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ABSTRACT

Using a sample of 411 members and their respective leaders from 72 Taiwanese corporate teams, we conducted a cross-level study and found that 1) teammates' shared work values were positively related to team member performance and satisfaction with cooperation; 2) trustworthiness, or how a member was trusted by his or her teammates, mediated the relationship between shared work values and team member performance; and 3) trustfulness, or how a member trusted his or her teammates, mediated the relationship between shared work values and satisfaction with cooperation. Results provided support for the shared mental model theory and the directional nature of interpersonal trust.

KEYWORDS

interpersonal trust ■ shared work values ■ team dynamics ■ team member effectiveness ■ trustfulness ■ trustworthiness

The trend of globalization has contributed to a challenging environment for contemporary organizations, making it difficult for them to maintain traditional hierarchies and centralized structures. In response to fast-moving business environments, organizations have adopted flexible structural forms designed to reduce costs while simultaneously responding to changing customer demands (e.g. Boyett & Conn, 1991; Donnellon, 1996). Teams are viewed as being more suitable for such structural forms because they allow

members to deal with change and complexity more effectively. Previous research has focused extensively on factors that influence high team performance (see Salas et al., 1992 for a review). Among these factors, team members' shared mental models have received much attention because this construct has the potential to explain how members of effective teams interact with each other (Cannon-Bowers & Salas, 2001). Assessing shared mental models helps researchers make predictions about a team's likely effectiveness; it also assists practitioners to diagnose and solve problems regarding team member interaction.

Shared mental models refer to an organized mental representation of knowledge of team tasks, equipments, roles, goals, and attitudes that is shared by team members (Cannon-Bowers et al., 1990, 1993; Lim & Klein, 2006; Smith-Jentsch et al., 2005). Shared mental model theory argues that adaptability, which comes from similar or compatible knowledge, distinguishes effective teams from ineffective ones (Cannon-Bowers & Salas, 2001; Cannon-Bowers et al., 1993, 1995). Specifically, to effectively cooperate with teammates so as to adapt to changing environments, team members have to predict how their teammates are going to act. On the basis of their shared mental models, therefore, they take actions that are consistent and coordinated with those of their teammates. Recent empirical studies have evidenced a positive relationship between shared mental models, team processes, and team performance (Lim & Klein, 2006; Marks et al., 2001, 2002; Mathieu et al., 2000; Smith-Jentsch et al., 2005).

While these findings have been encouraging, several important questions are still left unanswered. First, shared mental model theory was proposed based on observations on teams engaging in dynamic and time-stressed environments (e.g. cockpit crews, see Cannon-Bowers et al., 1990, 1993). Prior studies investigating shared mental models mainly used undergraduates who performed laboratory tasks. A few studies sampled work teams who performed complex tasks in field settings (Lim & Klein, 2006; Smith-Jentsch et al., 2005), but their samples were still composed of teams engaging in dynamic tasks (e.g. military training or aviation control). To extend the generalizability of shared mental model theory, examination of the shared mental model construct with samples of teams focusing on management, advisory, project, service, or production duties is necessary. However, little research has paid attention to the empirical support gleaned from studies sampling teams other than action teams (i.e. teams that conduct complex, time-limited performance events involving audiences, adversaries, or challenging environments, see Sundstrom et al., 2000).

In addition, prior research of shared mental models was conducted at the team level. Given that each team member develops his or her own mental

models to depict, understand, and predict events in the surrounding environment (Ellis, 2006; Mohammed & Dumville, 2001; Rouse & Morris, 1986), shared mental models should have a substantial influence on outcomes, not only at the team level, but at the individual level as well. To the best of our knowledge, however, little prior study has addressed this issue. A cross-level analysis would properly answer how team-level shared mental models are related to individual-level team member effectiveness. Moreover, such cross-level research design linking team-level shared mental models and individual-level outcomes also enables the examination of psychological mechanisms underlying this relationship. To address this critical issue, the present study attempted to identify interpersonal trust as the potential mediator. Trust refers to the extent to which an individual believes in (and is willing to base his or her own actions on) another person's actions and decisions to take further action (Luhmann, 1979). In our theorization below, we argued that shared mental models are one of the core constructs which form a foundation for interpersonal trust, and that interpersonal trust mediates the positive relationship between shared mental models and team member effectiveness.

In sum, we theoretically extended previous research as follows. First, in a cross-level framework, we investigated whether shared work values, one type of shared mental model, are positively related to team member effectiveness in a field setting (i.e. non-action teams across a variety of Taiwanese industries). Second, we explored whether interpersonal trust mediates this positive relationship. Figure 1 outlines the framework of the present study. We argued that shared work values measured at the team level are positively related to two individual-level outcomes: team member performance and satisfaction with cooperation. We also postulated that interpersonal trust, an

Figure 1 Research framework

individual-level mechanism, mediates the shared work values–outcomes relationship.

Theory and hypotheses

Shared work values as a type of shared mental model

Many previous studies have argued that shared mental models do not refer to a unitary concept; multiple mental models co-exist among team members at a given point in time (Cannon-Bowers & Salas, 2001; Cannon-Bowers et al., 1993; Klimoski & Mohammed, 1994; Mathieu et al., 2000; Mohammed & Dumville, 2001; Rentsch & Hall, 1994). According to Cannon-Bowers and Salas (2001), four types of mental models can be shared by team members: task-specific knowledge, task-related knowledge, knowledge of teammates, and knowledge of attitudes or beliefs. Task-specific knowledge refers to knowledge about the specific procedures, sequences, actions, and strategies that are necessary to perform a task. Task-related knowledge refers to knowledge of information about team roles/responsibilities and interaction patterns. Knowledge of teammates involves team members' knowledge of each other – teammates' preferences, strengths, weaknesses, and tendencies to maximize team performance. Finally, knowledge of attitudes or beliefs refers to knowledge of teammates' general attitudes, values, or beliefs toward work tasks, working environments, or the work itself. Previous studies mainly focused on the former three types of shared mental models. However, the value similarity among team members may be as important as other shared cognitions when teams embedded in organizations and existing over time are investigated (Ilgen et al., 2005). Given that in the present study we attempted to investigate teams engaging in non-action tasks and operating permanently, we thus focused on shared work values as a representation of the shared mental models construct.

