimension Composite Scores and Team Performance

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.Goals	1.00														
2.Focus	.44***	1.00													
3.Performance management	.32***	.60***	1.00												
4.Team citizenship	.52***	.44***	.36***	1.00											
5.Participation	.56***	.42***	.39***	.53***	1.00										
6.Synthesis	.51***	.36***	.36***	.44***	.44***	1.00									
7.Team commitment	.16*	.20*	.19*	.17*	.20*	.19*	1.00								
8.Preparation	.21*	.24**	.33***	.33***	.22*	.15	.22*	1.00							
9.Feedback	.57***	.34***	.30***	.60***	.57***	.50***	.07	.32***	1.00						
10.Communic.	.44***	.17*	.15	.31***	.37***	.31***	-.09	.26**	.54***	1.00					
11.Involving others	.53***	.54***	.41*	.57***	.63***	.46***	.12	.29***	.56***	.38***	1.00				
12.Reaction to conflict	.46***	.29***	.20***	.35***	.34***	.41***	-.03	.23**	.44***	.40***	.41***	1.00			
13.Addresses conflict	.52***	.47***	.37***	.60***	.43***	.53***	.12	.16*	.41***	.20*	.56***	.41***	1.00		
14.Averts conflict	.32***	.34***	.24**	.37***	.28**	.26**	-.01	.21*	.39***	.28**	.29***	.44***	.34***	1.00	
15.Team performance	.40***	.40***	.41***	.39***	.44***	.51***	.24**	.40***	.50***	.35***	.48***	.40***	.36***	.32***	1.00
Mean <sup>a</sup>	32.51	30.00	29.06	31.45	33.33	33.01	44.67	31.16	33.35	31.90	32.33	44.71	33.39	32.25	18.44
Std. Deviation	32.16	32.82	29.78	29.18	30.67	31.74	32.84	29.25	31.85	31.53	30.11	36.70	35.11	33.04	1.82

N= 94 teams (480 team members). \*p<.05 \*\*p<.01 \*\*\*p<.001, two-tailed. <sup>a</sup> Mean percentage of high-effective team members in the teams.

Table 28  
 Post-hoc Linear Stepwise Regression of Team Performance on the Proportion of Highly Effective Team Members Based on  
 BOS Dimension Composite Scores

Model	Variables Entered	$\Delta R^2$	B	$\beta$	t	$R^2$	Adj. $R^2$	R	F
1. <sup>E</sup>	Synthesis of team's ideas		.01	.51	6.11***	.42	.41	.65	37.38***
2. <sup>E</sup>	Participation	.05	.01	.41	5.34***	.48	.47	.60	37.87***
3. <sup>E</sup>	Preparation	.01	.01	.26	3.54***	.51	.49	.71	32.24***
4. <sup>E</sup>	Involving others	.06	.01	.18	2.12*	.53	.51	.73	26.41***
Constant			16.42		130.86***				

N=94 teams. \* $p < .05$  \*\* $p < .01$  \*\*\* $p < .001$ . <sup>E</sup> – entered. B - Regression coefficient,  $\beta$  - Beta coefficient (standardized regression coefficient).

Only for extroversion does a non-linear solution contribute significantly to reducing the unexplained variation in individual effectiveness, over and above a linear solution ( $\Delta R^2 = 0.04$ , partial-F = 2.87,  $p < 0.05$ ). Figure 5 presents a plot of the relationship. Team members with very low extroversion scores and those with very high extroversion scores are less effective than are those with low, average and high levels of extroversion. The most effective extroverts are those with a high level of extroversion.

In a non-linear retest of hypotheses 8-12, a non-linear regression analysis was concerned with whether a team's aggregated personality explains significant additional variance in team performance after situational strength and a linear solution have already entered the equation. Situational strength and the linear solution act as covariates. Table 30 reveals that non-linear solutions do not contribute significantly to reducing the unexplained variation in team performance, over and above linear solutions.

Effect of the number of high personality team members on team performance:

Non-linear analysis of hypotheses 13-17. To retest hypotheses 13-17, team performance was regressed onto the number of high personality team members making up that team. This was accomplished through dummy variable coding the number of high personality members in a team. The team's situational strength was controlled for by entering it in an initial block. Findings are presented in Table 31. Partial-F values indicate that for none of the personality traits does the non-linear model provide predictive validity over the linear model.

Table 29  
 Standard Multiple Regression of Individual Team Member Effectiveness on Dummy Coded Personality Variables (Hypotheses 1-5 retested)

Personality	Expected Individual Effect.	B	$\beta$	t	R <sup>2</sup>	Adj. R <sup>2</sup>	R	F	Partial-F test <sup>b</sup>	$\Delta R^2$ <sup>b</sup>
<i>Neuroticism</i>										
Very High	3.42	-.61	-.11	-1.86	.02	.00	.12	1.40	1.91	0.01
High	3.71	-.33	-.09	-1.33						
Average	3.62	-.41	-.15	-2.07*						
Low	3.74	-.29	-.10	-1.44						
Very Low <sup>a</sup>	4.03	6.03		37.94***						
Extroversion					.05	.04	.23	2.68*	2.87*	0.04
Very High	3.40	.00	.00	-.00						
High	4.05	.65	.22	2.49*						
Average	3.64	.24	.09	.98						
Low	3.80	.40	.13	1.49						
Very Low <sup>a</sup>	3.40	5.40		24.17***						
Openness to Experience					.03	.02	.17	1.17	.15	0.02
Very High	4.02	.61	.14	1.92						
High	3.84	.43	.12	1.51						
Average	3.76	.34	.13	1.32						
Low	3.64	.23	.08	.88						
Very Low <sup>a</sup>	3.41	5.41		23.30***						
Agreeableness					.02	.01	.15	1.05	1.84	0.01
Very High	3.85	.38	.07	1.22						
High	3.99	.52	.15	2.20*						
Average	3.84	.38	.14	1.85						
Low	3.54	.07	.02	.32						
Very Low <sup>a</sup>	3.47	5.47		32.07***						
Conscientiousness					.04	.03	.20	3.93**	1.81	0.03
Very High	4.31	1.09	.20	2.70**						
High	3.96	.75	.26	2.29*						
Average	3.71	.49	.19	1.55						
Low	3.38	.17	.05	.49						
Very Low <sup>a</sup>	3.21	5.21		17.36***						

<sup>a</sup> Intercept. <sup>b</sup> Contribution of the nonlinear solution. N=480 (in 94 teams). \*p<.05 \*\*p<.01 \*\*\*p<.001. B - Regression coefficient,  $\beta$  - Beta coefficient.

## Team Member Effectiveness

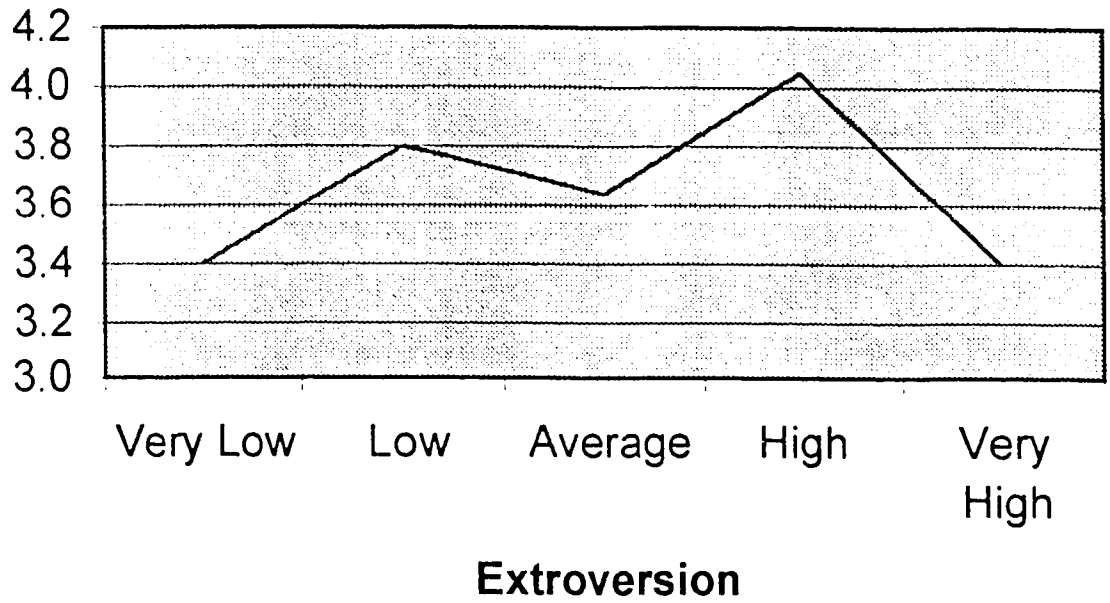


Figure 5. Plot of the Relationship between Extroversion and Individual Team Member Effectiveness

Table 30  
Standard Multiple Regression of Team performance on Dummy Coded Average Team Personality (retest of hypotheses 8-12)

Personality	Expected Team Effect.	B	$\beta$	t	R <sup>2</sup>	Adj R <sup>2</sup>	R	F	Partial-F test <sup>b</sup>	$\Delta R^2$ <sup>b</sup>
<i>Neuroticism</i>										
	172.00	4.00	.14	.99	.05	.04	.23	1.17	2.35	0.04
Very High	164.11	-3.89	-.13	-.94						
High	167.22	-.78	-.03	-.19						
Average	165.42	-2.58	-.09	-.63						
Low	168.00	168.00	56.43***							
Very Low <sup>a</sup>					.08	.07	.28	1.37	2.04	0.08
<i>Extroversion</i>										
	165.98	-4.02	-.34	-.99						
Very High	166.61	3.39	.11	.84						
High	166.35	-3.65	-.12	-.90						
Average	168.71	1.29	.04	.31						
Low	170.00	170.00	59.43***							
Very Low <sup>a</sup>					.04	.03	.21	.71	.33	0.03
<i>Openness to Experience</i>										
	168.77	5.30	.18	1.30						
Very High	169.16	5.16	.18	1.29						
High	165.59	1.59	.05	.39						
Average	168.77	4.77	.16	1.71						
Low	164.00	164.00	56.18***							
Very Low <sup>a</sup>					.04	.03	.20	.80	.44	0.01
<i>Agreeableness</i>										
	165.90	3.33	.12	.82						
Very High	167.17	2.03	.07	.49						
High	166.91	2.29	.08	.56						
Average	168.20	-1.00	-.03	-.24						
Low	169.20	169.20	57.28***							
Very Low <sup>a</sup>					.07	.02	.26	1.52	.48	0.02
<i>Conscientiousness</i>										
	170.95	8.95	.30	2.24*						
Very High	169.14	7.14	.25	1.81						
High	165.80	3.80	.12	.92						
Average	168.58	6.58	.23	1.67						
Low	162.00	162.00	56.53***							
Very Low <sup>a</sup>										

\* Intercept. <sup>b</sup> Contribution of the nonlinear solution. N=480 (in 94 teams). \*p<.05 \*\*p<.01 \*\*\*p<.001. B - Regression coefficient,  $\beta$  - Beta coefficient (standardized regression coefficient).



Table 31  
 Standard Multiple Regression using Dummy Variable Coding of Team Performance on the Proportion of Team Members in a Team that  
 are High in Trait Scores (retest of hypotheses 13-17)

Personality	Expected Individual Effect	B	$\beta$	t	R <sup>2</sup>	Adj. R <sup>2</sup>	R	F	Partial-F test <sup>b</sup>	$\Delta R^{2,b}$
<i>Neuroticism</i>										
1 team member	16.58	-.44	-.17	-.47	.10	.06	.32	1.39	2.23	0.02
2 team member	16.69	-.33	-.11	-.35						
3 team member	15.66	-1.36	-.38	-1.40						
4 team member	17.41	.39	.07	.67						
5 team member <sup>a</sup>	17.02	17.02		18.73***	.06	.05	.24	1.41	1.95	0.03
<i>Extroversion</i>										
1 team member	16.35	-.73	-.73	-.73						
2 team member	16.53	.55	.55	.55						
3 team member	16.28	-.80	-.80	-.80						
4 team member	17.35	.27	.27	.27						
5 team member <sup>a</sup>	17.08	17.08		22.46***	.08	.07	.28	2.14	2.14	0.02
<i>Openness to Experience</i>										
1 team member	16.41	1.24	.38	1.52						
2 team member	17.03	1.86	.57	2.29*						
3 team member	16.28	1.11	.38	1.39						
4 team member	16.60	1.49	.43	1.81						
5 team member	16.66	15.17	.30	1.61						
6 team member <sup>a</sup>	15.17			20.03***	.06	.05	.25	.38	1.18	0.02
<i>Agreeableness</i>										
1 team member	16.51	.18	.18	.48						
2 team member	16.46	.13	.13	.29						
3 team member	16.93	.60	.60	1.20						
4 team member	16.50	-.17	-.17	-.20						
5 team member <sup>a</sup>	16.33	16.33		51.47***	.06	.05	.25	.60	.41	0.03
<i>Conscientiousness</i>										
1 team member	16.67	.10	.03	.27						
2 team member	16.04	.53	.14	1.32						
3 team member	16.77	.20	.03	.31						
4 team member	16.81	.24	.03	.30						
5 team member <sup>a</sup>	16.57	16.57		90.85***						

<sup>a</sup> Intercept. <sup>b</sup> Contribution of the nonlinear solution over a linear solution. N=94 (480 team members). \*p<.05 \*\*p<.01 \*\*\*p<.001. **B** - Regression coefficient,  $\beta$  - Beta coefficient (standardized regression coefficient).

