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Influence of teamwork aptitude and personal characteristics of team members on team effectiveness: How should we form effective teams?

Shinko Kimura

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INFLUENCE OF TEAMWORK APTITUDE AND PERSONAL CHARACTERISTICS OF TEAM MEMBERS ON TEAM EFFECTIVENESS: HOW SHOULD WE FORM EFFECTIVE TEAMS?

A Thesis
Presented to the
Faculty of
California State University,
San Bernardino

In Partial Fulfillment
of the Requirements for the Degree
Master of Science
in
Psychology:
Industrial/Organizational

by
Shinko Kimura
March 2007
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ABSTRACT

In the past two decades, there has been considerable research done to examine the factors that are important for team success, but very little regarding the best way to select members for teamwork. To explore possible criteria for building effective teams, six hypotheses were tested using 129 participants in 43 project teams. Two models of team composition were proposed. The first model (productivity) proposed teams composed of members with higher cognitive ability, agreeableness and conscientiousness (Big-Five personality), satisfaction, and Teamwork knowledge, skills, and abilities (KSAs) would predict team productivity best. The second model (synergy) proposed that teams with members higher in organizational citizenship behavior (OCB), Teamwork KSA, Big-Five personality, and cognitive ability would demonstrate process gain in their groups. Neither the productivity model nor the synergy model was supported. No group level model was supported, but an unexpected negative relationship between synergy (process gain) and the satisfaction of team members was found. These findings are discussed for their implications for team satisfaction and productivity.
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CHAPTER ONE
INTRODUCTION

Personnel Characteristics and Team Effectiveness

Currently, teamwork is a popular work design in many organizations. Superior teamwork provides benefits to an organization by helping the organization obtain its goals in a timely manner using limited resources (Caproni, 2001). However, not every team achieves its objectives. Many factors influence a team’s effectiveness; complex states of affairs within and beyond the team prevent or permit teams from achieving their goals. For example, the design of assigned tasks, team members’ characteristics, and organizational structures can have an influence on the team’s performance. Therefore, it is beneficial to explore the mechanisms important for forming an effective team. However, how to manage and support the team-based organization has not been fully explicated yet. Despite a burgeoning literature on teams and teamwork, scholars have not yet thoroughly examined the selection of individuals for forming teams. Therefore, how to select team members needs more exploration (McClough & Rogelberg, 2003).
With this thesis study, the focus was on how to form an effective team. To form an effective team, it is critical to identify individuals’ aptitudes that improve team performance, and determine how to apply those aptitudes to select team members. Also in the current study, I focused on two types of individual characteristics. First, dispositions of individuals that may lead to behaviors that facilitate team effectiveness in general were examined. Organizational citizenship behavior (OCB) and cooperative dispositions, represented by Teamwork KSAs, were used as measures of teamwork aptitudes. In addition to assessing these aptitudes, the influence of personal traits of individuals on team outcomes was assessed. I investigated team effectiveness, which was represented by unit (team) level productivity and satisfaction with the team.

What are Teams?

Since in a psychological sense, concepts or phenomenon should be operationally defined, team should be defined as well, especially since teamwork has been seen as a solution to business problems in a wide variety of industries. For instance, a computer system
corporation forms a project team to develop a new computer system, and a consulting firm develops different teams to respond to clients' needs. Forming a team has become a popular and potentially powerful strategy for modern organizations. As utilization of teams increases in organizations, many scholars have conducted studies to find the mechanisms of team functioning and teamwork. For instance, some researchers are interested in topics such as how to improve the effectiveness of team and team outcome (e.g. Tjosvold, Hui, Ding, & Hu, 2003). However, the definition of a team has not been well established yet; in contrast, the definition of a group has been broadly accepted. Therefore, exploring the definition of a group is a good starting point for examining the concept of teams.

Definitions of a Team and Group

The definition of "group" is widely accepted. The term "group" is used in many occasions across many areas of interest (Shaw, 1981). For the purpose of describing a collection of people who work together, a group is defined as "two or more people interacting interdependently to achieve a common goal" (Gary & Saks, 2001, p. 204). Myers (2002) defined a group as "two or
more people who, for longer than a few moments, interact with and influence one another and perceive one another as us” (p. 282).

On the other hand, the term “team” is hard to explain with just a few sentences, since “team” is a comparably new concept and shares some similarities with groups. Some researchers have tried to define a team empirically. Guzzo and Dickson’s (1996) definition describes more specific behavior of individuals in teams. They described a team as a collection of individuals who are interdependent in their tasks, who share responsibility for outcomes, who see themselves and who manage their relationships as a collective, and who manage their relationships across organizational boundaries. Similar to Guzzo and Dickson’s definition, Salas, Dickinson, Converse, and Tannenbaum (1992) stated that a team is “a distinguishable set of two or more people who interact dynamically, interdependently, and adaptively toward a common and valued goal/object/mission, who have each been assigned specific roles or functions to perform, and who have a limited life span of membership” (p. 4).
Since the distinctions of a team and group are ambiguous, many researchers use the two terms, "team" and "group," interchangeably. Cohen and Bailey (1997), who have written extensively about teams, did not differentiate between team and group in their initial work. Also, Stevens and Campion (1994) who reviewed the social psychology "literature on groups to determine KSA requirements for teamwork" (p. 503) found that the literature did not provide explicit guidance. From the efforts of these previous researchers, it is safe to state that the terms "team" and "group" are both describing a set of individuals, but a team tends to represent more complex relationships among its members, such as interdependency, and collaboration, than does a group. The relationship between teams and groups is not mutually exclusive, but rather the two can be viewed as a singular concept on a continuum.

Types of Teams

In an effort to understand the nature of the concept some researchers have approached the study of teams by clarifying more specific characteristics to identify functions of teams in organizations and the functions of individuals in teams. For instance, some researchers have
used typologies to understand teams. Among these researchers, Cohen and Bailey (1997) identified four types of teams: work teams, parallel teams, project teams, and management teams. Work teams were described as "continuing work units" which are enduring units of individuals who are responsible for certain performance. Traditionally, work groups are directed by supervisors who are responsible for decision making or controlling tasks or responsibility distributions among individuals in teams. Parallel teams are units of individuals pulled from different work units or jobs to serve an innovative function for which organizations are not well equipped. This team is usually formed for problem solving or tasks that relate to organizational improvement. Project teams are units of individuals with time limits and after finishing tasks, team members return to their original function or next projects. Usually, for this kind of team, team members possess higher levels of knowledge for certain areas and these professionals apply their expertise to projects. Finally, management teams are responsible for providing directions for sub-units under them and also overall performance of these business units are under their responsibility.
Other researchers have explained teams by using characteristics such as task design, group composition, and the team's external environment (e.g. Magjuka & Baldwin, 1991: Campion, Medsker, & Higgs, 1993: Gupta, Dirsmith, & Fogarty, 1994). These studies indicated the further difficulties of understanding the nature of teamwork. For example, even though higher autonomy of team members was found to be associated with higher performance of work teams, the same effects were not found for project teams (Cohen & Bailey, 1997). Henderson and Lee (1992) compared the effects of autonomy of individual team members and managers on team outcomes of project teams. They found that the level of an individual team members' autonomy on task performance positively related to team outcomes. In addition, their results indicated that managers' autonomy in controlling subordinates' contextual performance, such as providing feedback about their behavior and outcomes, which helps to facilitate team processes positively, influenced team outcomes; however, in the middle of the task, if managers tried to control team members' task performance by providing feedback and evaluating the outcome of task performance, these behaviors did not positively influence
final team outcomes. On the other hand, when team members had more authority to control task performance, autonomy was positively related to team outcomes. These studies, which attempted to clarify teams’ outcomes, have helped us to understand more fully the function and characteristics of teams. However, since these results may be a function of unique project team characteristics, generalizing the results to all types of teams is difficult.

The Value of Teams

One of the reasons for the difficulties in capturing the characteristics of teams with only one definition and differentiating “team” from “group” may be the multiple needs from inside and outside of organizations for which teams are chosen as a strategy for the organization. As mentioned previously, teams are built for many objectives and depending on the intentions teams vary widely. In some cases, needs for team correspond to new work systems in production lines (Cappelli & Rogovsky, 1994). In today’s competitive market, production systems of organizations are required to be more flexible to meet customers’ specific needs. To produce these customized products, organizations form teams from current employees.
who can work together to create products that none could have done individually. One of the benefits of this team forming strategy is that the organization does not need to hire new workers. Another strategy to improve the quality of the workforce has been creating teams and giving them a certain amount of decision making authority. This strategy could result in achieving better decision making, greater commitment, reduction of need for supervisors, and greater responsibility for decision making from individuals. In brief, teams are formed to obtain particular objectives. Even though all teams possess unique characteristics, all teams are composed of two or more competent individuals collaborating interdependently and expected to achieve their goals more effectively than individual work. Therefore, for the purpose of this study, the term “team” is going to be used even though it is clear from the literature there is large overlap in the concepts of “team” and “group.”
Primary Function of Teams: Synergy and Effectiveness

Synergy

There are many kinds of teams depending on organizational need or setting; however, all teams are expected to create team synergy (Caproni, 2001). Team synergy is "the idea that the team's output exceeds the sum of the outputs that would have been produced by the members of the team when employed outside of the team" (Rose, 2000, p. 375). For example, Alchian and Demsetz (1972) specified team outcomes as "marginal products," which use several sources of input, yield an output larger than just a sum of individual outcomes, and not all team products belong to individuals. The concept of synergy can also be articulated as a numerical formula, such as $f(A) + f(B) < f(A+B)$ (Alchian & Demsetz, 1972; Rose, 2000). Alchian & Demsetz also pointed out the difficulty of rewarding team outcomes especially as it is hard to determine a fair way to distribute rewards to individuals in teams. The source of synergy could be identified to some degree by using individual behaviors as factors; however, it is difficult to observe which portions of a team product were contributed by a
particular individual. For the purpose of this study, I focused on the quantitative way of defining synergy. However, not all researchers have agreed on a single definition of synergy. The genesis of the concept can be found in Gestalt psychology. For example, Corning (as cited in Knight, 2006) defined synergy as the whole, and the whole is a different entity from the sum of the products, which were produced separately by parts, which are the components of the whole. This definition describes synergy as the effects produced by parts that operate together, or perhaps the new entity can produce even better effects (Knight, 2006). These definitions of synergy, derived from Gestalt psychology, focus on the qualitative characteristics of outcomes. Simply, when small parts are put together as a whole, the 'whole' becomes something different from just a sum of the parts. The difficulty with a qualitative approach is that it becomes difficult to measure the 'whole' without reference to the sum of the parts. Thus, for this thesis, I will, by necessity, have to determine a more quantitative approach to measure team process.
Team Process and Synergy

The difference between team outcome and the sum of individual outcomes can be explained by team process. Process is "a series of behaviors, one following another, each determined to some degree by those that have gone before and each, in turn influencing those who will come later" (Steiner, 1972, p. 10). Also, process is evident when individuals or teams take steps to complete their tasks and responsibility (Steiner, 1972). Therefore, individuals’ activities are unified for the purpose of task completion. The major theoretical concept of team performance is an input-process-output model, which indicates that input from individuals by going through team process creates team outcome (Guzzo & Shea, 1992). Previously, many researchers examined team process behavior, such as providing information, making plans, asking for input, coordinating tasks, helping others, summarizing agreement, and participating in meetings (e.g., Stout, Salas, & Carson, 1994; Leedom & Simon, 1995; Sonnentag, 2001; Sundstrom, Busby, & Bobrow, 1997). These studies showed positive relationships between team process and team outcomes.
Team Process and Team Effectiveness

The concept of team process is also included in the work group effectiveness model of Campion et al. (1993). Through a comprehensive literature review, they identified and validated five common themes that facilitate team effectiveness: job design, interdependence, composition, context, and process. In their final model, the concept of process was represented by four characteristics: potency, social support, workload sharing, and communication/cooperation within the work group. Their model indicates the relationship between these five themes and group effectiveness, which was measured by productivity, satisfaction, and manager judgments. Productivity means how many products a team can generate. An effective group can generate better outcomes when compared with the labor, time, or cost of an individual. The criterion to determine if a team has a better outcome is dependent on task or industry. Manager judgments indicate that the outcomes of efficient groups are perceived as high performance by managers. Finally, individuals working with effective groups tend to have higher overall job satisfaction (see Figure 1). Through two validation efforts, Campion et al. (1993) found the
process characteristics indicated significant relationships with team effectiveness. Campion et al.'s (1993) study indicated the importance of individuals' attitude and behavior, such as an individuals' belief that his or her team can be effective, an individual's display of helping behaviors and positive social interaction, an individuals' perception of fair workload, and collaboration by communication. All of the personal characteristics combined facilitate team effectiveness.

Team Process and Team Ineffectiveness

Even though synergy is always expected for teams and team process is one of the key features of team efficiency, there is considerable evidence that teams may not be more productive or effective than individuals because of process loss (Steiner, 1972). Steiner stated that actual productivity could be conceptualized as "potential productivity" minus "losses due to faulty process," which is the process loss. According to this concept, successful groups have more resources, which increases potential productivity, and should result in less process loss, but might not. In other words, group productivity can possibly be maximized or minimized by group process. Therefore, using the team as a strategy
does not always guarantee process gain. So, it can be stated that a team cannot be effective or synergetic without appropriate behavior of team members, which facilitate group activities including team process. Therefore, one of the ways to overcome the disadvantages of team is forming teams with the best individuals.