Values are defined as one's ideas about what is better and what is worth doing. They affect one's selection of behavioral goals (Kluckhohn, 1951). Values refer to internalized beliefs automatically directing behavior toward reward and away from punishment (Kilmann et al., 1985; Wiener, 1988); values are also widely used to describe, explain, and predict an individual's behavior in work settings (Caldwell & O'Reilly, 1990). Hence, we followed this line of literature to define work values as internalized beliefs about what is worth doing at work. Additionally, the term 'shared' is used to denote that members need to hold similar, if not identical, work values. That is, team members must hold similar work values to draw common interpretations, have compatible perceptions, and ultimately reach effective decisions

(Cannon-Bowers & Salas, 2001). Therefore, shared work values, in the present study, are operationalized by assessing the similarity of work values among team members. It should be noticed that shared work values and culture are conceptually overlapped but different constructs. Although culture can be defined as a set of cognitions shared by members of a social unit, it also refers to norms, symbols, rituals, and other cultural activities that revolve around shared values as the defining element (e.g. Ouchi & Wilkins, 1985; Schein, 1985; Smircich, 1983). A strong culture can generate and reinforce shared values (Schneider, 1987); shared values 'are expressed in organizational choices and then reinforced within organizational contexts' (O'Reilly et al., 1991: 492).

Shared work values and team member effectiveness

Team member effectiveness can be behavioral and attitudinal. Behavioral effectiveness includes team member performance, citizenship behavior, creativity, and so on. Attitudinal effectiveness refers to team members' psychological states, such as satisfaction and commitment. In the present study, we concentrated on both behavioral and attitudinal outcomes: team member performance and satisfaction with cooperation. Shared mental model theory posits that when team members are similar in terms of their values, those shared values result in congruous interpretations and compatible perceptions about tasks and environments (Cannon-Bowers & Salas, 2001; Cannon-Bowers et al., 1993). In other words, members' shared values facilitate well-matched interpretations of the environment, which promote high-level performance. For example, it may be the case that when all team members value the attempt to challenge the status quo, innovative ideas are more frequently put forward and are more readily accepted by other team members. In such circumstances, both the quantity and the quality of innovative ideas increase. Ultimately, the practice of innovation is more likely to be effective.

Thus, shared mental model theory suggests that shared work values are positively related to team member effectiveness (Lim & Klein, 2006; Marks et al., 2001, 2002; Mathieu et al., 2000; Smith-Jentsch et al., 2005). If individuals share similar work values to other team members, individuals' interpretations of surrounding environments are more likely to be similar to those of their teammates. Team members' reactions to surrounding environments are more likely to be appreciated by other members. They also make a more accurate estimation of teammates' behavior and know well about teammates' potential needs. As a result, they obtain necessary support from other members more easily. Such support enhances team members' efficiency

and timeliness of work; quality of outcomes is also very likely to increase. Even when team members are unable to freely communicate with each other, they are more likely to understand each others' behavior so precisely that smooth interaction enhances high-quality interpersonal relationships among team members. More specifically, members of such teams know when and how to support each other without the need to communicate; they are also confident of receiving the necessary assistance from each other without having to call for help.

We argue that such interpersonal relationships benefit both behavioral and attitudinal team member effectiveness. Behaviorally, such relationships ensure that team members acquire the necessary information and assistance enabling them to accomplish sub-tasks assigned to them; team member performance such as outcome quality, work efficiency, and timeliness is thus improved. Attitudinally, high-quality interpersonal relationships also facilitate team members' positive feelings at work, such as a high level of satisfaction with the cooperation process. Although not empirically testing the relationship between shared work values and performance or satisfaction with cooperation, previous studies have provided empirical evidence for the positive relationship between shared work values and job satisfaction (Bretz & Judge, 1994; Chatman, 1991; O'Reilly et al., 1991), cohesive atmosphere (Jehn & Mannix, 2001), and team social integration (Harrison et al., 2002). Hence, we make the following hypotheses:

Hypothesis 1: Shared work values are positively related to team member performance.

Hypothesis 2: Shared work values are positively related to satisfaction with cooperation.

Interpersonal trust: Trustworthiness and trustfulness

The field of organizational behavior has witnessed an increasing emphasis on interpersonal trust. Given that economic action is embedded within networks of social relationships, efficient cooperation is only possible when trust exists among interdependent actors (McAllister, 1995). Trust involves some level of dependence on the other party (Whitener et al., 1998). Such dependence may result in actual loss if the other party takes unexpected action. However, trust enables people to take risks because they believe that others will not take advantage of them (Porter et al., 1975). They are not only confident, but also willing to act on the basis of the words, actions, and decisions of individuals they trust (McAllister, 1995).

Whitener et al. (1998) argued that the nature of interpersonal trust is an exchange relationship. For example, how employees perceive their managers is an important antecedent in the degree of employees' trust toward their managers (Mayer et al., 1995). Employees are more willing to act on the basis of the words, actions, and decisions of competent, benevolent, and honest managers because such managers are less likely to exploit their employees. At the same time, managers also strive to seek out trustworthy subordinates according to subordinates' capabilities and characteristics (Graen & Scandura, 1987). Managers tend to delegate important tasks to employees they trust because they expect that such employees will repay them with satisfying performances. In short, when two parties establish a trust relationship, no party plays the role of pure initiator or receiver; both sides initiate and receive trust simultaneously. The directional nature of trust reveals that, for a focal team member, the concept of interpersonal trust consists of two elements: *trustfulness*, how a team member trusts other members, and *trustworthiness*, how a team member is trusted by other members.

Recently, interdisciplinary literature on trust has highlighted the differentiation between trustfulness and trustworthiness (Hardin, 2002; Kiyonari et al., 2006; Li, 2007; Schoorman et al., 2007; Snijders & Keren, 2001). Such differentiation between different directions of trust is important because trust as an exchange process, unlike other relationship constructs, such as leader-member exchange (Graen & Uhl-Bien, 1995), is not necessarily mutual and reciprocal (Brower et al., 2000). For instance, a subordinate may highly trust his or her supervisor because he or she witnesses the honesty of this supervisor; this supervisor is so honest that he or she does not take advantage of his or her subordinates. However, the supervisor does not necessarily trust this subordinate to the same extent because this subordinate, who highly trusts the supervisor, may lack critical skills required to accomplish assignments; the supervisor may not consider his or her subordinate competent enough to require his or her delegation with correspondent performance. Similarly, within a team, a team member's trustworthiness is not necessarily equal to his or her trustfulness. In a recent review, Schoorman et al. (2007) thus noted that the unidirectional measure of trust has clear limitation. They called for empirical research that integrates multi-directional trusts into a single research framework.