Trait profiles at the individual and team levels. Linear regression analysis was used to assess whether there is a unique profile (combination) across the Big Five that distinguishes a more effective team member from a less effective one. Cognitive ability and situational strength were treated as covariates – they were designated as one block and entered first. The Big Five constituted the second block. Within this latter block the regression was stepwise. Conscientiousness is the only personality trait to enter and remain in the equation ( $\Delta R^2 = 0.05$ ,  $t = 4.00$ ,  $p < 0.001$ ; Table 31). Conscientiousness explains unique variance over and above situational strength and cognitive ability – it has incremental validity. As a post-hoc analysis, a hierarchical regression procedure was conducted to determine whether cognitive ability has incremental validity over and above conscientiousness. Situational strength entered the equation first, followed by conscientiousness and cognitive ability. Cognitive ability has incremental validity over situational strength and conscientiousness ( $\Delta R^2 = 0.03$ ,  $t = 3.45$ ,  $p < 0.001$ ; Table 33).

Non-linear stepwise analysis was also conducted and the results are in Table 34. This table reveals that the most predictive non-linear personality profile of effective team members consists of “high” extroversion and “high” to “very high” conscientiousness ( $R^2 = .11$ ). In addition, cognitive ability which was entered as a covariant is also significant ( $t = 3.58$ ,  $p < 0.001$ ). Since cognitive ability was a covariant, “high” extroversion and “high” to “very high” conscientiousness have incremental validity over cognitive ability.

Table 32  
Linear Stepwise Regression of Individual Team Member Effectiveness on Personality Controlling for Cognitive Ability and Situational Strength

Model	Variables Entered	$\Delta R^2$	B	$\beta$	t	R <sup>2</sup>	Adj. R <sup>2</sup>	R	F
1. <sup>a</sup>	Your team imposes structure and constraints on your behaviour		.04	.15	1.82	.06	.05	.25	7.59***
	Your team imposes structure and constraints on the behaviour of other team members		.00	-.01	-.09				
	Cognitive ability	.04***	.01	.21	4.38***				
	Conscientiousness	.05***	.01	.19	4.00***	.11	.10	.33	11.96***
2. <sup>b</sup>	Constant		3.10		23.53***				

N=480 (in 94 teams). \*\*\*p<.001    <sup>a</sup> Standard regression    <sup>b</sup> Stepwise regression. B - Regression coefficient,  $\beta$  - Beta coefficient (standardized regression coefficient).

Table 33  
Post-hoc Hierarchical Regression Analysis to Determine the Incremental Validity of Cognitive Ability over Conscientiousness after Controlling for Situational Strength

Order	Independent Variables Entered	$\Delta R^2$	B	$\beta$	t	R <sup>2</sup>	Adj. R <sup>2</sup>	R	F
1.	Your team imposes structure and constraints on your behaviour	--	.13	.12	1.32	.03	.02	.16	9.39**
2.	Your team imposes structure and constraints on the behaviour of other team members	.00	.00	.05	.52	.03	.02	.16	4.82**
3.	Conscientiousness	.04***	.00	.17	3.24***	.07	.06	.26	8.42***
4.	Cognitive ability	.03***	.00	.18	3.47***	.10	.09	.32	10.05***
	Constant		2.81		20.62***				

N=480 (in 94 teams). \*p<.05 \*\*p<.01 \*\*\*p<.001. B - Regression coefficient (standardized regression coefficient).

Stepwise regression analyses were also used to assess whether there is a unique profile across the Big Five that distinguish more effective *teams* from less effective ones. Analysis was first conducted using the teams' *aggregated* personality. Each team's cognitive ability and situational strength were treated as covariates. Aggregated personality traits constituted the second block. Within this latter block the regression was stepwise. Table 35 presents the results of the analysis.

Conscientiousness is the only personality trait to enter and remain in the equation, as was the case in the individual level analysis ( $\Delta R^2 = 0.09$ ;  $t = 3.00$ ,  $p < 0.01$ ). Table 35 also shows that a team's conscientiousness explains unique variance over and above its situational strength and cognitive ability – it has incremental validity.

As a post-hoc analysis, a hierarchical regression procedure was conducted to determine whether a team's cognitive ability has incremental validity over and above its conscientiousness. Situational strength entered the equation first, followed by conscientiousness and cognitive ability. Results are in Table 36. It was found that cognitive ability has incremental validity over situational strength and conscientiousness ( $\Delta R^2 = 0.10$ ;  $t = 2.67$ ,  $p < 0.01$ ).

Table 34  
 Non-Linear Stepwise Regression of Individual Team Member Effectiveness on Personality Controlling for Cognitive Ability and Situational Strength

Block	Variables entered	$\Delta R^2$	B	$\beta$	t	$R^2$	Adj. $R^2$	R	F
1.	Your team imposes structure and constraints on your behaviour		.03	.10	1.20	.06	.05	.25	7.59***
	Your team imposes structure and constraints on the behaviour of other team members		.00	.03	.40				
	Cognitive ability	.05***	.01	.18	3.58***				
2. <sup>a</sup>	High Extroversion	.05***	.07	.10	2.82**	.11	.09	.33	6.84***
	High Conscientiousness		.09	.13	2.47*				
	Very High Conscientiousness		.16	.12	2.28*				
	Constant		3.46		38.67***				

N=480 (in 94 teams). \* $p < .05$  \*\* $p < .01$  \*\*\* $p < .001$ . a Stepwise regression. B - Regression coefficient,  $\beta$  - Beta coefficient (standardized regression coefficient).

Lastly, linear stepwise regression analysis was used to assess whether there is a unique profile across high personality and high ability team members that distinguishes a more effective team from a less effective one. The team's situational strength and the proportion of high ability team members were treated as covariates by entering them in the first block. The Big Five constituted the second block. Within this latter block the regression was stepwise. Table 37 presents the results of the analysis. Conscientiousness, extroversion and openness to experience enter and remain in the equation ( $\Delta R^2 = .24$ ,  $p < 0.001$ ). Table 37 also shows that these traits have unique variance over and above situational strength and cognitive ability – they have incremental validity.

As a post-hoc analysis, a hierarchical regression procedure was conducted to determine whether the proportion of high cognitive ability team members has incremental validity over and above the proportion of high conscientiousness, extroversion and openness to experience team members. Situational strength entered the equation first, followed by conscientiousness, extroversion, openness to experience and cognitive ability. Results are in Table 38. It was found that the proportion of high ability members in a team has incremental validity over situational strength and the proportion of high personality members ( $\Delta R^2 = .05$ ;  $t = 2.49$ ,  $p < 0.05$ ).

Table 35  
Linear Stepwise Regression of Team Performance on Team Personality Controlling for Cognitive Ability and Situational Strength

Model	Variables Entered	$\Delta R^2$	B	$\beta$	t	R <sup>2</sup>	Adj. R <sup>2</sup>	R	F
1. <sup>a</sup>	Your team imposes structure and constraints on your behaviour		.50	.15	.92	.10	.09	.32	3.34***
	Your team imposes structure and constraints on the behaviour of other team members		-.76	-.21	-1.30				
	Cognitive ability	.09**	.17	.28	2.67**				
	Conscientiousness	.09**	.07	.30	3.00**	.19	.16	.45	4.14***
2. <sup>b</sup>	Constant		9.58		4.56***				

N=94 teams. \* $p < .05$  \*\* $p < .01$  \*\*\* $p < .001$ . a Standard regression b Stepwise regression. B - Regression coefficient,  $\beta$  - Beta coefficient (standardized regression coefficient).

Table 36  
Post-hoc Hierarchical Regression Analysis to Determine the Incremental Validity of the Team's Cognitive Ability over the Team's Conscientiousness after Controlling for the Team's Situational Strength

Order Independent Variables Entered	$\Delta R^2$	B	$\beta$	t	R <sup>2</sup>	Adj. R <sup>2</sup>	R	F
1. Your team imposes structure and constraints on your behaviour	--	.50	.15	.93	.04	.03	.07	.38
2. Your team imposes structure and constraints on the behaviour of other team members	.00	-.76	-.21	-1.30	.04	.03	.07	.53
3. Conscientiousness	.05**	.07	.30	3.01**	.09	.06	.31	2.93*
4. Cognitive ability	.10**	.17	.28	2.67**	.19	.16	.45	4.14**
Constant		9.58		4.56***				

N=94 teams. \* $p < .05$  \*\* $p < .01$  \*\*\* $p < .001$ . B - Regression coefficient,  $\beta$  - Beta coefficient (standardized regression coefficient).

**Table 37**  
**Linear Stepwise Regression of Team Performance on Proportion of High Personality Team Members Controlling for the Proportion of High Cognitive Ability Team Members and Situational Strength**

Model	Variables Entered	$\Delta R^2$	B	$\beta$	t	R <sup>2</sup>	Adj. R <sup>2</sup>	R	F
1. a	Your team imposes structure and constraints on your behaviour		.32	.10	.66	.06	.06	.30	3.01***
	Your team imposes structure and constraints on the behaviour of other team members		-.64	-.18	-1.24				
2. b	Cognitive ability	.31***	.45	.22	2.49*			.61	8.55***
	Conscientiousness		.77	.38	4.18***	.37	.33		
	Extroversion		.43	.26	2.84**				
	Openness to experience		.33	.22	2.51**				
	Constant		13.08		10.39***				

N=94 teams. \*p<.05 \*\*p<.01 \*\*\*p<.001 a Standard regression b Stepwise regression. B - Regression coefficient,  $\beta$  - Beta coefficient.

**Table 38**  
**Post-hoc Hierarchical Regression Analysis to Determine the Incremental Validity of High Cognitive Ability over High Conscientiousness after Situational Strength is Controlled for**

Order	Independent Variables Entered	$\Delta R^2$	B	$\beta$	t	R <sup>2</sup>	Adj. R <sup>2</sup>	R	F
1.	Your team imposes structure and constraints on your behaviour	.00	.32	.10	.66	.00	.01	.00	.22
2.	Your team imposes structure and constraints on the behaviour of other team members	.01	.64	.18	1.24	.01	.01	.10	.59
3.	Conscientiousness	.13***	.72	.38	4.18***	.14	.11	.37	4.87**
4.	Extroversion	.15**	.43	.26	2.84**	.29	.25	.54	8.89***
5.	Openness to experience	.04*	.33	.22	2.51**	.33	.29	.57	8.52***
4.	Cognitive ability	.05*	.45	.22	2.49*	.37	.33	.61	8.56***
	Constant		13.09		10.39***				

N=480. \*p<.05 \*\*p<.01 \*\*\*p<.001. B - Regression coefficient,  $\beta$  - Beta coefficient (standardized regression coefficient).



## CHAPTER 5

### Discussion

This study provides insight into staffing and developing teams by: 1) identifying *traits* useful in *selecting* autonomous work team members and 2) identifying *behaviours* that could be targeted in *developing* existing team members. As its main contribution, this study makes the link between traits (personality and cognitive ability) and (in)effective team member behaviour within autonomous work teams that perform a variety of different tasks. This research is unique in that it: (1) considered the performance of intact autonomous work teams executing a variety of different tasks over 13 weeks, (2) used the FFM as a predictor of individual team member effectiveness and overall team performance, (3) made observations of performance relevant behaviours, (4) made several methodological improvements over past studies and (5) used well established measures and procedures.

#### Identifying the Traits that Should be Used to Select Team Members

Team level analysis suggests that a human resource practitioner should consider staffing a team with people in the top third of the population in extroversion, openness to experience, conscientiousness and who are relatively high in cognitive ability. In combination, these traits predict team performance fairly well -- about 37 percent of the variation in team performance.

Both linear and non-linear trait profiles forecast individual team member effectiveness about equally well – eleven percent of the variance in individual

effectiveness. Since both linear and non-linear profiles are equally predictive, a human resource practitioner should choose to use the profile that involves the least number of trait measurements – the most parsimonious combination. The non-linear combination of traits is high conscientiousness, high but not very high extroversion and higher cognitive ability (Figure 6)<sup>25</sup>. The linear profile, consisting of just conscientiousness and cognitive ability, is the most parsimonious.

The relationship between extroversion and individual effectiveness is an inverted-U, suggesting that performance may suffer if selection mechanisms overemphasize extroversion as a favourable team member attribute. This supports Barry and Stewart's (1997) finding of an inverted-U relationship between a team's extroversion and its performance. Day and Silverman (1989) note that such findings are "somewhat troublesome in that linear models are more common in predicting job success" (p. 34).

Recommendations. In the final analysis, human resource practitioners should select team members in about the top 33% of the population, but, below the top 7% of the population in extroversion and in the top third of the population in openness to experience and conscientiousness. Also, they should select people higher in cognitive

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<sup>25</sup> The predictive validity of the non-linear profile is actually *underestimated* as a result of reduced variance in personality. Development of the non-linear model required restricting the variance of personality traits - a continuous personality variable was grouped into five orthogonal categories ranging from very high to very low. In the process of taking a continuous variable and providing an average score to represent each grouping of that variable, variance is being constrained. So, for our understanding of the role played by FFM traits in predicting team member performance the non-linear model actually provides a more complete picture. The non-linear analysis helps one better understand the characteristics of effective team members. That is, effective team members are best characterized by taking into account personality elevation. This information may be useful for theory development.

ability. At the very minimum, team members should be selected for as high a cognitive ability and conscientiousness score as available. This trait combination is the most parsimonious predictor of individual team member effectiveness and is essential to team performance. These results support the hypothesis by Barrick and Mount (1991) that conscientiousness is important for any job, regardless of whether it is self-managed or traditional in structure. Yet, the results do contradict those recently reported by Barry and Stewart (1997). To their surprise, they found “no direct role for conscientiousness either at the individual or group level” (p. 75). The discrepancy may be explained by the tasks completed. In the Barry and Stewart study, the tasks mainly required creativity while in this study, the tasks were conceptual and behavioural as well (cf. Barry and Stewart 1997; McGrath 1984). Individual effectiveness results are also consistent with the concept that performance is best predicted by measures of an employee’s *will* to perform well and by that employee’s *ability* to perform well. That is, the “will-do” and “can-do” components. Conscientiousness measures the “will-do” aspect and cognitive ability the “can-do” aspect. This tenant seems to hold whether selecting for the traditional job context or the team context.