How can Organizations Put Together Good Teams?

To form effective and competitive teams, organizations can select competent individuals as team members, or alternatively train them. To select or train individuals, the first process should be to identify competencies for the job or tasks through job analysis, which is "a purposeful and systematic process for collecting information on the important work-related aspects of a job" (Gatewood & Field, 2001, p. 269). Through the job analysis, some possible types of work-related information can be obtained. Typically, the following information is collected in a job analysis: work activities which include what a worker does and how, why, and when these activities are conducted, capability of manipulating equipment necessary for performing work
activities, context of the work environment, and requirements of personal characteristics for performing the job (Gatewood & Field, 2001). Without proper identification of the important aspects of a job, selection or training will not be successful; suitable competencies should be identified for each job.

Therefore, for forming efficient and competent teams, organizations should identify the desired teamwork behavior by examining individual behaviors that facilitate team effectiveness. However, as previously mentioned, teams vary depending on many factors. Therefore, certain aspects of core teamwork behavior must be addressed for creating an appropriate selection system.

Team Effectiveness and Competencies

Effective team outcomes require team members to possess certain competencies (Cannon-Bowers, Tannenbaum, Salas, and Volpe, 1995). In examining a half century of the development of the teamwork concept, Cannon-Bowers et al. (1995) provided teamwork dimensions and created a team effectiveness model by modifying the original model of Tannenbaum, Beard, and Salas (1992). Their modified
model of team effectiveness emphasizes the role of team competencies in the context of team performance (see Figure 2). Their model includes two kinds of competencies, individual task competencies and team competencies. Their model also indicates that team outcome is directly affected by internal and external organizational and situational characteristics, individual task competencies, and team competencies. Also, individual task competencies and team competencies are affected by task and work characteristics (Cannon-Bowers et al., 1995).

Cannon-Bowers et al. (1995) argued that team competencies could be classified into two categories: whether the competency is specific to a particular task or the team. In this model, the natures of team competencies are categorized into team generic and team specific competencies and these two competencies are further distinguished into team specific or task generic (see Figure 3). According to the categories, there are four types of team competencies (see Figure 4). Context driven competencies are dependent on specific characteristics of both team and task, team contingent competencies are specific to team characteristics but not
to types of tasks, task contingent competencies are specific to certain tasks but not to team characteristics, and transportable competencies are not specific to team or task characteristics.

Transportable competencies are especially suitable for cross-situational teams, in which individuals work on different tasks with a variety of team mates (Cannon-Bowers et al., 1995). Of particular interest is that the competencies can be seen as appropriate as basic competencies for a good team player (Cannon-Bowers et al., 1995). Some of the specific transportable competencies hypothesized by Cannon-Bowers et al represent an understanding of the teamwork skills necessary for effective team performance, which include interpersonal skills, communication skills, and task motivation. In addition, team members should have positive attitudes toward collaboration and want to contribute to effective team performance.
Identifying Transportable Competencies for Teamwork

Distinction between Contextual and Task Performance as Components of Overall Performance

The teamwork behaviors that are classified into transportable competencies can be construed as contextual performance rather than task performance. When we look back on the history of the study of performance, Borman and Motowidlo’s (1993; Motowidlo, Borman, & Schmit, 1997) distinction between task performance and contextual performance has notable implications for developing appropriate selection-systems. They claimed that selection criteria should embrace a domain of not only task related activities but also contextual activities. Task performance indicates “job-specific behavior,” which is necessary to fulfill “core job responsibilities.” On the other hand, contextual performance consists of “non-job specific behavior,” such as cooperating with coworkers, and committing to jobs. Contextual behavior contributes to organizational effectiveness in ways that shapes the organizational, social, and psychological context that serves as the catalyst for task activities and process (Borman & Motowidlo, 1997). Borman and
Motowidlo (1993) identified five categories of contextual performance as follows:

(a) volunteering to carry out task activities that are not formally a part of the job
(b) persisting with extra enthusiasm or effort when necessary to complete own task activities successfully
(c) helping and cooperating with others
(d) following organizational rules and procedures even when personally inconvenient
(e) endorsing, supporting, and defending organizational objectives (p. 73).

The distinction between task and contextual behavior was made clear by several studies (e.g. Borman & Motowidlo, 1997; Vanscotter, 2000; Kiker & Motowidlo, 1999; Griffin, Neal, & Neal, 2000). For example, Motowidlo and Van Scotter (1994) examined the contribution of task and contextual behavior on overall performance ratings. Three kinds of performance were rated by three different supervisors, and each result was correlated with each other. They found that individuals' task and contextual behaviors contributed separately to overall performance of individuals. Task performance
explained 18.49% of variance in overall performance, and contextual performance explained 16.81% of variance in overall performance. Task and contextual performance shared 4.00% variance with each other.

The results of the Motowildo and other studies suggest variance in overall performance can be explained by contextual behavior as well as task performance. If so, selection criteria, which include both task and contextual performance, could predict individuals' performance in organizations better than task performance criteria only. One might expect that contextual performance is likely to be an important feature of team function, since the five distinctions of Borman and Motowidlo (1993) included individuals' positive aptitudes toward being good workers, and helping and collaborating with other coworkers. In turn, these aptitudes are likely to be very important in facilitating team process.

**Importance of Competencies for Teamwork**

In comparing teamwork to individual work, working in a team environment obviously requires additional competencies. In general, interpersonal skills are very important. When individuals are working in individual-based environments, a lack of interpersonal skills is
less consequential when compared with individuals working in a team-based environment (Lawler, 1986). Also, Seers (1989) suggested that team-based settings required individuals in teams to possess capabilities to communicate with peers and supervisors. As previously introduced, these teamwork competencies can be either situationally specific or generic. For organizations, selecting or training team members (depending on each specific situation) may be the ideal for team building; however, if the perfect team building situation is not feasible or possible, use of transportable competencies as criteria of selection and training might be appropriate and more practical. Previous scholars have defined several behaviors, which should facilitate teamwork behavior. In this study I am interested in if these existing concepts can be utilized for building teams.

Organizational Citizenship Behavior

Construct of Organizational Citizenship Behavior

Contextual performance is not the only concept that has focused on the areas of performance relative to task activities. Several researchers have introduced similar
concepts (e.g. prosocial behavior). Among these concepts, the idea of organizational citizenship behavior (OCB) has taken a dominant position. Also, it is appropriate to state that OCB can represent transportable competencies for contextual performance, since the concept of OCB captures generic helping and collaborating activities at individual levels, which are necessary for individuals in a team to exhibit. Organ (1988) introduced the concept, OCB, as an "individual behavior that is discretionary, not directly or explicitly recognized by the formal reward system, and that in the aggregate promotes the effective functioning of the organization" (p. 4). Through the attempts of refining the definition, the feature of "discretionary" became problematic. In using the term, "discretionary," Organ intended to define OCB as behavior that provides an indirect contribution to organizational outcomes; sometimes the indirect contribution may be rewarded but the organizationally sanctioned reward could not be expected. In other words, individuals' supporting behavior toward others would happen whether or not there was remuneration for the contribution of individuals. In later writings, Organ
(i.e., Organ, 1997) dropped the requirement in his definition that OCBs be discretionary.

OCB consists of five categories: altruism, conscientiousness, sportsmanship, courtesy, and civic virtue (Organ, 1988). Altruism includes helping behaviors for other individuals "with organizationally relevant tasks or problems." Conscientiousness behaviors of individuals in organization are to "go well beyond the minimum required levels" of their role. Sportsmanship is behavior to endure some unpleasant circumstances without "complaining, petty grievances, railing against real or imaging slights, and making federal cases out of small potatoes." Courtesy is behavior pointed toward preventing problems relating with work issues from occurring. Finally, civic virtue is behavior that indicates the individuals' responsible participation and involvements in or concern about the future of their organizations. These dimensions were initially confirmed by Podsakoff, MacKenzie, Moorman, and Fetter (1990) through confirmatory factor analysis. As previously mentioned, there are some other taxonomies of behavior similar to OCB (e.g. Brief & Motowidlo, 1986; George & Jones, 1997). However, from among these taxonomies, Organ's five
dimensions of OCB have received the most attention by researchers. The reason for the dominant position of these five dimensions is that they have the longest history in studies about OCB (LePine, Erez, & Johnson, 2002).

Although the reputation of OCB is strong, there have been reasons to reconsider the constructs of OCB. One of these reasons has been the high intercorrelations among these five factors. With the study of Podsakoff et al. (1990), the intercorrelations ranged from a high of .86, which was the correlation between courtesy and altruism to a low of .45 which was the correlation between sportsmanship and civic virtue. Some researchers have contemplated whether these five dimensions appropriately represent the construct of OCB, whether these OCB constructs should be reconfigured. In addition, other researchers have reconsidered the model of OCB itself. In other words, some have argued that the OCB constructs have not been well defined. According to the multidimensional constructs taxonomy of Law, Wong, and Mobley (1998), Podsakoff et al.'s (1990) OCB construct is regarded as a latent model, which is a higher level construct underlying its dimensions, such as IQ. However,
interestingly, Law et al. (1998) also indicated two other possible models of the multidimensional OCB construct. First, they argued that we could define OCB using an aggregate model, which indicates a multidimensional construct with an algebraic function of its constructs. Another model is a profile model, which provides several patterns or profiles by combining dimensions.

In addition to the suggestion of other possible models, another issue with OCB has been about the similarities with contextual behavior. Organ (1997) argued that in the rapidly changes in organizations and work places, OCB could not be defined exclusively as "extra role" or "beyond job" anymore, and the supporting behaviors become part of the job. Morrison (1994) suggested that there were individual differences of definition of in-role and extra-role behavior. His study showed that some individuals perceived OCB as in-role, even though their job descriptions did not include these behaviors and they were not explicitly evaluated on or rewarded for them. Organ has suggested that OCB does not need to be defined by reference to reward or extra role, and in doing so, the content of OCB becomes very close to the definition of contextual behavior. Borman and
Motowidlo (1993) also mentioned that OCB included contextual behavior. Taken together with the concept of transportable team effectiveness, it is reasonable to consider OCB as a contextual factor that may contribute to effective teamwork behavior.

Teamwork Knowledge, Skill, and Ability

Construct of Teamwork Knowledge, Skill, and Ability

In addition to OCB, Teamwork KSAs are another possibility for being part of transportable competencies for teamwork. Stevens and Campion (1994) identified a set of KSAs necessary for the teamwork environment. They focused on an individual level of appropriate behavior and created a test to measure them as KSAs. Stevens and Campion (1999) conceptually divided KSAs into task and non-task KSAs. Stevens and Campion (1994) developed the contents of the Teamwork KSAs measure by reviewing several major bodies of literature pertaining to groups in the areas of organizational psychology, social psychology, socio-technical theory, and industrial engineering. They identified two major categories of Teamwork KSAs (interpersonal KSAs and Self-management-
KSAs) with five sub-categories (e.g. conflict resolution KSAs, communication KSAs, and planning and task coordination KSAs).

Several previous studies have demonstrated that using the Teamwork KSAs can improve team performance. In addition to Stevens and Campion (1994, 1999), McClough and Rogelberg (2003) used the Teamwork KSA test as a selection measure for team composition. The study indicated that individuals who scored higher on the Teamwork KSA tests, tended to receive higher ratings from external raters and peers on performing the task of developing a new project.

Previous research (e.g. Sonnentag, 2001; Stout, et al., 1994) indicated that contextual performance improved outcomes of teams; however, as also previously noted, contextual performance is hard to define. Because Stevens and Campion argue they have identified aptitudes unique to team settings (Stevens & Campion, 1994) and given the nature of the constructs of Teamwork KSAs, I am suggesting that the Teamwork KSAs also represent specific contextual performance for team working.
Consistent and Inconsistent Effects of Organizational Citizenship Behavior on Team Productivity

It is generally accepted that OCB has a positive influence on overall business unit performance (Dunlop & Lee, 2004). Initially, Organ (1988) proposed that conceptually OCB contributes to organizational productivity in general, since OCB helps the process of transforming an organization's limited resources into its product efficiently with less wasted resources. In addition to the conceptual work of Organ, some studies have indicated that OCB has a positive influence on organizational effectiveness. For example, Koys (2001) found a positive correlation between OCB and profitability of restaurant business practice, and also the study indicated a positive correlation between OCB and job satisfaction of employees. In addition, the results of several previous studies found that managers perceived helping behavior of employees as a positive attitude toward their jobs, and these perceptions contributed to the managers giving employees positive ratings (e.g. Motowidlo & Van Scotter, 1994; Borman, Dorsey, & White, 1995). Therefore, it would seem that
high levels of OCB should have a positive influence on team effectiveness.