To fully capture directional trust relationships within a team, we utilized the notion of network centrality in social network theory (Bond & Kenny, 2002; Burt, 1992; Ibarra, 1993, 1995). Network centrality indicates the extent to which an individual is part of a network. An individual's position in a given network is more central if he or she has strong linkages

with others in the network. Conversely, an individual's position is more marginal if he or she has weak linkages with other members in the network. In considering the directions of relationships, social network researchers define out-degree centrality as the linkage from the focal actor to the other actors, and in-degree centrality as the linkage from the other actors to the focal actor. In terms of interpersonal trust, the out-degree centrality of trust refers to the extent to which a focal team member trusts his or her teammates (i.e. trustfulness of the focal member), whereas the in-degree centrality of trust refers to the extent to which a focal member is trusted by his or her teammates (i.e. trustworthiness of the focal member).

Interpersonal trust as the mediating mechanism

According to shared mental model theory, shared work values lead to similar interpretations of tasks and environments (Cannon-Bowers & Salas, 2001; Cannon-Bowers et al., 1993). Such interpretations are crucial in enhancing interpersonal trust because individuals who share analogous interpretations of environments tend to react in similar ways and thereby more easily meet each other's expectations (Zucker, 1986). More specifically, when team members share similar work values, they are more likely to observe the same issue from compatible perspectives, come up with similar solutions to the same problem, and respond to the same situation in a like manner. Even without sufficient communication, it is easier for members who share similar values than it is for those who think differently to anticipate teammates' future behavior. Such members are more confident that their teammates will emphasize mutual interests rather than maximize personal advantage. They are also more willing to depend on teammates' words, actions, or decisions because the potential loss resulting from teammates' unexpected behavior is low. Likewise, they are more trustworthy because they are less likely to take advantage of their teammates and more likely to meet teammates' expectations.

Moreover, trusting and being trusted by others in the same social categories satisfy the need for connectedness (Ashforth & Mael, 1989; Turner et al., 1987). That is, by trusting as well as being trusted by teammates who share similar values, team members derive positive feelings of team attachment. Additionally, the same prediction is also supported by the attribution literature. Individuals are more attracted to others who are similar to themselves than they are to those who are dissimilar (Byrne, 1971; Newcomb, 1956). Interpersonal attractiveness leads to many attributions of positive characteristics (Eagly et al., 1991; Feingold, 1992); attractive persons are treated more positively than unattractive ones. Therefore, when

team members share work values, increased interpersonal attractiveness may enhance trustworthiness and trustfulness. Therefore, although the literature on team research to date has provided little empirical evidence, we draw on the theories referred to above to make the following hypothesis:

Hypothesis 3: Shared work values are positively related to trustworthiness and trustfulness.

Previous studies have identified trust as the antecedent to many favorable outcomes such as decreasing uncertainty (Luhmann, 1979), reducing transaction and management costs (Rousseau et al., 1998), improving cooperative efficiency (Kasperson et al., 1992; Lewicki & Bunker, 1996), and enhancing communication quality (Kee & Knox, 1970; O'Reilly, 1978). According to these studies, there are at least two mechanisms linking interpersonal trust and favorable outcomes. First, interpersonal trust helps enhance effectiveness through the effect of trust initiators. Individuals who trust the other party are more willing to reduce unfriendly, inimical, or punitive monitoring behavior (Rousseau et al., 1998), cooperate with the other party (Lewicki & Bunker, 1996), and provide relevant and critical information to the other party (Zand, 1972). The trusted party therefore encounters fewer obstacles, obtains necessary resources, and acquires critical information to accomplish assignments at work. As a result, necessary assistance and critical information provided by trust initiators not only enhance trust receivers' work quality, efficiency, and timeliness, but also improve receivers' positive perception of cooperation between the two parties. Second, interpersonal trust increases effectiveness through the effect of trust receivers. Individuals who receive trust tend to emotionally support the other party (Kee & Knox, 1970), provide positive feedback (Kasperson et al., 1992), and exert effort to fulfill the other party's expectations (Luhmann, 1979). Hence, individuals who initiate trust perceive more social support, better communication quality, and fewer feelings of uncertainty. Consequently, a high-quality interpersonal relationship benefits both trust initiators' behavioral performance and their positive attitudes at work.

Therefore, we hypothesize that shared work values are positively related to team member outcomes through the mediation of both concepts of interpersonal trust, trustworthiness, and trustfulness. Within a team, one way for teammates to evaluate each others' trustworthiness is by judging whether they and their teammates share similar work values (Cannon-Bowers & Salas, 2001; Cannon-Bowers et al., 1993; Mathieu et al., 2000). Shared work values result in similar interpretations of environments and thereby reactions to enhance mutual interests (Cannon-Bowers et al., 1993).

That is, teammates sharing work values are more likely to take actions that meet other members' expectations. Therefore, team members tend to trust such teammates; trustworthy teammates receive more delegation, less monitoring, and more useful and important information. Avoiding the need to deal with unnecessary interpersonal conflict, they focus mainly on tasks assigned to them. With the assistance of information provided by other members, they are more likely to experience smooth problem-solving processes and come up with effective solutions. Eventually, the performance of trustworthy teammates improves. At the same time, the delegation or assistance of other members also denotes a high-quality interpersonal relationship. Trustworthy members are thus more likely to experience positive feelings such as satisfaction with cooperation.

Hypothesis 4a: Shared work values are positively related to team member performance through the mediation of trustworthiness.

Hypothesis 4b: Shared work values are positively related to satisfaction with cooperation through the mediation of trustworthiness.