Relating individual team member attributes to team performance. A number of studies have aggregated each team member’s score on a predictor and divided by the number of team members to obtain an average score for that team. This method of determining the team’s personality, cognitive ability or behavioural effectiveness may

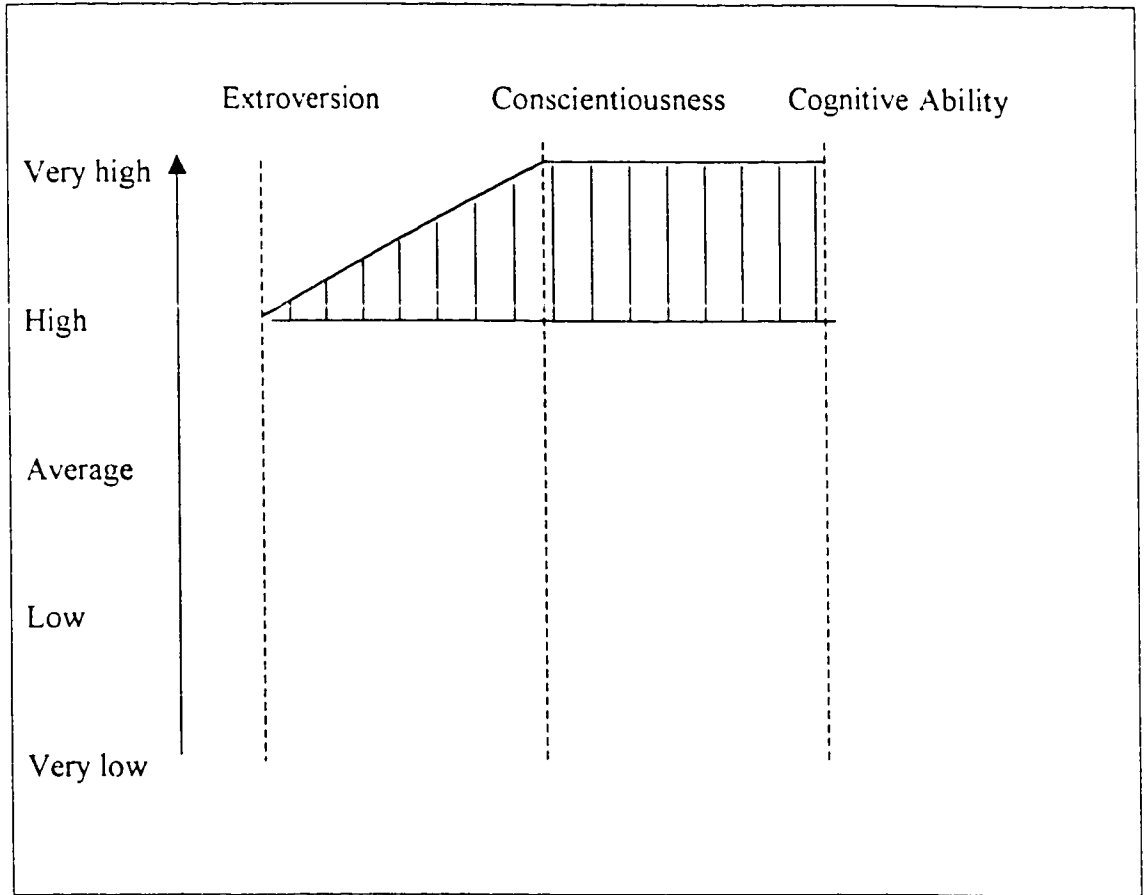


Figure 6. Trait Profile Most Predictive of Individual Team Member Effectiveness.

sometimes be problematic. Consider two teams. Team one has three members with two very high and one low extrovert -- scores of 70.00, 70.00 and 30.00 respectively. Team two has one very high and two average scores – 70.00, 50.00 and 50.00 respectively. Both teams have an average extroversion level of 56.67. If the two teams performed differently because the first contained one more member very high in extroversion than did the second team, then the team's conscientiousness score would not be a useful predictor of team performance. Knowing the proportion of highly extroverted members is useful when staffing a team. This appears to be the case for both extroversion and openness to experience because the *team's* average score on these traits does not predict its performance but the *proportion* of highly extraverted and open to experience team members did. In sum, using a team's trait score, or a composite score for the team, seems to be generally a less useful predictor of team performance than is the proportion of high-scoring members on a personality trait<sup>26</sup>.

#### Identifying Behaviours that Should be used to Select Team Members and to Develop Existing Team Members

Most experts suggest that human resource systems such as selection, job analyses and performance appraisals should be behaviourally based. But what are the specific performance-relevant behaviours that contribute to team performance? This study provides the first typology of performance-relevant team member behaviours based upon

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<sup>26</sup> High-personality trait members are those with  $T > 55$  – generally capturing scores in the top 33% of the population's score. In the case of extroversion where the relationship with individual effectiveness is non-linear the cut-off used to determine high-scoring members includes the "high" and "very high" categories used in the dummy variable coding. That is, the determination of highly extraverted team members sufficiently captures those extroverts that are most likely to be superior performers.

actual observations. Not only is the typology provided here supported empirically but it is also congruous with typologies composed previously. Table 39 provides a “quick view” of related constructs in two recently published typologies by Stevens and Campion (1994) and Hyatt and Ruddy (1997). The table illustrates that most dimensions generated in this study are similar to characteristics that other researchers have inferred to be important for team performance<sup>27</sup>.

In addition to the BOS dimensions that map onto Stevens and Campion’s and Hyatt and Ruddy’s typologies, four other dimensions emerged from this study that do not appear to correspond well with Stevens and Campion’s KSAs or Hyatt and Ruddy’s typology. The dimensions are: 1) team citizenship, 2) commitment to the team, 3) synthesis of ideas and 4) preparation for team meetings.

Behaviourally based selection and development. The behaviours in the BOS can be used to staff teams. For instance, they can be assessed by means of a behaviourally based structured interview. Each of the behavioural groupings on the BOS impact team performance quite well. Some behavioural dimensions impact team performance purely by effecting task performance, e.g., preparation for team meetings. Others, impact the interpersonal elements of team interaction, e.g., reaction to conflict. Still others, fall somewhere in between, e.g., the team citizenship group of behaviours.

What is the best *combination* of behaviours for *predicting* team performance?

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<sup>27</sup> Prior literature is typically logical and conceptual rather than empirical.

Table 39

## BOS Dimensions and Corresponding Constructs in the Literature

Dimension (Factor)	Items corresponding to each factor		Related Constructs	
	Stevens and Campion	Hyatt and Ruddy	Stevens and Campion	Hyatt and Ruddy
Goal setting/achievement	<ul style="list-style-type: none"> <li>Does not participate in setting team goals (R)</li> <li>Participates in developing strategies to achieve team goals</li> </ul>		<ul style="list-style-type: none"> <li>Goal setting and Performance</li> </ul>	<ul style="list-style-type: none"> <li>Goal Orientation</li> </ul>
Focusing on the task-at-hand	<ul style="list-style-type: none"> <li>Draws team members into off-topic discussions (R)</li> <li>Does not try to bring off-topic team members back on topic (R)</li> <li>Participates in off-topic conversations (R)</li> <li>Draws team members into discussions that are relevant to achieving the goal</li> <li>Asks for help in order to get other team members to focus on the goal</li> <li>Reminds other team members of the team's goal</li> </ul>			<ul style="list-style-type: none"> <li>Process focus</li> </ul>
Performance management	<ul style="list-style-type: none"> <li>Assigns tasks and roles to team members</li> <li>Sets time deadlines for achieving tasks</li> <li>Tells the team how much time they have left to do a task</li> </ul>		<ul style="list-style-type: none"> <li>Goal setting and Performance</li> <li>Planning and task coordination</li> </ul>	<ul style="list-style-type: none"> <li>Goal Orientation</li> </ul>
Team citizenship	<ul style="list-style-type: none"> <li>Uses humour to create a positive team atmosphere</li> <li>Volunteers to do things that no one else wants to do</li> <li>Keeps working when others quit</li> <li>Exercises initiative by acting independently for the benefit of the team</li> <li>Takes the lead in coming up with ideas</li> <li>Seeks information from resources from outside of the team</li> </ul>			
Participates in problem solving	<ul style="list-style-type: none"> <li>Offers ideas</li> <li>Asks relevant questions</li> <li>Accepts team roles and tasks as required</li> <li>Voices unique ideas</li> </ul>		<ul style="list-style-type: none"> <li>Collaborative problem solving</li> </ul>	<ul style="list-style-type: none"> <li>Interpersonal work group processes</li> </ul>
Synthesis of ideas	<ul style="list-style-type: none"> <li>Builds on the group's ideas by offering solutions</li> <li>Summarizes and organizes the group's ideas</li> </ul>			
Commitment to team	<ul style="list-style-type: none"> <li>Misses team meetings (R)</li> <li>Comes to team meetings late (R)</li> </ul>			
Preparation for meetings	<ul style="list-style-type: none"> <li>Does not read the required material before team meetings (R)</li> <li>Brings the required material to the team meetings</li> </ul>			

Table 39 continued  
 BOS Dimensions and Corresponding Constructs in the Literature

Dimension (Factor)	Items corresponding to each factor		Related Constructs	
	Stevens and Campion	Hyatt and Ruddy	Stevens and Campion	Hyatt and Ruddy
Providing/reaction to feedback	<ul style="list-style-type: none"> <li>Personally attacks individuals that provide negative feedback (R)</li> <li>Criticizes others' contributions (suggestions, ideas and behaviour) without offering alternatives (R)</li> <li>Provides constructive feedback to team members for behavioural improvement</li> <li>Says positive things to team members regarding their performance</li> </ul>	<ul style="list-style-type: none"> <li>Goal setting and Performance</li> <li>Collaborative problem solving</li> </ul>	<ul style="list-style-type: none"> <li>Interpersonal work group processes</li> <li>Goal Orientation</li> </ul>	
Communication	<ul style="list-style-type: none"> <li>Dominates the discussion (R)</li> <li>Ignores what other team members are saying (R)</li> <li>Carefully listens to what others are saying (e.g., maintains eye contact, nods etc.)</li> </ul>	<ul style="list-style-type: none"> <li>Communication</li> </ul>	<ul style="list-style-type: none"> <li>Interpersonal work group processes</li> </ul>	
Involvement of others	<ul style="list-style-type: none"> <li>Clarifies and explains issues when someone does not understand</li> <li>Asks other team members what they think</li> </ul>	<ul style="list-style-type: none"> <li>Collaborative problem solving</li> </ul>	<ul style="list-style-type: none"> <li>Interpersonal work group processes</li> </ul>	
Reaction to conflict	<ul style="list-style-type: none"> <li>Leaves conflicts unresolved by not saying anything or ignoring some team members (R)</li> <li>Leaves a conflict unresolved by leaving the meeting (R)</li> <li>Leaves a conflict unresolved by moving on to another topic (R)</li> </ul>	<ul style="list-style-type: none"> <li>Conflict resolution</li> </ul>		
Strategy to address conflict	<ul style="list-style-type: none"> <li>Clarifies contentious issues in a conflict</li> <li>Politely gives advice in a conflict</li> <li>Politely confronts team members on their tardiness</li> <li>Provides an alternative solution that is agreeable to other team members when a conflict occurs</li> </ul>	<ul style="list-style-type: none"> <li>Conflict resolution</li> </ul>	<ul style="list-style-type: none"> <li>Goal Orientation</li> </ul>	
Averts conflict	<ul style="list-style-type: none"> <li>Resorts to personal attacks when a problem arises (R)</li> <li>Tries to calm down team members that are in a conflict</li> <li>Takes a stance on an issue and is not willing to budge</li> </ul>	<ul style="list-style-type: none"> <li>Conflict resolution</li> </ul>	<ul style="list-style-type: none"> <li>Interpersonal work group processes</li> </ul>	

R – Reversed items

• Hyatt and Ruddy (1997) studied autonomous work teams and used quantitative methods to develop 13 dimensions that contribute to team performance. However, their factor structure was marred with a high degree of redundancy and they suggested that additional research be conducted in order to generate a more parsimonious work group effectiveness factor structure.



When staffing intact autonomous work teams that complete a variety tasks, a human resource practitioner should select people that 1) synthesize the team's ideas, 2) participate in team problem solving, 3) focus on the task-at-hand, 4) involve others, 5) are committed to the team, 6) participate in goal setting/achievement, 7) manage the performance of other team members, 8) provide feedback and react well to feedback and are 9) good team citizens. These behaviours explain about 72 percent of the variation in performance of the teams studied and should be incorporated into behaviourally based selection tools.

BOS dimensions can also be used to determine the role a new or existing member should assume within a team. For instance, a person that exhibits the behaviours captured under the "performance management" and "goal setting/achievement" BOS dimensions may act well in a leadership role (cf. Cohen, Chang and Ledford 1997).