However, it is not so simple to conclude that OCB will have positive effects on team effectiveness. Some of previous research about OCB has provided inconsistent results and not all five components of OCB have influenced team performance comparably. For example, Podsakoff, Ahaerne, and MacKenzie (1997) examined the effects of OCB on quality and quantity of group outcomes at a paper mill. Their results indicated a significant positive impact of each OCB component except for civic virtue on quantity or quality. Also, contrary to the wide acceptance of a positive effect of OCB on group effectiveness, Dunlop and Lee (2004) found comparatively little effect of OCBI (OCB, Individual) on supervisor ratings. OCBI did not have positive effects on performance in the fast food industry. (The study distinguished OCB into OCB, Individual, which is OCB toward other individuals, and OCBO, which is toward organizations.)

Possible Reasons for the Inconsistencies

These inconsistencies can be explained by complex mechanisms of how OCB influences team effectiveness. The
mechanisms of OCB influencing business units' effectiveness are not simple for several reasons. One of the reasons is that OCB can contribute to organizational effectiveness by influencing the practice of producing service and goods indirectly. Podsakoff and MacKenzie (1997) concluded that OCBs might enhance managers or coworkers' productivity by creating harmony between individuals or encouraging a smooth flow of procedures. According to their reasoning, individual levels of OCB may influence other individuals in their business unit and, as a result of the interaction between individuals, create a positive influence on team outcomes. From their conceptual work, it may be accurate to state that many factors influence the process directly and indirectly in a not yet fully understood dynamic manner.

Another possible reason for these inconsistent results is the existence of contextual factors, which can influence individuals' attitudes toward OCB. Paine and Organ (2000) insisted that the culture of society and organization influences individuals' perception of OCB and exposure to OCB. Therefore, if experiments are conducted with different tasks or performance outcomes in different industries, certain components of OCB will be
more appropriate than others and OCB may operate effectively or it may not. Consistent with Paine and Organ, Podsakoff, Ahaerne, and MacKenzie (1997) stated that these inconsistencies could be explained by appropriate contextual factors for each case. As previously mentioned, to identify the best competencies for each situation is the ideal selection strategy; however, to capture generic characteristics of individuals' contextual performance for teamwork is the purpose of this study. Because of these complex factors, it has been accepted by many researchers that OCB has generally positive effects on business unit’s effectiveness despite the inconsistent effect on organizational and team effectiveness.

Organizational Citizenship Behavior and Job Satisfaction

It is conventionally accepted that, in general, OCB contributes to organizational effectiveness by facilitating positive relationships among team members (e.g. Podsakoff and MacKenzie, 1997; Bolino, Turnleyd, & Bloodgood, 2002). In other words, the impact of OCB on organizational productivity is indirect because OCB’s direct impact is on employees’ attitudinal outcomes.
Therefore, it is more sensible to investigate the relationship between OCB and job satisfaction. In fact, there are several studies which have indicated OCB positively relates to job satisfaction in group settings. For example, Murphy, Athanasou, and King (2002) reported a .67 correlation between OCB and overall job satisfaction, which in this case was an aggregated score combining satisfaction for supervision, work, people, pay, and promotion.

Therefore, as one form of a transportable competency, OCB's ability to predict job satisfaction will be examined in this study. Furthermore, since this study is focusing on the influence of individual team members' teamwork behavior on team level outcomes, individual participants' OCB levels are expected to predict effectiveness after the team is formed. Therefore, this study will examine the relationship between team level satisfaction for their outcome and individual team members' OCB, leading to the first hypothesis.

Hypothesis 1 (a): Teams formed with individuals who express higher OCBs will demonstrate higher
job satisfaction at a unit level than those formed with individuals who express less OCB.

Teamwork Knowledge, Skill, and Ability and Team Effectiveness

In addition to OCB, Teamwork KSA has already demonstrated positive effects on team effectiveness through increased managerial ratings. Through the validation process of Teamwork KSA measurement, Stevens and Campion (1999) reported a significant correlation between Teamwork KSA and overall task performance \( (r = .56) \), which was measured by supervisory ratings of technical knowledge and learning orientation. That correlation indicated 31.36 % of total variance in task related performance could be explained by Teamwork KSA.

It should be mentioned that the number of studies that have examined the relationship between Teamwork KSA and team effectiveness is not large and the results of these studies have been inconsistent. Miller (2001) reported non-significant effects of Teamwork KSA on overall team productivity, which was measured by a grade for team projects completed by students. However, interestingly, the correlation between one subscale of
Teamwork KSA, planning and coordination KSA, and the project grade was positively correlated ($r = .30$). From these previous studies, it may be still too early to conclude that Teamwork KSA positively influences team outcomes. However, the kinds of aptitudes, that are measured by Teamwork KSA shares conceptual similarity with contextual behavior; therefore, it is still reasonable to suggest that Teamwork KSA can contribute to forming effective teams as well as OCB. For example, Kimura et al. (2005) found that the amount of variance shared between OCB and Teamwork KSAs was 10.24%. This level of shared variance indicates that the constructs have limited redundancy, with considerable unshared variance. This study will examine if individual levels of Teamwork KSA can contribute to better team productivity by positively influencing the contextual behavior of individuals.

Hypothesis 1 (b): Teams formed with individuals who possess higher Teamwork KSAs will exhibit greater productivity than those formed with lower Teamwork KSAs.
What Factors of Individuals Influence These Behaviors?

If teamwork behavior plays an important role for team effectiveness, productivity and satisfaction, it is constructive for organizations to make efforts to identify what factors affect team members’ behaviors. Many researchers have studied predictors of teamwork behaviors. For example, Bacharach, Bendoly, and Podsakoff (2001) tested which external factors influence OCB. They found that positive feedback about team outcomes positively influenced the amount of OCB expressed by individuals in teams. In addition to the external factors, individuals’ personal characteristics have been examined. Williams and Shiaw (1999) investigated the relationship between individuals’ dispositional traits, personality, and mood states. The results indicated that individuals’ intentions to exhibit OCBs were significantly, negatively affected by negative personality, and positive personality or current mood could not add incremental validity. Even though these studies could only identify predictors and not causal relationships, it is clear that for organizations that value these helping behaviors, it is very valuable to
identify the personal characteristics, which influence helping behaviors. Especially from the personnel selection perspectives of team formation, these characteristics of individuals are very important since whether individuals would perform the teamwork behavior is a necessary criterion for selection.

Therefore, to select the best individuals to form a team, practical and appropriate predictors for teamwork behaviors are necessary. Selection may be more important in practice as training can only enhance, not reproduce, raw talent (Paris, Salas, & Cannon-Bowers, 2000). One of the areas in which organizations cannot influence much after the selection process is in individual’s personality characteristics. Also, trait information is usually very obtainable at the outset because an organization can get this information by testing the candidate before hire. Therefore, to think about what aspects of individuals influence teamwork behavior is another issue to be explored here.

Organizational Citizenship Behavior and Personality

One set of characteristics, which influence individuals’ behaviors, is personality. There are several
typologies to describe individuals' personal characteristics (e.g. Meyers-Briggs type personality). Among these, the emergence of the Big-Five personality typology has triggered considerable interest in the role of the personality in the work place because of the abundance of empirical research and a clear measurement framework (Robertson & Callinan, 1998). The Big-Five personality typology has traditionally labeled these five factors: extraversion, agreeableness, conscientiousness, emotional stability, and openness (Goldberg, 1990).

Previous studies support that the Big-Five personality influences several job attitudes, including job satisfaction. There are three significant outcomes of individuals, whose personal characteristics may influence: job performance, job and work attitude, and career choices (Robertson and Callinan, 1998). For example, Cropanzano, James, and Konovsky (1993) examined the influence of negative and positive dispositions on job satisfaction. They expected and found significant correlations between these variables since these dispositional characteristics relate to individuals' emotional reactions toward environmental events that generate job satisfaction. Therefore, it is also expected
that personality and OCB, which is broadly accepted as attitudinal, will have a positive influence on job satisfaction of team members.

The association between OCB and personality has been discussed and tested by many scholars. Kimura et al. (2005), for example, found that OCB and Big-Five Personality constructs correlated at .32 in a structural equation model, thus evidencing significant overlap between the two latent constructs. OCB is not purely a dimension of big five personality; however; each OCB dimension has a relationship with different aspects of the big five dimensions (Kimura, et al., 2005; Organ, 1994). Among the factors of Big-Five personality model, agreeableness and conscientiousness most consistently influence factors of OCB. According to Organ (1994) agreeableness basically describes a personality factor which relates to "how well a person typically gets along with those around us" (p. 471). The situation or "atmosphere," in which individuals are getting along well generate "reciprocal liking and esteem" (p. 471). In addition, Organ (1994) also mentioned conscientiousness of the Big-Five, which has been empirically expressed by "adjectives, such as neat, punctual, careful, self-
disciplined, and reliable" (p. 471). These descriptions are very alike with the characteristics measuring conscientiousness of OCB in impersonal ways, such as "punctuality, attendance, rule compliance, productive use of time, and care for organizational property" (p. 471).

In addition, even though the research correlating OCB with personality variables are not consistent (e.g. Organ, 1994), much past research supports the theoretical suggestion that OCBs and Big Five factors do correspond to one another in meaningful ways. For example, Neuman and Kickul (1998) examined the effect of agreeableness and conscientiousness on OCB mediated by two-way communication among employees, and found a mediation effect and positive correlations between all components of OCB and those two personality factors. Their findings can be interpreted to mean that certain personality factors have an indirect and direct effect on, OCB in situations with a lot of give and take communication. Considering the positive relationship between OCB and satisfaction, if personality factors can positively influence OCB, as a result of the effects, individual members' personality and OCB should also positively influence satisfaction. Also, teams, which are formed by
members possessing these characteristics, would be expected to have higher satisfaction at the team level when compared with teams formed with members with less of these characteristics. Therefore, in the current study I will test the influence of the personal characteristics and OCB on team level satisfaction.

Hypothesis 2 (a): Individual members' agreeableness and conscientiousness of Big-Five personality factors will add incremental validity beyond the individual levels of OCB to predict unit level team member satisfaction.

**Cognitive Ability and Teamwork Knowledge, Skill, Ability**

In addition to the personality traits of individuals, general cognitive ability has also attracted the attention of researchers. Because of the wide applicability to many occupations and situations, cognitive ability provides several benefits for organizations' selection process especially from economic and utility perspectives. If organizations can apply the same selection method over different job families, the cost for developing selection systems will be more economical. Schmidt, Hunter, and McKenzie (1979)
estimated the impact of aptitude tests on productivity of computer programmers working for the U.S. federal government and concluded that the selection system, which utilized a standard aptitude test, provided significant impact on the productivity of the programmers. Meta analyses have shown the power of cognitive ability in predicting job performance. When Hunter and Hunter (1984) reanalyzed Ghiselli's (1973) data of mean validity of general cognitive ability using meta analysis, they found that the mean validity of cognitive ability ranged from 0.27 to 0.61. This mean validity was very large across many kinds of job families. Even the smallest mean validity 0.27 for sales clerk demonstrated the utility of cognitive ability testing. Schmidt and Hunter (1998) later introduced results of using multiple methods that included general mental ability (GMA). Their results of meta-analysis indicated that combinations of GMA and a work sample test yielded .63 mean validity, GMA and integrity test indicated .65 mean validity, and GMA and a structured interview indicated .63 mean validity.

Nevertheless, there have been setbacks that prevent cognitive ability tests to be an all-around player in the selection field. Specifically, Avis, Kudisch, and
Fortunato (2002) pointed out three disadvantages of using cognitive ability as a selection method. First, even though cognitive ability predicts overall job performance, cognitive ability does not necessarily predict all aspects of job related activity (Motowidlo & Van Scotter, 1994). Second, cognitive ability does not predict job performance very well, if the job is low in complexity (Hunter & Hunter, 1984). And last, using general cognitive ability tests presents serious discrimination issues, such as adverse impact (Hunter & Hunter, 1984).

However, at the same time, there are a few factors, which encourage the inclusion of cognitive ability to select team members. First of all, these disadvantages of using cognitive ability for selection can be reduced by using multiple selection methods and steps. Also, employing multiple methods reduces adverse impact with careful considerations of alternative methods. However, many studies report that although employing multiple methods reduces adverse impact it cannot prevent all potentially illegal discrimination Getewood & Field, 2001, p. 240). Nevertheless, to explore the influence of
cognitive ability on selection is still valuable to develop selection system with high utility.

In this study I will explore the impact of cognitive ability on team performance. Theoretically, cognitive ability should correlate more strongly with Teamwork KSA than OCB. Stevens and Campion (1994) postulated that unlike personnel or dispositional traits, Teamwork KSA can be influenced by management efforts. Wagner (2000) mentioned that practical intelligence, which demonstrates our cognitive ability to respond to the problems outside of the school settings, can contribute to individuals' abilities to handle real world issues, which have multiple approaches and answers. These characteristics would seem to support the higher impact of cognitive ability on behavior necessary for working in a teamwork environment.

Historically, a positive relationship between cognitive ability and task performance has been well established. However, only a limited number of studies have investigated the relationship between general cognitive ability and team aptitude, which is represented by Teamwork KSA. For example, some studies found the positive effect of cognitive ability on contextual
behavior (e.g. Motowidlo and Van Scotter, 1994). Therefore, for the current study, to improve team effectiveness, how individual levels of cognitive ability influence individuals' teamwork behavior and as a result how these individual characteristics influence productivity as a team will be examined. Because the Teamwork KSAs represent team aptitude, they are expected to be more predictive than general cognitive ability of team task outcomes.