We also posit that shared work values are positively related to outcomes through the mediation of trustfulness. Shared work values are one of the foundations for the trust evaluation. Team members tend to consider their teammates trustworthy if their teammates share similar values to their own. They have little difficulty in anticipating teammates' future actions, even in the absence of sufficient communication (Stout et al., 1996); relationship uncertainties are reduced (Luhmann, 1979). They feel comfortable delegating important tasks and providing critical information to trustworthy teammates because they are confident that their teammates will not take advantage of them. As a result, their performance is enhanced because reduced relationship uncertainties and better anticipation of other members' future actions help them focus on assigned tasks rather than on interpersonal conflicts. They also feel satisfied with the degree of cooperation between themselves and trustworthy teammates; they perceive and secure pleasant interpersonal relationships, and are thus glad to continue cooperating.

Hypothesis 5a: Shared work values are positively related to team member performance through the mediation of trustfulness.

Hypothesis 5b: Shared work values are positively related to satisfaction with cooperation through the mediation of trustfulness.

Methods

Sample and procedure

Data for the present study were obtained from team members in multiple Taiwanese organizations. Team leaders enrolled in an EMBA program in Taiwan were asked to participate in the present study. Given that the tendency for interaction recedes as team size increases, only supervisors leading a team with less than 15 members were included in this study (Katzenbach & Smith, 1993). They helped the authors distribute subordinate questionnaires to team members directly reporting to them and rated these subordinates' performance at work during the class in the supervisor questionnaires. In subordinate questionnaires, team members completed items measuring their work values, interpersonal trust, satisfaction with cooperation, and demographic information. The protection of each participant's privacy was emphasized. Completed surveys were returned directly to the authors in sealed and pre-addressed envelopes. Ninety-one out of a total of 130 sets of surveys were returned, representing a response rate of 70 percent. We then examined team member questionnaires for these 91 teams, ruling out invalid surveys; data from a specific team were entirely dropped if the number of respondents in this team was less than 60 percent of its team size. Ultimately, we retained data from 72 teams with 411 team members in total.

Our sample fairly represented various industries, including both the manufacturing (44 teams, 61%) and the service sectors (28 teams, 39%). It included teams from the electronics manufacturing industry, information technology industry, food processing industry, automobile industry, retail service industry, medical service industry, and public service sector. There were 30 general management teams, 24 research and development teams, and 18 total quality management teams. The average team size was 8.84 ($SD = 4.22$), and the average team tenure was about three years (34.58 months, $SD = 24.55$ months). Gender distribution was about equal (55% were male, 45% were female). Thirty-five percent of the team members were younger than 30 years old, 27 percent were 31–35 years old, 16 percent were 36–40 years old, 18 percent were 41–5 years old, and 4 percent were more than 46 years old. Approximately 71 percent of the participants held college or higher educational degrees, and the average tenure of the sample was 5.36 years. In addition, team members came from at least three distinct departments; the average cross-departmental membership was 5.67 (from three to eight departments, $SD = 1.93$).

Measures

A Chinese version of English items was created in accordance with Brislin's (1986) procedure for conventional translation and back-translation. We also converted several five-point or seven-point scales into six-point scales because previous studies showed that Chinese subjects tend to choose the midpoint in odd-number Likert scales (Yang & Chiu, 1987).

Shared work values

Value systems vary among different cultural settings (Hofstede, 1980; Hofstede et al., 1990). Although well-constructed questionnaires measuring work values were available (e.g. Organizational Culture Profile; O'Reilly et al., 1991), they were developed in Western societies, so they may not capture the representative set of work values in the Chinese context. Therefore, we developed a new measure for the present study. We followed Caldwell and O'Reilly's (1990) approach to develop this measure. We started our work by conducting an extensive review of indigenous studies (e.g. Cheng, 1990; Kuo et al., 2001), as well as several preliminary qualitative investigations. We attempted to identify items that 1) could be used to describe any Chinese team members, 2) would not be equally characteristic of all team members, and 3) would be easy to understand. Redundant, irrelevant, or difficult to understand items were then removed according to the criteria above. The final set of questions consisted of 21 items depicting general work values (see Appendix for the items). Participants rated how much they emphasized a specific value on a six-point scale ranging from 1, 'very unconcerned', to 6, 'very concerned'.

Harrison and Klein (2007) recommended that researchers measure within-unit value variability by either within-group standard deviation or mean Euclidean distance. These two measures share similar conceptual and mathematical properties; there is no particular advantage of either operationalization over the other. In the present study, we adopted mean Euclidean distance to measure shared work values at the team level. We followed Bovasso's (1996) and Tsui et al.'s (1992) suggestion to compute the individual Euclidean distance. Within a team, the Euclidean distance of one member, i , from all other members, j , refers to the root mean squared distance between each of those i, j pairs on the average score for the 21 value statements (V): $\sqrt{[\sum (V_i - V_j)^2 / (n)]}$. We then computed the mean Euclidean distance for each team: $\sum \{ \sqrt{[\sum (V_i - V_j)^2 / (n)]} / (n) \}$. Given the six-point scale that we used, the lower and upper bounds of the mean Euclidean distance were 0 and 3.54, respectively. We further subtracted the mean Euclidean distance from 5 (the

difference between the maximum and minimum response point) to reverse the scale so that greater values represented higher levels of shared work values. This reversed measure ranges from 1.46 to 5.

To allow an adequate test of hypotheses regarding shared work values at team level, we had to verify that substantial between-team variability in team members' Euclidean distance existed in our sample. Mathieu and Taylor (2007) suggested that team-level measures 'must possess sufficient between group variability to afford reasonable power . . . to drive cross-level effects in meso-mediational tests' (p. 147). They recommended one of the intra-class correlation coefficients, ICC(2), as the most applicable indicator. We derived an ICC(2) for team members' Euclidean distance of .95, which far exceeded the value considered the lowest acceptable, .70 (Klein & Kozlowski, 2000). The respective *F*-value for team members' Euclidean distance was 19.40 ($p < .01$), also indicating significant difference of mean Euclidean distance across teams.