The BOS is also a good tool for teams that require a member to take on a specific role. For instance, if a team needed a gatekeeper (someone who facilitates the participation of others in the team) then the team should seek someone that exhibits the behaviours found under the "involves others" BOS category. Similarly, the usefulness of selection criteria in predicting team performance may vary in response to a team's mandate (Hyatt and Ruddy 1997; Klimoski and Jones 1994). One may work backwards from the team task to determine the essential team behaviours. For instance, a management team established to negotiate a collective agreement may benefit from people that exhibit effective conflict related BOS behaviours (avert conflict, react well if a conflict does occur and forwards a strategy to address conflict). A further step for trait

based selection may be to work backwards and focus on selecting for the traits that predict conflict related behaviours -- emotional stability (opposite of neuroticism), extroversion, openness to experience and agreeableness. Similarly, if an existing team lacks a person to take on a specific role then the desired behaviours may be developed in its members. Table 40 presents the behaviours that may link to some common team roles.

#### Mapping of Personality and Cognitive Ability onto Team Member Behaviour

Situationalists argue that a person's behaviour is mainly dictated by his or her environment and the search for dispositional effects will likely prove unproductive (Davis-Blake and Pfeffer 1989; Ghiselli 1973; Mischel 1968; Reilly and Chao 1982; Schmitt, Gooding, Noe and Kirsh 1984). Others argue that dispositional constructs are relevant to understanding human behaviour (House, Shane and Herold 1996). This study adds to the growing evidence in support of the dispositional approach -- personality and cognitive ability, to varying degrees, are manifested in how a team member behaves. These behaviours in turn impact team performance.

Even recently, it has been stated that the contribution made by personality in predicting job performance is modest at best (Adler 1996; Schneider 1996). This conclusion has almost exclusively been rooted in associations between personality and *global* assessments of job performance.

Table 40

**BOS Dimensions Associated with Common Team Member Roles**

<b>Team Member Roles<sup>a</sup></b>	<b>Role Description<sup>a</sup></b>	<b>BOS Dimension</b>
<i>Task roles</i>		
Initiator-Contributor	Suggests new ideas to solve a group problem or new ways for the group to organize for the task	<ul style="list-style-type: none"> <li>▪ Participate in team problem solving</li> <li>▪ Performance management</li> <li>▪ Synthesis of ideas</li> </ul>
Information seeker/Information giver	Deals with information and facts about the group's task	<ul style="list-style-type: none"> <li>▪ Preparation</li> <li>▪ Synthesis of ideas</li> <li>▪ Team Citizenship</li> </ul>
Opinion seeker/Opinion giver	Deals with the group's values regarding its task.	<ul style="list-style-type: none"> <li>▪ Involvement of others</li> <li>▪ Strategy to address conflict</li> <li>▪ Providing feedback</li> </ul>
Elaborator	Goes into detail about how group plans would work.	<ul style="list-style-type: none"> <li>▪ Goal setting/achievement</li> <li>▪ Performance management</li> </ul>
Coordinator	Coordinates group activities.	<ul style="list-style-type: none"> <li>▪ Goal setting/achievement</li> <li>▪ Performance management</li> <li>▪ Focusing on the task-at-hand</li> </ul>
Orienter	Keeps the group focused on its goals.	<ul style="list-style-type: none"> <li>▪ Focusing on the task-at-hand</li> </ul>
Evaluator	Compares group accomplishments to a standard.	<ul style="list-style-type: none"> <li>▪ Performance management</li> <li>▪ Providing feedback</li> </ul>
Energizer	Tries to keep up the group's energy level.	<ul style="list-style-type: none"> <li>▪ Team Citizenship</li> <li>▪ Involvement of others</li> </ul>
Recorder	Acts as the memory of the group.	<ul style="list-style-type: none"> <li>▪ Synthesis of ideas</li> <li>▪ Performance management</li> </ul>
<i>Maintenance Roles</i>		
Encourager	Praises and encourages group members.	<ul style="list-style-type: none"> <li>▪ Providing feedback</li> </ul>
Harmonizer	Tries to keep relations between group members harmonious.	<ul style="list-style-type: none"> <li>▪ Averts conflict</li> </ul>
Compromiser	Offers to compromise own position to keep the group harmonious.	<ul style="list-style-type: none"> <li>▪ Effective communication</li> <li>▪ Reaction to conflict</li> <li>▪ Averts conflict</li> </ul>
Gatekeeper	Facilitates the participation of the others in the group.	<ul style="list-style-type: none"> <li>▪ Involvement of others</li> <li>▪ Performance management</li> <li>▪ Providing feedback</li> </ul>
Standard setter	Sets or applies standards to the group's work.	<ul style="list-style-type: none"> <li>▪ Performance management</li> <li>▪ Providing feedback</li> </ul>
Group observer/commentator	Supplies the group with observations of its procedures.	<ul style="list-style-type: none"> <li>▪ Providing feedback</li> <li>▪ Performance management</li> </ul>
Follower	Goes along with group.	<ul style="list-style-type: none"> <li>▪ Team commitment</li> <li>▪ Participates in team problem solving</li> <li>▪ Preparation</li> </ul>

<sup>a</sup>From Field and House (1995)

A “personality-global assessment of job performance” association may be weak for a number of reasons. For instance, a salesperson may be extroverted and may exhibit numerous desired behaviours, but still not meet sales targets because of a decline in demand for his or her product, lack of resources, etc. There are two separate issues that are of concern to the human resource practitioner – one is to maintain a stock of employees that exhibit the desired behaviours and the other is that these behaviours get translated into the desired outcomes. The focus of this study is on the former – showing that personality and cognitive ability map onto performance relevant behaviours in teams and therefore can be used to select employees that exhibit performance relevant behaviours.

Even though some personality traits predict team member effectiveness weakly, or not at all (i.e., neuroticism and agreeableness), these same traits predict some performance-relevant behaviour quite well. The strengths of many of the trait-specific (in)effective behaviour correlations were greater than the strength of the trait-global measure of individual team member effectiveness correlation. In three instances, more than 30 percent in the variation in a behavioural dimension could be explained by the traits studied here (participation in team problem solving, preparation for team meetings and effective communication). Consider the case of openness to experience. A team member’s openness to experience correlates 0.17 (corrected for attenuation) with the peer-assessed global measure of individual effectiveness. However, openness to experience has stronger correlations with three specific (in)effective team behaviours, e.g., it correlates at  $r = 0.29$  with “synthesis of new ideas” which in turn correlates very

strongly with the global measure of a team member performance ( $r = 0.84$ ). At the team level of analysis, the average team score on the “synthesis of new ideas” dimension correlates fairly well ( $r = 0.67$ ) with the team’s performance. For all the traits studied, some personality→specific (in)effective behaviour→individual effectiveness paths are stronger than the personality→global measure of a team member performance path. This finding is consistent with Adler’s (1996) notion that aggregate output measures of performance do not adequately capture the personality-rooted stylistic influence that the Big Five has on job performance.

Some traits are positively related to some (in)effective team member behaviours and negatively related to others. This phenomenon is most prevalent in the case of extroversion. Extroversion is inversely predictive of team commitment, effective communication and focusing on the task-at-hand. Simply correlating extroversion with a composite global measure of a team member’s overall effectiveness underestimates the contribution that this trait can make in predicting specific (in)effective team member behaviours. That is, the negative correlations reduce the effect size of the overall positive correlation between extroversion and individual team member effectiveness. This finding helps clarify why in the previous literature the strength of the relationship between some personality traits and performance measures has been highly variable. The strength of the relationship between some personality traits and outcomes is dependent upon the types of behaviours required to achieve those outcomes. Consider the case of extroversion. If completion of the team task requires that a team member exhibit mainly team citizenship behaviours ( $r = 0.20$  with extroversion;  $\beta = 0.12$ ,  $t = 2.14$ ,  $p < 0.05$ ) and participation in

team problem solving ( $r = 0.35$  with extroversion;  $\beta = 0.19$ ,  $t = 3.94$ ,  $p < 0.001$ ) then one may reasonably expect the association between extroversion and individual or team outcomes to be positive and quite strong<sup>28</sup>. This is because the behaviours required to achieve the outcome are strongly and positively associated with extroversion. However, if completion of the task also required a high degree of team commitment ( $r = -0.14$  with extroversion for this BOS dimension;  $\beta = -0.22$ ,  $t = -3.96$ ,  $p < 0.001$ ), effective communication ( $r = -0.27$ ;  $\beta = -0.28$ ,  $t = -4.28$ ,  $p < 0.001$ ) and reaction to conflict ( $r = -0.09$  with extroversion;  $\beta = -0.22$ ,  $t = -4.06$ ,  $p < 0.001$ ) then one may obtain a negative correlation between extroversion and individual or team outcomes.

In short, most global measures of performance require some degree of aggregation of an individual's effectiveness on several behaviours. Thus, it is of no surprise that the correlation between a trait and a global measure of performance may under-estimate the correlation between that trait and some specific performance relevant behaviours.

Previously, it was not known which trait attribute(s) predicted which behaviours. This study provides a mapping of traits onto (in)effective team member behaviours. Table 41 summarizes the findings. In addition, this table suggests roles that may be assumed by people who have various trait attributes, with little or no additional training.

The degree to which team members exhibit (in)effective behaviours significantly impacts their team's performance. In addition, when selection of team members is not possible (e.g., when teams already exist and members can not be removed from the

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<sup>28</sup> A strong relationship is around 0.26 according to Cohen (1977).

team), effective behaviours may be fostered in team members (e.g., taught or reinforced) and ineffective ones discouraged (e.g., punished or extinguished).

FFM traits and specific behaviours. The first two columns of Table 41 summarize key findings with respect to a trait-behaviour links. Driskell, Hogan and Salas (1987) hypothesized that neuroticism would correlate negatively with group performance on all tasks. This study did not support their conjecture – neuroticism did not correlate significantly with individual team member effectiveness or team performance. However, neurotics do exhibit several types of behaviours that are detrimental to team performance (and none that improve team performance; Table 41). When these behaviours are very important to the performance of a team's task, neuroticism may predict team performance. Neurotics do not actively participate in team activities and when they do they have a tendency to be unfocused. Furthermore, they do not handle conflict and performance feedback well.

Neurotics lack self-efficacy for team related tasks (Thoms, Moore and Scott 1996). Their lack of team participation in problem solving and synthesizing of ideas may be due to their lack of self-efficacy. The negative association between neuroticism and reaction to and averting conflict is consistent with the belief that emotionally unstable people are relatively irrational and volatile when under pressure and therefore

Table 41  
 Traits Related to Behaviours and Suggested Roles for People with Various Trait Attributes

Trait Associated with BOS Dimension	BOS Behavioural Dimensions	Suggested Role(s)	Suggested Training and Development needed for the roles
Emotional Stability (opposite of Neuroticism)	<ul style="list-style-type: none"> <li>▪ Goal setting/achievement</li> <li>▪ Focus at the task at hand</li> <li>▪ Performance management</li> <li>▪ Participate in team problem solving</li> <li>▪ Effectively provide feedback to other team members/react well to feedback</li> <li>▪ React effectively to conflict</li> <li>▪ Address conflict</li> <li>▪ Averts conflict</li> </ul>	<ol style="list-style-type: none"> <li>1. Orienter</li> <li>2. Evaluator</li> <li>3. Standard setter</li> <li>4. Group observer / commentator</li> <li>5. Initiator / contributor</li> <li>6. Opinion seeker / opinion giver</li> <li>7. Elaborator</li> <li>8. Coordinator</li> <li>9. Compromiser</li> </ol>	<ol style="list-style-type: none"> <li>1. No additional training required</li> <li>2. No additional training required</li> <li>3. No additional training required</li> <li>4. No additional training required</li> <li>5. No additional training required</li> <li>6. No additional training required</li> <li>7. Synthesis of ideas</li> <li>8. Involving others</li> <li>9. Synthesis of ideas</li> </ol>
Extroversion	<ul style="list-style-type: none"> <li>▪ Team citizenship</li> <li>▪ Participation</li> <li>▪ Address conflict</li> <li>▪ No team commitment</li> <li>▪ Ineffective communicator</li> <li>▪ Ineffective reaction to conflict</li> <li>▪ Poor focus on the task-at-hand</li> </ul>	<ol style="list-style-type: none"> <li>1. Energizer</li> </ol>	<ol style="list-style-type: none"> <li>1. Involvement of others</li> </ol>
Openness to experience	<ul style="list-style-type: none"> <li>▪ Participation</li> <li>▪ Synthesis of ideas</li> <li>▪ Involvement of others</li> <li>▪ Addresses Conflict</li> <li>▪ Averts conflict</li> </ul>	<ol style="list-style-type: none"> <li>1. Harmonizer</li> <li>2. Opinion Seeker/Giver</li> <li>3. Recorder</li> <li>4. Energizer</li> <li>5. Initiator-Contributor</li> </ol>	<ol style="list-style-type: none"> <li>1. No training required</li> <li>2. Providing feedback</li> <li>3. Performance Management</li> <li>4. Team Citizenship</li> <li>5. Performance Management</li> </ol>
Agreeableness	<ul style="list-style-type: none"> <li>▪ Effective communication</li> <li>▪ Involving others</li> <li>▪ Averts Conflict</li> <li>▪ Team commitment</li> </ul>	<ol style="list-style-type: none"> <li>1. Harmonizer</li> <li>2. Energizer</li> <li>3. Compromiser</li> </ol>	<ol style="list-style-type: none"> <li>1. No training required</li> <li>2. Team citizenship</li> <li>3. Reaction to conflict</li> </ol>