Hypothesis 2 (b): Teamwork KSAs will provide incremental validity beyond the validity of cognitive ability to predict team productivity.

Total Model of Team Efficiency

Throughout the previous discussion, the effects of OCB and Big-Five personality, and Teamwork KSA and cognitive ability on productivity and satisfaction of teams have been discussed individually. Now, it is important to discuss how to form effective teams considering all factors, which have been discussed. For that purpose, I will start by talking about satisfaction as a dependent variable.
Satisfaction has drawn the attention of many scholars. Satisfaction itself is important as an effective outcome and also a predictor related to other important outcomes (Van Scotter, 2000). For example, according to the team effectiveness model of Campion et al. (1993), satisfaction was classified as an outcome of team. Also, Hackman and Oldham’s (1980) job characteristics model that describes the relationship among five core characteristics of jobs, psychological states, and outcomes, includes satisfaction as a key outcome. At the same time, several studies have reported the positive influence of satisfaction as an independent variable on individuals’ performance. Regardless of the number of previous studies, the causal relationship among performance and satisfaction should be determined in groups too. Therefore, including satisfaction as an independent variable may add incremental predictability of team productivity.

Hypothesis 3: Team productivity will be predicted best by the model which includes cognitive ability, agreeableness and conscientiousness of Big-Five personality, Teamwork KSA, OCB, and satisfaction.
Individual Characteristics, Group Process and Synergy on Team Productivity

There are many explanations of mechanisms of synergy, or how individual contributions aggregate to enhance team outcomes. Some scholars have focused on factors outside of teams, such as team or organizational climate (e.g. West, 1990). I want to focus on the creation of synergy from the perspective of selection; therefore, how individual characteristics may influence synergy will be examined in the rest of this literature review and tested in my study.

Throughout this introduction, the relationship among individual characteristics, OCB, Teamwork KSA, Big-Five characteristics, and cognitive ability, and team outcomes have been the focus. OCB and Teamwork KSA especially have been treated as representative of teamwork aptitudes. In addition, I have been focusing on agreeableness and conscientiousness of the Big-Five personality factors, and cognitive ability as personal traits, which positively influence each of OCB and Teamwork KSA. Throughout the discussion, these four variables have been described as factors to improve team process. The logic to support the positive relationship between the four
variables and team outcomes is that these individual characteristics can influence team productivity positively by promoting group process. Therefore, it is appropriate to state that collectively these characteristics should positively influence the creation of team synergy.

This preposition was rationally extracted from a review of the previous literature. For example, through a team creativity study, Taggar (2002) found that a “team-creativity relevant processes” mediated the relationship among individuals’ creativity and team creativity. The process helped teams to generate a synergistic product, which was more than the sum of individual creativity. Pirola-Merlo and Mann’s (2004) findings also supported Taggar’s claim that team creativity was not simply an aggregation of individual creativities but included the effects of a team process. Interestingly, some of the behaviors and characteristics of Tagger’s “team creativity-relevant process” overlap with the concepts of OCB and Teamwork KSA. For instance, the concept of team citizenship, which indicated volunteer behavior toward tasks nobody was willing to do, is very similar to OCB. Also, both the team creativity-relevant process and
Teamwork KSA value effective communication skills and conflict resolution skills. Therefore, as one of the important internal factors of teams related to better team outcomes, focusing on the function of team process on synergy is very reasonable.

Now it is important to examine whether the synergetic outcomes are actually positively influenced by teamwork behavior, such as OCB and Teamwork KSA. In addition, it is also important to include the personal traits, such as personality factors and cognitive ability, which are expected to influence the teamwork behavior positively. Therefore, it will be examined whether OCB and Teamwork KSA positively influence the creation of synergy, and whether individual members' agreeableness and conscientiousness of Big-Five personality factors will strengthen the relationship among synergy and teamwork behavior.

Hypothesis 4: In the model which includes OCB, Teamwork KSA, Big-Five personality, and cognitive ability, synergy will be demonstrated (i.e., there will be productivity in teams beyond individual contributions).
CHAPTER TWO

METHOD

Participants

A total of 177 participants grouped into 59 teams, participated in the experiment. They were students at California State University, San Bernardino (CSUSB) enrolled in undergraduate psychology classes. No conditions were set for participants to volunteer for this study with regard to race, color, gender, national origin, or religion. Among the 177 participants, members of 12 teams did not follow instructions to complete the exercises, and thus 12 teams were dropped from further analysis. Specifically, data from five teams were dropped from further analysis because one team member left the experiment in the middle of the exercise, and data from seven groups were dropped from further data analysis when one of each group’s members did not complete the NASA task as directed. These teams evaluated two items as of equal importance instead of rank ordering the 15 items from 1 to 15. Therefore, data from 141 participants or 47 teams remained for analysis.
Procedures

Recruiting Participants

Participants were recruited from upper division psychology classes at CSUSB. Participants were informed about the experiment from psychology professors and a communication board located near the psychology department office. Participants obtained four points extra credit with the agreement of their instructors.

In addition to the availability of extra credit to encourage participation, participants were informed of a lottery opportunity. After finishing the experiment, participants wrote down their contact information on a ticket for the lottery and dropped the ticket into a sealed box at the laboratory where the experiment was conducted. At the conclusion of the study, the experimenter drew out a ticket to award a prize, a $20 gift certificate to Macy's department store.

Participants were asked to sign up for a scheduled time in the performance assessment laboratory. When three group members had registered for a given time, they were contacted by the experimenter to confirm their intended participation in the experiment. The experiment schedule was confirmed by telephone or e-mail.
Surveys and Individual Task

After all registered participants appeared at the performance assessment laboratory, the procedures of the experiment were explained to them. First of all, participants were asked to complete an informed consent and a demographic data survey. Then, each participant completed online the Wonderlic Personnel Test, a general cognitive test. The test was timed; once the participant began, the test had to be completed within 12 minutes. As a second phase of the experiment, individuals independently completed the NASA Moon survival exercise. Then, the three participants composing a team were asked to move to a smaller room to complete the same NASA Moon survival exercise as a team. Before they started working on the team task, the experimenter collected each participant’s answer sheet of the survival task.

Conducting a Group Task

Participants as a team received instruction on the NASA Moon survival exercise from the researcher. (More information is given below in the Group tasks section about the NASA Moon survival exercise.) Then, participants discussed with their team the survival
exercise and created a final listing to be turned in to the experimenter.

Completing Follow-up Survey

After completing the NASA team task, participants were asked to complete a satisfaction survey assessing their work as a team. As each team member completed the survey, he or she left the experimental laboratory.

Individual and Group Task

Participants as both an individual and team completed the NASA Moon Survival Exercise that was adapted from Hall and Watson (1970). The task requires participants to rank order 15 items according to their importance to survive a 200-mile cross-country trek on the Moon. The hypothetical setting, which was provided to participants, is as follows: Participants become crew members of a space ship, and the ship has crashed on the surface of Moon on a point 200 miles from their mother ship. To survive, they have to travel to the mother ship. They have limited resources (15 items of varying utility), because all other devices or resources were destroyed by the crash. The crew members have to evaluate the 15 items with respect to their importance for the survival of the crew during their 200 mile trek. The
correct ranking of the 15 items has been determined by subject matter experts from the Crew Equipment Research Section of the NASA Manned Spacecraft Center at Houston, Texas (Hall & Watson, 1970). The items and their proper rankings are shown in Appendix A.

The NASA survival task was adopted for this study for three reasons. First, the exercise is an intellective task in which participants need to make their own judgments (Inanami, 1994). These characteristics of the task create opportunities for a team to create team process. Second, this task has been employed extensively in small group studies and the results can be compared among groups (Inanami, 1994). Interjudge reliability of experts’ rankings has been found to be .82 (Hall & Watson, 1970). Finally, a comparison of the individual and group outcomes from this task will allow us to evaluate the existence of synergy.

Scoring the NASA Survival Task

The quality of the team’s performance was evaluated by the sum of differences between a team ranking and correct answer for each item. The final score was indicated by a difference score that could range from 0 to 112 (0 representing no discrepancy in the rankings
when compared with the expert rankings and 112 representing the maximum discrepancy possible). The smaller number indicates better team performance, since it indicates that the team product is similar to the correct answers. On the other hand, a large number indicates poor team performance since the team product is so different from the correct answer (see Table 1).

Calculating Synergy

The comparison of the sum of the individual outcomes for the members of a team and that team’s outcome permits a quantitative estimate of how much synergy was created by the team relative to the performance of the individuals within the team. More specifically, the team’s final ranking difference score was subtracted from the mean discrepancies in rankings of the individual team members (see Table 2). A high number indicates more synergy. For example, a team composed of individuals whose discrepancy scores are relatively high but whose team achieves a low score for the team exercise are demonstrating considerable synergy; the discrepancy between the sum of the individual scores and the team score would be in the positive direction. In contrast, for a team in which the individual members’ discrepancy
scores are relatively low but whose team achieves a relative high discrepancy score for the team exercise are demonstrating negative synergy or process loss, and their resulting score will be negative.

Measures

Organizational Citizenship Behavior

The scales, which measure five dimensions as proposed by Organ (1988), were adapted from Podsakoff et al (1990). The five dimensions defined by Organ (1988) include altruism, conscientiousness, sportsmanship, courtesy, and civic virtue. The original OCB scales were developed by Podsakoff et al. (1990) to measure subordinates' OCB using supervisory ratings. For this study, the scales were modified to assess individuals' own OCB tendencies by adding a subject, "I," to every question. (See Appendix B.) This modification has been done in other studies (e.g. Williams & Shiaw, 1999)

The OCB measure includes 24 questions. Conscientiousness, sportsmanship, courtesy, and altruism are measured by five questions for each construct, and civic virtue is measured by four questions. Participants respond to a seven point Likert type scale ranging from
1, which stands for “Strongly Disagree,” to 7, which stands for “Strongly Agree.” Reliabilities for the subscales were .76 for civic virtue, .69 for conscientiousness, and .64 for sportsmanship, .52 for courtesy, and .78 for altruism for this study. Each score of the five dimensions of OCB was summed to obtain one composite score, and the composite score was utilized for hypothesis testing. I used a composite score because using five separate subscale scores as predictors in regression would have substantially reduced statistical power.

Teamwork Knowledge, Skill, and Ability

The Teamwork Knowledge Skill and Ability Test (Stevens & Campion, 1994) was used to assess participants’ interpersonal KSA including conflict resolution, collaborative problem solving, and communication KSA, and self-management KSA including goal setting and performance management, and planning and task coordination KSA. The test includes 35 multiple choice situational judgment items (see Appendix C). Participants were asked to choose one best answer for each item. Subscale scores are computed as well as a total score. The correct answers were summed to create a total
Teamwork KSA score; therefore, a test score can range from 0 to 35. The KSA has been used to predict success in work settings that require cooperation. Criterion validation studies of the measure have been conducted by the authors of the scale (Stevens & Campion, 1999). Alpha reliability for the overall composite was .65 for this study. Scores of each subscale were summed to obtain a composite score, and the composite score was utilized for testing hypotheses. Stevens and Campion (1999), the developers of the Teamwork KSA used a composite test score in their research and treated the composite as a measure of teamwork aptitude, which is the intended use for this thesis study.

General Cognitive Ability

The Wonderlic Personnel Test (WPT) was used for measuring general cognitive ability. The WPT is a short measure of cognitive ability including a total of 50 items. These items presented a variety of content, such as vocabulary, sentence arrangement, sentence parallelism, number series, analysis of geometric figures, logic, arithmetic problem-solving, and interpretation of proverbs. Two example items follow:
Example 1: When rope is selling at $.10 a foot, how many feet can you buy for sixty cents?
Example 2: (1) The boy plays baseball. (2) All baseball players wear hats. (3) The boy wears a hat. Assume the first 2 statements are true. Is the final one: True, False, or Not certain?

The test has been validated against a wide variety of measures and criteria. For example, the WPT has been employed in a number of industries to make hiring decisions. The reliability of WPT is relatively high. The WPT manual reports test-retest reliabilities ranging from .82 to .94, and alternate-form reliability ranging from .73 to .95. For this study, the WPT was administered online.

**Big-five Personality**

The 40-item Mini-Marker set (Saucier, 1994) was used for measuring Big-Five personality, which is composed of extraversion, agreeableness, conscientiousness, emotional stability, and intellect/openness. The Mini-Marker set is a subset of Goldberg's (1992) set of unipolar 100 adjective markers for Big-Five personality. Among these 100 items, eight adjectives for each Big-Five dimension had been identified through factor analysis (see Appendix
Participants were asked to choose a number, which indicated how accurately each adjective describes them. This measure has been shown to have adequate psychometric properties. Coefficient alpha for extraversion was .79, agreeableness was .76, conscientiousness was .80, emotional stability was .71, and intellect/openness was .69 for this study. I treated the score of each personality dimension as a continuous variable. Individuals who scored higher on certain dimension are assumed to express stronger personality than individuals who score lower on the dimension. For the further analysis, conscientiousness and agreeableness scores were summed to obtain a combined score. This combined score indicated that individuals who scored higher on the combined score were assumed to possess stronger conscientiousness and agreeableness.