Interpersonal trust

McAllister's (1995) measure of affect- and cognition-based trust was used to assess interpersonal trust, which consist of both 'good reasons' for dependence on others and emotional bonds between individuals (Lewis & Weigert, 1985; Luhmann, 1979). It contains five affect-based trust items and six cognitive-based trust items. On a six-point scale ranging from 1, 'strongly disagree', to 6 'strongly agree', team members rated their agreement with each statement about each member of their respective teams. Because variances explained by 11 items were not significantly larger than those explained by the six highest loading items (three for affect-based items, and three for cognitive-based items), we used the six-item version to measure interpersonal trust in the present study. These items were: 'We have a sharing relationship'; 'We can both freely share our ideas, feelings, and hopes'; 'I can talk freely to this individual about difficulties I am having at work and know that (s)he will want to listen'; 'If I share my problems with this person, I know (s)he will respond constructively and caringly'; 'This person approaches his/her job with professionalism and dedication'; 'Given this person's track record, I see no reason to doubt his/her competence and preparation for the job'; and 'I can rely on this person not to make my job more difficult through careless work'. Although McAllister (1995) argued that affect-based and cognitive-based trust should be viewed as two distinct concepts, an explanatory factor analysis using principal component analysis with promax rotation showed that the final set of six items was loaded on single factor accounting for 57.27 percent of the variance

(loadings = .69–.81). Therefore, rather than computing separate measures for affect- and cognition-based trust, we calculated trustworthiness and trustfulness for teammates' overall trust.

Trustworthiness and trustfulness were analyzed using a network-analysis program, UCINET 5.0 (Borgatti et al., 1999). UCINET 5.0 provides the computation of out-degree and in-degree centrality. Out-degree centrality of interpersonal trust, or trustfulness, refers to the sum of a focal member's trust in each respondent within his or her team, divided by the total number of respondents within the team. In-degree centrality of interpersonal trust, or trustworthiness, refers to the sum of each respondent's trust in the focal member, also divided by the total number of respondents within the team. Because data with missing values had to be excluded to compute in- and out-degree centrality, *N*s for trustworthiness and trustfulness (344 and 346, respectively, see Table 1) were much less than other studied variables.

Team member performance

Farh et al.'s (1991) Job Performance Scale was used to measure team member performance. This scale contains four items. On a six-point scale ranging from 1, 'poor', to 6, 'excellent', team leaders/supervisors rated each team member's quality of work, efficiency of work, ability to complete work on time, and overall performance. The internal consistency coefficient for this measure was .93.

Satisfaction with cooperation

Three items revised from Tjosvold's (1988) Team Satisfaction Scale were used to measure team members' satisfaction with cooperation. On a six-point scale ranging from 1, 'strongly disagree', to 6, 'strongly agree', team members rated their agreement with statements about their satisfaction with the degree of cooperation within teams. These items were: 'I have a cooperative relationship with my teammates', 'I am glad to continue cooperating with my current teammates', and, 'I am confident that I will achieve future success if I cooperate with my current teammates again'. The internal consistency coefficient for this measure was .90.

Control variable

All scales that we used in the present study have upper and lower bounds. When the mean score is near the upper or lower bounds, the variability of

the score is often lower. Because of this potential confound, the effect of the variability of within-unit attribute may actually result from the effect of the mean of that attribute. Diversity researchers thus argued that when examining the relationship between the variability of an attribute and other variables, investigators should first statistically control for the within-group mean of the attribute (Harrison & Klein, 2007; Jackson et al., 2003). Additionally, prior research on organizational culture also pointed out that work values have substantial effects on a variety of employee attitudes and behaviors, such as commitment, efficacy beliefs, cooperative behavior, and performance (Chatman & Barsade, 1995; Chatman & Spataro, 2005; Earley, 1994; Hofstede et al., 1990; O'Reilly & Chatman, 1996). In other words, it is very likely that not only the variability of within-team values but also the mean of within-team values are related to team members' trust and work outcomes. Taken together, we included each team's average score for the work value statements as a control variable.

Data analysis

Since we hypothesized that shared work values, a team-level variable, are positively related to two individual-level work outcomes (i.e. team member performance and satisfaction with cooperation) through the mediation of individual-level interpersonal trust, our research framework reflected a cross-level nature. Our data set also involved a nested structure: 411 members nested with 72 work teams. As a result, we used hierarchical linear modeling (HLM) to test our hypothesized relationship. We analyzed shared work values at the group level of analysis (i.e. 'Level 2'), and trustworthiness, trustfulness, team member performance, and satisfaction with cooperation at the individual level of analysis (i.e. 'Level 1'). Because the HLM program does not accept data with any missing values, data of 14 teams and their 78 members were first eliminated. Results of our cross-level analysis were thus based on 58 teams and their 333 members.

Because a considerable part of the data was deleted, several tests were performed to examine whether this deletion significantly altered our sample composition. Two χ^2 tests revealed that team demographics of the 58 teams were similar to those of the original 72 teams. In the remaining sample, there were 34 manufacturing (59%) and 24 service (41%) teams (χ^2 -value = 0.99, d.f. = 1, $p > .05$). The 58 teams included 24 general management teams, 18 research and development teams, and 16 total quality management teams (χ^2 -value = 1.00, d.f. = 2, $p > .05$). The t tests also showed that the means of team size and team history were not significantly influenced by the removal

of data with missing values (t -value = 0.67 and 0.19, respectively, $p > .05$). Finally, a further check of team members' demographic data suggested that the distribution of gender, age, and educational background of the remaining 58 teams were not significantly different from those of the original 72 teams. In sum, statistical tests above provided evidence for the homogeneity of sample composition between the remaining and original teams.

To test our hypothesized meso-mediation model (Hypotheses 4 and 5), we followed the procedures recommended by Mathieu and Taylor (2007), which are correspondent with Baron and Kenny's (1986) mediation test. The testing process included three steps. The goal of step 1 was to show the existence of the relationship between the independent variable (shared work values) and outcomes (team member performance and satisfaction with cooperation) without the presence of mediators (trustworthiness and trustfulness). Step 2 established the connection between the independent variable and mediators. Step 3 added the independent variable into the equation containing mediators-outcomes relationship. The addition of the independent variable must not significantly predict the variation of outcomes for full mediation to be supported.