Table 41 continued  
 Traits Related to Behaviours and Suggested Roles for People with Various Trait Attributes

Trait Associated with BOS Dimensions	BOS Behavioural Dimensions	Suggested Role(s)	Suggested Training and Development needed for the roles
Conscientiousness	<ul style="list-style-type: none"> <li>▪ Goal setting/Achievement</li> <li>▪ Focus on the task-at-hand</li> <li>▪ Team commitment</li> <li>▪ Performance Management</li> <li>▪ Synthesis of ideas</li> <li>▪ Preparation</li> <li>▪ Team citizenship</li> <li>▪ Participation</li> <li>▪ Providing feedback</li> </ul>	<ol style="list-style-type: none"> <li>1. Elaborator</li> <li>2. Co-ordinator</li> <li>3. Oriented</li> <li>4. Recorder</li> <li>5. Evaluator</li> <li>6. Standard setter</li> <li>7. Group observer/commentator</li> <li>8. Information seeker/giver</li> </ol>	<ol style="list-style-type: none"> <li>1. No additional training required</li> <li>2. No additional training required</li> <li>3. No additional training required</li> <li>4. No additional training required</li> <li>5. No additional training required</li> <li>6. No additional training required</li> <li>7. No additional training required</li> <li>8. No additional training required</li> </ol>
Cognitive ability	<ul style="list-style-type: none"> <li>▪ Goal setting/achievement</li> <li>▪ Performance management</li> <li>▪ Participation</li> <li>▪ Synthesis of ideas</li> <li>▪ Preparation</li> <li>▪ Involving others</li> <li>▪ Addresses Conflict</li> <li>▪ Team citizenship</li> <li>▪ Effective Communication</li> </ul>	<ol style="list-style-type: none"> <li>1. Initiator-contributor</li> <li>2. Elaborator</li> <li>3. Recorder</li> <li>4. Information seeker/giver</li> <li>5. Coordinator</li> <li>6. Energizer</li> <li>7. Standard setter</li> <li>8. Group observer/commentator</li> <li>9. Follower</li> <li>10. Evaluator</li> </ol>	<ol style="list-style-type: none"> <li>1. No additional training required</li> <li>2. No additional training required</li> <li>3. No additional training required</li> <li>4. No additional training required</li> <li>5. Focusing on the task-at-hand</li> <li>6. No additional training required</li> <li>7. Providing feedback</li> <li>8. Providing feedback</li> <li>9. Team commitment</li> <li>10. Providing feedback</li> </ol>

handle conflict, which is generally a stressful event, poorly. Similarly, receiving performance feedback may also be stressful. Almost any behaviour that requires leadership (e.g., goal setting/achievement) was expected to be negatively correlated with neuroticism (see Hogan, Curphy and Hogan 1994). Thus, it is not surprising that neurotics are poor at performance management, taking and providing feedback and keeping the team focused on the task-at-hand.

Little was previously known about the specific role of extroversion in teams. Some scholars have suggested that extroversion contributes mostly to the interpersonal aspect of team interaction (e.g., Driskell, Hogan and Salas 1987; Piedmont and Weinstein 1994) and that the social aptitude of extroverts positively impacts team performance (Bouchard 1969; Hogan 1991; Shaw and Harkley 1976; Williams and Sternberg 1988).

Although Barry and Stewart (1997) hypothesized that the contributions of extroverts to team outcomes would be felt through socioemotional inputs rather than task inputs<sup>29</sup> they found that both socioemotional- and task-related inputs significantly correlated with extroversion. Mann (1959) reported that sociability and surgency (elements of extroversion) might act by increasing the degree of group members' *task-related* participation. That is, extroverts are likely to participate in all team activities regardless of whether they are task or socioemotional in nature.

In this study, it was found that the contribution of extroversion is felt through four behavioural dimensions. These dimensions have elements of both socioemotional and

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<sup>29</sup> Socioemotional inputs were: 1) stimulates discussion, 2) helps maintain focus and 3) helps work together. Task inputs were: 1) takes work seriously, 2) quality concerns, 3) performs up to level, 4) pulls weight and 5) high expectations.

task contributions. For instance, extroversion predicts the “team citizenship” behavioural dimension. This BOS dimension contains both socioemotional type behaviours (e.g., uses humour to create a positive team atmosphere) and task type behaviours (e.g., takes the lead in coming up with new ideas).

Overall, extroverts are active team members, but they have a tendency to be easily distracted and likely to be absent or late for meetings. Why are extroverts likely to be tardy or absent? Judge, Martocchio and Thoresen, (1997) report that both extroversion and conscientiousness predict absenteeism. With respect to extroversion, they suggest that “extroverts may characterize work as dull and routine” (p. 746) and thus they would rather seek out exciting new situations and activities.

Similarly, the negative correlation with team commitment and staying focused on the task-at-hand may be related to the propensity of extroverts to seek pleasurable social interactions at the expense of efficient management of task demands.

Barry and Stewart (1997) speculated that diminishing task-focus might explain why team performance declines when there are many extroverts in a team. Likewise, one may speculate that the inverted-U relationship between extroversion and team member performance may be due to people very high in extroversion being unable to remain focused – their input is off-topic.

Why did extroversion correlate negatively with the “effective team communication” BOS dimension? Extraverts are expected to participate frequently in group discussions regardless of topic, situation or group composition (Mann 1969). This may negatively impact the peer-rating of an extrovert’s communication effectiveness

within a team when the contributions of the extravert lacks focus. Additionally, the extrovert's input may also reflect a lack of knowledge because (s)he did not adequately prepare for the team meeting (extroversion does not correlate significantly with preparation). Lastly, the "dominance" associated with extraverts may also be perceived negatively by peers when rating an extravert's communication.

Because a team member's performance was measured by peer assessments, it is also plausible that extroversion yields an impression management effect whereby team members perceive that extroverts are engaging in effective task-related behaviours, when in fact, they are not. Perceptions of the task and socioemotional contributions of team members may be highly correlated (Barry and Stewart 1997), therefore, the findings of this study in this regard must be interpreted with some caution.

Prior to this study there was little evidence to support the contention that openness to experience contributed to team performance. Here, it was found that those open to experience contribute through generating ideas, soliciting ideas from others and then synthesizing and summarizing the team's ideas. In addition, they avert conflict and address conflict when it does occur – one may speculate that they do this by using their creativity (cf. McCrae 1987) to suggest a win-win solution. These results confirm Pettersens' (1991) proposition that openness to experience is an important characteristic for members of autonomous work teams to have.

Teams members in this study were required to solve problems, therefore it is not surprising that creative and open-minded individuals were assessed as exhibiting (in)effective behaviours on two dimensions – participation in problem solving and

synthesis of ideas. Furthermore, it is not surprising that those who are open to experience display behaviours found within the “involving others” dimension. This may be due to the “ideas” facet of openness to experience which involves being curious about others’ ideas. Openness to experience correlates with cognitive ability (Costa and McCrae 1992). Nonetheless, it predicts BOS behavioural groupings that are not predicted by cognitive ability – team commitment and averting conflict. These behaviours may represent some of the unique contribution of openness to experience over cognitive ability in explaining individual effectiveness and team performance.

Agreeableness significantly predicts four of the fourteen BOS dimensions although it does not predict individual team member effectiveness. Hogan, Curphy and Hogan (1994) suggested that the agreeableness trait should be evidenced in effective team communication. Shaw (1981), suggested that facets of agreeableness may contribute to behaviour that facilitates social interaction, group cohesiveness and satisfaction in groups. These types of outcomes may be expected from behaviours in the effective communication, involving others, showing commitment to the team and averting conflict BOS dimensions. Our expectations are confirmed. Agreeable people ensure other team members are involved in the team and understand what is happening. They seek a harmonious setting by involving others, not being absent or tardy and by preventing conflict.

The level of conscientiousness (Barrick and Mount 1991; Tett et. al. 1994) and cognitive ability (Schmidt, Hunter and Perlman 1981; Campbell 1990) possessed by a job incumbent has been associated with superior task performance in the individual personnel

selection literature. How do team members higher in cognitive ability and conscientiousness behave? Some behaviour is common to both traits – goal setting/achievement, performance management, team citizenship, preparation, synthesis of ideas and preparation. Other behaviours are unique to each trait. Conscientiousness is associated with the ability to focus on the task-at-hand, commitment to the team and providing and reacting well to feedback. Cognitive ability is associated with addressing conflict and involving others. Some of the unique explanatory power of conscientiousness over cognitive ability may be due to its ability to predict the behaviours in the focus on the task-at-hand, providing feedback/reaction to feedback and team commitment BOS dimensions. Similarly, some of cognitive ability's incremental validity over conscientiousness may come from its ability to predict the behaviours in the addressing conflict and involving others BOS dimension. This requires further study. In terms of specific behaviours, conscientiousness contributes mainly to task type behaviours. Cognitive ability on the other hand contributes to task type behaviours as well as socioemotional type behaviours.

### Future Research

The advantage of the research design used here is that it allowed for control of some possible confounds (e.g., status differences, organizational politics, prior experience in teams, resources available, tasks to be completed, etc.) and provided a relatively large number of teams performing similar tasks in comparable contexts. The advantage of controlling potentially confounding variables is that any relationship between the independent and dependent variables may be isolated to a greater degree than is possible

in a study conducted within a “real” organization (see Driskell and Salas 1992). However, controlling of confounding variables results in simplification of the team situation, arguably limiting the generalizability of the results obtained (Barry and Stewart 1997; Kichuk 1997). Future studies need to be conducted in actual organizations where other “real life” variables in addition to personality and cognitive ability impact the team’s performance. This will allow determination of whether personality and cognitive ability remain important in determining behaviour or team outcomes when other factors are present.

Team member roles provide an interesting and potentially useful way of organizing and applying the information presented in this study. Charting how traits and behaviours relate to team member roles may provide direction in assignment of roles to new and existing team members. In addition, this type of mapping may help in the design of training and development programs by identifying the desired behaviours for each role. Future research should serve to relate personality and specific (in)effective team member behaviours to team member roles. For instance, an orienter role mainly involves keeping the group focused on its goals. The BOS dimensions related to this role may be “focusing on the task-at-hand” (Table 34). People who remain focused and help other team members focus are conscientious, not neurotic and not extroverted. Thus, this trait combination might be a valuable predictor of a team member who will perform well in the orienter role. Other hypotheses may be constructed in this manner. These hypotheses

may be tested through an experiment<sup>30</sup>. Members of teams in the experimental groups may be assigned roles according to those suggested in Table 41 and members of teams in one control group may be allowed to complete tasks without being assigned roles. In another control group, team members may be assigned roles at random. It is expected that teams in the control groups would perform less well than those in the experimental group. The teams in the first control group may perform better than those in the second control group because team members may intuitively take on roles (emergent roles) they believe themselves to be best suited to and these roles may be fairly similar to their ideal roles.

Changes in an organization's larger social system can bring about changes in the teams situated in it. That is, one need not aim interventions directly at teams to change their performance. Interventions aimed at the surrounding organizational system may also bring about improved team performance. The information provided in this study could also be used to determine the best work environment for a team with a particular trait profile. First, a needs analysis is required to determine a team's trait profile and subsequently what it is good at and what it is not so good at. The team's deficiencies would be based upon the behaviours not associated with the traits of the members that make up the team. These behaviours are expected to be the ones that impede the teams performance. The results of the team analysis can be used to restructure the work environment. For instance, if a team lacks goal setting/achievement type behaviours then the appropriate work environment for the team would be one that provides well-

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<sup>30</sup> Most empirical research on composition and team performance in recent years has investigated variables associated with team performance without intervening or experimenting to effect those variables (Guzzo and Dickson 1996).



established goals and subgoals with clear ways of achieving them. A field study may be conducted to determine what improvements in team performance are made when the environment is changed to compensate for behaviours that the team is unable to do itself.

There is fervent debate over the best level at which to measure personality (Adler 1996). Some advocate assessment at the high levels of the hierarchy using broad constructs like integrity (Ones, Viswesvaran and Schmidt 1993; Schmidt, Ones and Hunter 1992). Others advocate greater fidelity by recommending assessment at the Big Five level (Barrick and Mount, 1993), while still others recommend assessment at the facet level as well as at the Big Five level (Costa and McCrae 1992; Costa 1996). The level that predicts behaviour best should be determined. Perhaps, measurement at the facet level predicts (in)effective team member behaviour best. In situations where selection for specific behaviour is being made (e.g., averts conflict) for specific types of teams (e.g., collective bargaining team) a human resource practitioner may possibly be better served by measuring a few facets that predict the behaviour than measuring at the FFM level.

### Limitations

In this study, we analyzed cognitive ability, personality, behaviour, and team performance in intact autonomous work teams experiencing genuine performance incentives over a series of tasks. Research in this area has predominantly used laboratory methods in post-hoc-short-lived groups. The problem with laboratory studies is that there is little likelihood that meaningful and unique norms develop -- this limits the generalizability of their findings to "real-world" intact autonomous work teams.

However, in this study the use of teams that disband after a few months also limits generalizability to teams that are together for longer periods of time. Still, in many firms teams are together for roughly the period studied here and thus my results are directly applicable to these teams.