In addition to the previous predictor measures, team outcomes were evaluated by three dimensions: productivity, synergy, and individuals' satisfaction with their teams.

Productivity

Productivity was measured by using team scores of the NASA survival game. The criterion for productivity
was measured by how closely the team's consensual rankings (i.e., those made by the team) mirrored the rankings as determined by NASA professionals.

**Synergy**

Synergy was measured by comparing individual and team scores. As previously mentioned, compared with individuals, teams should provide better outcomes and should have less discrepancy as a whole with the correct answers than the individual. The team outcomes gain benefit from the combination of individual abilities as teams through the team process; however, it is possible that some teams would experience process loss and in fact do worse than their average individual NASA ratings would indicate. In this study, a team score and the average score of individuals within the team were compared to determine if teams experienced synergy or process loss. See Table 2 for examples.

**Satisfaction**

Three types of satisfaction measures were employed to assess satisfaction of team members after they completed the team task: A mutual satisfaction measure modified from Smith and Barclay (1997), a team satisfaction survey from Gradstein (1984) and a general
satisfaction and two specific satisfaction measures from Hackman and Oldham (1980). (See Appendix E for the items.) Smith and Barclay’s (1997) mutual satisfaction measure was originally developed to assess the satisfaction of the relationship between selling partners. Smith and Barclay defined mutual satisfaction as “the extent to which both partners in a relationship are satisfied and it reflects both the degree and congruence of partner evaluations” (p. 5). Composite reliability (internal consistency) was .81 for this study. These 6 items are self report Likert-type scales (1=strongly disagree, 7=strongly agree).

Three team satisfaction items were adapted from Gladstein (1984). The measure, which consists of self report Likert-type items (1=strongly disagree, 5=strongly agree), originally was used to measure the satisfaction with being a team member in the work place. The coefficient alpha was .73 for this study.

Measures of general job satisfaction, internal work motivation, and satisfaction for coworkers were adapted from Hackman and Oldham (1980). Three items of general job satisfaction assessed a group members’ overall satisfaction with their team members. The original
general satisfaction scale of Hackman and Oldham had five items. However, for this research purpose, two items, "I frequently think of quitting this job" and "People on this job often think of quitting," were eliminated, since the items might not be appropriate for measuring satisfaction for a short term group task. The coefficient alpha of all five items has been reported as .76 (Hackman & Oldham, 1975). For this study, the three-item measurement of general satisfaction yielded a .75 coefficient alpha. Six items of internal work motivation assessed a degree to which the employees' positive internal feelings when working effectively on the job, and negative internal feelings when doing poorly. The alpha of the items was .52 for this study. Another three items measured the satisfaction with co-workers. The alpha of all three items was .73 for this study. To modify the original measure for this research purpose, the term "job" and "work" were changed to "group task."

Scores from these five adapted subscales were summed to obtain one composite score to evaluate multiple dimensions of participants' perception of team satisfaction. A principal component analysis had indicated that the items from these subscales loaded on
one component and accounted for 41% of total variance among the 20 items.

This study utilized satisfaction as a team outcome. Because this study measured satisfaction by individual participants' ratings of satisfaction but satisfaction was also to be used as a team level variable, it was important to ascertain that raters had a certain level of agreement within their team. To assess whether the participants of this study perceived the questions in agreement, an estimate of intrarater reliability (rWG) was calculated for the five subscales of satisfaction for all 43 teams (James, Demaree, & Wolf, 1984). Across all the satisfaction subscales the rWG for the 43 groups was high. Average rWG for all groups was .88. (See Table 3 for further information regarding rWG of each subscale.)

Intraclass correlations (ICC) were calculated through the random coefficient regression analyses whenever an individual variable was aggregated for a team level analysis and used as a dependent variable. These ICCs are indicated with a ρ within each relevant analysis. For example, the ICC for the composite satisfaction scale score when satisfaction was aggregated
at the unit level as a team level outcome was .35. For those variables which were not used as dependent variables, their ICCs were using the VARCOMP procedure in SPSS; these variables and their ICCs were the cognitive ability test (.13), composite OCB scores (.00), Teamwork KSA (.00), and the combined conscientiousness and agreeableness scores (.05). These intraclass correlations are low but it would not be expected that there would be high relationships within the teams on these variables as these are individual dispositions team members brought with them to the group project.

Planned Analyses

There are two levels of interest within this study: the individual and the team. To capture the influence of individual characteristics on team level outcomes, two different analyses were employed. Multi level modeling using a random coefficient (RC) regression in SPSS was employed to analyze a team level dependent variable (DV) when both independent variables (IVs) and DV are measured at the individual level (Cohen, Cohen, West, & Aiken, 2003). For hypotheses 1(a) and 2(a), all IVs and the DV, satisfaction, were measured at the individual level. The satisfaction of team members was expected to be predicted
by these personal characteristics. However, even though the IVs and DV were measured at an individual level, through the use of RC regression analysis, group level satisfaction can be predicted from individual characteristics and from team level characteristics. When the team level outcome is the DV, RC analysis avoids increasing Type I error caused by smaller standard error or alpha inflation. Also, this analysis at group level allows us to obtain a mean of each predictor and DV at group levels (Cohen, et al., 2003). The sample size for these analyses was 129.

In the cases that the DV was measured as a team level (e.g., the NASA rankings completed by the team as a team), regression analysis or hierarchical regression analysis was utilized at the team unit level. Employing hierarchical regression analysis provided the opportunity to determine the amount of variance that could be attributed uniquely to group performance from individual and grouped variables. When the DV was measured at a team level, IVs which were measured at individual levels were aggregated to create team mean scores. Hypotheses 1(b), 2(b), 3, and 4 were analyzed with this method. The sample size for these analyses was 43. The constructs of OCB,
Teamwork KSA, Big-Five personality, and team satisfaction include several sub-dimensions. Throughout this study, these sub-dimensions were summed to obtain composite scores for each construct except for Big-Five personality. (For Big-Five personality, only agreeableness and conscientiousness were combined.) There were two reasons why the composite or combined scores were utilized for analysis. OCB, Teamwork KSA, and Big-Five personality are well-established constructs that have multiple sub-dimensions, and I focused on how the constructs as a whole influenced team performance; therefore, composite scores were utilized for further analysis. To capture the construct of team satisfaction from different viewpoints, five different dimensions of team satisfaction were selected for this study and assessed, but to retain enough power for this study, these sub-dimensions were summed to one composite score since team satisfaction was utilized as both DV and IV. That is, five different sub-scales were combined into one total score to measure team satisfaction.
RESULTS

Data Screening

Prior to the analysis, data cleaning and screening were conducted. First, reverse coding was performed for required items. (Please see the scales in Appendices A through E for details regarding the reverse coding.) Then, missing data analysis and estimated mean imputation in SPSS were conducted before creating composite measurements. Since there were no variables that included more than five percent of missing data, no t-test scores from the MVAL SPSS analyses were calculated.

First, normality of the distributions was examined for each composed score by using an absolute value $z$ of 3.3 for skewness and kurtosis. Agreeableness and openness from Big-Five personality, general satisfaction, and team satisfaction indicated significant skewness and kurtosis. Distribution of the variable agreeableness (Big-Five personality) indicated $z$ for skewness as -5.20 and $z$ for kurtosis as 3.50; distribution of openness (Big-Five personality) indicated $z$ for skewness as -5.40, and $z$ for
kurtosis as 4.46; distribution of general satisfaction indicated z for skewness as -4.15; and finally, the distribution of team satisfaction indicated z for skewness as 5.13. To investigate the factors causing the non-normal distributions, univariate and multivariate outliers were examined. Five univariate outliers from 4 teams were identified and these four teams were eliminated from further analysis. As a result of the elimination of these 12 participants, all the other composite measures were normally distributed, except for agreeableness (z = -3.95 p<.001) and team satisfaction (z = 5.26 p<.001). Although these two variables were skewed, no transformations were done and no more cases were eliminated. The removal of the four teams and 12 participants left a total of 129 responses from 43 teams which were further analyzed. The means and standard deviations of studied variables for 129 respondents with 43 teams are reported in Table 4.

Hypotheses Testing

To address the overriding research question, whether individual cognitive ability, Teamwork KSA, Big-Five personality, and OCB were predictive of team level
outcomes of productivity and satisfaction and of the expected synergy that was expected to result from the team process, four sets of analyses were conducted.

Hypothesis 1(a)

I stated in this hypothesis that teams formed with individuals who expressed higher OCBs would demonstrate higher team satisfaction at a team unit level than those teams formed with individuals who expressed less OCB. RC regression analysis indicated that teams were significantly different in overall satisfaction: 35.29% of the variance associated with overall team satisfaction was between teams, \( \hat{\rho} = .35, \text{Wald} Z = 6.56, p < .001, F(26, 78, 1) = 23.21, p < .001 \). However, the subsequent level RC regression indicated that although OCB scores varied significantly by team, OCB scores did not significantly predict overall team satisfaction, Wald Z = .26, p = .80.

Hypothesis 1(b)

In this hypothesis, I predicted that teams formed with individuals who possessed higher Teamwork KSAs would exhibit greater productivity than those formed with lower Teamwork KSAs. Regression analysis with clustered data (i.e., team level data was used, \( n = 43 \)) indicated that
the team level NASA task scores were not significantly predicted by team Teamwork KSAs (the mean of the Team KSA scores for each team), $F(1, 41) = 2.43, p = .126, R = .24, R^2 = .06$, although the direction of the relationship was in the expected direction ($\beta = -.24$).

**Hypothesis 2(a)**

For this hypothesis, I predicted that individual members' Big-Five personality factor agreeableness and conscientiousness scores would add incremental validity beyond the individual levels of OCB to predict unit level team member satisfaction. RC regression analysis did not indicate significant incremental validity of combined agreeableness and conscientiousness of Big-Five personality factor, $F(1, 15.15, 1) = .39, p = .85$.

**Hypothesis 2(b)**

In this hypothesis, I had predicted that Teamwork KSA would provide incremental validity beyond the validity of cognitive ability to predict team productivity. Hierarchical regression analysis with clustered data indicated that the Wonderlic scores averaged by individual team significantly positively predicted team task; Teamwork KSA did not significantly add incremental validity. In other words, the team
averages on the Wonderlic scores predicted team outcome comparably with and without the Teamwork KSA scores.

Model which includes cognitive ability and Teamwork KSA:
$$F(1, 41) = 5.70, \ p < .05. \ R = .38, \ R^2 = .15; \ R^2 \ Change$$

with Teamwork KSA = .026: Regression coefficient of cognitive ability, $$\beta = -.31, \ t(40) = -2.07, \ p < .05,$$
Regression coefficient of Teamwork KSA, $$\beta = -.16, \ t(40) = -1.1, \ p = .28, \ y = -1.05*\text{Cognitive Ability} - .68*\text{Teamwork KSA} + 77.16$$

**Hypothesis 3**

The hypothesis that team productivity will be predicted best by the model that includes cognitive ability, combined agreeableness and conscientiousness of Big-Five personality, Teamwork KSA, OCB, and satisfaction was tested with hierarchical regression analysis. The combination of the team averages of cognitive ability, agreeableness and conscientiousness of Big-Five personality, Teamwork KSA, OCB, and satisfaction did not significantly predict team productivity. See Table 5 for correlations of the variables in the model. For the model which includes all the variables, $$F(5, 37) = 2.91, \ p < .05; \ R = .53, \ R^2 = .28; \ R^2 \ Change \ with \ OCB \ and \ Big-Five$$
personality = .07, \( R^2 \) Change with satisfaction = .069. 
(See Table 6 for regression coefficients.)

**Hypothesis 4**

The hypothesis that in the model which included team averages of OCB, Teamwork KSA, Big-Five personality, and cognitive ability, synergy would be demonstrated (i.e., there will be productivity in teams beyond individual contributions) was tested with regression with the team level variables. Synergy was a team level variable with team level predictors. The multiple regression was not significant, \( F(4, 38) = .79, p = .54, y = -0.83 \times \text{Cognitive} + 0.54 \times \text{TeamworkKSA} - 0.12 \times \text{OCB} + 0.13 \times \text{Big-Five} - 18.949, R = .28, p = .08, R^2 = .08 \) (See Table 7 for correlations of studied variables with hypothesis 4, and Table 8 for regression coefficients.) Because the sample size was 43, the computed power for this analysis was relatively low \( (f^2 = .09) \).

**Additional Analyses**

Generally the results of this study did not support the proposed hypothesis. Additional analyses were conducted to explore the data set.
The mean NASA survival game of 43 teams was 43.12 and that of 129 individuals was 52.28. Team outcomes were better than individual level outcomes when means were compared. In addition, a t-test of these means indicated a significant difference, \( t(170) = 4.41, p < .001 \). The team NASA scores were significantly better than the mean of the individual NASA scores. Therefore, there was synergy based on simple means of outcomes and t-test, but this process gain was not predicted by any of the predictors used.

To see how each studied variable related to each other, correlation analysis was conducted at both individual and team levels. The correlational analysis of the variables at the individual level indicated expected relationships. Cognitive ability was significantly correlated with Teamwork KSA positively and the NASA survival task (individual) negatively, OCB was significantly positively correlated with satisfaction and Big-Five Personality, Big-Five personality was significantly positively correlated with satisfaction and Teamwork KSA. (See Table 9 for correlation coefficients.)