Results

Among studied variables, trustworthiness, trustfulness, team member performance, and satisfaction with cooperation were all measured at the individual level. Hence, we first conducted an individual-level confirmatory factor analysis to examine the construct distinctiveness of these four variables. Because of the large number of items used to measure the variables, subscales served as indicators of the latent constructs (Bagozzi & Heatherton, 1994). Two indicators for trustworthiness were created: the out-degree centrality of three affect-based items and that of three cognition-based items. Two indicators for trustfulness were created by computing the in-degree centralities of both affect- and cognition-based items. For team member performance and satisfaction with cooperation, items were treated as indicators. Results of the confirmatory factor analysis evidenced our individual-level construct distinctiveness: a four-factor model with each indicator loaded on its expected construct fitted the data well ($\chi^2 = 73.79$, d.f. = 55, NNFI = .96, CFI = .97, IFI = .97, RMSR = .03, RMSEA = .06).

Means, standard deviations, and correlations for all variables appear in Table 1. There was a positive relationship between trustworthiness and trustfulness ($r = .36$, $p < .01$), which suggested that team members trusted by other members are likely to trust teammates as well. Shared work values were

Table 1 Means, standard deviations and correlations among all studied variables

Variables	Mean	SD	N	1	2	3	4	5
1. Values (mean)	4.88	0.40	406 ^a					
2. Shared work values (difference)	3.76	0.25	406 ^a	.29**				
3. Trustfulness	4.43	0.61	346	.15**	.13*			
4. Trustworthiness	4.41	0.49	344	.23**	.19**	.36**		
5. Satisfaction with cooperation	4.74	0.82	408	.17**	.16**	.53**	.26**	
6. Team member performance	4.54	0.84	373	.27**	.27**	.24**	.59**	.18**

^a Group-level shared values (both mean and difference) are assigned back to individuals.

* $p < .05$; ** $p < .01$.

positively related to trustworthiness and trustfulness ($r = .19$ and $.13$, $p < .01$ and $.05$, respectively), as well as to the two outcomes: team member performance and satisfaction with cooperation ($r = .27$ and $.16$, respectively, $p < .01$). These results provided preliminary support for our hypotheses. Additionally, Cohen and Cohen's (1983) test of difference between two dependent correlations indicated that the trustworthiness–team member performance relationship was stronger than the trustworthiness–satisfaction with cooperation relationship ($r = .59$ and $.26$, respectively, t -value = 5.78, $p < .01$). Similarly, the trustfulness–satisfaction with cooperation relationship was statistically stronger than the trustfulness–team member performance relationship ($r = .53$ and $.24$, respectively, t -value = 4.88, $p < .01$). These comparisons suggested that trustworthiness and trustfulness have distinct effects on different outcomes. More specifically, trustworthiness is more proximal to behavioral outcomes such as team member performance, while trustfulness has a stronger relationship with attitudinal outcomes such as satisfaction with cooperation than with behavioral outcomes.

Cross-level analyses for the examination of meso-mediation models are shown in Table 2. Models 3 and 5 established the first step for testing meso-mediation models: examining the independent variable–outcome relationship. After controlling for the mean of within-team work values, we found that the beta weights for shared values on both team member performance and satisfaction with cooperation were significant (beta weights = 0.80 and 0.33, $p < .01$ and $.05$, respectively). These positive beta weights suggested that shared work values are positively related to team member performance, as well as to satisfaction with cooperation, thus supporting Hypotheses 1 and 2 – that shared work values are positively related to team member performance and satisfaction with cooperation. Models 1 and 2 built the

Table 2 Results of cross-level analysis of shared work values, interpersonal trust and team member performance^a

Variables		Trust- worthiness	Trust- fulness	Team member performance		Satisfaction with cooperation	
		Model 1	Model 2	Model 3	Model 4 ^b	Model 5	Model 6 ^c
Intercept	γ_{00}	2.09*	2.31*	-0.94	-3.20**	2.41*	0.61
Controls:							
Values (mean)	γ_{01}	0.25*	0.21*	0.50**	0.23	0.22*	0.05
Independent variable: Shared work values (difference)	γ_{02}	0.29*	0.29*	0.80**	0.45	0.33*	0.11
Mediators:							
Trustfulness	γ_{10}				0.07		0.67**
Trustworthiness	γ_{20}				1.04**		0.10

^a Data including missing values were deleted before conducting analyses. *N* for hierarchical linear modeling = 58 teams and 333 team members.

^b Level 1: Team member performance = $\beta_0 + \beta_1 \times \text{Trustfulness} + \beta_2 \times \text{Trustworthiness} + r$. $\beta_k = \gamma_{k0}$ for $k = 1$ to 2.

Level 2: $\beta_0 = \gamma_{00} + \gamma_{01} \times \text{Values (mean)} + \gamma_{02} \times \text{Shared work values (difference)} + u_{00}$.

^c Level 1: Satisfaction with cooperation = $\beta_0 + \beta_1 \times \text{Trustfulness} + \beta_2 \times \text{Trustworthiness} + r$. $\beta_k = \gamma_{k0}$ for $k = 1$ to 2.

Level 2: $\beta_0 = \gamma_{00} + \gamma_{01} \times \text{Values (mean)} + \gamma_{02} \times \text{Shared work values (difference)} + u_{00}$.

* $p < .05$; ** $p < .01$.

second step for testing meso-mediation models – investigating the relationship between independent variables and mediators (i.e. trustworthiness and trustfulness). We found that positive beta weights for shared work values were significant in regard to both trustworthiness (beta weight = 0.29, $p < .05$) and trustfulness (beta weight = 0.29, $p < .05$). These findings supported Hypothesis 3 – that shared values are positively related to interpersonal trust, including trustworthiness and trustfulness. Models 4 and 6 demonstrated the final step for examining meso-mediation models – adding the independent variable into the mediator–outcome equation. In Model 4, a significant beta weight for trustworthiness on team member performance was observed (beta weight = 1.04, $p < .01$), while the beta weight of trustfulness was insignificant (beta weight = 0.07, $p > .05$). Moreover, indicating the existence of full mediation, the beta weight for shared work values on team member performance was insignificant (beta weight = 0.45, $p > .05$). In Model 6, a significant beta weight for trustfulness on satisfaction with cooperation was also observed (beta weight = 0.67, $p < .01$), while the beta

weight for trustworthiness was insignificant (beta weight = 0.10, $p > .05$). Furthermore, the beta weight of shared work values on satisfaction with cooperation was insignificant (beta weight = 0.11, $p > .05$). Model 4 and 6 thus supported Hypotheses 4a and 5b – that shared work values are positively related to team member performance through the mediation of trustworthiness, but not through the mediation of trustfulness, and that shared work values are positively related to satisfaction with cooperation through the mediation of trustfulness, rather than through the mediation of trustworthiness. Hypotheses 4b and 5a were unsupported.