There are several potential limitations with respect to the generalizability of the results, stemming from the use of a student sample. The main concern may arise from the suitability of business students as proxies for the actual work population that participates in team activities. As mentioned under the participants section of the methodology section of this paper there is a good rationale for the use of a student sample -- within an actual field setting there may be much more homogeneity in personality than is the case for university students (see Judge and Cable, 1997; Schneider, 1996). Therefore, the use of a student sample, rather than an actual work sample, should allow for a more accurate determination of personality relationships. Still, there may be a restriction of range in cognitive ability. However, the sample used in this study did not differ substantially from population norms to the extent that might have been expected. The student sample scored slightly higher, on average, than the population norm (i.e., the average student ability score = 26.75 and median = 26.00 versus the adult working population norm of 21.75 on average, median = 22.00), however, the distribution of scores in this student sample were not different enough from the population norms (i.e., the standard deviation for the sample was 5.79 versus 7.60 for the adult working population) to warrant a great deal of concern with respect to restriction of range<sup>31</sup>.

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<sup>31</sup> Norms are from the U.S. but are expected to be fairly accurate estimates of Canadian standards.

A measurement limitation in some trait studies is common method variance. In this study, personality was assessed by questionnaire and cognitive ability through written responses to test questions. Several peers assessed individual effectiveness and an independent instructor assessed team performance. Thus, measurement was by several methods and common method variance is not deemed to be of substantial concern. Moreover, peer-appraisals have been shown to be a good method of assessing performance: they are amongst the most reliable sources of appraisal and they are also valid predictors of job performance (Latham and Wexley 1994). Empirical evidence does not support treating likability or other criterion bias as a significant problem when peer-assessments are used (Barry and Stewart 1997; Schmitt, Pulakos, Nason and Whitney 1996).

### Summary

The first step to attaining a well performing team is selecting the right members (Campion, Medsker and Higgs 1993; Kichuk 1997). Previously, little attention was given to the staffing of teams (Klimoski and Jones 1994). Research in the personnel selection literature suggests that if relevant traits are identified for a specific job or role then the future job performance of potential employees can be predicted (Barrick and Mount 1991; Day and Silverman 1989; Tett, Jackson and Rothstein 1991). Similarly, if relevant trait attributes of team members are established, then these attributes can be used to predict future team performance (Driskell, Hogan and Salas 1987).

This study demonstrates that self-report personality measures and a general cognitive ability test can and should be valuable to practitioners as part of their arsenal of

selection tools used in the evaluation of potential team members. In sum, findings suggest that the FFM and cognitive ability may provide a fruitful basis from which to examine team performance.

Effective team members are high in cognitive ability and conscientiousness – they have the “ability” and the “will” to perform well. People with these traits are not only competent at most task-related behaviours but they are also quite socially adept. By and large, selecting team members high in extroversion, openness to experience, conscientiousness and cognitive ability could prove a beneficial strategy to improving team performance. Extroversion is unique in that too much extroversion leads to poor individual effectiveness – they may tend to get too off-focus. So, in the case of extroversion human resource practitioners are advised to select people that are high but not very high in extroversion (scores between the 66<sup>th</sup> and 93<sup>rd</sup> percentile).

Through extensive observation of critical incidents of (in)effective team member behaviour it was discovered that there are 14 behavioural dimensions that varyingly predict team outcomes. These can be used to design behaviourally based structured interviews, performance appraisal tools, compensation systems, etc. They denote the behaviours that should be developed in training programs. In the past training programs have promoted behaviours inferred to be important to team performance and as a result the quality of team training programs have varied. To-date, training has been haphazard. It has not been based on sound empirical evidence of the most important team behaviours. If a team member is trained to effectively exhibit all the behaviours discovered here they should be extremely effective contributors. Another approach may

be to develop in team members the behaviours that their trait profiles indicate they are *not* predisposed to. This may simply start by providing team members with trait profiles and pointing out how they are predisposed to behaving and what they are unlikely to exhibit in terms of effective behaviour. Previously, we alluded to how the trait→behaviour→team performance mapping can be used to select team members for roles. There are numerous other uses and applications for the personality and cognitive ability→individual behaviour→individual effectiveness→aggregate individual effectiveness→team outcome mapping.

FFM traits and cognitive ability map onto the behavioural dimensions discovered here – they predict some performance-relevant behaviours better than they do global measures of individual team member effectiveness and team performance. In turn, each of the behavioural dimensions discovered here significantly impact team performance. Researchers that relate traits to global performance criterion are ignoring the subtle ways in which traits impact performance outcomes – their approach is too heavy-handed. Upon contemplation, the behaviours that map to personality traits “make sense”. That is, the mapping derived empirically also appears sensible.

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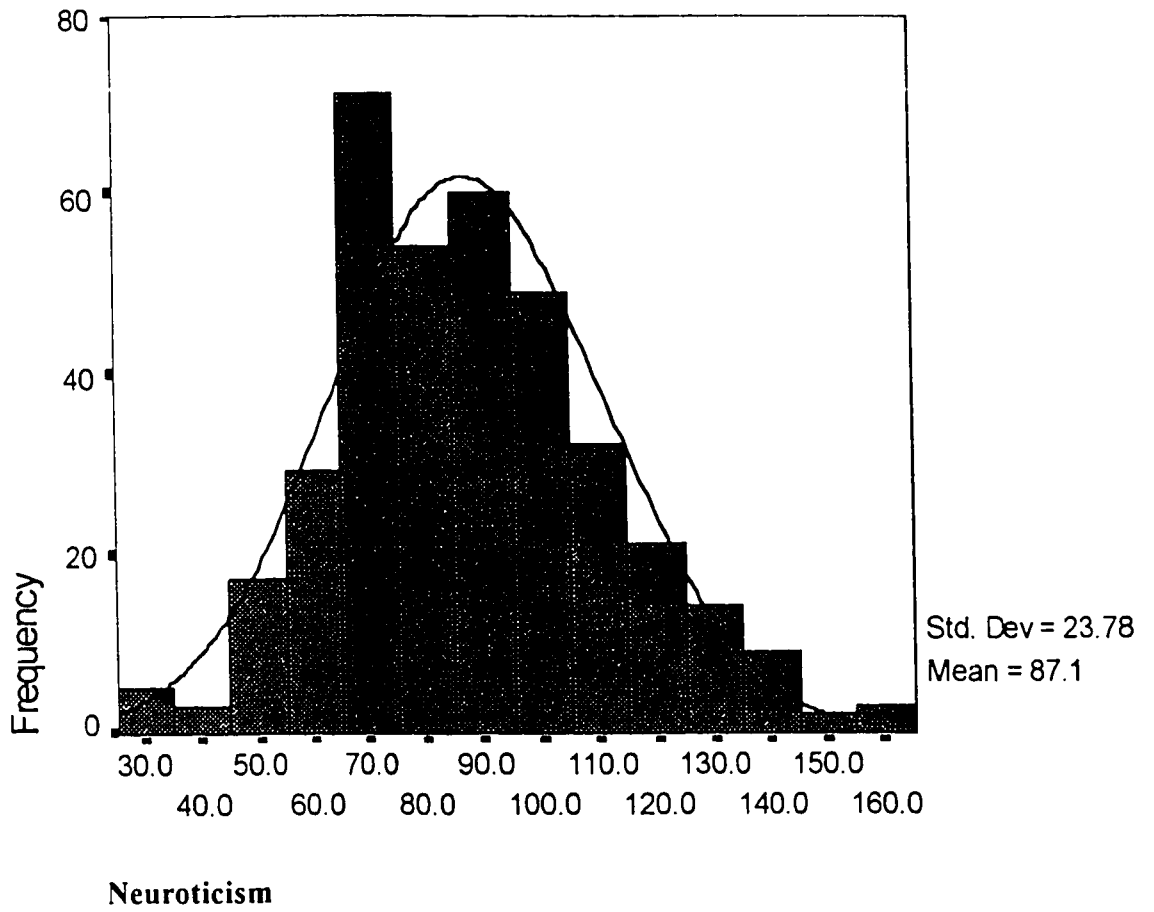
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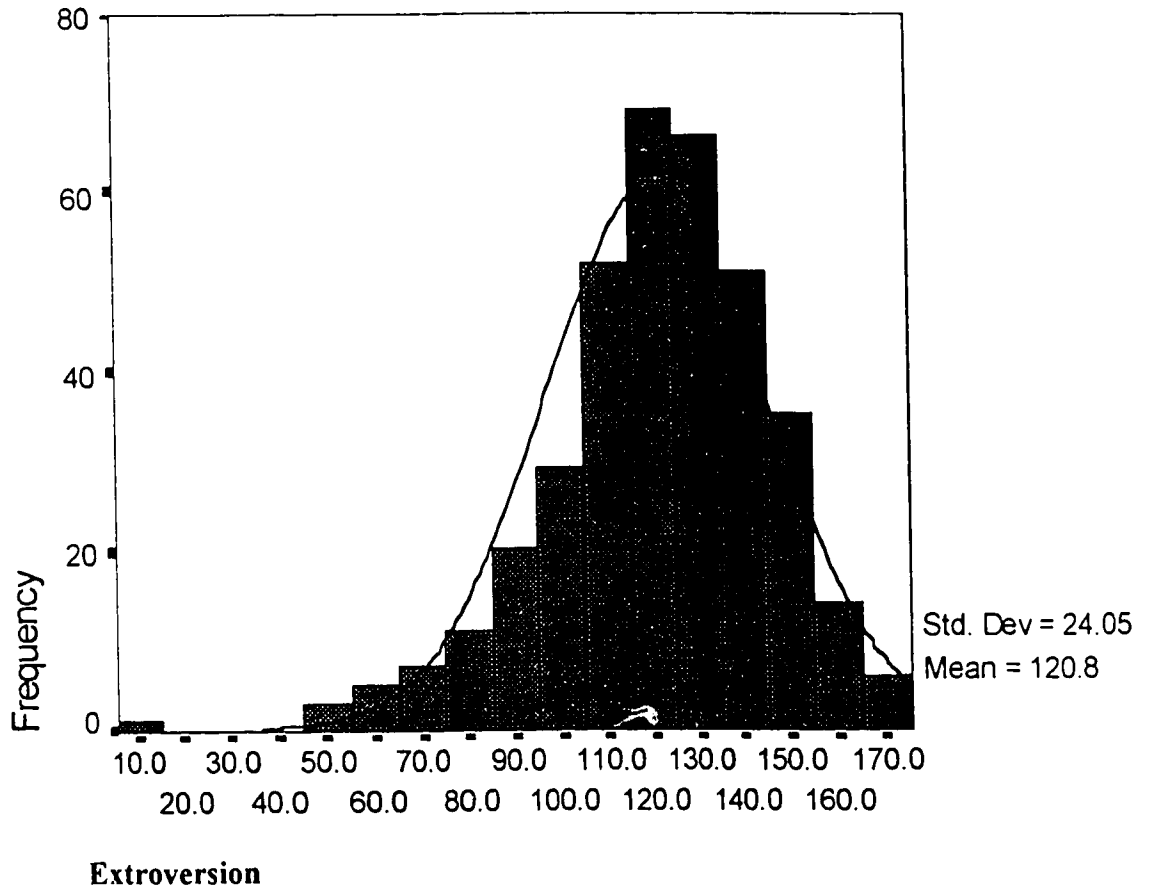
Appendix A: Distributional Properties of Key Variables