The same relationships were expected at team level analysis: however, team level co relational analyses did
not reveal many significant relationships. OCB and Big-Five personality indicated significant correlation each other at both team and individual level of analysis as supported by past researchers. In addition, an unexpected correlation was found. There was a significant negative relationship between synergy and satisfaction. In other words, when team members were less satisfied with team or team activities, these teams exposed more synergy. (See Table 7 for correlation coefficients.)
Throughout the long history of psychology, individuals' behavior in group settings has been an interest for many scholars. More recently, the popularity of implementing teams as a business strategy has kindled additional interest in studying team process. Responding to the popularity of teams, many scholars have studied teams or groups, and have made valuable findings regarding individual traits which would lead to individuals' success in group settings. These previous studies covered various aspects of individual behaviors. However, in contrast to the number of the explorations, there have not been many studies regarding how best to select team members. Therefore, with this study, I explored what combination of individual characteristics could compose effective teams.

With this study, I defined a team as a set of people who are expected to create synergy which is "the idea that the team's output exceeds the sum of the outputs that would have been produced by the members of the team when employed outside of the team" (Rose, 2000, p. 375).
Therefore, a team is not just a gathering of people. A team should exhibit productivity that is greater than the sum of individual productivities. Synergy was created by most of the teams in this study. The mean scores of the teams were greater than the scores generated by the individuals who composed the teams.

Furthermore, for this study, the ability of a team to produce team productivity which exceeded the sum of individuals' productivities was considered team effectiveness. There are several factors that can positively influence team effectiveness. Among those factors, I focused on specific factors expected to influence team process. To identify competencies for forming an effective team, I focused on certain factors that within the context of teamwork would facilitate better team process and improve team effectiveness.

There have been several previous research studies which have indicated contextual performance is not necessarily unrewarded or extra role behavior, but may be directly relevant to performance. Borman, Dorsey, and White (1995), for example, examined the effects of 17 interpersonal factors, which included behaviors or characteristics, such as social skills, backup behavior,
generosity, and providing advice on peer and supervisor ratings. Borman et al. found that ratings of performance were greater for those who had more of the interpersonal factors. In addition, Conway (1999) evaluated performance on managerial positions. He found that part of contextual behavior, interpersonal facilitation, overlapped with task performance of the leaders. In this study I attempted to demonstrate that measures of contextual behavior would impact individual and team performance.

Specifically, the initial goal of this study was to examine the influence of individuals' characteristics on team level performance when they are team members. The influence of four individual level characteristics, such as OCB, Teamwork KSAs, general cognitive ability, and Big-Five personality, on team performance were specifically examined. By identifying the relationship of these four variables and team outcomes, this study intended to help develop effective team formation schemes from a selection perspective and investigate possible factors, which could facilitate team performance. Through this study I conducted a series of six analyses to test several hypotheses aimed at those objectives.
The first hypothesis that teams formed with individuals who reported higher OCB would demonstrate higher team satisfaction at a unit level than those formed with individuals who express less OCB was not supported. In addition, it was expected in Hypothesis 2 that individual members' agreeableness and conscientiousness of Big-Five personality would add incremental validity beyond the individual levels of OCB to predict a unit level team member satisfaction. This prediction was not supported. I expected that OCB and the combination of OCB and personality would influence individuals' job attitudes since dispositional characteristics of individuals reflect individuals' emotional reactions. Past studies have indicated that the degree of OCB of team members and personality would have a direct impact on satisfaction; past studies have indicated that five dimensions of OCB have a strong relationship with those of Big-Five personality, especially agreeableness and conscientiousness. Therefore, I expected that OCB would positively predict satisfaction, and agreeableness and conscientiousness of the Big-Five personality would provide incremental validity in predicting team satisfaction. The result of
the hierarchical linear model analysis indicated that there were significant differences in levels of satisfaction among teams, but no significant statistical evidence which supported establishing a relationship between OCB, agreeableness, conscientiousness, and team satisfaction at the team level.

Even though the expected model was not established, there were some interesting statistical findings at the individual level. At the individual level, I correlated five OCB subscales, conscientiousness and agreeableness of Big-Five personality, and satisfaction. The individual level results indicated that aggregated satisfaction and all the OCB subscales except for sportsmanship significantly positively correlated with each other. (See Table 10 for correlations of OCB variables.) Individuals with higher levels of OCB reported more satisfaction. Also, each subscale of OCB and conscientiousness and agreeableness of the Big-Five personality significantly positively correlated with each other. Individuals with stronger conscientiousness and agreeableness personality had higher OCB scores. (See Table 11 for correlations of personality variables.) However, in contrast to some of the literature, only the personality variable of
extraversion consistently correlated with the composite satisfaction variable in this study; the Big Five factors of conscientiousness and agreeableness did not significantly correlate with satisfaction. These results parallel results from a recent study, by King, George, and Hebl (2005) who found that the interaction of conscientiousness and agreeableness predicted supervisor's ratings of helping behavior better than either variable alone; only extraversion significantly correlated with helping behavior. Similarly, in this study, a multiplicative composite of agreeableness and conscientiousness significantly correlated, $r = .19$, $p = .032$, with the overall satisfaction variable whereas the individual variables of agreeableness and conscientiousness were not significantly correlated with satisfaction. This outcome suggests, as did King et al's findings that interactive effects of dispositional traits may need to be considered, rather than their simple ones.

The result from the correlation analysis indicated that individual level satisfaction was significantly positively influenced by individual's OCB; however, OCB did not have a statistically significant influence on satisfaction at the team level. Also, the result of
hypothesis testing indicated that conscientiousness and agreeableness of Big-Five personality did not add incremental validity over OCB to predict satisfaction. These results suggest that personality of individuals did not have a direct impact on satisfaction; however, personality can be a mediator for satisfaction. Future studies will be needed to explore more fully this area. Ilies and Judge (2003) found strong mediation effects of individuals' genetic characteristics on job satisfaction. They tested how the Big-Five personality factor and positive affectivity-negative affectivity would mediate all genetic influences on job satisfaction. They concluded, "Big Five traits mediate 23.63% of all genetic influences on job satisfaction." Even though the mediator effect of affectivity model was much stronger than the Big-Five personality in their study, it was apparent that personality influenced job satisfaction.

The second analysis assessed the hypothesis that Teamwork KSA would provide incremental validity beyond the validity of cognitive ability to predict team productivity. This hypothesis was not supported by this study. Teamwork KSA is a relatively new measurement. Therefore, a sufficient amount of empirical evidence has
not yet accumulated to support strongly the relationship between Teamwork KSA, cognitive ability, and team productivity. First analysis had indicated that Teamwork KSA did not predict team productivity at the team aggregated level of analysis. The correlation of cognitive ability (as measured by the Wonderlic) and the Teamwork KSA was .37, which is consistent with earlier work by Stevens and Campion (1999). In the process of validating Teamwork KSA measurement, they correlated Teamwork KSA with a composite of nine employment aptitude tests which included vocabulary, reading comprehension, expression/grammar, math problem solving, scales and graphs, visual pursuit, visual speed/accuracy, and mechanical reasoning. A composite score of the nine aptitude tests significantly correlated with Teamwork KSA, .81.

The constructs of Teamwork KSA are similar to well-established constructive behaviors and management skills; therefore, it is reasonable to expect the positive relationship between Teamwork KSA and team productivity. In addition, the positive role of cognitive ability on individual performance and team productivity has been well recognized. Since Campion and Stevens defined
Teamwork KSA as representative of teamwork behaviors that are learnable or trainable KSAs, whether Teamwork KSA predicts team productivity beyond cognitive ability was a very intriguing possibility. Unfortunately, although cognitive ability significantly positively predicted team productivity, Teamwork KSA did not add incremental validity.

To obtain a better understanding of the result of this analysis, a further series of analyses were conducted. At the individual level, Teamwork KSA total score and cognitive ability significantly positively correlated with each other $r = .23, p < .001$. Individuals with more cognitive ability also displayed higher Teamwork KSA scores. However, after the individual scores were aggregated into the team level scores, the relationship between Teamwork KSA and cognitive ability did not yield a significant correlation. This result implies that Teamwork KSA did not have a direct impact on team productivity. Based on the regression analysis, one might infer that whatever underlying ability is shared between the Wonderlic and the Teamwork KSA measure was what was correlating with the team productivity measure. At the minimum, individual Teamwork KSA scores did not
lead to differentiated team characteristics related to team productivity. (See Table 4 for means and standard deviations of Teamwork KSA scores.)

A number of explanations are possible for the unexpected result. The nature of the NASA survival tasks when discussed in a team setting may require more than cognitive ability. Perhaps intuitional insights are more valued by other team members than the logical explanations based on an individual’s cognitive ability (i.e. reasoning). The correlation between cognitive ability and the NASA task score was -.25, p < .01. Therefore, 6.25% of variance was shared. From this correlation analysis, it cannot be concluded that the NASA task required more individual level cognitive ability than the ability to exchange rational reasoning. However, the relationships among task characteristics and Teamwork KSA should be investigated further. There may be some characteristics of tasks that are necessary to trigger the aptitudes found within the Teamwork KSA construct. In the third analysis, the hypothesis was that team productivity would be predicted best by the model which included cognitive ability, agreeableness and conscientiousness of Big-Five personality, Teamwork KSA,
OCB, and satisfaction. I expected these four variables and satisfaction would predict team productivity best. However, the expected relationships among the five variables were not significantly established.

At last, testing of the fourth hypothesis assessed whether these four variables could predict synergy. For this analysis, synergy was defined as the situation where team ratings of the NASA survival task were lower than the mean scores of the individual team members. It was expected that in the model which included OCB, Teamwork KSA, Big-Five personality, and cognitive ability, synergy would be demonstrated (i.e., there will be productivity in the teams beyond individual contributions). The result of analysis did not support the model. The reason why this study did not get the expected result could be the relatively small sample size, N = 43, as the relationship was in the expected direction. An examination of synergy scores across teams indicated that of the 43 teams, eight teams experienced process loss, one team experienced neither process loss nor synergy, and 34 teams experienced synergy, thus indicating that there were effects of team process exhibited within the synergy variable. The maximum synergy score was 28.67, minimum
synergy score was -14.00, and the average synergy score was 9.17 with a 9.33 median. Clearly, the teams did exhibit effects of team process. It was not possible, however, to predict the level of synergy with the proposed variables.

Further analyses were conducted to explore these results. When I ran correlations of the five variables at the team level, all the correlations were in the predicted direction except for satisfaction. (See Table 7.) Satisfaction showed an opposite direction at the aggregated level. At the individual level, correlations between satisfaction and individual task score were not significant either; individuals who were proficient at the task were neither satisfied nor dissatisfied with the team activity, r = -0.08, p = .35.

The correlational analysis between synergy and the five subscales of satisfaction at the team aggregated level demonstrated that all the satisfaction subscales were significantly positively correlated with each other. Interestingly, this analysis also indicated that groups that had higher scores on internal motivation, general satisfaction, and mutual satisfaction created less synergy. (See Table 12 for correlation coefficients.) In
general, the satisfaction subscales indicated how satisfied individual team members were with their relationships with other team members. Therefore, the analysis indicated that participants who were satisfied with their teams' working relationships did not demonstrate higher team level performances, but lower performance. This result suggests that these participants might not have focused on performing on the team task, but on building good working relationships with their team members.

The results of the correlational analysis cannot provide more than fuel for speculation, but there might have been important group dynamics throughout the laboratory experiment that paper and pencil measurements could not capture. Possibly, unmeasured leadership factors could have impacted the teams. For example, if there was a strong leader who had confidence in his answers for the NASA survival task and regardless of other members' feelings, the leader directed the team discussions toward his preferred rankings, there may have been team members dissatisfied with the group dynamic. These teams might have had higher scores as a team and thus demonstrated a synergetic effect on the measurement
relative to the other teams without such leaders, but the
team members with strong directive leaders were not
necessarily happy with those circumstances.

This possibility is reminiscent of the Ohio State
Leadership Studies that classified leader behavior into
consideration or initiating structure leaders:
Considerate leaders “act in a friendly and supportive
manner” and the initiating structure leader “structures
his or her own role and the roles of subordinates toward
attainment of the group’s formal goals” (Yukl, 2001, p.
50). Adopting these categories, many studies have been
conducted. Fleishman and Harris (1962) found inverse
relationships between turnover rate and consideration
leader behavior, and a positive relationship between
turnover rate and initiating structure leader behavior.
These relationships could be an explanation of this
study’s finding of a negative correlation between
satisfaction and synergy. With a dominant leader who had
also done well on the NASA task, the team would have been
be productive as indicated by the synergy score, but
members may not necessarily have liked the leader and, in
turn, the team. If the participants were not happy with a
dominant leader who created team process that led to a
better team score, their satisfaction toward the team would be negative. In contrast, a high consideration leader would provide more attention to the relationships among the group members who would have found the team experience more satisfying, but didn't attend to the group task.