In summary, we found substantial support for the hypothesized model. According to our data analysis, shared work values were positively related to team member performance through the full mediation of trustworthiness. The mediation of trustfulness between shared work values and satisfaction with cooperation also received full support.

Discussion

The purpose of the present study was to employ a cross-level framework to investigate the relationship between shared work values, a team-level construct representing one type of shared mental model, and outcomes at the individual level. Moreover, we used such cross-level analysis to further examine the potential psychological mechanism underlying the shared work values–outcomes relationship. We differentiated between trustworthiness and trustfulness in the present study because of a recent call for improving the unidirectional conceptualization of trust (Schoorman et al., 2007). Finally, to broaden the generalizability of the shared mental model theory, we sampled day-to-day operation teams across a variety of industries rather than small two- or three-person teams in the laboratory, or specific kinds of teams engaging in dynamic and time-stressed environments.

The hypothesized relationship between shared work values and individual-level outcomes (i.e. team member performance and satisfaction with cooperation) received full support. In addition, we found that trustworthiness, instead of trustfulness, fully mediated the shared work values–team member performance relationship. We also found that trustfulness, rather than trustworthiness, completely mediated the relationship between shared work values and satisfaction with cooperation.

Theoretical contributions

The findings of the present study contribute to the existing literature on organizational behavior as follows. First, while researchers argued that

shared mental model theory has potential value as an explanatory mechanism for understanding all kinds of effective teams (Cannon-Bowers & Salas, 2001), prior research only provided empirical support from laboratory teams or teams engaging in dynamic and time-stressed tasks. Laboratory studies of shared mental models in general examine small teams that engage in clearly defined and relatively simple tasks for short periods of time. Obviously, teams in real organizations form with more members, have longer duration, and perform tasks of greater variety, complexity, and uncertainty. These aspects may 'result in differences in the strength of the relationship observed among the variables in the lab versus the field' (Lim & Klein, 2006: 406). Although findings of field studies investigating combat teams (Lim & Klein, 2006) or aviation control teams (Smith-Jentsch et al., 2005) may generalize to other action teams, additional research that tests the generalizability of the shared mental model theory is needed. Sampling non-action teams in various Taiwanese organizations, the present study filled this important void. Our results were consistent with the prediction of the shared mental model theory in such a way that shared work values facilitate compatible interpretations of the environment among team members and ultimately enhance effectiveness. Such findings elevated our confidence in shared mental models as an explanatory mechanism for day-to-day operation teams.

Second, although the shared mental model theory has been intensively utilized at the team level (Ellis, 2006; Marks et al., 2001, 2002; Mathieu et al., 2000), no empirical study has examined it in a cross-level framework. Our results suggested that shared mental models such as shared values should have a substantial influence not only on team-level outcomes, but also on individual-level outcomes. At the team level, shared mental models have been proven to benefit team performance in a variety of areas, such as quality, efficiency, operational readiness, and points earned in the combat simulation (Cannon & Edmondson, 2001; Lim & Klein, 2006; Marks et al., 2001, 2002; Mathieu et al., 2000; Smith-Jentsch et al., 2005). At the individual level, we found that shared work values were also positively related to team member performance.

An interesting observation is that our findings, along with results of prior studies, suggest that shared mental models mainly have a positive effect on team members. The downside of shared mental models is less clear. Could shared mental models lead to negative outcomes such as groupthink? When team members shared highly similar work values, would shared work values hamper team-level outcomes, such as problem-solving processes, or individual-level outcomes, such as creativity? For example, Leonard-Barton (1992) found that although shared cognition is necessary for team effectiveness, it may also be detrimental to team adaptability and innovation.

Moreover, the literature on strong cultures also noted that a strong culture can have a negative effect, including 'pressure-cooker' cultures, barriers to change, and difficulty in creating an inclusive environment (e.g. Schein, 1985). Similarly, if team members share values that are dysfunctional (e.g. values about not sharing information), they very well might contribute to ineffective performance. We thus call for future research to probe the unfavorable effects of shared values.

Third, we found that in addition to behavioral performance, shared values were also positively related to individual-level work attitudes. This finding is consistent with conclusions of diversity research (Harrison et al., 2002; Jehn & Mannix, 2001; Jehn et al., 1999; O'Reilly et al., 1991), which suggest that value diversity leads to less satisfaction and lower commitment. Though how shared mental models influence behavioral outcomes was well documented, little attention has been paid to the shared mental models–attitudinal outcomes relationship. Our study provided initial support for this relationship, but future research should further explore it.

Fourth, and more importantly, the present study identified a psychological process by which shared work values are related to team member effectiveness. While prior studies have pointed out that team processes mediate the relationship between shared mental models and team-related performance (e.g. Mathieu et al., 2000), they employed the team-level research framework so that empirical examinations of psychological mechanisms underlying team processes were limited. Interpersonal trust has been viewed as a facilitator of team processes (Sitkin & Roth, 1993). Cannon-Bowers and Salas (2001) also suggested that motivational states, such as trust, are likely to mediate the indirect relationship between shared values and performance. Theorizing that shared values help team members perceive and interpret environments compatibly (Cannon-Bowers et al., 1993), the present study supported these notions with a cross-level framework. Future research is now needed to investigate whether trust also mediates the relationship between other types of shared mental models (e.g. shared task-specific knowledge or shared knowledge of teammates) and team-related outcomes. Another interesting research direction is to examine whether task interdependency moderates the shared work values–trust–effectiveness relationship. As task interdependency increases, shared work values might have stronger effects on trust and team member effectiveness.