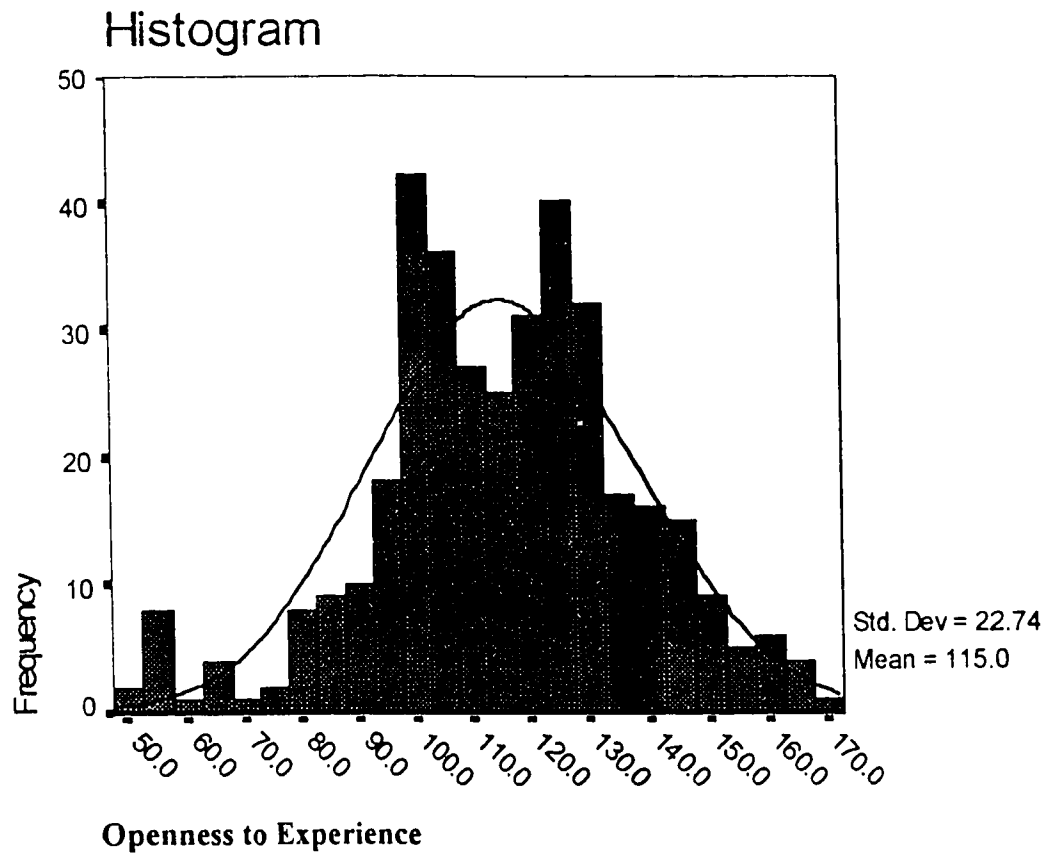
### Histogram

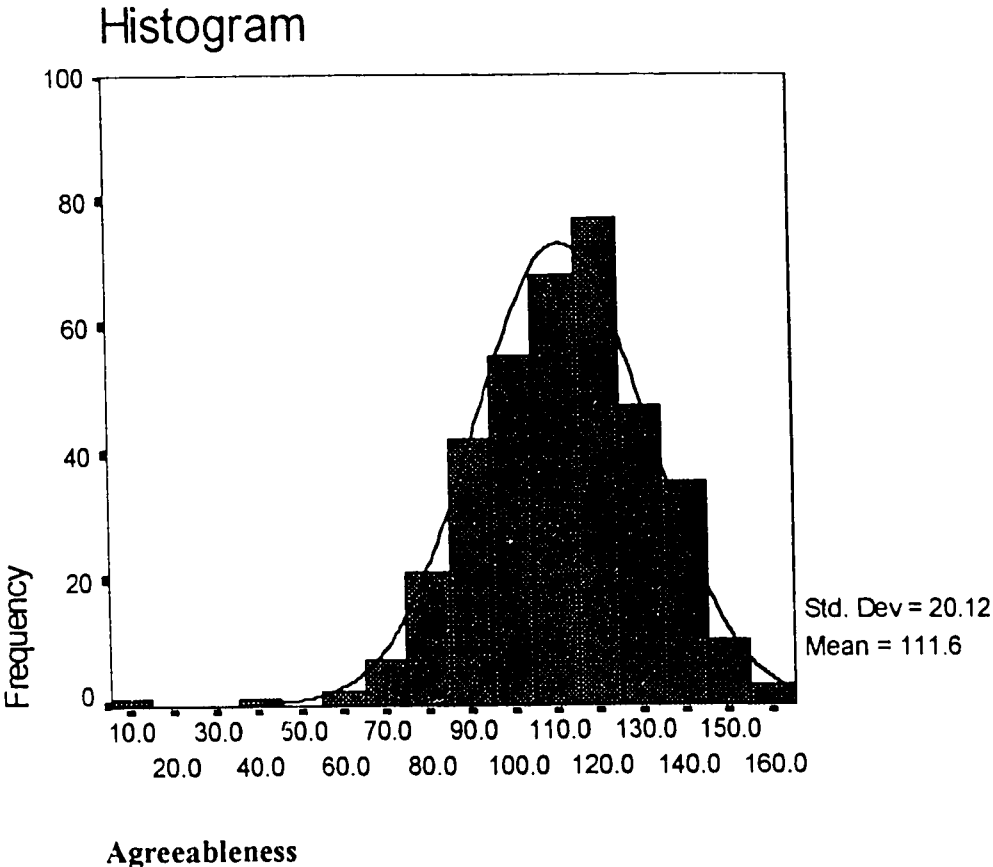




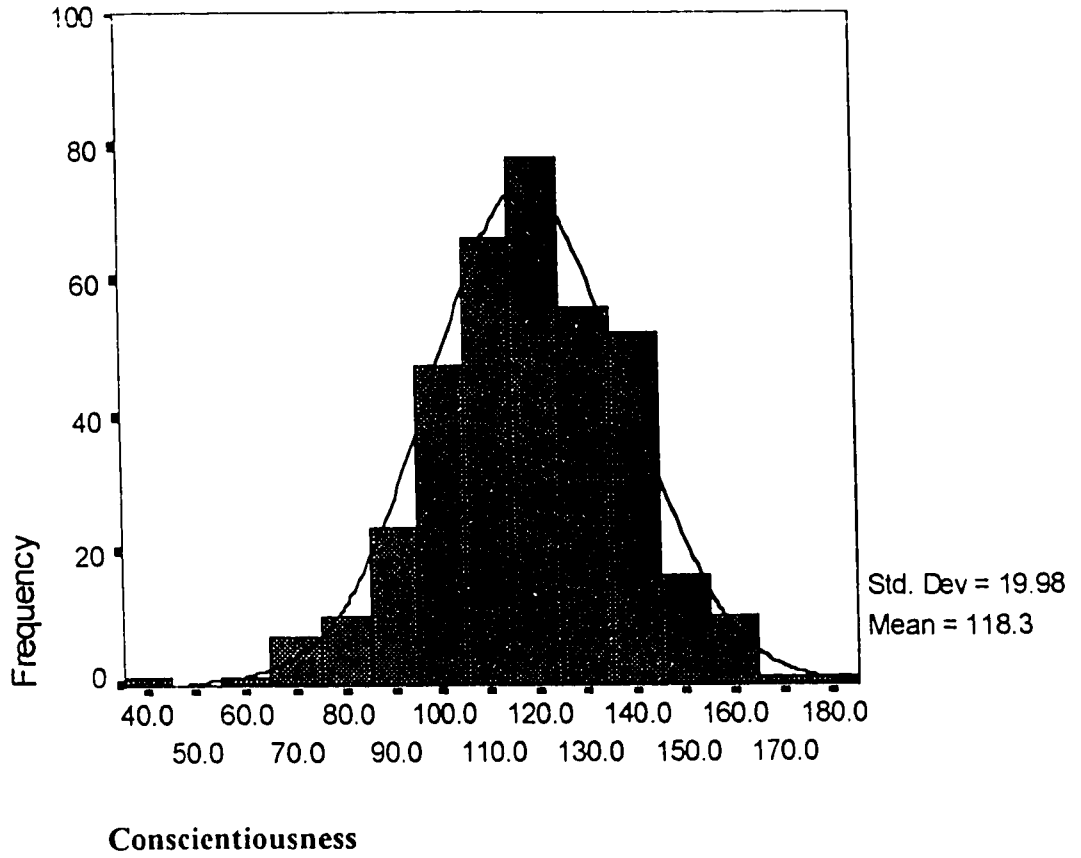
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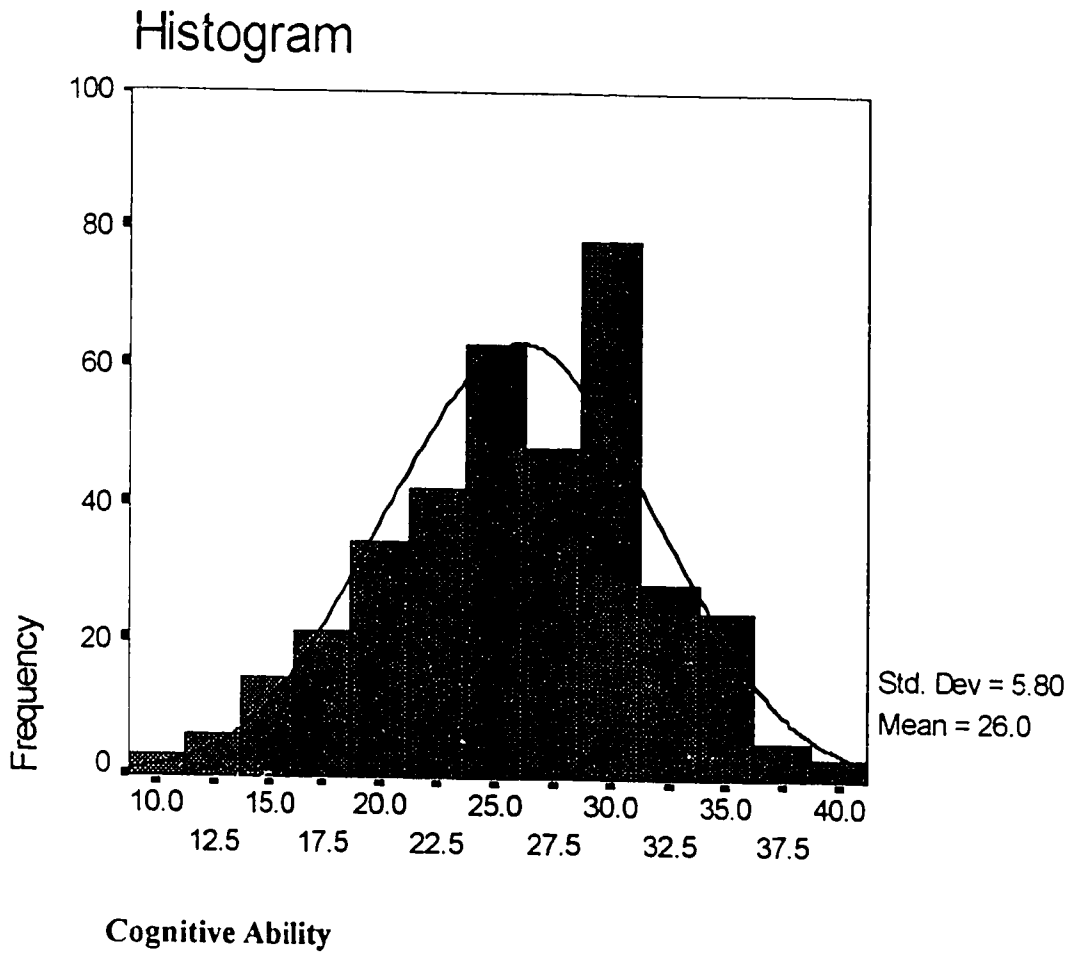