The most important point would be whether the satisfaction of participants leads to high team productivity or effectiveness. Several studies have explored this possibility (i.e. Bass, 1990; Fisher & Edwards, 1988). Some studies have indicated that teams with high satisfaction toward their high consideration leader could not provide high productivity and that teams with low satisfaction toward their initiating structure leader provided high productivity; however, the results have been inconsistent and further studies to establish empirical theories are still necessary (Yukl, 2001, p.52). Even though the relationship between members' satisfaction and team productivity has not been well established, this study's result is consistent with some of these past studies. Team productivity and effectiveness in this study could be influenced by the behavior of leaders who emerged during the team task. To
capture the leadership effects, videotaping the communication among team members while they were working on the team task might lead to empirical data, rather than speculation.
Overall, this study indicated unexpected results. The concept of team or group has been well studied by many researchers and from different perspectives. However, this study explored a relatively new area of the well-known concept. Therefore, these unexpected results do not necessarily mean that the relationships do not exist. For example, a previous study in this area which evaluated the relationships among Teamwork KSA, Big-Five personality, and OCB at the individual level indicated significant relationships between Teamwork KSA and OCB, \( r = .32 \) (Kimura, et al., 2005). However, this thesis study did not reveal a significant relationship between OCB and Teamwork KSA. Further exploration of related topics might be necessary to benefit business practices implementing teams and using the Teamwork KSA measure.

There are other factors which possibility influenced these unexpected outcomes. The appropriateness of methodology must be discussed. The first question was whether the NASA survival task created opportunities for participants to exchange their ideas; in other words, it
is possible that the task was not the best type of task in which to evaluate the consequences of the team process. More specifically, the nature of the task might not have permitted synergy to occur or for there to be evidence of group process occurring. For one thing, the way in which I used the NASA survival task did not provide for feedback regarding the correctness of answers during the task. Further, there was no way to make sure all the participants actually participated in the activities as a member of the team, and therefore, it is possible that a measurable team process may not have been created by the participants within the teams.

Another question to be addressed was whether it is can be assumed that team process happened without actually measuring the process, which cannot be done with paper and pencil measures. In this study, it was assumed that team process was happening and the positive effects would result in positive team productivity. However, because this study focused on the effects of the personal characteristics of OCB, Teamwork KSAs, Big-Five personality, and reactions to the team experiences (team satisfaction) as well as the results of the task done in the team setting, the process to link the personal
characteristics and team outcomes was not in fact measured.

In this study, I assumed that team process influences team productivity in one way: when team process had positive impact, teams had exposed synergy, and when team process had negative impact, teams experienced process loss. However, the effects of team process are not straightforward. Mathieu and Schulze (2006) tested how team attributes, in terms of formal plans and knowledge, influenced team performance and how transition and interpersonal processes mediated the relationships over four episodes. They found that team knowledge and formal plans had a statistically significant impact on team performance over four episodes. However, unlike the expectation from empirically established theory, interpersonal processes did not have a significant mediation effect on team performance. The results of this study and Mathieu and Schulze's study suggest that teamwork knowledge or aptitude may not have a direct impact on team process in every situation. As previously mentioned, videotaping the team activity and analyzing the team process as well as investigating team leadership would facilitate the
understanding of the effects of team process and these techniques are recommended for future research.

Relating to the ambiguity of the definition of team process, the appropriateness of the definition of synergy could also be criticized. As previously mentioned, the definition of synergy varies among researchers. I focused on the quantitative effects of synergy in this study because I wanted to conduct quantitative analyses of data. After experiencing team process, most teams in this study produced outcomes that were quantitatively better than the sum of the individual outcomes. However, it is possible that the effects of team process may have had other, qualitative components that were not measurable by the measurements within this study. In other words, it is possible that as the Gestalt definition of synergy implies, a team becomes a different entity than the simple sum of its individuals after going through the team process.

Finally, another factor which might have influenced the results of this study was the consequence of the task performance. As I initially defined, teams are usually defined differently relative to groups since teams have more communication, and teams are task and result
oriented. For team members, the process of team development is likely to be motivated by the consequences for the team. If team members are not motivated to produce good outcomes as a team, there may be no team process which includes uncomfortable conflicts of opinions, and the team may not produce a team product. With this study, the motivation of participants toward the task was probably weak since the result of the NASA team task would not do anything for the participants' lives after the experiment.

Conclusion

This study examined how individual level cognitive ability, teamwork aptitudes, OCB, personality affect team level satisfaction, productivity and synergy. From the results of past studies, it was expected that teams with individuals who have higher teamwork aptitude and cognitive ability would display team efficiency more than those with lower teamwork aptitude, and cognitive ability. Also, it was expected that dispositional characteristics of individual would have an impact on team level satisfaction; specifically, teams with individuals who had higher OCB attitudes and the
personality variables conscientiousness and agreeableness would be more satisfied with their teams and team activities more than those who had lower OCB attitude and conscientiousness and agreeable personalities. Furthermore, including the satisfaction as one of predictors, it was expected that as a model, Teamwork KSA, cognitive ability, OCB, personality, and satisfaction would predict effective team performances. None of the expectations at the team level were supported by analyses in this study; additional correlational analyses indicated a negative relationship between synergy and satisfaction. Less satisfied teams experienced more synergy than teams with individuals who were satisfied with their teams. These correlational analyses of individual level data confirm that the expected relationship might exist but this study did not confirm any proposed factors that might lead significant team level outcomes. Among the studied variables, cognitive ability was the most powerful variable to predict team productivity.
APPENDIX A

THE NASA SURVIVAL TASK
**Instruction**

You are a member of a space crew originally scheduled to rendezvous with a mother ship on lighted surface of the moon. Due to mechanical difficulties, however, your ship was forced to land at a spot some two hundred miles from the rendezvous point. During the crash landing, much of the equipment aboard was damaged and, since survival depends on reaching the mother ship, the most critical item available must be chosen for the two hundred mile trip. Below are listed the 15 items left intact and undamaged after landing. Your task is to rank order them in terms of their importance in allowing your crew to reach the rendezvous point. Place the number 1 by the most important item, the number 2 by the second most important and so on through number 15, the least important.

<table>
<thead>
<tr>
<th>Items</th>
<th>Rank order (Answer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Box of Matches</td>
<td>15</td>
</tr>
<tr>
<td>Food concentrate</td>
<td>4</td>
</tr>
<tr>
<td>50 feet of nylon rope</td>
<td>6</td>
</tr>
<tr>
<td>Parachute silk</td>
<td>8</td>
</tr>
<tr>
<td>Portable heating unit</td>
<td>13</td>
</tr>
<tr>
<td>Two 0.45 calibre pistols</td>
<td>11</td>
</tr>
<tr>
<td>1 case dehydrated Pet milk</td>
<td>12</td>
</tr>
<tr>
<td>2 hundred-pound tanks of Oxygen</td>
<td>1</td>
</tr>
<tr>
<td>Stellar map (of the moon's constellation)</td>
<td>3</td>
</tr>
<tr>
<td>Lift raft</td>
<td>9</td>
</tr>
<tr>
<td>Magnetic Compass</td>
<td>14</td>
</tr>
<tr>
<td>5 gallons of water</td>
<td>2</td>
</tr>
<tr>
<td>Signal flares</td>
<td>10</td>
</tr>
<tr>
<td>First aid kit containing injection needles</td>
<td>7</td>
</tr>
<tr>
<td>Solar-powered FM receiver-transmitter</td>
<td>5</td>
</tr>
</tbody>
</table>
APPENDIX B

ORGANIZATIONAL CITIZENSHIP BEHAVIOR
Instruction for participants
Please read following statement carefully and circle one number, which accurately express your agreement with each sentence. The smaller numbers indicate that you disagree with the statement, and bigger numbers indicate that you agree with the statement.

Scale & Scoring
The following Likert type scale was utilized. As shown in instruction section, participants choose one number out of 1 to 7. Each score were aggregated to create a subscale score. To acquire total OCB score, each score of subscales were further summed. Scores from items with (R) were reverse coded for further analysis.

1-----2------3------4------5------6------7
Strongly Disagree Strongly Agree

List of items and categorization into subscales

<table>
<thead>
<tr>
<th>OCB Subscale</th>
<th>Item No.</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conscientiousness</td>
<td>3</td>
<td>I believe in giving an honest day’s work for “An honest day’s pay.”</td>
</tr>
<tr>
<td></td>
<td>18</td>
<td>My attendance at work is above the norm.</td>
</tr>
<tr>
<td></td>
<td>21</td>
<td>I do not take extra breaks.</td>
</tr>
<tr>
<td></td>
<td>22</td>
<td>I obey company rules and regulations even when no one is watching.</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>I am one of the most conscientious employees.</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>I am the classic “squeaky wheel” that always needs greasing. (R)</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>I use a lot of time complaining about trivial matters. (R)</td>
</tr>
<tr>
<td>Sportsmanship</td>
<td>7</td>
<td>I tend to make “mountains out of molehills.” (R)</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>I always focus on what’s wrong, rather than The positive side. (R)</td>
</tr>
<tr>
<td></td>
<td>19</td>
<td>I always finds fault with what the organization is doing. (R)</td>
</tr>
<tr>
<td>Civic Virtue</td>
<td>6</td>
<td>I keep abreast of changes in the organization.</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>I attend meetings that are not mandatory, but are Considered important.</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>I attend functions that are not required, but help the company image.</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>I read and keep up with organization announcements, memos, and so on.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td></td>
</tr>
</tbody>
</table>
| **Courtesy** | 8. I consider the impact of his/her actions on coworkers.  
14. I do not abuse the rights of others.  
17. I take steps to try to prevent problems with other workers.  
20. I am mindful of how my behavior affects other people’s jobs. |
| **Altruism** | 1. I help others who have heavy workloads.  
5. I try to avoid creating problems for coworkers.  
10. I am always ready to lend a helping hand to those around him/her.  
13. I help others who have been absent.  
15. I willingly help others who have work related problems.  
23. I help orient new people even though it is not required. |
APPENDIX C

TEAMWORK KNOWLEDGE, SKILL, AND ABILITY
The Teamwork Knowledge, Skill, and Ability is a proprietary instrument and the authors do not permit reproduction for any purpose other than to administer the test.
APPENDIX D

BIG-FIVE PERSONALITY
**Instruction for participants**

Please use this list of common human traits to describe yourself as accurately as possible. Describe yourself as you see yourself as the present time, not as you wish to be in the future. Describe yourself as you are generally or typically, as compared with other persons you know of the same sex and of roughly your same age.

Before each trait, please write a number indicating how accurately that trait describes you, using the following rating scale:

**Scale and Scoring**

The following Likert type scale was utilized.

<table>
<thead>
<tr>
<th>Inaccurate</th>
<th>Accurate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely</td>
<td>Very</td>
</tr>
<tr>
<td>Moderately</td>
<td>Slightly</td>
</tr>
<tr>
<td>Slightly</td>
<td>Extremely</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>

Participants’ scores for each item were summed up to the subscale scores following five factors. Scores of items with (R) were reverse coded before summed to subscales.

<table>
<thead>
<tr>
<th>Agreeableness</th>
<th>Conscientiousness</th>
<th>Emotional Stability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold (R)</td>
<td>Inefficient (R)</td>
<td>Envious (R)</td>
</tr>
<tr>
<td>Cooperative</td>
<td>Sloppy (R)</td>
<td>Fretful (R)</td>
</tr>
<tr>
<td>Harsh (R)</td>
<td>Disorganized (R)</td>
<td>Jealous (R)</td>
</tr>
<tr>
<td>Kind</td>
<td>Efficient</td>
<td>Moody (R)</td>
</tr>
<tr>
<td>Rude (R)</td>
<td>Organized</td>
<td>Relaxed</td>
</tr>
<tr>
<td>Sympathetic</td>
<td>Practical</td>
<td>Temperamental (R)</td>
</tr>
<tr>
<td>Unsympathetic (R)</td>
<td>Systematic</td>
<td>Touchy (R)</td>
</tr>
<tr>
<td>Warm</td>
<td>Careless</td>
<td>Unenvious</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Extraversion</th>
<th>Openness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bashful (R)</td>
<td>Creative</td>
</tr>
<tr>
<td>Bold</td>
<td>Deep</td>
</tr>
<tr>
<td>Energetic</td>
<td>Imaginative</td>
</tr>
<tr>
<td>Extraverted</td>
<td>Intellectual</td>
</tr>
<tr>
<td>Quiet (R)</td>
<td>Philosophical</td>
</tr>
<tr>
<td>Shy (R)</td>
<td>Uncreative</td>
</tr>
<tr>
<td>Talkative</td>
<td>Unintellectual</td>
</tr>
<tr>
<td>Withdrawn (R)</td>
<td>Complex</td>
</tr>
</tbody>
</table>
APPENDIX E

SATISFACTION
Scale and scoring
The satisfaction survey was composed with five sections. Each section started with instructions and scales. Scores of each item were summed to five subscales. To acquire total satisfaction score, scores of these five subscales were aggregated. The following is the actual measurement utilized for this study. For clarification, subscales were specified after each item, which were not appeared on the actual measurement. Items with (R) were reverse coded before being summed into subscales. For

**Instruction:** Now please indicate how satisfied you are with each aspect of your job listed below. Once again, write the appropriate number in the blank beside each statement.