Fifth, in differentiating between trustworthiness and trustfulness, the present study contributed to the trust literature by using a social network approach to provide a more precise understanding of the directional nature of interpersonal trust. Researchers have more and more frequently applied social network theory as a method of analysis (e.g. Ashworth & Carley,

2006; Ren et al., 2006). Adapting the measurement technique of network centrality (Bond & Kenny, 2002; Burt, 1992; Ibarra, 1993, 1995), we divided the concept of trust into trustworthiness (in-degree centrality) and trustfulness (out-degree centrality) according to the directions of trust, and thus avoided potential misunderstandings emerging from the utilization of unidirectional trust measure. A fruitful area for future research is thus to test the relationship between trustworthiness and trustfulness. Do high levels of trustworthiness lead to subsequent trustfulness? In our sample, we found a moderate, significant association between trustworthiness and trustfulness ($r = .36, p < .01$, see Table 1). The positive relationship provides preliminary support for the concept of the reciprocity of trust. Rather than assuming one party's trust and the other party's trust to be equivalent, empirical studies should further investigate whether one party's trust affects the other party's trust in return (Schoorman et al., 2007; Serva et al., 2005).

Moreover, in the present study, we found that while trustworthiness uniquely predicted behavioral effectiveness, such as team member performance, only trustfulness explained variations in attitudinal effectiveness, such as satisfaction with cooperation. Our results suggested that interpersonal trust is more likely to enhance trust receivers' behavioral outcomes because trustworthiness brings them necessary assistance and information. However, trustworthiness is unrelated to trust receivers' satisfaction with cooperation perhaps because of increased workload or responsibility. The results of the present study also suggested that interpersonal trust tends to improve trust initiators' attitudinal outcomes because trustfulness helps them experience a high-quality relationship. Nevertheless, trustfulness does not significantly affect trust initiators' performance possibly due to lack of access to critical resources. To the best of our knowledge, it is the first study that emphasized the bidirectional nature of trust and provided support for the distinction between the effects of trustworthiness and the effects of trustfulness. Future research should accumulate more empirical evidence for this newly discovered distinction.

A few methodological advantages also strengthened our confidence in our results. First, we reduced the possibility of common method bias by collecting data from two sources: team members and their supervisors/leaders. Moreover, by taking other respondents' scores into account, the measure of one respondent's trustworthiness and trustfulness was not merely a self-rated indicator. In addition, our sample included teams from different industries, in different functions, and in a cultural context (Taiwan) characterized by collectivism and an emphasis on interpersonal reciprocity (Yang, 1981; Yu & Yang, 1994). Thus, the present study contributes to the literature by showing the external validity of the shared mental model and trust theories developed in Western countries.

Limitations

First, as the data collected did not necessarily include all the members of each team, the data may not reflect a complete picture of team interaction processes. However, we set a sample requirement that at least two-thirds of team members should be included as subjects for each team so that the unfavorable effect of this limitation should be substantially reduced. Second, while our sample of a variety of teams was an advantage, it could become a disadvantage as well. To sample various teams to test the generalizability of the shared mental model theory, we could not clearly define all types of shared mental models. Future research could focus on specific teams that have identical functions and come from similar industries to enable the investigation of the interactions among different types of shared mental models. This effort enables the investigation of whether shared knowledge has a larger effect than shared values, or vice versa. Third, while the shared mental models literature speculated on both mental model similarity and mental model accuracy, the present study only examined the former. However, in our model, we added the teams' average value scores as a control variable. The positive relationships between mean value scores and other studies variables (see Table 1) ruled out the possibility that dysfunctional (or inaccurate) values were shared in our sample, and thus impeded performance. Fourth, our cross-sectional design precluded causal interpretation. For example, two team members who trusted each other may have had more opportunities to interact with each other, so they were more likely to absorb each others' viewpoints. As cooperation builds, they learned to interpret the environment from each others' point of views. As a result, they shared more work values because of a high degree of interpersonal trust. In spite of the consistency between our results and theoretical reasoning, the cross-sectional design did not allow us to completely exclude alternative explanations. Future study might strengthen causal inferences by using longitudinal or experimental designs. Finally, as suggested by Klimoski and Mohammed (1994), awareness of the shared values may have a great impact on our results. While we did not collect items assessing the degree to which individuals were aware that they held similar values to their team members, future research should explicitly measure this construct.

Practical implications

Our results highlight several important areas of practical application. First, we found that a higher degree of shared work values among teammates relates significantly to higher levels of interpersonal trust, and this, in turn, leads to better team members' work quality and efficiency in the workplace. Although the effect of shared values on creative performance and team

innovation is less clear, organizations and managers can be more confident of the positive relationship between shared values and the efficiency of following instructions or guidelines to complete tasks. Shared work values also benefit team members' satisfaction with cooperation. In addition, by differentiating between trustworthiness and trustfulness, our results suggest that team leaders need to consider not only how to earn team members' trust, but also how to trust them. Moreover, trusting team members and being trusted by them might have distinct effects on team member effectiveness. By demonstrating trustworthy behaviors, such as behavioral consistency, integrity, etc., team leaders can develop team members' trustfulness, and, in turn, increase team members' satisfaction with cooperation. By showing their trust in team members, leaders can enhance team members' trustworthiness, and thereby provide team members with better conditions for concentrating on job performance. Team leaders should take care in pursuing the goal of utilizing interpersonal trust. If they would like to see changes in team members' behavioral patterns, initiating trustworthy behavior may be a less direct method of achieving that goal than showing trustfulness. Conversely, it is trustworthy behavior that has a stronger effect than trustfulness on increasing team members' positive perceptions at work.

Conclusion

In summary, the findings of the present study strengthened the generalizability of the shared mental model theory. Our cross-level framework also evidenced interpersonal trust as the psychological mechanism underlying the shared mental models–individual outcomes relationship. Moreover, the fact that trustworthiness and trustfulness are distinctive concepts having different effects suggests that investigating the directional nature of trust well reveals the sophisticated phenomena of trust relationships. Continued research on trust is likely to yield profound insights by using multi-directional trust measures.

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Appendix: Value statements used to measure shared work value

1. Achievement orientation
2. An emphasis on ethics
3. Being cost-effective
4. Being efficient
5. Being entrepreneurial
6. Being farsighted
7. Being highly organized
8. Being precise
9. Being result oriented
10. Being rule oriented
11. Being socially responsible
12. Courtesy
13. Emphasizing a single culture throughout the organization
14. Fitting in
15. Having a good reputation
16. Honesty
17. Opportunities for professional growth
18. Paying attention to detail
19. Risk taking
20. Security of employment
21. Stability

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