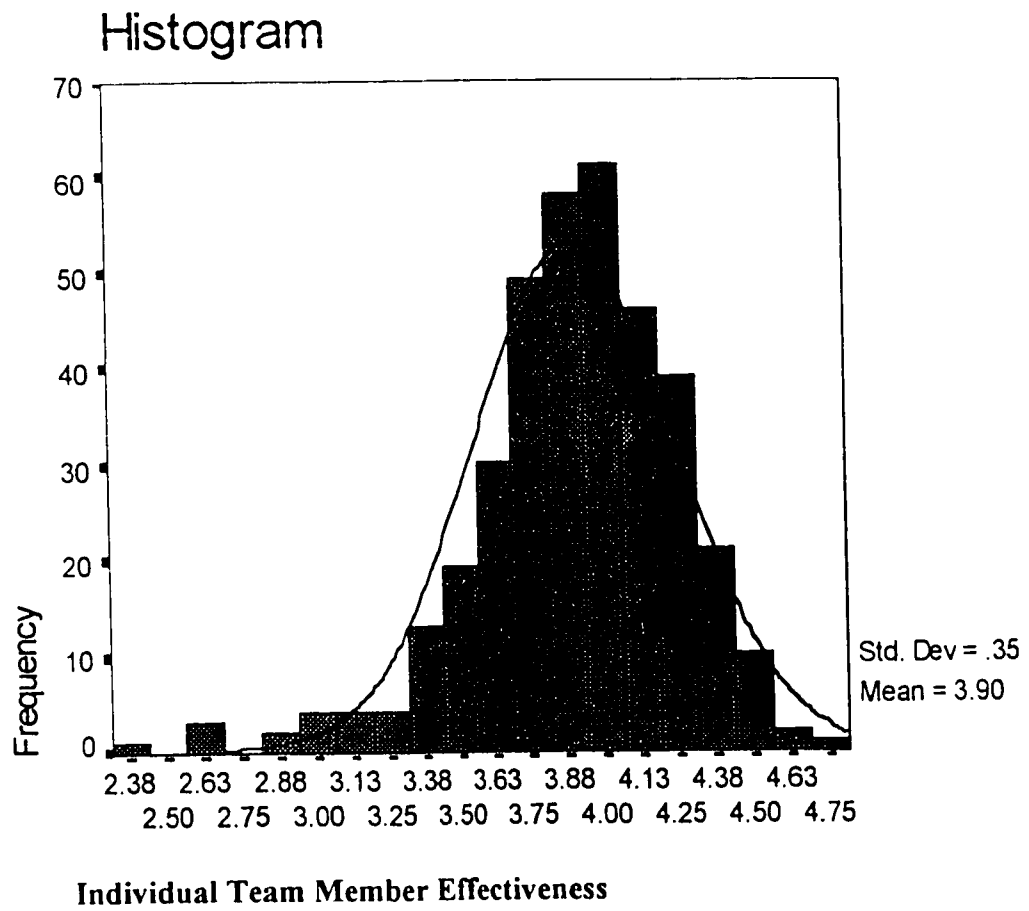




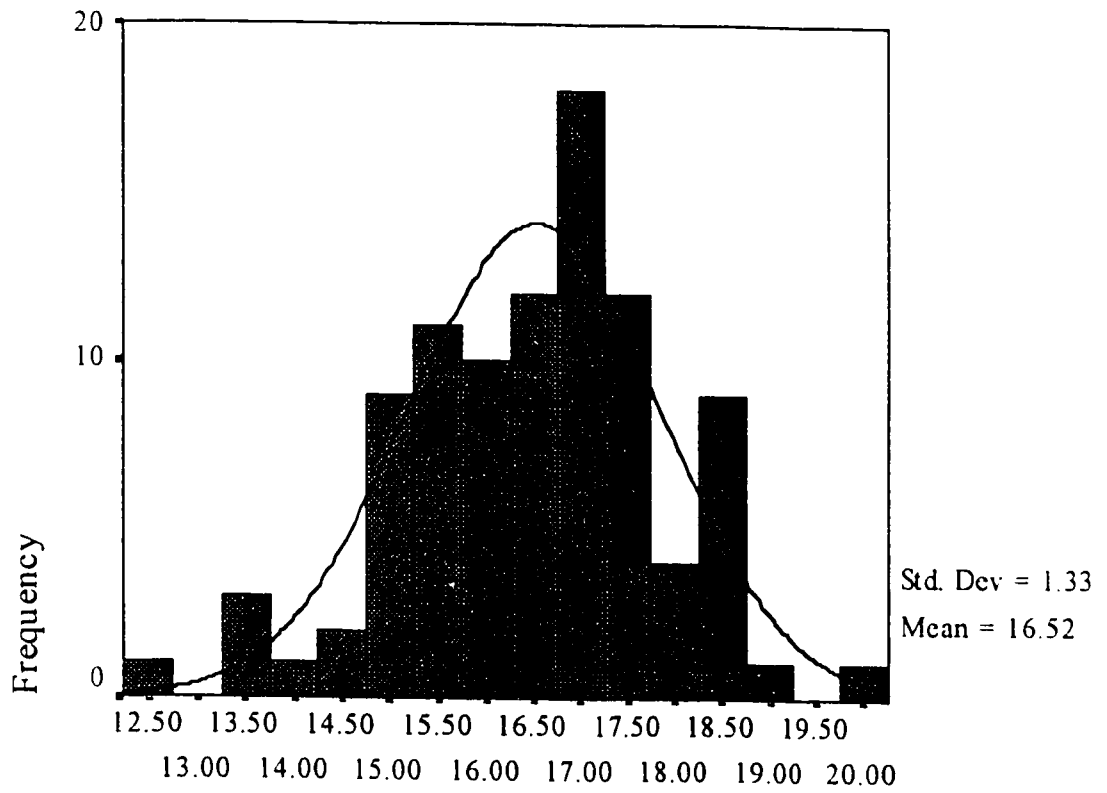
# Histogram







### Histogram



**Overall Team Performance**

Appendix B: Sample of Exercises Completed by Teams

**Tutorial Exercise**

**Exercise Instructions:**

1. Choose a recording secretary for your group. This person is required to write the answers for the group on this sheet. All other group members should take notes for use in the class discussion.
2. Each person should describe either the best or the worst job they have ever had. Explain why the job was satisfying or dissatisfying (5-7 min).
3. Take all of the characteristics that made the jobs satisfying or dissatisfying and group them into meaningful clusters (for example, physical characteristics of the job, co-workers etc.). (3-5 min)
4. Using the experiences and characteristics that produced satisfying jobs, describe some solutions that managers could use to prevent and/or correct jobs from being dissatisfying. Please consider the feasibility of your solutions (7-8 min).

**A. Description of Job:**

- 1.
- 2.
- 3.
- 4.
- 5.

**B. Satisfying Characteristics:**

- |    |     |
|----|-----|
| 1. | 7.  |
| 2. | 8.  |
| 3. | 9.  |
| 4. | 10. |
| 5. | 11. |
| 6. | 12. |

Continued .....



**C. Dissatisfying Characteristics:**

1.	7.
2.	8.
3.	9.
4.	10.
5.	11.
6.	12.

---

**D. Clusters of Characteristics:**

1.	5.
2.	6.
3.	7.
4.	8.

Continued...

---

**E. Managerial Solutions**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

---

**Team Member Signatures - September 18 & 19, 1996**

- |    |    |
|----|----|
| 1. | 4. |
| 2. | 5. |
| 3. |    |



## Tutorial Exercise

**Exercise Instructions:**

1. Reread (or read) the case at the end of chapter 4 of your textbook (p 117-119).
2. Answer the questions below neatly in the space provided.
3. Be sure to include terms/concepts from the lectures and textbook in your answers.
4. Write your answers in complete sentences - NO POINT FORM!
5. Be aware of the point values of the questions and watch your time!

1. Use the concepts of *stereotyping* and *halo* to explain the contrast between the Golden Boys and the Audit Drones. (5 marks).
  
2. Are there any aspects to the organization of work at BH&A that could lead to perceptual problems in performance appraisal? (5 marks)
  
3. Suppose that you were appointed to a newly created position at BH&A, Manager of Diversity Assurance. What would you do to better manage diversity at the firm? (10 points)

TEAM MEMBERS SIGNATURE HERE PLEASE:

- |    |    |
|----|----|
| 1. | 4. |
| 2. | 5. |
| 3. | 6. |

## Tutorial Exercise

---

1. Have one group member identify a job. Briefly describe this job.
  2. List two critical incidents of particularly effective or ineffective behaviour from that job. Be sure to include the *situation*, the *behaviour*, and the *outcome* for each incident!
  3. Develop a **Situational Interview (SI)** question and a **Patterned Behaviour Description Interview (PBDI)** question for each critical incident.
  4. Develop a benchmark scoring scale to rate the responses to the SI and PBDI questions. Use a 3-point scale ranging from ineffective (1) to effective (3) behaviour.
- 

1. Job and brief description (2 marks):

2. Critical incident #1 (3 marks):

a) SI Question (2 marks):

b) SI Answer Key (3 marks):

c) PBDI Question (2 marks):

d) PBDI Answer Key (3 marks):

3. Critical Incident #2 (3 marks):

a) SI Question (2 marks):

b) SI Answer Key (3 marks):

c) PBDI Question (2 marks):

Continued...

d) PBDI Answer Key (3 marks):

TOTAL: 28 marks

TEAM MEMBERS SIGNATURES HERE PLEASE:

## Tutorial Exercise

---

**Object:** To create Behavioural Observation Scales (BOS) to peer-evaluate the members of your tutorial group.

1. Complete this exercise on a scrap piece of paper and **transfer your answers to this sheet only when you are completely finished** - you will be generating lists and later organizing them. use your space wisely!
2. Generate a list of behaviours that are critically effective or ineffective to the teamwork process in your tutorial group (i.e. critical incidents). These should be real behaviours that the group has experienced (i.e.: *After the supervisor leaves, Jane always works hard*).
3. Choose which of these incidents you want to use in the evaluation of your group members' participation in the tutorial sessions and change the incident into a behavioural observation statement. (i.e.: *Does the job when the supervisor is gone*). Be sure to include a wide variety of incidents so that your evaluation will be a comprehensive assessment of your team members' contributions.
4. Develop a BOS for each incident by adding a **Likert scale** to the statement (i.e.: *Does the job when the supervisor is gone Almost Never 1 2 3 4 5 Almost Always*)
5. Decide how heavily each item will be weighted in the final analysis (i.e. 20%:5%... all equally weighted etc) The weightings you chose will depend on how important your group considers each item to be.
6. Group similar items together under headings (i.e.: Motivation to work hard)
7.
  - a) Does the job when the supervisor is gone:  
Almost Never 1 2 3 4 5 Almost Always
  - b) Refuses to work overtime:  
Almost Always 1 2 3 4 5 Almost Never
8. Your BOS will be marked based on it being:
  - written in present tense
  - behaviourally based
  - reflective of critical incidents
  - well written \*(It will probably be marked out of 40 marks)
9. When you are finished, all group members should sign the agreement on the back stating that your group peer evaluation will be based on the BOS you just completed.

I agree that my tutorial peer evaluation will be based on the BOS created by my group, as outlined above  
 TEAM MEMBERS SIGNATURES HERE PLEASE.

- |    |    |    |
|----|----|----|
| 1. | 2. | 3. |
| 4. | 5. | 6. |

## Tutorial Exercise

---

**OBJECTIVE:** To polish the **Behavioural Observation Scales (BOS)** you created in tutorial last week.

Take the Behavioural Observation Scale you made in exercise 6 and polish it up. Modify the scales, reword some items, rethink the headings (try considering some of the headings I gave you) and the weightings you have given each category or item. Fix any of the changes I have suggested. Make it the best BOS that you can.

For next week in tutorial (OCTOBER 30 & 31) hand in typed, polished copy of your peer evaluation BOS (also hand in this exercise sheet with your rough notes on it).

This polished copy must include:

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2. A title
  3. A space for the appraisee's name
  4. A space for the group number
  5. A preamble describing the BOS and instructions for its use
  6. Directions on how to score your BOS
  7. A statement of agreement for all group members to sign (& signatures)
  8. A space to put the total score for the appraisee on the evaluation
    - Please keep a copy of the BOS that you hand in. You will be required to bring 20 copies of it for the peer evaluations at the end of the term\*
-



## Tutorial Exercise

---

**Exercise Instructions:**

Read the article and answer the three questions in the space below. Point form may be used, but be sure that the meaning of your answers is clear. Give complete explanations. Use the concepts from the lectures and textbook (chapters 7 & 6) to help you with your answers.

---

1. Which plan (discussed in lectures and the textbook) does the Levi payment scheme most closely resemble? (1 point)
  
  
  
  
  
  
  
  
  
  
2. Is this plan likely to be effective? Why or why not? Please be specific and substantiate your arguments in reference to class lectures &/or textbook. (5 points)
  
  
  
  
  
  
  
  
  
  
3. If you were the administrator of this payment scheme what might you do differently to maximize employee motivation toward the corporate objective? Be creative and give a full answer. (6 points)

Total 12 points

TEAM MEMBERS SIGNATURES HERE PLEASE:







Appendix D: BOS

Peer Evaluation

Your name: \_\_\_\_\_ Group number: \_\_\_\_\_  
 Your student number: \_\_\_\_\_

Please evaluate your team members on the questions below, based on your observations in the 2BA3 tutorials. Your evaluations will be strictly confidential.

Almost Never	1	2	3	4	5	Almost Always		
				Person 1	Person 2	Person 3	Person 4	Person 5
				First name:	_____	_____	_____	_____
				Second name:	_____	_____	_____	_____
1.					_____	_____	_____	_____
2.					_____	_____	_____	_____
3.					_____	_____	_____	_____
4.					_____	_____	_____	_____
5.					_____	_____	_____	_____
6.					_____	_____	_____	_____
7.					_____	_____	_____	_____
8.					_____	_____	_____	_____
9.					_____	_____	_____	_____
10.					_____	_____	_____	_____
11.					_____	_____	_____	_____
12.					_____	_____	_____	_____
13.					_____	_____	_____	_____
14.					_____	_____	_____	_____
15.					_____	_____	_____	_____
16*					_____	_____	_____	_____
17.					_____	_____	_____	_____
18.					_____	_____	_____	_____
19 *					_____	_____	_____	_____

<b>Almost Never</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>Almost Always</b>				
						Person 1	Person 2	Person 3	Person 4	Person 5
20. Asks for help in order to get other team members to focus on the goal.						_____	_____	_____	_____	_____
21. Does not read the required material prior to team meetings.						_____	_____	_____	_____	_____
22. Assigns tasks and roles to team members.						_____	_____	_____	_____	_____
23. Personally attacks individuals that provide negative feedback.						_____	_____	_____	_____	_____
24. Sets time deadlines for achieving task.						_____	_____	_____	_____	_____
25. Provides constructive feedback to team members for behavioural improvement.						_____	_____	_____	_____	_____
26. Says positive things to team members regarding their performance.						_____	_____	_____	_____	_____
27. Participates in developing strategies to achieve team goals.						_____	_____	_____	_____	_____
28. Leaves conflicts unresolved by moving on to another topic.						_____	_____	_____	_____	_____
29. Carefully listens to what others are saying. (e.g., maintains eye contact, nods etc.)						_____	_____	_____	_____	_____
30. Clarifies and explains issues when someone does not understand						_____	_____	_____	_____	_____
31. Offers ideas.						_____	_____	_____	_____	_____
32. Leaves conflicts unresolved by not saying anything or ignoring some team members.						_____	_____	_____	_____	_____
33. Looks at subjects from new perspectives.						_____	_____	_____	_____	_____
34. Reminds other team members of the team's goal.						_____	_____	_____	_____	_____
35. Volunteers to do things that no one else want to do.						_____	_____	_____	_____	_____
36. Politely gives advice in a conflict.						_____	_____	_____	_____	_____
37.* Produces novel but potentially useful ideas.						_____	_____	_____	_____	_____
38. Provides an alternative solution that is agreeable to other team members when a conflict occurs.						_____	_____	_____	_____	_____
39. Resorts to personal attacks when a problem arises.						_____	_____	_____	_____	_____
40. Asks relevant questions.						_____	_____	_____	_____	_____
41. Draws team members into discussions that are relevant to achieving the goal.						_____	_____	_____	_____	_____
42. Uses humour to create a positive team atmosphere.						_____	_____	_____	_____	_____
43. Participates in <i>off-topic</i> conversations.						_____	_____	_____	_____	_____

<b>Almost Never</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>Almost Always</b>												
							Person 1	Person 2	Person 3	Person 4	Person 5							
44. Misses team meetings.							_____	_____	_____	_____	_____							
45. Criticizes others' contributions (suggestions, ideas and behaviour) without offering alternatives.							_____	_____	_____	_____	_____							
46. Draws team members into off-topic discussions.							_____	_____	_____	_____	_____							
47.* Discovers new relationships.							_____	_____	_____	_____	_____							
48. Leaves conflicts unresolved by leaving the meeting.							_____	_____	_____	_____	_____							
49.* Forms new combinations from old concepts.							_____	_____	_____	_____	_____							
50. Keeps working when others quit.							_____	_____	_____	_____	_____							
51.* Assumes "leadership".							_____	_____	_____	_____	_____							
52. Brings the required material to the team meetings.							_____	_____	_____	_____	_____							
53. Your team imposes structure and constraints on <i>your</i> behaviour.												Strongly Agree	1	2	3	4	5	Strongly Disagree
54. Your team imposes structure and constraints on the behaviour of <i>other</i> team members.												Strongly Agree	1	2	3	4	5	Strongly Disagree

**Thank you for your participation in this study.**  
 NOTE: \* Items used for another study and not relevant to this study.