**How satisfied are you with this aspect of your group work?**

1 2 3 4 5 6 7
Extremely Dissatisfied Slightly Neutral Slightly Satisfied Extremely
Dissatisfied Dissatisfied Satisfied Satisfied

1. The group members I talk to and work with on the group task.
   (Group member)
2. The chance to get to know the group members while on the group task.
   (Group member)
3. The chance to help other people while at work. (Group member)

**Instruction:** Now please indicate how you personally feel about your group task. Each of the statements below is something that a person might say about his or her group task. You are to indicate your own personal feelings about your job by marketing how much you agree with each of the statements.

**How much do you agree with the statement?**

1 2 3 4 5 6 7
Disagree Disagree Disagree Agree Agree Agree
Strongly Slightly Neutral Slightly Strongly

1. My opinion of myself goes up when I do this group task well.
   (Internal work motivation)
2. Generally speaking, I am very satisfied with this group task. (General)
3. I feel a great sense of personal satisfaction when I do this group task well.
   (Internal work motivation)
4. I am generally satisfied with the kind of work I do this group task.
   (General)
5. My own feelings generally are not affected much one way or the other by how well I do on this group task. (Internal work motivation)

**Instruction:** Now please think of the other people in your team who hold the same group task you do. Please think about how accurately each of the statements describes the feelings of those people about the group task.

It is quite all right if your answers here are different from when you described your own reactions to the job. Often different people feel quite differently about the same job.

How much do you agree with the statement?

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Disagree</td>
<td>Disagree</td>
<td>Disagree</td>
<td>Agree</td>
<td>Agree</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
<tr>
<td></td>
<td>Strongly Disagree</td>
<td>Slightly Neutral</td>
<td>Slightly Agree</td>
<td>Strongly Agree</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

_____ 1. Most people on this job feel a great sense of personal satisfaction when they do the job well.
(Internal work motivation)

_____ 2. Most people on this job are very satisfied with the job. (General)

_____ 3. Most people on this job feel bad or unhappy when they find that they have performed the group task poorly. (Internal work motivation)

**Instruction:** Now please indicate how satisfied you are with each aspect of your group task listed below. Once again, write the appropriate number in the blank beside each statement.

How much do you agree with the statement?

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strongly Disagree</td>
<td>Neutral Agree</td>
<td>Strongly Agree</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Disagree</td>
<td>Agree</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

_____ 1. I am satisfied with my present colleagues (Team)

_____ 2. I am pleased with the way my colleagues and I work together (Team)

_____ 3. I am very satisfied with working in this team (Team)
Instruction: Please indicate your agreement or disagreement with the following six statements.
Once again, write the appropriate number in the blank beside each statement.

1 2 3 4 5 6 7
Disagree Disagree Disagree Agree Agree Agree
Strongly Slightly Neutral Slightly Strongly

(R) 1. Some aspects of our working relationship could be better. (Mutual)
____ 2. Overall, we are both quite satisfied with our working relationship. (Mutual)
_____ 3. I am happy with my working relationship with this rep. (Mutual)
_____ 4. Compared to other working relationships I've known or heard about, the one I have with this rep is quite good. (Mutual)
_____ 5. I am happy with his/her contribution in identifying and developing joint sales opportunities. (Mutual)
_____ 6. I think she/he likes working with me. (Mutual)
APPENDIX F

TABLES
**Table 1**

*Example of calculation of team productivity outcome*

<table>
<thead>
<tr>
<th>Items</th>
<th>Rank order (Correct)</th>
<th>Rank order (Individual)</th>
<th>Rank order (Group)</th>
<th>Individual Score$^a$</th>
<th>Group Score$^b$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Box of Matches</td>
<td>15</td>
<td>7</td>
<td>13</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Food concentrate</td>
<td>4</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td>-1</td>
</tr>
<tr>
<td>50 feet of nylon rope</td>
<td>6</td>
<td>10</td>
<td>8</td>
<td>-4</td>
<td>2</td>
</tr>
<tr>
<td>Parachute silk</td>
<td>8</td>
<td>9</td>
<td>8</td>
<td>-1</td>
<td>0</td>
</tr>
<tr>
<td>Portable heating unit</td>
<td>13</td>
<td>13</td>
<td>13</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

$\Sigma = 5 \quad \Sigma = 3$

---

$^a$ Individual score = $\Sigma \{\text{Rank order (correct)} - \text{Rank order (individual)}\}$

$^b$ Group score = $\Sigma \{\text{Rank order (correct)} - \text{Rank order (group)}\}$
Table 2

Example of synergy

<table>
<thead>
<tr>
<th>Group No.</th>
<th>Individual score</th>
<th>Group mean of individual score (A)</th>
<th>Group score (B)</th>
<th>(A) - (minus) (B) = Synergy Scorea</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>12</td>
<td>12</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>5</td>
<td>.9</td>
<td>15</td>
<td>-6</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a Positive number indicates existence of synergy and, bigger number indicates better synergy.
Table 3

Means, medians, maximums, minimums, and standard deviations of interrater reliability of satisfaction subscales

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>Median</th>
<th>Minimum</th>
<th>Maximum</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group Member Satisfaction</td>
<td>0.86</td>
<td>0.91</td>
<td>0.27</td>
<td>1.00</td>
<td>0.15</td>
</tr>
<tr>
<td>Team Satisfaction</td>
<td>0.97</td>
<td>0.98</td>
<td>0.75</td>
<td>1.00</td>
<td>0.04</td>
</tr>
<tr>
<td>Mutual Satisfaction</td>
<td>0.94</td>
<td>0.95</td>
<td>0.73</td>
<td>1.00</td>
<td>0.05</td>
</tr>
<tr>
<td>Internal Motivation</td>
<td>0.69</td>
<td>0.81</td>
<td>-0.19</td>
<td>0.96</td>
<td>0.28</td>
</tr>
<tr>
<td>General Satisfaction</td>
<td>0.95</td>
<td>0.97</td>
<td>0.71</td>
<td>0.99</td>
<td>0.05</td>
</tr>
</tbody>
</table>
Table 4

Mean and standard deviation of studied variables for 129 responds with 43 teams

<table>
<thead>
<tr>
<th></th>
<th>Individual Level</th>
<th></th>
<th>Team Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>Median</td>
<td>SD</td>
</tr>
<tr>
<td>Teamwork KSA</td>
<td>19.39</td>
<td>19.00</td>
<td>4.77</td>
</tr>
<tr>
<td>Conflict Management</td>
<td>2.74</td>
<td>3.00</td>
<td>0.96</td>
</tr>
<tr>
<td>Collaborative Problem Solving</td>
<td>4.03</td>
<td>4.00</td>
<td>1.74</td>
</tr>
<tr>
<td>Communication</td>
<td>6.80</td>
<td>7.00</td>
<td>1.90</td>
</tr>
<tr>
<td>Goal Settings and Performance</td>
<td>2.83</td>
<td>3.00</td>
<td>1.34</td>
</tr>
<tr>
<td>Management Planning and Task</td>
<td>2.99</td>
<td>3.00</td>
<td>1.23</td>
</tr>
<tr>
<td>Coordination</td>
<td>OCB</td>
<td>128.60</td>
<td>127.00</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>27.98</td>
<td>28.00</td>
<td>3.96</td>
</tr>
<tr>
<td>Civic Virtue</td>
<td>19.34</td>
<td>19.00</td>
<td>4.41</td>
</tr>
<tr>
<td>Courtesy</td>
<td>27.82</td>
<td>28.00</td>
<td>3.60</td>
</tr>
<tr>
<td>Altruism</td>
<td>27.98</td>
<td>28.00</td>
<td>3.83</td>
</tr>
<tr>
<td>Sportsmanship</td>
<td>25.49</td>
<td>26.00</td>
<td>4.34</td>
</tr>
<tr>
<td>Big-Five Personality</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extraversion</td>
<td>48.08</td>
<td>48.00</td>
<td>10.00</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>60.00</td>
<td>61.00</td>
<td>7.53</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>53.64</td>
<td>55.00</td>
<td>9.33</td>
</tr>
<tr>
<td>Emotional Stability</td>
<td>46.48</td>
<td>47.00</td>
<td>9.63</td>
</tr>
<tr>
<td>Openness</td>
<td>54.42</td>
<td>55.00</td>
<td>8.08</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>104.55</td>
<td>105.00</td>
<td>12.13</td>
</tr>
<tr>
<td>Group Member Satisfaction</td>
<td>16.78</td>
<td>17.00</td>
<td>2.77</td>
</tr>
<tr>
<td>Satisfaction for Internal Motivation</td>
<td>24.69</td>
<td>24.00</td>
<td>4.09</td>
</tr>
<tr>
<td>General Satisfaction</td>
<td>17.25</td>
<td>18.00</td>
<td>2.30</td>
</tr>
<tr>
<td>Team Satisfaction</td>
<td>13.42</td>
<td>13.00</td>
<td>2.13</td>
</tr>
<tr>
<td>Mutual Satisfaction</td>
<td>32.41</td>
<td>32.00</td>
<td>4.86</td>
</tr>
<tr>
<td>Cognitive Ability</td>
<td>19.91</td>
<td>20.00</td>
<td>5.01</td>
</tr>
</tbody>
</table>
Table 5

Correlations among variables tested in hypothesis 4

<table>
<thead>
<tr>
<th>Items</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Teamwork KSA Team Mean</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Cognitive Ability Team Mean</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. OCB Team Mean</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Big-Five Personality Team Mean</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Satisfaction Team Mean</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. NASA Team Score</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>7. Synergy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N = 43

* Correlation is significant at the 0.05 level (2-tailed)

** Correlation is significant at the 0.05 level (2-tailed)
Table 6

*Individual level correlation between Organizational Citizenship Behavior and aggregated satisfaction*

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Conscientiousness</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Civic Virtue</td>
<td>0.48**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Courtesy</td>
<td>0.33**</td>
<td>0.16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Altruism</td>
<td>0.52**</td>
<td>0.49**</td>
<td>0.43**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Sportsmanship</td>
<td>0.09</td>
<td>0.05</td>
<td>0.16</td>
<td>0.18*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. OCB Total</td>
<td>0.73**</td>
<td>0.68**</td>
<td>0.60**</td>
<td>0.79**</td>
<td>0.47**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Satisfaction Total</td>
<td>0.35**</td>
<td>0.29**</td>
<td>0.31**</td>
<td>0.35**</td>
<td>0.13</td>
<td>0.43**</td>
<td></td>
</tr>
</tbody>
</table>

N = 129

* Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.05 level (2-tailed)
### Table 7

*Individual level correlation between Organizational Citizenship Behavior and aggregated Conscientiousness and Agreeableness*

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Conscientiousness</td>
<td></td>
<td></td>
<td></td>
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<td>2. Civic Virtue</td>
<td>0.48**</td>
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<td>3. Courtesy</td>
<td>0.33**</td>
<td>0.16</td>
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<tr>
<td>4. Altruism</td>
<td>0.52**</td>
<td>0.49**</td>
<td>0.43**</td>
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<td>5. Sportsmanship</td>
<td>0.09</td>
<td>0.05</td>
<td>0.16</td>
<td>0.18*</td>
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<td>6. Conscientiousness &amp; Agreeableness</td>
<td>0.31**</td>
<td>0.27*</td>
<td>0.28**</td>
<td>0.31**</td>
<td>0.32*</td>
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N = 129

* Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.05 level (2-tailed)
Table 8

*Team level correlation between satisfaction and synergy score*

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<td>1. Synergy Score</td>
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<td>2. Group Member Satisfaction</td>
<td>-0.24</td>
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<td>3. Internal Motivation</td>
<td>-0.32*</td>
<td>0.56**</td>
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<td>4. General Satisfaction</td>
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<td>0.67**</td>
<td>0.61**</td>
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<tr>
<td>5. Team Satisfaction</td>
<td>-0.17</td>
<td>0.56**</td>
<td>0.43**</td>
<td>0.71**</td>
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<td>6. Mutual Satisfaction</td>
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<td>0.70**</td>
<td>0.44**</td>
<td>0.79**</td>
<td>0.72**</td>
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</table>

N = 43

* Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.05 level (2-tailed)
APPENDIX G

FIGURES
Themes/Characteristics

Criteria

Effectiveness

**Job Design**
- Self-Management
- Participation
- Task Variety
- Task significance
- Task Identity

**Interdependence**
- Task Interdependence
- Goal Interdependence
- Interdependent Feedback and Reward

**Composition**
- Heterogeneity
- Flexibility
- Relative Size
- Preference for Group Work

**Context**
- Training
- Managerial Support
- Communication/Cooperation Between Groups

**Process**
- Potency
- Social Support
- Workload Sharing
- Communication/Cooperation Within Groups

Themes and characteristics related to work group effectiveness
(Campion, Medsker, & Higgs, 1993)
Model of team effectiveness
(Cannon-Bowers, Tannenbaum, Salas, and Volpe, 1995).
Nature of team competencies
(Cannon-Bowers, Tannenbaum, Salas, and Volpe, 1995).
Types of team competencies
(Cannon-Bowers, Tannenbaum, Salas, and Volpe, 1995).
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factors on supervisor and peer performance rating.  
Journal of Applied Psychology, 80(1), 168-177.


organizational performance: A review and suggestions for future research. Human Performance, 10(2), 133-151.


